iSherig 2014 - 2018

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Ministry of Education

iSherig

Education ICT Master Plan 2014 - 2018

Educating for GNH

iSherig

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2014 - 2018

Ministry of Education
Royal Government of Bhutan

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CONTENTS

April 17, 2015

FOREWORD

Over the past five decades, we have been successful in expanding access to education services. We are now facing challenges related to the provision of quality education due to rising societal expectations and public concerns on the inability of the education system to adequately prepare the young Bhutanese to face the emerging challenges lying ahead.

In response to these concerns, this Ministry is intiating numerous reforms one of which is development of Education ICT Master Plan titled '*iSherig*'.

The *iSherig* lays out broad national visions to harness the power of ICT in schools, non formal education centres and colleges to enhance the quality of teaching and learning. Many countries in the Asian region too have embarked on similar reform strategies to improve the quality and relevance of their education systems.

To realize the vision of the *iSherig*, around 27 major projects are planned to be implemented in the next five years.

I urge all the relevant agencies to ensure that the ICT projects are properly implemented within the given timeframe.

Mingbo Dukpa

དཔལ་ལྡན་འབྲུག་གཞུང་། ཤེས་རིག་ལྷན་ཐག།
Royal Government of Bhutan
Ministry of Education
Thimphu : Bhutan

MoE/2014/1218 4th September 2014

Foreword

Recognizing the important role that education plays in shaping a nation's future, our visionary Monarch's have always accorded the highest priority to the education sector. Investments in education have equipped our people with the knowledge and skills that have created opportunities for them to contribute to the nation building process.

Bhutan has a vision of becoming a knowledge based society; to achieve this vision the education system must address the needs of a rapidly changing world driven by dramatic technological revolution. The purpose of developing the iSherig (Education ICT Master Plan) is to provide a road map to ensure that all our children have equitable access to quality education. School leaders and educators can, through the use of ICT, help children to achieve the desired learning outcomes.

Since 2001 the Ministry has undertaken various initiatives in the use of ICT in education in improving access to quality education. The **iSherig** is intended to lay the foundation and create an enabling environment for future ICT initiatives in education.

The **iSherig** is our first Education ICT Master Plan and has been developed under the guidance of IT Specialists from IDA, Singapore by a core team of highly competent Bhutanese Team comprising of policy makers, School IT teachers, school Leaders, and IT professionals. The master Plan has been developed through a consultative process engaging various stakeholders and mainly focuses on three broad areas: **iAble** - capacity building of teachers, students and lab assistants, provision of infrastructure and equipments; **iBuild** - content creation including production of interactive materials and digital textbooks, development of management information systems and **iConnect** - internet connectivity, networking and sharing of best practice and ICT programmes in schools and institutions.

The success of the Master Plan hinges on the support and the ability of all stakeholders to implement programs in the plan effectively in a coordinated manner. Most of the activities identified under the Master plan have been mainstreamed into the 11th FYP.

Therefore, I would urge all the departments, divisions, district education offices and schools to ensure that all activities under this master plan are implemented in a timely manner.

Finally, I would like to thank Ministry of Information and Communications, International Development Agency, Temasek Foundation, Singapore and the Swiss Development Corporation for providing both financial and technical support. My special appreciation goes to the Core Team for their commitment and professionalism in the formulation of an ICT policy that is relevant to our needs, implementable and sustainable.

Tashi Delek!

Sangay Zam
Secretary

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EXECUTIVE SUMMARY

This education sectoral ICT master plan is a follow-up from Bhutan eGov Master Plan developed in 2012. It was formed to harness power of ICT as an enabling tool in teaching and learning as well as to rationalize and streamline ICT activities, systems and projects under the Ministry of Education (MoE) and across the education sector.

Bhutan has made great progress in educating its people since the introduction of formal education in the 1950s. Today, education is widely accessible to all Bhutanese children and adult learners, even in remote parts of the country. With accessibility to education in place, the attention is now turned towards improving the quality of education, and ICT is an enabling tool to effect this change. The government too has in recent years invested heavily into providing ICT infrastructure to schools and to the community across the country. This ICT Master Plan for education will guide the ongoing investment in ICT projects in the educator sector over the next 5 years.

The vision and outcomes for this Education ICT Master Plan are as follows:

Vision	**Quality education enhanced by ICT for a knowledge society**		
Outcomes	Effective teaching and learning environment	Efficient educational administrative systems	Motivated life-long learners for the 21st century

In order to achieve these outcomes, 3 key strategic thrusts have been identified to focus our investment into areas that can make the biggest impact to the communities. These are:

Thrusts	**Description**	**Focus**
iAble	Enhance capacity building for students, educators and support staff and industry	iAble focuses on programmes that will develop the capabilities and capacities of students, educators, supporting staff and the industry so as to best utilize the many investment into infrastructure, systems and content in the sector.

Thrusts	Description	Focus
iBuild	Strengthen ICT integration into curriculum, pedagogy and assessment	iBuild develops the content for an ICT-driven curriculum to support a vibrant ICT-led teaching and learning environment across Bhutan.
iConnect	Enhance nation-wide education and learning ICT infrastructure and systems	iConnect enables better access to ICT resources, computers and the Internet in the educational institutions and communities to support teaching and learning across the country. It also establishes governance structures to drive the implementation of ICT projects in the education sector.

This Education ICT Master Plan is named iSherig which translates to ICT in Education in general sense. Specifically "i" alludes to innovation and integration that this master plan intends to promote through use of ICT in Education. iSherig logo is represented by a flower. Each of the three petals represents a strategic thrust, namely iAble, iBuild and iConnect explained above. The jewels in the centre of the flower represent the government's desire to help every individual and learner in the educational institutions, communities and government agencies in the education sector. iSherig is designed to impact and benefit everyone in the education sector, from the youngest learners to adult learners, to the educators and to the administrators. iSherig will be implemented over 5 years from 2014 to 2018, and will lay the foundation for future advances in the use of ICT in education in Bhutan.

iSherig comprises a total of 27 projects grouped into nine programmes. The nine programmes are grouped into three strategic thrusts as follows:

Thrust	Programmes
iAble	1. ICT capacity development for educators 2. ICT capacity development for students 3. ICT capacity development for learning support
iBuild	4. Promote educational interactive materials and software 5. Pervasive use of e-learning in educational institutions

Thrust	Programmes
iConnect	6. Computerisation Programme 7. Expansion of MIS, admin and communication systems 8. Establish distributed learning support infrastructure 9. Establish governance and Programme management framework

A total of over Nu 833.35 million is anticipated for the rollout of iSherig. 21 projects are already in the 11th FYP and rationalized into iSherig while 6 are new projects. The investments in iSherig will transform Bhutan's education landscape and boost Bhutan's move to transform itself into a knowledge-driven economy for the 21st century.

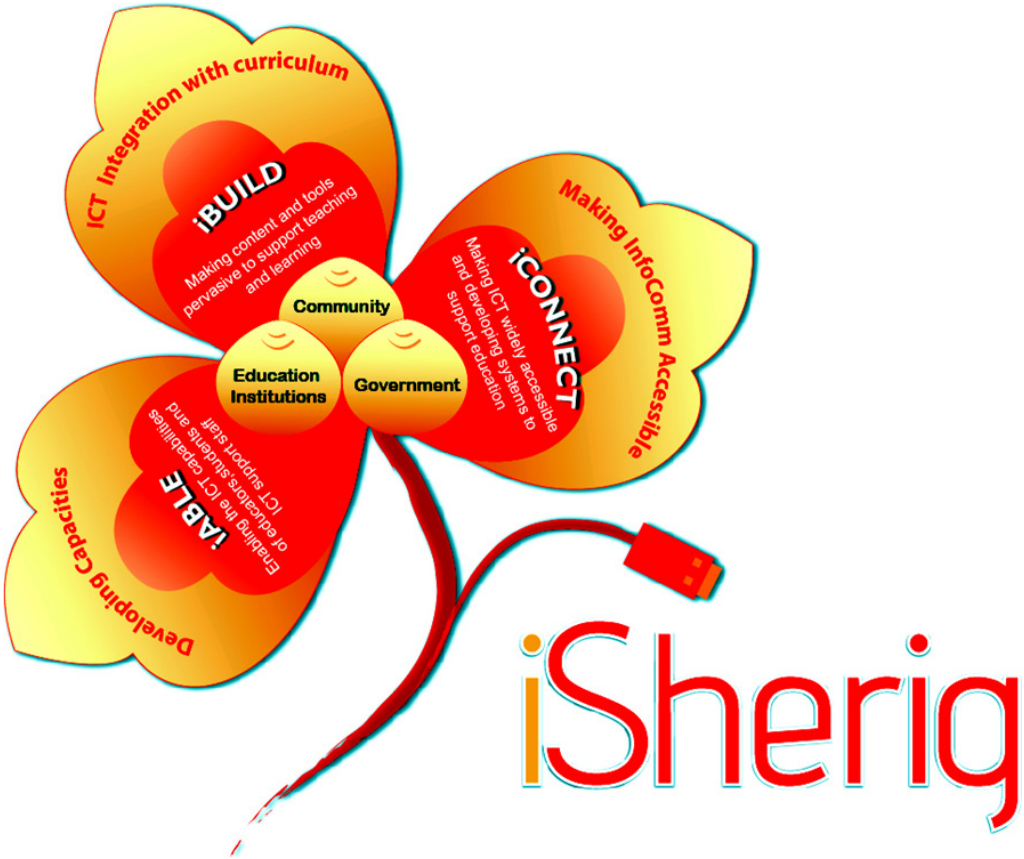


Figure 1: Overview of iSherig

ACKNOWLEDGEMENTS

The development of this Education ICT Master Plan would not have been possible without the support from several stakeholders and donor agencies. The Ministry of Education owe special thanks to several agencies and people.

We would like to thank the Ministry of Information & Communications and the IDA International, Singapore for all the guidance and support provided to the Core Team during the master plan development period.

We would also like express our gratitude to the Temasek Foundation not only for funding this master plan development project but also for another ICT project Weaving Infotech Resources into Education (WIRED) aimed at infusing ICT into classroom teaching and learning.

We would also like to thank the Swiss Development Corporation for their generous contribution in funding the sectoral master plan development project.

The Ministry of Education would also like to thank all participants of the roundtable meetings and the interviews from government organizations, corporate agencies and private industries for their insightful views and suggestions (refer Annexure for the name list of officials).

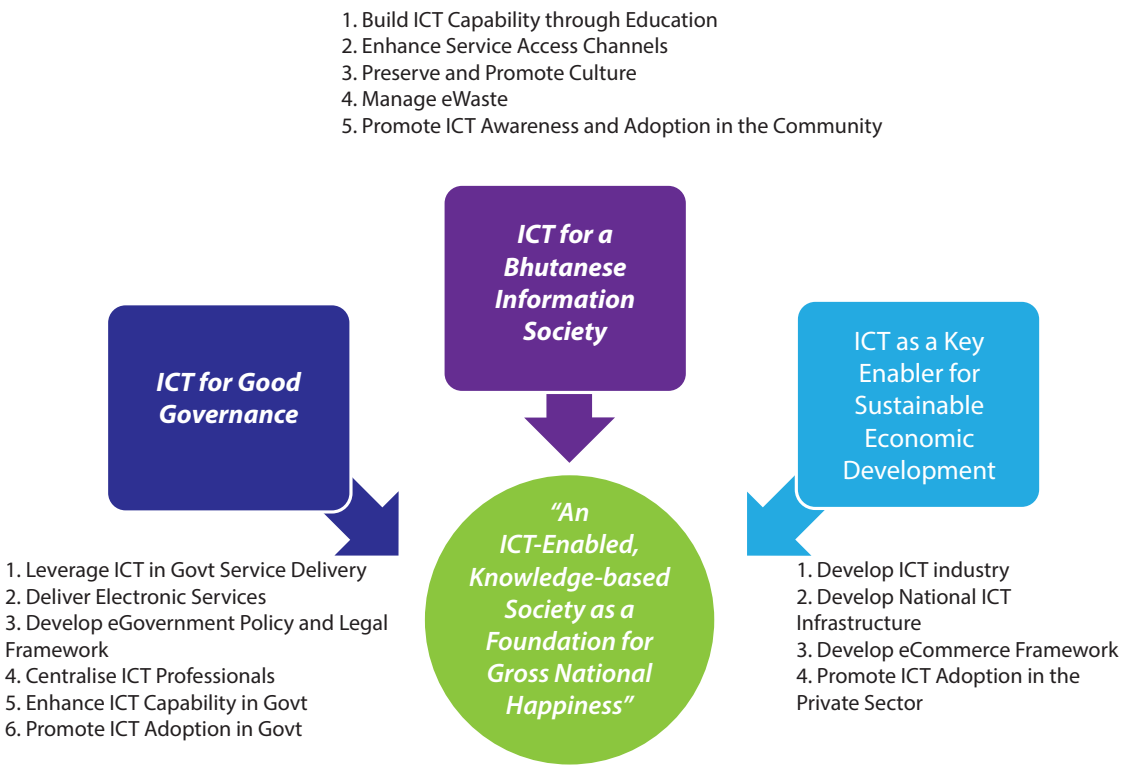
Similarly, we would also like to thank DEOs/TEOs, Dzongkhag IT Officers, principals, teachers, students, and ECCD proprietors/facilitators for participating in the survey and providing honest responses, which formed one of the important bases for developing the master plan. Also, we would like to thank the resource persons from RUB, BCSEA, NFECD and HRD of MoE for providing valuable inputs related to their organizations.

Last but not the least, this Education ICT Master Plan would not have been possible without the hard work and commitment of our iSherig Core Team. Therefore, the Ministry of Education would like to thank the Core Team members for the commendable work they have delivered.

CHAPTER 1

INTRODUCTION

Bhutan developed a 5-year eGov Master Plan in 2012. The eGov Master Plan sought to establish a clear roadmap of ICT initiatives that would cut across the whole government. Various initiatives and budgets were developed and aligned to three broad desired outcomes - ICT for Good Governance, ICT for a Bhutanese Information Society and ICT as a Key Enabler for Sustainable Economic Development. These outcomes form the foundation of Bhutan's ICT Vision: "An ICT-enabled, knowledge-based society as a foundation for Gross National Happiness".



ICT Vision, Desired Outcomes and Strategies

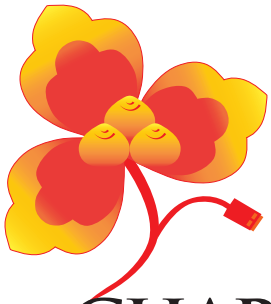
Figure 2: Bhutan eGov Master Plan

Various projects in the eGov Master Plan are currently underway, including Infrastructure projects such as the National Broadband Master Plan project, Government Wide Intranet and Government to Citizen (G2C) initiative. These projects are at the broad government level. The focus is now extended to the sectoral level, focusing initially on three sectors: Education, Healthcare and Tourism.

An education sector master plan development team was formed to focus on the following broad areas:

1. *Harness the power of ICT as an enabling tool in teaching and learning;*
2. *Rationalize and streamline ICT activities, systems and projects under the Ministry of Education (MoE) and across the education sector.*

The core team for master plan development comprised of representatives from various departments under MoE, Dzongkhag/Thromde education office, college of education, and schools. The team was supported by an advisor and consultants from Singapore. This master planning exercise was also supported by the Royal Government of Bhutan and the Temasek Foundation of Singapore. The master plan development task took place from July to November 2013.



CHAPTER 2

EDUCATION ICT MASTER PLAN

2.1 VISION

"Quality education enhanced by ICT for a knowledge society"

Rooted in the principles of Gross National Happiness (GNH) and the core mission of the Ministry of Education, the goal of the Education ICT Master Plan is to leverage the power of ICT to enable and enhance the accessibility of quality education for all citizens of Bhutan.

2.2 DESIRED OUTCOMES

Through the Education ICT Master Plan, the Ministry aims to achieve the following outcomes:

- **Effective teaching and learning environment**

  An effective teaching and learning environment enabled by ICT allows greater collaboration among educators and learners, and which provides learners with a more personalised and active learning experience with the clear objective of guiding learners towards desirable learning outcomes.

- **Efficient educational administrative systems**

  Efficient educational administration and communication systems that are streamlined to inter-operate together at the enterprise level will enable greater work productivity and efficiency in the operations of the education sector, hence freeing up more time for educators and ministry staff to focus on delivering the core mission of MoE.

- **Motivated lifelong learners for the 21st century**

  A key goal of MoE is to promote lifelong learning through both formal and non-formal education in order to enable citizens to participate meaningfully and constructively in the society. To this end, ICT can serve as the key enabler by making education more accessible and engaging for learners of all ages so as to foster a culture of life-long learning in Bhutan and develop citizens ready to seize the opportunities of the 21st century.

2.3 STRATEGIC THRUSTS

The following three strategic thrusts form the roadmap for achieving the desired outcomes:

- *Enhance capacity building for students, educators and support staff and industry (iAble)*
- *Strengthen ICT integration into curriculum, pedagogy and assessment (iBuild)*
- *Enhance nation-wide education and learning ICT infrastructure (iConnect)*

The overall Education ICT Master Plan is summarised in the diagram below:

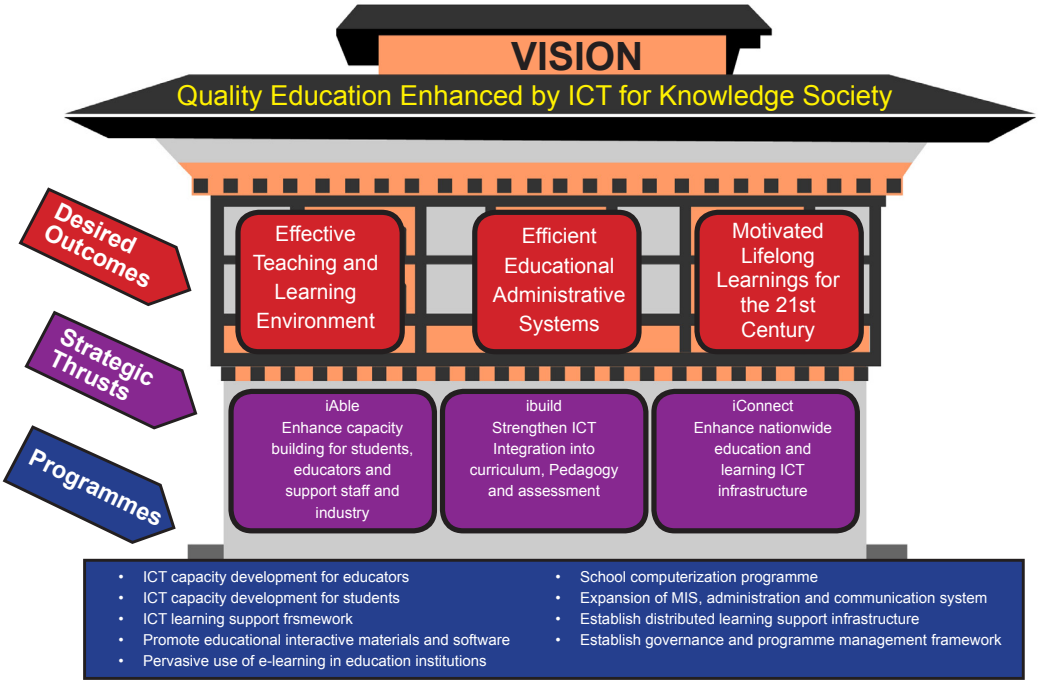


Figure 5: Overview of Education ICT Master Plan

2.4 EXPECTED KEY OUTCOMES BY THE END OF 2018

- 100% of students from class IV onwards trained in ICT
- 100% of teachers equipped to use ICT for teaching and learning
- 100% of ICT Laboratory Assistants trained to maintain schools' ICT laboratories and to help teachers with use of ICT in teaching and learning
- 15% of lessons taught in schools facilitated by use of ICT
- Students and educators able to access fully digitized textbooks enriched with interactive learning objects in at least 3 subjects
- All schools in Bhutan provided with computers at a ratio of 1:30 for primary schools and 1:10 for secondary schools
- 100% of students at higher learning institutions have email accounts and access to online learning
- All schools in Bhutan connected with Internet

2.5 EDUCATION IN 2018 - THE iSHERIG KHORLO

The diagram below seeks to illustrate the scenario of ICT in Education by 2018 through "pervasive connectivity in schools and homes".

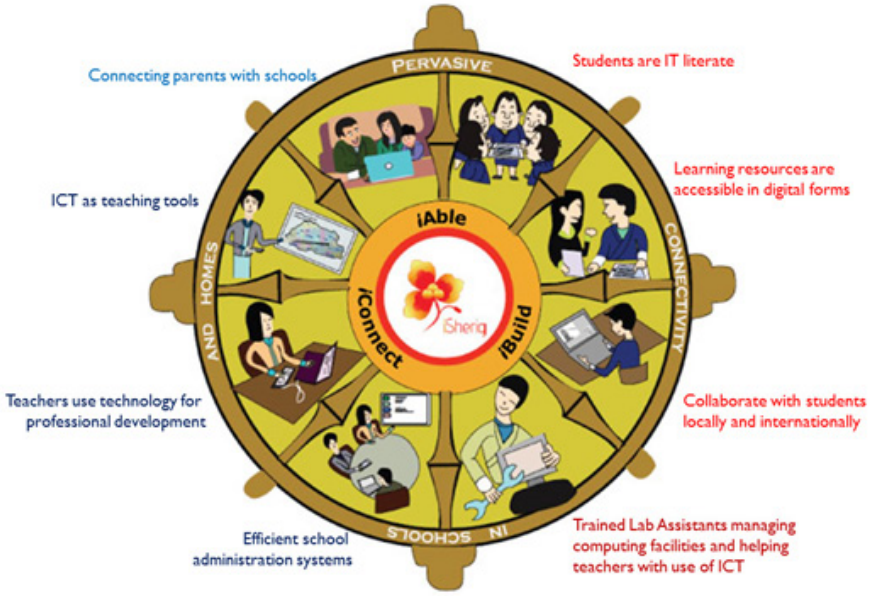


Figure 6: The iSherig Khorlo – Education in Bhutan in 2018

CHAPTER 3

PROGRAMMES AND PROJECTS IN iSHERIG

iSherig is a collection of many projects to be implemented over the next 5 years that will form Bhutan's push for "quality education enhanced by ICT". There are a total of 27 projects grouped into nine programmes under three thrusts in iSherig. They are summarized in the diagram below, which also forms the logo for iSherig.

- **'iAble'** *is the thrust that develops the participants of the education sector with the capacities and capabilities for the use of ICT for teaching and learning. This includes educators, students, ICT support personnel and the ICT industry.*
- **'iBuild'** *is the thrust that enables content and tools to become pervasive across the education sector to support teaching and learning in effective ways.*
- **'iConnect'** *covers the programmes and projects that will make ICT infrastructure and systems more widely accessible to the participants of the education sector.*

Collectively, these programmes will impact educational institutions, government agencies in the education sector and the community at large. These three groups of stakeholders are the jewels in the centre of the iSherig logo, representing Bhutan's desire to make treasures out of its people with the effective use of ICT through the projects that will be executed.


ICT Integration with curriculum
iBUILD
Making content and tools pervasive to support teaching and learning
Making InfoComm Accessible
iCONNECT
Making ICT widely accessible and developing systems to support education
Community
Education Institutions
Government
Developing Capacities
iABLE
Enabling the ICT capabilities of educators, students and ICT support staff

iSherig

3.1 'iABLE THRUST': ENHANCE CAPACITY BUILDING FOR EDUCATORS, STUDENTS AND SUPPORT STAFF

The 'iAble Thrust' comprises of three programmes with a total of ten projects. This aim to raise the ICT capacities of educators, students, support staff and the industry to a level that will allow more effective use of the ICT policies, infrastructure, systems, resources and facilities that will be made available through iSherig. Without adequate capacity building, even well designed policies and the most sophisticated technologies would not be able to achieve the desired education results.

The programmes and projects are listed below:

Programme 1.1 ICT Capacity Development for Educators	**Project 1.1.1** Enhance ICT as teaching tool in curriculum in the Colleges of Education
	Project 1.1.2 Enhance professional development of teacher in use of ICT in teaching
	Project 1.1.3 Establish structures to empower and recognise teachers in use of ICT
	Project 1.1.4 Develop e-learning programme for Non-Formal Education (NFE) instructors
Programme 1.2 ICT Capacity Development for Students	**Project 1.2.1** Review curriculum of computer studies subject
	Project 1.2.2 Develop comprehensive curriculum for ICT literacy
	Project 1.2.3 Develop cyber wellness in students
Programme 1.3 ICT Capacity Development for Learning Support	**Project 1.3.1** Establish professional development plan for ICT laboratory & other laboratory assistants
	Project 1.3.2 Develop framework for industry capability development
	Project 1.3.3 Establish educational technology expertise within the Royal University of Bhutan (RUB)

PROGRAMME 1.1 ICT CAPACITY DEVELOPMENT FOR EDUCATORS

Teachers are the key resource in the school system. To attain quality education which Bhutan desires, there is a need to raise the quality of teachers in the school. They determine whether technology is used appropriately and effectively. Appropriate use of ICT can catalyse the paradigmatic shift from teacher-centred pedagogy to more effective learner centred pedagogy. Capacity building of teachers as well as administrators and managers can play a major role in enabling this shift. Capacity building is not restricted to improving the ICT skills of the teachers but also to inspire them to exploit the potential of ICT in teaching and learning. There is a need to help them overcome the resistance to transit from old traditional teaching-learning methods to more effective ICT enabled methods where appropriate.

There are four projects in this programme which cover the training of pre-service and in-service teachers to establish the resources and organisational structures necessary to support educators in the effective use of ICT. A minimum level of ICT knowledge and skills in teaching and learning for teachers, ICT heads and supporting staff in schools will be provided through these projects.

While ICT can support new and innovative ways for formative and/or summative assessments, the priority of this master plan is to first lay the foundation for the pervasive use of ICT in teaching and learning. This will be an important area for MoE to consider in the next master plan. Nevertheless, through iSherig, teachers will be provided with tools and skills to assess using ICT.

PROJECT 1.1.1 ENHANCE ICT AS TEACHING TOOL IN CURRICULUM IN THE COLLEGES OF EDUCATION

The focus of teacher training colleges however should not be limited to training teachers on how to use ICT; rather it should provide teachers with skills required to use ICT in teaching and learning. A key ICT goal of all colleges of education should be that all teachers must have the knowledge and skills to use ICT and to integrate ICT into the curriculum and for assessing students' learning.

Important parameters that determine the success of ICT adoption in education

are the appropriateness of technologies, the suitability and quality of instructional materials and educational services made available, learning effectiveness and appropriation of new ways to teach using ICT. It is therefore important that these skills are taught to teachers at the pre-service stage so that they can be better equipped when they enter schools.

This project will define the skills required of pre-service teachers in using ICT in teaching and learning, and accordingly adjust the curriculum in the colleges of education.

Bhutan currently has three colleges of education at Paro, Samtse, and Centenary Institute of Education (CIE) at Yonphula, Trashigang. CIE currently caters only to in-service teachers. All pre-service teacher training programmes in Bhutan currently exposes trainee teachers to ICT as a compulsory subject. 'Functional ICT' (FIT) is taken by all trainee teachers. Paro College of Education has plans to replace FIT with a new module called 'Strategies for Teaching Using Computers' by 2014. Currently, FIT covers technical skills in the use of certain software and the Internet. However, many trainee teachers today come with basic ICT skills that are acquired in schools. Hence, colleges of education have found it more impactful to impart pedagogical skills on how to use ICT for teaching and learning rather than to teach ICT skills. The Royal Education Council (REC) is supporting CIE with ICT-enhanced pedagogy.

'Elective ICT' (EIT) is a course of study taken by trainee teachers who will teach computing as a subject in schools after graduation. The Paro College also plans to change one of the EIT modules into advanced programming as graduates have found that they need more exposure to JavaScript programming in order to teach at the class XI and XII levels. The Paro College has also recently initiated an exhibition for all EIT trainees to showcase their ICT projects. Useful multimedia learning objects and teaching ideas using ICT were presented. This application of ICT and pedagogical skills should be encouraged, with the possibility of having better learning objects curated by the Department of Curriculum Research & Development (DCRD) into its pool of electronic repository that all teachers can use.

The colleges of education constantly review their curriculum to ensure they remain updated to requirements. The colleges that offer courses for pre-service teachers are currently undertaking a major review of their ICT curriculum. This is

due to be completed by mid-2014, for implementation in 2015.

2013 - 2014	2015 - 2017
• Review curriculum to define ICT and use of ICT in teaching and learning skills required by all trainee teachers • Review curriculum to define ICT skills required by EIT trainee teachers	• Implement curriculum changes

No additional budget is required as this will be carried out by existing staff in the various colleges of education as part of their regular process to update curriculum.

Key measures of success for this project will include:

1. *Number of graduating teachers attaining the minimum ICT skills expected of teachers in Bhutan. The target is to achieve a rate of 100% for literacy with ICT for graduating teachers;*
2. *Number of graduating teachers able to demonstrate effective use of ICT in teaching and learning. The target is 100% of graduating teachers should be able to use ICT tools for teaching and learning;*
3. *Number of quality teaching and learning content created on ICT by trainee teachers through their projects. Such content can be collated through Project 2.1.1 for use by other teachers;*
4. *Ability of EIT graduates to teach computing subjects in schools.*

PROJECT 1.1.2 ENHANCE PROFESSIONAL DEVELOPMENT OF TEACHER IN USE OF ICT IN TEACHING

Continuous training and professional development of teachers in their ICT skills is important. The Chiphen Rigphel Project and other ICT training initiated by MoE for teachers have given every school teacher a basic ICT literacy. This forms a good foundation with which the Master Plan can build upon. The next phase is to empower teachers to use ICT as teaching tools in delivering their subjects. From time to time, it may also be necessary to update teachers with the essential ICT literacy skills on new technologies that they will find useful in their work.

There are several ways to achieve this, namely through organizing courses at

the central level or distributing training to be executed at the schools or at centres near the schools. However, giving another nationwide training is not economically viable. As such, devising a smarter way to bring training to the teachers is necessary.

Teacher Resource Centres

Given the geographical challenges of the country, the distributed approach is preferred. The 2012 In-service Education of Teachers (INSET) Master Plan of MoE has identified Teacher Resource Centres (TRCs) as the hub for providing professional development opportunities to teachers on a continuous and economically sustainable basis. As centres for professional development programmes, the TRCs are primarily used for conducting TRC Based In-service Programme (TRCBIP) for in-service teachers. In addition, teachers are able to access shared reference resources and office equipment that may not be available in their schools.

However, recent studies have highlighted a number of challenges in TRCs, such as the lack of operating funds, poor maintenance of resources and the lack of professional capacity of the TRC coordinators.

In an effort to revitalise the role of TRCs, MoE has developed a roadmap in the mid 2013 entitled "Road Map: Revitalization and Expansion of TRCs in Bhutan" (TRC Report). The TRC report envisages that a TRC shall be "a leading centre for continued professional development of teachers to enhance quality education".

In addition, the TRC report also proposed appropriate support structures and management system to ensure that the TRC can continue to function efficiently and fulfil its mandates. For example, it is proposed that

- TRCs will report to the new Professional Development Division (PDD) under the Secretariat of MoE.
- All TRCs will be supported by the Master Lead Teachers and the Cluster Lead Teachers, and the nearby schools will be attached to the TRC. Lead Teachers will operate out of and manage the Dzongkhag TRCs.

With this revitalised role of the TRC, it makes sense to leverage the potential of ICT to further enhance the capacity of the TRCs to achieve the core mandate of providing professional development opportunities for teachers. Professional development programmes appropriately infused with education technologies

will provide more engaging experience, allow greater peer collaboration and hence lead to better learning outcomes.

Learning through Practice

Programmes developed by the Professional Development Division (PDD) for in-service teachers should be designed with a blended mode of delivery in mind such that traditional face-to-face content and delivery is appropriately complemented with asynchronous and synchronous online learning activities and digital contents. For example, teachers can be encouraged to collaborate online with other teachers based at different TRCs or other locations using collaboration tools such as discussion forums, chats and wikis available on the nationwide e-learning platform.

Teachers should also be encouraged to take up projects and assignments involving the creation of digital contents which they can develop from readily available sources on the Internet. This way, teachers can apply the use of ICT in teaching and learning by actually going through the learning process themselves.

For ICT-enabled learning to take place, the TRCs must be equipped with the necessary equipment and infrastructure. Project 3.3.1 elaborates on the establishment of education technology standards for the TRC.

Development of PD Programme in the Use of ICT in Teaching

A comprehensive set of Professional Development (PD) curriculum should also be developed to impart the core knowledge and skills required for empowering teachers to use ICT in their teaching. PDD can use the teacher curriculum as a starting point to develop the new programme in collaboration with other organisations such as the Colleges of Education of the Royal University of Bhutan (RUB) and the private sector. In particular, under Project 1.1.1, there are similar initiatives targeted at pre-service teachers. Given that the end objectives are the same, there should be close collaboration between PDD and the Colleges of Education to ensure that both sets of curriculum are kept consistent with each other.

Master ICT teachers should be identified to be trainers for their peers in the area of ICT literacy skills and the use of ICT in teaching. There should be at least one

Master ICT teacher in each TRC, and the Master ICT teacher should be from a school near the TRC.

Beyond the traditional mode of workshop-based training, as a means of knowledge transfer, the Master ICT teachers can also serve as "champions" to help build a vibrant network of teachers, school leaders and ICT professionals to share their experience of using ICT in classrooms.

2014	2015	2016	2017	2018
Review and develop curriculum	Identify and train one teacher for each TRC to be Master ICT teacher	Roll out PD programmes to all TRCs	• Monitor and improve the curriculum. • Continuous upgrading of Master ICT teachers	

An annual outlay of Nu 0.5 million is expected to train Master ICT Teachers in ICT related curriculum to become effective guides to fellow teachers.

Key measures of success for this project will be:

1. *Number of trained Master ICT teachers;*
2. *Total number of teachers and training hours spent on professional development activities in ICT related subjects.*

PROJECT 1.1.3 ESTABLISH STRUCTURES TO EMPOWER AND RECOGNISE TEACHERS IN USE OF ICT

Another distributed strategy to extend the reach of ICT training is to work directly with them in their schools. This will necessitate each school to have a teacher responsible for ICT initiatives at the school level.

School ICT Heads and School-level Initiatives

Appointing a teacher who is tech savvy as the school's ICT head can enable every school to define and adapt an ICT implementation most suitable for the school. The role of the school's ICT Head can include, but not limited to:

a. Work with the different subject teachers and help them acquire the skills to utilize ICT in their lesson delivery and keep them updated with the changing trends in the digital teaching world. Training can be done by school's ICT

Head or to arrange for training from TRC or from MoE.

b. Work with other Heads of Department to monitor and assess the individual teacher's use of ICT in teaching. Effective monitoring and assessment system should be in place if a school needs to integrate ICT as a tool for effective teaching learning.

c. Oversee the school's ICT assets and track the usage to gauge the effectiveness in the use of resources.

d. Supervise the ICT Laboratory Assistants.

e. Be the point of contact for MoE in implementing iSherig initiatives in the school.

Some schools have, on their own initiatives, appointed teachers to be the ICT Heads. It is proposed that this practice be replicated all schools. The ICT Head can have a reduced teaching load in order to have more time to carry out the ICT initiatives. The Human Resource Division (HRD) of MoE, in consultation with DCRD and the Department of School Education (DSE) can spell out the job description for the school ICT Head and the types of skills needed in areas such as change management, integration of ICT into curriculum, implementation of ICT initiatives with other heads of department in the school. Principals should be briefed on the job description and guidelines on the selection of their ICT Heads.

School principals can work with the School ICT Heads to map out the plans to maximise the use of ICT in teaching and learning in the school including ICT training programmes for their teachers.

In-service Training Opportunities

In addition, selected ICT teachers can be given opportunities to pursue higher studies depending on the availability of sponsorship or budget. They can also sign up for distance learning courses to upgrade their skills. For example, the Royal Education Council (REC) had piloted a six-month online teaching programme with the University of Maryland with five teachers. REC is currently working on an ICT enhanced pedagogy programme in collaboration with University of Columbia in NY, USA, targeted at science and mathematics teachers for the

middle and higher secondary schools. REC will also explore the use of open source tools in schools. Professors from the University of Columbia will train master trainers in Bhutan to train other teachers. This group of master trainers and teachers will then be sent to the TRC or schools to benefit different cluster of schools.

Professional Learning Teams

The In-service Education of Teachers (INSET) Master Plan 2012 recommended to adopt Professional Learning Teams (PLTs) as one of its 10 key strategic areas of focus for teacher development. A PLT is a group of teachers who come together to share interest in a common education field. They will exchange ideas of practices through seminars, workshops, and structured observation sessions, guided by Master Lead Teachers and Lead Teachers who are more experienced in the field. INSET Master Plan recommended that every teacher must join at least one PLT. Therefore, it will be timely to establish a PLT for ICT in teaching and learning. As proposed in Project 1.1.2, Master ICT teachers based in the TRCs can be the "champions" to develop the PLT for ICT.

The proposed milestones are as follows:

2014	2015
• Develop detailed job scope of and KPIs for School ICT Heads. Organize communications through briefing sessions for principals and appoint ICT Heads by last quarter of 2014 • PLT: Establish a track in ICT in teaching and learning	• Move into operational mode and monitor progress of School ICT Heads and the impact of their efforts • Monitor participation and effectiveness of PLT's ICT track

A budget of Nu 2.5 million is suggested for the purpose of training of the ICT Heads to enable them to be more proficient in their roles. This is based on Nu 5,000 per ICT Head for around 500 schools.

No additional budget is required for the PLT on ICT in teaching and learning as this will be part of the budget for PLT in the 11th FYP.

Key measures of success for this project will include:

1. *Number of ICT Heads appointed by the schools. The aim is to appoint an*

ICT Head in every school that has been provided with at least a computer laboratory;

2. *Level of ICT implementation in schools measured against standards defined by MoE;*
3. *Number of teachers participating in the ICT PLT;*
4. *Frequency of activities in ICT PLT.*

PROJECT 1.1.4 E-LEARNING FOR NFE INSTRUCTORS

Non-Formal Education (NFE) was started in 1991 to provide lifelong education opportunities to adults who had missed out on formal schooling. It is managed by the Non-Formal and Continuing Education Division (NFCED) under the Department of Adult and Higher Education (DAHE) of the MoE. As of 2013, there are 885 NFE centres catering to 9,628 learners who are enrolled in basic literacy and post literacy programmes in *Dzongkha* (the National language). Functional English programmes were introduced in 2012.

NFE instructors are typically school educators who sign up to teach in the evenings after work. Currently, new NFE instructors are recruited whenever there are NFE centres requiring new Instructors or to replace NFE instructors who have resigned. Training for new instructors is typically conducted half yearly to fully prepare them to teach in NFE centers. Hence, there is often a gap between the time a new instructor undergoes training and starts to teach.

E-Learning has the ability to bridge this gap. As NFE instructors are usually school teachers, many of them may have access to the computer and the Internet from home or from their school. NFCED can put up essential notes and teaching plans for NFE instructors online. NFCED can also record key parts of training conducted for new instructors in the video or audio format and make these available to new instructors. In this way, new instructors can undergo self-learning if they have to teach before undergoing the 6-monthly face-to-face training. In addition, the face-to-face training session could potentially be shortened if trainees have first studied the online content posted by NFCED.

Under Project 3.3.2, Community Learning Centres (CLCs) across the country can be further equipped with learning technologies and wherever feasible, CLCs could be co-located with Community Centers (CCs) to avoid duplication of services. NFE instructors may use these CLCs/CCs for self-learning. Relevant

contents can also be loaded onto the tablet computing devices so that new NFE instructors can borrow for self-learning.

It is recommended that a study be first conducted to identify the courses with the greatest need for training of new NFE instructors and the suitability of training programmes of NFE instructors to be made into e-learning form. The study can take place in first half of 2017, with development of materials in second half of 2017 and rollout of the e-learning programme from 2018.

The proposed milestones are as follows:

2017	2018
• Take stock of current courses and identify most suitable courses to create e-learning content for NFE instructors. • Develop e-learning materials.	• Roll out e-learning programme for NFE instructors for selected courses.

The estimated budget for development of content is Nu 2.0 million (Nu 0.2 million per course and total of 10 courses) and an annual maintenance cost of Nu 1.0 million to keep the courses updated or to create new content.

Key measures of success for this project will include:

1. *Number of e-learning courses created for training NFE instructors;*
2. *Number of e-learning participants in the project.*

PROGRAMME 1.2 ICT CAPACITY DEVELOPMENT FOR STUDENTS

Under the MoE curriculum, ICT as a subject was initially taught from class IX and above. From 2010, the Chiphen Rigpel Project introduced basic ICT literacy from classes VII-XII as a general subject for all students with 32 periods of ICT lessons a year per student. In addition, for classes IX and X, Computer Application is an elective subject offered to students with interest and aptitude for computing. Students can further opt for Computer Studies which cover advanced computer programming and computing concepts in classes XI and XII.

There are three projects in this programme. They are designed to update the existing courses taught in schools with relevant technologies. A project will be

initiated to help students use the Internet and computers safely from an early age to be consistent with the goals of GNH.

PROJECT 1.2.1 REVIEW CURRICULUM OF THE COMPUTER STUDIES SUBJECT

There has been strong interest in computing as a subject of study taught at classes XI and XII. In 2012, a total of 1246 students took the Board examination administered by Bhutan Council for School Examinations & Assessment (BCSEA) for this subject.

MoE has already identified the need to revise the ICT/Computing curriculum for classes IX to XII and has embarked on developing a new curriculum. Classes XI and XII elective computing subject will be updated to include technologies and skills that are relevant to current job market and for higher studies in ICT.

Computing is a hands-on subject. The curriculum can also include practical projects that will require students to work individually and collaboratively to create contents and applications such as websites or mobile apps. Good projects can be showcased to promote innovation and creativity amongst new generation of Bhutanese youths. Annual ICT competitions for best projects by students could be organised by MoE in collaboration with sponsors.

The current curriculum review which had already commenced is expected to be completed in 2014.

2014	2015	2016
• Review elective ICT curriculum for class XI and XII.	• Redesign elective ICT curriculum for class XI and XII. • Teacher orientation.	• Implementation and monitoring • Organise annual computing project competition.

This project will be undertaken by DCRD using existing manpower resources. A budget of Nu 4.0 million is required to pay allowances to teachers involved in

curriculum development and to conduct teacher orientation for all existing in-service ICT teachers and pre-service EIT trainee teachers. Budget for ICT project competition may be secured through external sponsors.

Key measures of success for this project will include:

1. *Number of good ICT projects created by students;*
2. *Attainment of minimum ICT standards expected of computing students;*
3. *Ability of graduating computing students to apply their skills in the workplace.*

PROJECT 1.2.2 DEVELOP COMPREHENSIVE CURRICULUM FOR LITERACY WITH ICT

Literacy with ICT currently starts from classes VII to XII through the Chiphen Rigpel Project. With plans to provide computers to primary schools in the 11th FYP, it is recommended to provide literacy with ICT from classes IV to X for all students.

There are overlaps in the contents of Chiphen Rigpel Project's literacy programme and DCRD's computer elective subjects as follows:

a. Computer fundamentals b. Network basics c. Office application (Word/ Excel/ PowerPoint/ Access) d. Internet	Classes IX and X
e. HTML and Java Script f. Advanced office application (Word and Excel)	Classes XI and XII

DCRD has identified these overlaps and has started the development of new ICT curriculum framework which also covers the literacy component from classes IV to X. The existing elective Computer Applications subject offered for classes IX and X will be discontinued. When Chiphen Rigpel Project ends in 2015, MoE will implement its new literacy with ICT curriculum from classes IV to X in phases. Besides technical skills, the new curriculum will include ethics in use of ICT such as cyber safety, plagiarism and responsible use of computers.

- Ongoing development of textbooks

- Teacher orientation and implementation from class IV
- Ongoing monitoring

2014	2015	2016
• Develop ICT curriculum framework	• Develop textbooks • Hire new ICT teachers to cover shortfall	• Ongoing development of textbooks • Teacher orientation and implementation from class IV • Ongoing monitoring

This project will be undertaken by DCRD using existing manpower resources. A budget of Nu 6.0 million is required to conduct training and orientation on new curriculum for all existing in-service and pre-service ICT teachers.

There will be a need for ICT teachers at classes IV to VIII. This requirement could be met with the recruitment of ICT instructors currently employed by Chiphen Rigpel Project. MoE could also look at training existing teachers in the schools to teach the course.

With the implementation of new literacy with ICT programme, there will be an additional of about 426 primary schools (PS) and lower secondary schools (LSS) requiring ICT teachers from 2016. This may require an annual budget of Nu 77.0 million (assuming average salary of Nu. 15,000 per ICT teacher who are not necessary at the graduate level) to recruit addional ICT instructors. However, fewer instructors may be needed if existing teachers are trained to teach new curriculum for the lower classes.

Based on the table below, we assume literacy with ICT classes will be introduced to all LSS and some PS in 2016. By 2018, all schools will have the programme. We further project that most of the training can be executed by existing teachers. Hence, we estimate that only 25% of the programme will be taught by instructors with a budget of Nu. 42.12 million from 2016-2018.

Year	2014	2015	2016	2017	2018
New implementation			200	110	116
Total new schools			200	310	426

Year	2014	2015	2016	2017	2018
Manpower cost @ Nu 180,000 p.a.			36,000,000	55,800,000	76,680,000
Contract cost @ 20%			7,200,000	11,160,000	15,336,000
Contract cost @ 25%			9,000,000	13,950,000	19,170,000
Contract cost @ 30%			10,800,000	16,740,000	23,004,000
Contract teachers @ 25%			50	78	107
Cost at 25% over 3 years					42,120,000

Table 6: Projection of literacy with ICT programme implementation

Key measures of success for this project will include:

1. *Number of students attaining a minimum literacy with ICT skill level;*
2. *Number of students receiving regular literacy with ICT training in schools. The aim is to have 100% of students having 32 periods of ICT lessons a year from class IV onwards;*
3. *Ability of school leavers to apply their ICT skills in the workplace.*

PROJECT 1.2.3 DEVELOP CYBER WELLNESS IN STUDENTS

Countries with high Internet penetration and ICT literacy rates face the challenges of dealing with harmful online behaviours such as accessing inappropriate content, excessive time spent on computers, engaging in illegal activities and cyber bullying. The anonymity of the Internet gives perpetrators the perception that they can get away easily compared to similar physical acts.

Children will have more time and opportunities to be online. They are especially vulnerable as they can be easily influenced. These harmful behaviours will go against the principles of GNH. Hence, it is important to devise strategies to deal with this even as the country moves ahead to provide ICT skills to its citizens and improve on the ICT infrastructure.

Cyber wellness refers to the wellbeing of Internet users. It involves an understanding of the risks of harmful online behaviours, an awareness of how to protect oneself and other Internet users from such behaviours. While children can be taught in schools, there is also the need for various stakeholders and a

nationwide effort to make the programme effective.

DCRD will establish curriculum and engagement programme in cyber wellness for all students as part of their literacy with ICT programme, as well as a holistic approach to involve other stakeholders. DCRD will also support the Department of Information and Media (DoIM) of the Ministry of Information and Communications (MoIC) to implement awareness programmes nationwide. DoIM could also produce multimedia and short videos to create awareness on cyber wellness.

2015	2016
• Develop cyber wellness programmes.	• Train teachers and rollout programmes.

This project will be undertaken using existing resources at DCRD. No additional budget is required.

PROGRAMME 1.3 ICT CAPACITY DEVELOPMENT FOR LEARNING SUPPORT

The three projects under this programme look into the supporting framework for effective use of ICT in education through equipping the support personnel in schools and at RUB as well as to enable the private industry to support the goals of iSherig.

PROJECT 1.3.1 ESTABLISH PROFESSIONAL DEVELOPMENT PLAN FOR ICT LABORATORY AND OTHER LABORATORY ASSISTANTS

ICT Laboratory Assistants

As Bhutan progresses into the 21st century and integrates more ICT into the teaching and learning, access to a computer and the Internet is important. For many students and even teachers, the computer laboratory is the only place to access these facilities. Therefore, a fully functional laboratory is important to every school.

ICT Laboratory Assistants are the driving force behind the efficiency of the ICT

infrastructure in schools. Their knowledge and skills have a direct influence on the functioning of computer laboratories in schools. However, many of the computer laboratory assistants were employed as general laboratory assistants and assigned by their schools to take on the role of computer laboratory assistants. Recent ICT Laboratory Assistants are recruited based on their ICT skills but they are not specifically trained to support teachers in use of ICT for teaching and learning.

Many of the ICT Laboratory Assistants in the field are self-trained on the job. Formal trainings were provided to only a few on specific ICT skills. The lack of the necessary technical skills translates into the computer laboratory being not properly maintained and utilised.

The following are programmes that can be provided to ICT Laboratory Assistants before they are formally appointed, and the same can be administered to in-service ICT Laboratory Assistants through the School Based In-service Programme (SBIP).

1. **Hardware Maintenance Training**: ICT Laboratory Assistants must have the ability to diagnose basic hardware problems and perform maintenance.
2. **Software Installation and Troubleshooting**: They can be trained to install software and fix common software issues.
3. **Network and Internet**: ICT Laboratory Assistants can be trained to set up and maintain the network to ensure a reliable and consistent Internet access.
4. **Content Building and Training**: ICT Laboratory Assistant can also assist teachers in developing digital content material for their subjects or help and train teachers to use certain software to develop content. More promising ICT Laboratory Assistants may also be put on an instructional design course where they can learn the basics of content development to help teachers.

Other Laboratory Assistants

Other laboratory assistants working fulltime in the Geography, Biology, Chemistry and Physics laboratories are a potential group of people who can also be trained in use of content development tools to assist teachers in developing ICT enabled lessons.

The proposed milestones are as follows:

2014	2015	2016
• Develop curriculum for training • Training of 30% of existing ICT laboratory assistants on the hardware and software maintenance and management, and on key software for content creation used by teachers	• Review and adjust curriculum • Training of 50% of existing ICT laboratory assistants on the hardware and software maintenance and management, and on key software for content creation used by teachers	• Training for all remaining 20% of ICT laboratory assistants • Training for all remaining 20% of other laboratory assistants
• Training of 30% of laboratory assistants from other subjects on key software for content creation used by teachers	• Training of 50% of laboratory assistants from other subjects on key software for content creation used by teachers	

A budget of Nu 30.0 million has been allocated for the training of ICT laboratory assistants and other laboratory assistants in the 11th FYP.

Key measures of success for this project will include:

1. *Number of laboratory assistants trained. 100% of ICT laboratory assistants should be trained through this project;*
2. *Effectiveness of laboratory assistants in their work through survey with heads of department in schools and with principals.*

PROJECT 1.3.2 DEVELOP FRAMEWORK FOR INDUSTRY CAPABILITY DEVELOPMENT

Sustaining ICT development in the education sector in any country is a long-term and continuous endeavour. The effort by the government alone may not be sustainable. While the government can make the initial investment into building up the ICT capacity within the public sector, the involvement of a viable private sector is equally important to support the development, the mandate of which is assumed under the Private Sector Advisory Panel under the e-Gov Governance structure.

Therefore, it is vital for the Royal Government of Bhutan (RGoB) to take a strategic view and invest in the development of the ICT industry in Bhutan which will in turn help to support and sustain the e-Government and ICT development initiatives of RGoB. The Bhutan e-Government Master Plan had proposed to develop "ICT as a Key Enabler for Sustainable Economic Development". Under this track, following strategies and principles were identified:

3G: Strategies for ICT Industry Development

1. Grow Bhutanese capabilities based on selected niche technologies and business drivers;
2. Groom Bhutanese ICT manpower and enterprises by leveraging industry partnerships; and
3. Generate demand and accelerate adoption of ICT.

The recommended principles for development of the ICT industry are:

1. Establish a definite role for ICT industry development;
2. Take a focused approach and identify niche areas;
3. Leverage partnerships when developing capabilities;
4. Boost the domestic demand for ICT.

In the 11th FYP, MoIC will drive the implementation of this strategy through various programmes. These programmes are generally broad-based and non-domain specific. Since these initiatives will benefit the education sector, it is recommended that MoE partner with MoIC on specific projects that are relevant to the education sector. Some potential areas of MoE-MoIC collaboration include:

1. ICT Manpower Development

The education sector form the key demand for specific ICT professionals such as instructional designers and interactive content developers, which may not be the primary focus area for MoIC. Therefore, MoE can partner with MoIC in targeted talent development programmes for these type of professionals. MoE can also collaborate with the Royal University of Bhutan (RUB) and Technical and Vocational Training Institutes under the Ministry of Labour and Human Resources (MoLHR) in the capacity development of those talents, targeting

both full-time students and adult learners who are seeking to upgrade their skills and qualifications.

2. Demand Generation

The execution of iSherig will generate demand for ICT products and services in a big way. MoE will need to strike a balance between 'Build' or 'Buy' by allowing the private sector to supply products and services instead of completely relying on internal resources to develop in-house. Through proper acquisition planning, MoE can aggregate demand through programmes such as bulk tenders and hence generate substantial interest from the industry vendors.

3. Grants and Incentives

Under the e-Government Master Plan, MoIC intends to develop an incentive mechanism in the form of grants to encourage take-up and support capacity building. These incentives cover the areas of manpower, technology development and industry collaborations.

MoE can co-own or take the lead on grants that are relevant to the education sector. For example, MoE can offer grants to private sector firms that are keen to work with schools on innovative ICT projects or projects that allow schools to better leverage the infrastructure that MoE will develop under the Education ICT Master Plan. Sponsorships from private conglomerate or from overseas can be secured to drive some of the grants.

In the development of grant programmes, it is important that eligibility requirements for the applications are designed to benefit local enterprises and local citizens.

MoIC intends to rollout grant programmes and ICT manpower development initiatives in First Year (2014). Inter-ministerial joint task force should be set up within 2014 so as to maximise synergy and the effectiveness of the programme.

The planning will be done with existing manpower within MoE. Funding for grants will depend on programmes to be devised or availability of such funds from external agencies. Hence, no additional budget is anticipated in the meanwhile.

2014	2015 - 2018
• Formulate plans to develop the industry • Secure funding for grants and industry development • Hold industry briefing to update on plans involving private sector • Launch projects that require public-private partnership	• Review progress and adjust plans • Launch more projects and grants

Key indicators to track the success of this initiative include:

1. *Number and total value of grants disbursed;*
2. *Successful completion of projects supported through grants;*
3. *Number of ICT professionals who benefited from MoE Talent Development programme;*
4. *Number and total value of ICT tender awarded to the industry, particularly to the local enterprises.*

PROJECT 1.3.3 ESTABLISH EDUCATIONAL TECHNOLOGY EXPERTISE WITHIN RUB

RUB has implemented its Virtual Learning Environment (VLE) since 2011. The system is now in use across all RUB colleges. Today, many of the lecturers and students in RUB colleges are familiar with the technical aspects in the use of VLE.

RUB at the moment has a VLE Coordinator and VLE administrator directly reporting to the Dean of Academic Affairs. The challenge faced at the moment is designing and developing of content using multimedia tools. RUB plans to develop expertise in ICT pedagogical approach within the 11th FYP.

The next stage for RUB is to acquire the instructional design and multimedia development expertise into an in-house Education Technology Team. This team of professionals can assist lecturers to develop teaching and learning contents and support the use of ICT. Duties for the RUB Education Technology team can include:

- *Provide appropriate support in instructional design, learning technologies, web development and evaluation of e-learning initiatives in RUB;*

- *Support the integration of technologies into innovative, student-centred and enquiry-based approaches to learning.*

Initially, a team comprising one instructional designer and two multimedia developers can be formed in one college. RUB can secure volunteer lecturers across various faculties and colleges who wish to have more innovative and effective use of ICT in their lessons. They can be the initial pilot group to work with the Education Technology Team. Thereafter, the Education Technology Team can be expanded to all colleges based on the learning experience from the pilot.

This project can commence in early 2015 with the hiring for the Education Technology Team and identification of the pilot batch of lecturers to work with.

2015	2016 - 2018
• Define job scope • Hire team • Secure lecturers for pilot projects • Commence piloting	• Evaluate success of pilot and determine rollout in other RUB colleges

A one-time equipment and software budget of Nu 0.15 million and yearly recurring budget of Nu 0.6 million is anticipated for each Education Technology Team for creation of content.

3.2 'iBUILD THRUST': STRENGTHEN ICT INTEGRATION INTO CURRICULUM, PEDAGOGY AND ASSESSMENT

Quality curriculum is at the heart of quality education. Teacher quality, infrastructure and organizational culture are other agents that determine the quality of education. In this age of information, knowledge is power, and ICT a potent tool to harness this power. ICT provides a potent enabling technology to enhance and enrich traditional teaching and learning.

Children born this century is growing up in a digital world which Prensky (2001) describes as the "net generation" or "digital natives". In contrast, their parents are labelled "digital immigrants". According to Yelland (2001) traditional educational environments do not seem to be suitable for preparing learners

to function or be productive in the workplaces of today's society. She urges educational institutions to incorporate the use of new technologies in schools to prepare their students for life in the 21st century.

Teachers will need to relook traditional pedagogy in schools to realise the potential of ICT for learning or risk ICT programmes becoming expensive add-ons. Schools must build on the foundation that ICT allows today's digital natives to communicate, collaborate and learn in different ways. Schools need to integrate ICT into regular teaching and learning, and this necessitates change in school curriculum to make the classrooms more engaging.

In a student-centred learning environment in this 21st century, students can become active players in their own learning, working together on a project as a team, rather than be passive receivers of knowledge. Students today also learn through exploring appropriate resources and information.

Hence, the two programmes and six projects under the 'iBuild thrust' seek to make teaching and learning more effective by making electronic resources, tools, software and systems more accessible and to cater to how students learn in today's age of technology.

Programme 2.1 Promote Educational Interactive Materials and Software	**Project 2.1.1** Establish a plan for acquiring electronic resources and tools for learning and assessment
	Project 2.1.2 Digitize school textbooks
	Project 2.1.3 Subscription to online databases
	Project 2.1.4 Enhance teacher plans and textbooks with use of ICT
Programme 2.2 Pervasive Use of E Learning in Education Institutions	**Project 2.2.1** Establish E-learning platform for learning institutions
	Project 2.2.2 Drive adoption of Virtual Learning Environment at RUB

PROGRAMME 2.1 PROMOTE EDUCATIONAL INTERACTIVE MATERIALS AND SOFTWARE

The web has a vast number of electronic resources (e-resources) useful for instructional purposes. Electronic resources can make accessing information for teaching and learning and other purposes more efficient and convenient. The integration of ICT in education requires the support of good e-resources.

There are many web portals that contain teaching ideas, lessons and curriculum materials. The vast store of e-resources on the Internet, once evaluated, enable teachers, librarians, and teacher educators to augment severely limited resources at minimum or no cost, and to keep current with the latest educational theories and practice. Some useful free e-resources include:

- *Wikipedia*
- *Google Books*
- *Khan Academy*
- *Project Gutenberg*
- *UNESCO Bangkok's web portal for teachers and UNESCO Bangkok's e-Library*
- *The Gateway to 21st Century Skills*

The four projects that have been proposed in this programme aim to generate useful new content aligned to Bhutan's education needs, acquire essential and relevant content and to drive the effective use of customised and free electronic resources.

PROJECT 2.1.1 ESTABLISH A PLAN FOR ACQUIRING ELECTRONIC RESOURCES AND TOOLS FOR LEARNING AND ASSESSMENT

Free and acquired e-resources and tools will play an important part in iSherig. There are already collections of e-resources and tools by various organisations in Bhutan, such as Rigsum Sherig collection, NIIT CD-ROMs collection, BCSEA resources, ECCD collection of materials, and those by DCRD, MoE. In the colleges of education, EIT trainee teachers use free software tools such as Google Docs,

Google Map, Audacity, Story Bird, SimCity, and many more to make teaching and learning content for their projects.

It will be useful for MoE to initiate a project to gather and consolidate these and other e-resources. A process can also be put in place to guide and encourage the acquisition of new contents and tools in the future.

DCRD which drives the curriculum development for the schools can lead the development of this framework to identify relevant e-resources that can be useful to the teaching of the academic curriculum. And also make recommendations on how these resources may be leveraged by teachers in schools. As this becomes more prevalent, DCRD should also establish a framework that educates teachers on what constitutes good content, how to leverage and contribute to the development of good content, ethics on the use of such content including intellectual property rights, how to distribute the content and how users can give feedback on the content.

In establishing the plan for acquiring and distributing content and tools, DCRD could adopt industry best practices. This framework could also guide the partnership with industry to create new content in Project 1.3.2. Some of the principles and guidelines in accessing electronic resources could be:

- *Security and access controls*
- *Digital rights management and intellectual property rights*
- *Information sharing*
- *Searchability*
- *Quality and reliability*
- *Age and gender appropriateness*
- *Consistency*

The age suitability of the content can start from ECCD. Special consideration can also be given to content and tools for learners with special needs.

As part of this effort, training is essential so that the people designated to manage or administer the resources can utilize industry best practices and standards to better deliver on their roles.

MoE can also explore partnerships with organisations to convert suitable contents into digital form. For example, the Bhutan Broadcasting Service (BBS) owns educational content such as documentary shows that may be relevant to subjects such as Geography, Science, History and Agriculture. BBS is willing to share these materials with MoE to be made into learning resources. BBS is also willing to provide its recording studio and crew to co-create content with MoE to be screened on free-to-air channels during the off-peak times.

In addition, BCSEA has a rich collection of past examination questions, model answers and good answers from previous years' top students. These are also available for content creation. MoE could explore partnerships with other agencies and overseas partners on projects where MoE can add value through its pedagogical expertise to generate new content relevant for Bhutan.

The proposed milestones are as follows:

2014	2015 - 2018
• Develop plan • Acquire content and tools • Devise method to distribute content and tools to educators and schools • Form partnerships	• Ongoing development based on plan

A budget of Nu 26.0 million has been allocated for DCRD from the 11th Plan that could be utilized in part and in conjunction with Project 2.1.2. In view of the more ambitious implementation recommended in iSherig for both projects, the master plan team recommends an additional budget of Nu 14.0 million for both projects.

PROJECT 2.1.2 DIGITIZE SCHOOL TEXTBOOKS

Increasingly publishers are jumping into the digital textbook market but most are simply digital representations of books in PDF. Digital textbooks as described here is more than exact digital replication of printed books. EdSurge termed 'digital textbooks' as "electronic books which are stored, accessed and managed on computer or web-based tools. Some are simply digitized versions of print textbooks, others incorporate interactive features and are optimized for

different platforms."

Digital textbooks provide obvious ease of portability, and their inherent ability to embed multimedia learning resources is a powerful advantage over the conventional textbooks. However students must have access to computers and high speed Internet to reap the benefits of digital textbooks.

As mentioned earlier, today's students are digital natives and it becomes exciting and easier for them to learn using technology. In traditional classroom practices, lesson preparation puts a huge burden on teachers. With multimedia objects embedded in digital textbooks, teachers save time on preparing teaching and learning resources. Formative assessments can be tailored to the needs of the students and can be conducted immediately. Questions from BCSEA and model answers can be made into interactive multimedia form to be inserted into the digital textbooks. Video contents from BBS or animations from external sources approved to be used and distributed in Bhutan can be inserted into these digital textbooks too.

In this proposal, digital textbooks are not meant to replace the printed textbooks, but to provide a richer learning environment for students and teachers, provide updates and rectification of content if necessary and to better support the learners with special needs.

The existing school textbooks of Bhutan are wholly print-based. Although some are made available online in the digital format, they are merely static PDF versions of the printed textbooks. Except for some textbooks for middle and higher secondary classes, the intellectual property (IP) rights of textbooks belong to the Ministry of Education, which eases the process of conversion to digital textbooks. DCRD and NFCED are the two agencies responsible for developing books for schools and NFE centres respectively. At present, some early initiatives include the use of web-links in textbooks for the Science curriculum. There are plans to extend similar initiatives to the Mathematics curriculum in 2014.

People involved in producing digital textbooks must be familiar with the digitization process as described in earlier paragraphs and the use of authoring tools. In addition, they must also be cognizant of the need to make digital resources equally accessible to learners with special needs. This can be approached as follows:

1. Subject Curriculum Officers or Programme Officers of the above two agencies aggregate and curate electronic resources as per the requirements of their subject content or topic. They will require training on how to use appropriate tools for aggregating and curating resources.
2. Having a group of instructional designers and multimedia developers to support subject experts to create digital textbooks in the format usable by students and teachers. Appropriate multimedia software and authoring tools for digitizing textbooks must be identified and acquired for use by this group of people. Use of specialized software and skills may be necessitated for digitizing Dzongkha books.
3. Due considerations must be given to ensure that the textbooks are accessible to learners with special needs especially the visually impaired and the hearing impaired. This not only means digital textbooks have to be accessible by text to speech reading software such as JAWS (Job Access With Speech) but are also available in other accessible format such as audio books, video lessons with subtitles, etc.
4. In terms of readiness, the digitization of textbooks can start with Science, Mathematics and English in phased manner. These are the subjects where the new curriculum reform has taken place and therefore no major content changes are anticipated for several years. There are two options to go about doing this. All these subjects can start in parallel starting from the primary level, or start with one subject and complete it for different classes. The implementation in schools may be carried out in two phases: first, a pilot can be conducted in selected schools and later, roll out to all schools. The resources can be made available both online and offline.

Although this is an on-going long term project, some milestones are identified as a monitoring mechanism to check the progress of the project and to provide timely remedial supports. Milestones over the five year period are provided in the table below.

Piloting the digital textbooks in selected schools is a goodway to test the products and the acceptance level of schools. The feedback from it will provide a sense of how accepting the students and teachers are of such a change. The most important measure of success is how well these digital textbooks are integrated in classroom practices. The ICT skills of teachers and students, quality of Internet and availability of computers are other factors which can hinder the

successful use of digital textbooks in classrooms.

2014	2015	2016	2017	2018
Training of subject experts to digitization process	Creating digital textbooks for Secondary Mathematics and Secondary Sciences	Creating digital textbooks for Primary Science and Secondary English	Creating digital textbooks for Primary Mathematics and Primary English	Creating digital textbooks for Dzongkha
	Teacher orientation and pilot testing of digital textbooks in selected schools	Rollout digital textbooks to all schools through CD, tablets and online		
Creation of in house team of instructional designers and multimedia developers				

A project will share the proposed Nu 40.0 million budget with Project 2.1.1.

Key indicators to track the success of this initiative include:

1. *Number of digital textbooks created;*
2. *Number of interactive multimedia, videos and animations added to digital textbooks;*
3. *Usage of the digital textbooks.*

PROJECT 2.1.3 SUBSCRIPTION TO ONLINE DATABASES

Access to the global wealth of knowledge in the form of research journals, reports and scholarly papers is a key enabler for researchers to carry out quality research work. Recognizing this, RUB has expanded access to online databases for their academic staff and students over the years. Currently, the university subscribes to ProQuest, an online database, to supplement limited library collection of colleges and to provide access to up-to-date publications. The University is also exploring other free online databases such as Directory of Open Access Journals (DOAJ). In addition, the colleges have also subscribed to some online databases such as Journal Storage(JSTOR) and Access to Global

Online Research on Agriculture(Agora). Details of subscription by the colleges are as given in the table below:

Colleges	List of online journals and databases used
College of Natural Resources	ProQuest
	Agora
	DOAJ
Sherubtse College	ProQuest
	JSTOR
	DOAJ
Samtse College of Education	ProQuest
	DOAJ
Jigme Namgyal Polytechnic	ProQuest
	DOAJ
Institute of Language and Cultural Studies	ProQuest
	DOAJ
College of Science and Technology	ProQuest
	DOAJ
Gaeddu College of Business Studies	ProQuest
	DOAJ
Paro College of Education	ProQuest
	DOAJ

In addition, the availability of various free online databases and journals are being explored to be made available to the staff and students.

Under RUB's 11th FYP, the university plans to expand access to online research databases for the various colleges to ensure that each college has access to at least two database systems. RUB has a budget of Nu15.0 million for capital outlay for this plan.

In collaboration with RUB, the Department of Information Technology & Telecom (DITT) of MoIC also plans to establish Druk Research and Education Network (DrukREN) in the country in 11th FYP.

MoE could also tap on the RUB's subscription and other new initiatives such as DrukREN to be used by teachers and students.

PROJECT 2.1.4 ENHANCE TEACHING PLANS AND TEXTBOOKS WITH USE OF ICT

Information is growing at an exponential rate in today's world. ICT can support teaching and learning by providing access to different sources of information beyond what is taught by teachers. It provides tools for online communication and collaboration. It can break the monotony of traditional pedagogy and provide a variety to teaching and learning.

Today's students, the digital natives, come to school with very different experiences than that of the digital immigrants. Schools now need to adapt to the current needs of students and identify new and engaging learning. Assessments, likewise, have not kept pace with new modes of working, and must change along with teaching methods, tools, and materials (Horizon Report, 2009). Hence, this project aims to update teaching plans and textbooks where appropriate with suggested good use of ICT tools and resources.

In recent years, DCRD has taken steps to integrate ICT into curriculum. For example, training teachers on the use of Geometers' SketchPad and GeoGebra for the teaching of Mathematics and incorporating web links in textbooks for teaching Science. There is a need to expand and strengthen ICT integration in all subjects. Paro College of Education is also in the process of replacing the Functional ICT Module (FIT) with Strategies for Teaching Using Computers by 2014.

The aim of this project is to help all teachers use ICT as an "enabling" tool in teaching and learning. Some examples to understand the integration of ICT into teaching subjects are provided below:

- **Language**: Listening and speaking skills can be enhanced by using recorded materials played through computers or other ICT mediums. Children will learn to use appropriate voice levels, articulation and body language, gestures and eye contact by watching audio video contents.
- **Science**: Formulate questions or hypotheses that can be investigated scientifically using Internet research to identify problems or by using interactive learning objects for students to experiment with different

parameters to observe the simulated effects.

- **Mathematics**: Construct suitable data displays such as graphs from given or collected data.
- **Social Studies**: Getting students to conduct a survey and forecast a trend by plotting the graph with spreadsheet software.
- **History**: Identify and locate relevant sources by using Internet search engines, museum collections and library catalogues.
- **Geography**: Present findings and ideas in a range of communication forms, for example, written, oral, graphic, tabular, visual and maps, using geographical terminology and digital technologies.

This project will see DCRD incorporating ICT resources in textbooks and ICT infused sample lessons. In addition, DCRD could organise a yearly competition to gather the best lessons or learning objects created by teachers, with special awards to be given to the teachers who created them. Best lessons and learning resources will be consolidated by DCRD and made available to all educators.

Below are the milestones over the 5 year period:

2014	2015	2016	2017	2018
Training of subject experts in identification and integration of ICT into lessons Review Economics and Science curriculum to include ICT-infused lessons Rollout revised materials and train relevant teachers	Review Mathematics curriculum to include ICT-infused lessons Rollout revised materials and train relevant teachers	Review Dzongkha curriculum to include ICT-infused lessons Rollout revised materials and train relevant teachers	Review one other subject curriculum to include ICT-infused lessons Rollout revised materials and train relevant teachers	Review one other subject curriculum to include ICT-infused lessons Rollout revised materials and train relevant teachers

This project will share the budget earmarked for Project 2.1.1 and Project 2.1.2.

Key indicators to track the success of this initiative include:

1. *Number of training courses to be delivered to teachers on use of ICT-driven lesson plans;*

2. *Number of lessons plans used by teachers that uses ICT in teaching and learning. Our aim is that by the end of this five year plan, at least 15% of all lessons taught in schools will incorporate the use of ICT.*

PROGRAMME 2.2 PERVASIVE USE OF E-LEARNING IN EDUCATION INSTITUTIONS

The Internet is becoming increasingly pervasive through a wide range of computing and mobile devices. With the large amount of multimedia resources and different learning strategies through ICT that will be made available through the iAble projects in Programme 1.1, there is a need for a platform to manage and track learning by students. E-learning has immense potential to support the key components of learning: active engagement, participation in groups, interaction, feedback, and connection to real-world experts. It can enhance the collaboration and communication between teachers and students. When e-learning is effectively integrated into the different subject areas, teachers take on the roles of facilitators, advisers, content experts and coaches; and makes teaching and learning more meaningful and fun. E-learning also changes the way teachers teach, offering educators the effective ways to reach different types of learners and assess student understanding through multiple means. In addition, e-learning can also promote the concept of lifelong learning, allowing learning to take place anywhere andanytime. A well-integrated interactive e-learning platform can provide additional stimulus for knowledge translation into real life practices.

Thus, establishing a vibrant e-learning environment in education institutions has been identified as a key programme that would strengthen and promote ICT integration into the curriculum, pedagogy and assessment thrust. Following two projects have been identified under this programme.

PROJECT 2.2.1 ESTABLISH E-LEARNING PLATFORM FOR LEARNING INSTITUTIONS

E-learning platform would bring added value in terms of providing accessibility to rich electronic materials for schools and NFE centres. With its interactive medium it can extend the learning environment and enrich classroom experiences. It will also allow them to collaborate and foster knowledge exchange amongst the

mainstream students as well as NFE learners in different parts of the country. In addition, well designed e-learning contents can promote focused learning thereby avoiding wastage of time and effort for both teachers and students.

The proposed nationwide e-learning platform will provide customized learning content and tools for tracking learning and collaboration. A good e-learning platform will also allow teachers to explore alternative ways of learning assessment such as projects, online forums and even games.

For schools, this platform will be used as a supporting tool to supplement their face-face teaching-learning. For NFE, apart from being a resource repository, the platform can be leveraged to support online training programmes to train NFE instructors. In addition, the Early Childhood Care and Development (ECCD) facilitators will be able to find resources and courses to enrich their knowledge.

Other features that would be useful include searchable repositories of interactive electronic materials and online question banks from BCSEA. A good e-learning platform can also provide a publishing platform where both teachers and students can create, contribute and rate contents. This system can also have built-in communication tools for interacting with parents, students and the community, including a Short Messaging System (SMS) for sending urgent alerts to parents. The platform must be able to support Dzongkha, the national language in Bhutan.

Implementation Approach

The e-learning platform will be centrally located in the Government Data Centre. Depending on the adoption and usage, the computer servers can be scaled up to manage the loads on the system. It is recommended that the management of the application and the data centre be outsourced to vendors so that the teachers and schools can focus on improving the learning experiences of the students, and raising the quality of contents and content delivery.

Several platforms worth considering include open source systems with collaboration features such as Moodle. The system can be outsourced to a private enterprise for customisation, support and maintenance.

This is a long term project that requires careful planning, designing, piloting and adequate training of school administrators, ICT Heads, teachers, ICT Laboratory

Assistants and students. The e-learning platform may be rolled out in three phases over a period of five years, starting from 2015. It has to be implemented in close consultation with MoIC, who is mandated with the promotion and laying out of the nationwide backbone network infrastructure.

The project can be piloted in 30 schools, comprising of all levels, spread across two Dzongkhags. Two Dzongkhags may be identified considering proximity to technical expertise to ensure timely support during piloting phase.The pilot phase will provide valuable insights on how to improve the system and to fix technical issues before nationwide implementation.

Some proposed milestones are as follows:

2015	2016	2017	2018	Beyond 2018
Phase one: Development & installation of e-learning system/server at Government Data Centre When development is completed, kick start pilot testing in 30 different schools in two Dzongkhags		Phase two: Installation of e-learning system/server at 10 other Dzongkhag and extend it another 100 schools in the country Kick start phase three in second half of 2017 and continue to 2018		Phase three: Installation of system/server in the remaining Dzongkhags and expand e-learning service to the rest of the schools

The budget suggested is mainly for the purpose of the outsourced data centre, support and maintenance and application licensing. Nu 25.0 million is budgeted for initial setup, development costs and initial training costs. When fully operational, based on a targeted user base estimated at 200,000 users, a budget of Nu 15.0 million is required for annual training, support and maintenance.

Key indicators to track the success of this initiative include:

1. *Number of active online courses on the e-learning platform;*
2. *Number of teachers using the e-learning platform;*
3. *Number of active users accessing e-learning platform on monthly basis;*
4. *Percentage of online components in lesson plan in terms of lesson hours.*

PROJECT 2.2.2 DRIVE ADOPTION OF VIRTUAL LEARNING ENVIRONMENT AT RUB

RUB recognized the importance of a comprehensive e-learning strategy as an integral part of their long-term goal to improve the quality of education at RUB. ICT can enhance the quality of teaching and learning by bringing teachers and learners closer through virtual interactions even beyond the classroom. With the help of ICT, students have access to various learning resources, course materials and virtual classes. Students can also take charge of their own learning by way of accessing the classes and other resources available online. This way the quality of teaching and learning can be improved tremendously.

Moodle, the open source learning management system, was launched in 2011, as the university's Virtual Learning Environment (VLE) across all ten constituent colleges. A manager has been appointed to coordinate the development of educational technology and to support the operation and maintenance of VLE. 28 staff from the university have been trained in instructional design to support Moodle including ICT personnel for system configuration and upkeep. 40 modules have been uploaded and some of faculties and students have begun to use them actively. The VLE is yet to be rolled out to all colleges.

RUB's strategy to improve adoption of VLE includes:

- Developing some smart classrooms in all the colleges to facilitate blended learning;
- Developing capacity and familiarizing all staff to use VLE to the fullest and enhance active use of interactive platform with students. It was found that academics need more training in the philosophy and hands-on use of instructional design for optimum use of Moodle
- Upgrading and maintaining vibrant VLE to cope with the fast changing scenario of the technological advancement.
- Upgrading Internet connectivity to ensure effective and efficient connectivity for university users both on and off-campus.
- Developing learning resources and making them available online through the VLE or other complementing platforms.
- Subscribing to anti-plagiarism software.

The capital outlay for implementing the VLE adoption strategy will come from

the overall budget of Nu126.2 million in 11th FYP.

Key indicators to track the success of this initiative include:

1. *Number of active online courses on VLE platform. RUB's goal is to increase modules that are using VLE to increase from 30 currently to 100 by the end of 2018.*
2. *Number of faculty using the VLE platform.*
3. *Number of active users accessing e-learning platform on monthly basis.*
4. *Satisfaction level of faculty on ability of VLE to support their teaching and learning objectives.*

3.3 'iCONNECT THRUST': ENHANCE NATIONWIDE EDUCATION AND LEARNING ICT INFRASTRUCTURE AND SYSTEM

There are four programmes and eleven projects under the 'iConnect Thrust'. These are designed to provide better access to computing devices in educational institutions, in teachers' resource centres and in the community learning centers (CLCs), as well as better information management systems to support administrative processes. This thrust also looks into the overall supervisory mechanisms and reorganisation within MoE for monitoring and implementation of iSherig.

Programme 3.1 Computerisation Programme	**Project 3.1.1** Equip schools with computing devices
	Project 3.1.2 Establish Internet and Intranet Connectivity for schools
	Project 3.1.3 Expansion of network in RUB
Programme 3.2. Expansion of MIS and Admin Systems	**Project 3.2.1** Review and enhance Management Information Systems
	Project 3.2.2 Implement online student admission and common email systems for RUB
	Project 3.2.3 Implement online email for all MoE educators

Programme 3.3 **Establish Distributed Learning Support Infrastructure**	**Project 3.3.1** Establish education technology standards for Teacher Resource Centres
	Project 3.3.2 Equip Community Learning Centres with learning technologies
	Project 3.3.3 Strengthen regional ICT support for computer maintenance
Programme 3.4 **Establishment of Governance and Programme Management Framework Within MoE**	**Project 3.4.1** Creation of steering committee and coordination mechanism to monitor ICT programmes
	Project 3.4.2 Creation of Education Technology Division (EdIT)

PROGRAMME 3.1 COMPUTERISATION PROGRAMME

In order to promote ICT integration into teaching and learning, there are many aspects that have to be taken into consideration such as technical, training, financial, pedagogical and infrastructure needs of schools. This computerisation programme is focused on ensuring the availability of a suitable ICT Infrastructure in schools and colleges.

Under this programme, there are three important projects which will provide computing devices and connectivity to all schools and across RUB.

PROJECT 3.1.1 EQUIP SCHOOLS WITH COMPUTING DEVICES

Through Chiphen Rigpel Project, ICT laboratories have been established in 168 secondary schools. Another 2,544 computers were supplied to the schools through government funding, and 27 desktop computers were distributed to the schools in 4 Dzongkhags with support from MoIC. In addition, under the "one laptop per child" (OLPC) project, 210 "XO Laptops" were donated to 21 schools in 19 Dzongkhags. 15 primary schools in 15 Dzongkhags also received 20 Intel's Classmate PCs each (300 in total). Apart from the government schools, all existing private schools also have ICT facilities.

Furthermore, the 'Empowering Teachers' Project enabled 3,972 teachers to purchase computers with concessional loans.

Despite these initiatives, the existing infrastructure is far from sufficient to meet current ICT needs in schools. In a recent survey of schools (a survey conducted in September 2013 as a part of this master plan development), more than half of the schools responded that they have less than six computers that can be used for teaching and learning. The number of computers for administrative purposes are even fewer with the majority of respondents having 2 or less computers.

The lack of adequate and working computing devices is a major risk factor to the success of the Education ICT Master plan and must be addressed through the coordinated effort of MoE and MoIC.

Options for Computing Devices

Desktop PCs have until now been the computing device of choice in schools. However, technology advancements have opened up new options that are more cost effective, "future-proofed" and reliable.

N-Computing

Under the 11th FYP, the school IT Unit has proposed for the use of N-computing as a cost-effective option for computer equipping. N-computing is a technology that allows multiple users to share a single operating system simultaneously. Trials have shown that one ordinary desktop computer can cater to between 6 and 11 students at the same time. Through a survey conducted by the school IT unit across 53 Chiphen Rigpel Project schools covering 10 Dzongkhags on the reliability of N-computing, it was found that 30% felt it was 'very good', 59% of the respondents felt that the system was 'good', and 11% of the respondents felt otherwise.

Based on the following assumptions, it is estimated that the use of N-computing translate to a cost-saving of Nu 0.59 million for each secondary school laboratory and Nu 0.36 million for each primary school laboratory.

- 6-11 users to simultaneously share a single operating system
- 30 users per laboratory in the secondary school
- 18 users per laboratory in primary school

Tablet Devices for Learners

In 2011, sales of smart devices outstripped sales of PCs for the first time. This is an irreversible trend with smartphones and tablet devices growing in 2012 at annual growth rate of +46% and +78% respectively, while PC sales experienced a decline (-1.2%) for the first time in history. In a recent forecast by research firm, IDC, tablet sales alone is forecasted to overtake that of PCs (desktops and laptops), and smart devices will account for about 87% of total sales of Internet connected devices.

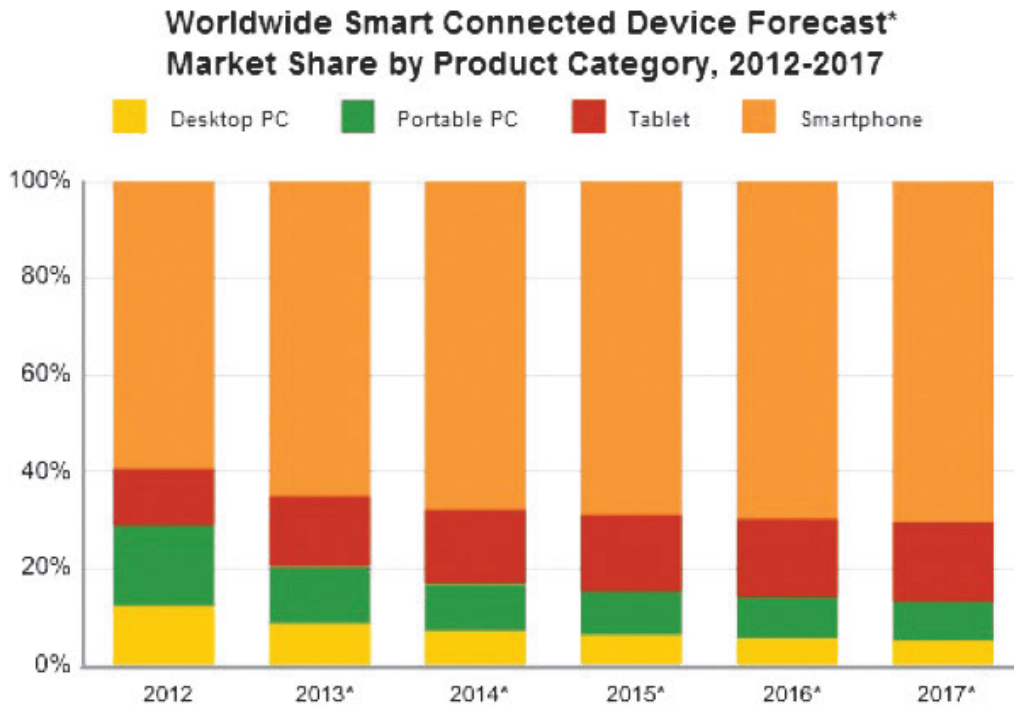


Figure 7: Global Smart Connected Device Demand. Source: IDC

The key factors driving this exponential growth of the smart devices at the expense of the traditional PCs include:

- *The attractiveness, both as a lifestyle and practical choice, of the ability to be connected to information, services, entertainment and other users anytime and anywhere;*
- *Rapid advancements in both computing and connectivity technologies are driving down the cost for consumers;*

- *Explosive growth in the availability of mobile applications offering abundance of choice for consumers to do most, if not all, tasks previously requiring PCs to be possible on the smart devices.*

In Bhutan, the popularity of smart devices is also evident from the September 2013 survey. Six in ten teachers responded that they own an Internet-enabled smart device, while almost a quarter of students said they own or have access to such devices.

This mobility and smart computing revolution is also affecting education. The New Media Consortium's 2013 Horizon Report editions for K-12 and Higher Education have identified mobile learning and tablet computing as the technology trends that are within the "Time-to-Adoption Horizon" of one year or less.

For Bhutan, the key benefits of tablet-based learning are as follows:

1. **Engaged learning experience**

   Between the smart phones and tablets, tablets have become an obvious device of choice for education because tablets have larger display formats, portability, flexibility, and intuitive interface. A number of schools in the other countries have turned to tablets as a viable strategy for the delivery of engaged learning experience for learners. Therefore, it is also important for the Bhutanese youths to use mobile technology for learning.

2. **Portable devices for remote centres**

   Tablet-based learning can play a significant role in MoE's mission to deliver quality education to every citizen. In a geographically diverse country, tablets are much easier to deploy to the learners all across the country. The portability of tablets also allows the devices to be shared and delivered to remote learning centres "on-need-basis". This will be beneficial to the computerisation effort for schools and the non-formal education (NFE) programme. Compared to a country-wide deployment of large number of desktop PCs, a Tablet devices for Learners will be a cost-effective strategy.

3. **Future-proof technology**

   This Master Plan takes a long term planning horizon of five years or more. Therefore, it makes sense to leverage on a more future-proof technology

like mobile technology that is more likely to still remain relevant after five years.

There are also examples of nationwide tablet programme for education. Thailand also started a bold and ambitious move to embark on a "One Tablet PC per Child" programme to address inequality and uneven standards of education quality across the country. Reportedly, 120,000 tablets have already been distributed to children till date.

Crucial to the feasibility of a tablet project in Bhutan is the ability to acquire large numbers of low cost tablets with adequate specifications. Prices of tablets have fallen significantly in recent years with Android-based devices. Chipmaker Intel is also planning to launch a new low cost Atom chips that can help to bring prices of entry-level tablet to below US$ 100. Through a bulk purchase, cost per tablet can be further reduced.

Since cost of tablets is lower than cost of PC computers, by reducing the numbers of PCs originally planned for and re-channelling the funds for acquiring tablets, more Internet-enabled computing devices can be deployed to the schools compared to a PC-only solution. This will further bring down the student to computer ratio.

A pilot Tablet devices for Learners can be launched under this Master Plan with 2,000 tablets targeting a group of selected pilot schools from the different Dzongkhags. Up to 100 of the tablets should also be distributed to Teacher Resource Centres and to the Community Learning Centres. At US$ 100 each, the cost of the devices alone is estimated to be US$ 200,000 or Nu 13.0 million (US$ 1=Nu 65).

A capital outlay budget of Nu 14.0 million is recommended where Nu 13.0 million is estimated for the cost of devices and Nu 1.0 million for related project cost and development or licensing of relevant mobile applications. This can be funded from overall budget of Nu 351.79 million planned in the 11th FYP for "setting up computer laboratories in all schools and provide internet and other related services".

Support for inclusive learning

According to UNESCO, ICTs offer a great potential to support lifelong learning

for all groups of students, including those who have special educational needs. The application of ICTs must enhance independence, integration, and equal opportunities for such people and in this way will facilitate their inclusion in society as valued, respected, and contributing members. In 2006 UN Convention on the Rights of Persons with Disabilities emphasized that accessibility of ICTs for persons with disabilities are as important as the accessibility to other domains. In order to empower people with special education needs through the use of ICT in their education, they need accessible ICTs and assistive technologies.

Some of the assistive technologies to assist the visually impaired are as follows:

1. **Screen magnifier** : This is possible within the operating system of the computer. For example,MAGIC screen magnifier with speech for low vision users.
2. **Alternatives to the visual display** : These include screen readers, which speak the text displayed on the screen, and refreshable Braille displays, which translate the text to Braille. Examples of screen readers include JAWS, NVDA (Non Visual Desktop Access), Windows Eyes, Homepage Reader and Orca.
3. **Optical character recognition (OCR)** : Document scanners, in conjunction with OCR software, can translate printed text to electronic text that can be magnified or read aloud using the Assistive Technology mentioned above.
4. **PDAs** : Note-takers or accessible Personal Digital Assistants.
5. **Braillers** : It is a mechanical device or an equipment, similar to a typewriter, with the capability for direct output of embossed braille onto paper.
6. **Braille** : "A tactile system using patterns of raised dots representing letters and numbers". Embosser (a special printer) is used to produce braille. However, accessible PDAs can also be used to produce braille. This is commonly used by the visually impaired students in Bhutan.
7. **Electronic formats** : Talking books: It is either a human narrated or converted automatically into synthesized speech, also known as a 'Digital Talking book'. We can find free online service and downloadable services to convert text files into synthesized speech audio files in formats such as MP3.
8. **Accessible HTML or PDF**.

9. DAISY (Digital Accessible Information System)

The above mentioned accessible technology and assistive devices can be used in Bhutan because some of the software are available for free downloads. The pilot testing can be done in the Muenselling Institute at Khaling in the first phase. The Ministry of Education has to identify schools with students with special needs and then supply the schools with the accessible and assistive devices.

In addition to special needs students, the availability of devices and relevant applications, in line with the e-learning programme, will also bring tangible benefits to students from the mainstream. Teachers and parents will also benefit from the easy access to information that help them better understand where their children are headed in terms of development and provides the opportunities to incorporate early interventions.

Implementation Plan

Under the MoE's 11th FYP, there is already a school computerisation programme to set up computer laboratories and related ICT equipment. The expected capital budget for this programme is Nu 356.79 million or procurement of ICT equipment, which excludes Nu 5.0 million for providing accessible and assistive devices for special needs children, and a recurrent budget of Nu 30.0 million for setting up of ICT facilities in schools. It targets to bring down the computer-to-student ratio to 1:30 for primary schools and 1:10 for secondary schools. Through this school computerisation programme, schools will also be equipped with large screen LED for teaching and learning.

All devices and installed software must be based on the Ministry-wide Standard ICT Operating Environment (SOE) guidelines. Having a standard operating environment will significantly reduce operating and training cost as there will be fewer types of equipment and software versions for maintenance.

The implementation should follow a phased approach in order to manage the resulting support needs and resource needs that will arise from the deployment of more equipment. Thus for the implementation to be successful, a framework should be in place to support the users and administrators.

Implementation Timeline:

2014	2015	2016	2017	2018
Develop SOE guidelines Feasibility studies and field trials on N-computing	Set up computer laboratories in all newly established MSS /HSS and LSS excluded from Chiphen Rigpel Project followed by all the remaining HSS	Set up in schools where inadequate computers exist and supply the additional computers Equipping the remaining MSS	Set up computer laboratories in all primary school Complete the deployment of devices to the LSS	Equipping of the rest of the PS
Conduct feasibility study on Tablet devices for learners	Acquire digital resources and develop digital textbooks (through Project 2.1.1 and 2.1.2) Define hardware and software specifications for tablets	Develop mobile education apps that will be pre-loaded onto tablets Conduct procurement tender for tablets	Pilot roll-out to selected schools Distribute to TRCs Distribute to CLCs/CCs	

Key indicators to track the success of this initiative include:

1. *Number of schools with computer laboratories. There should be demonstrable progress towards the eventual goal of 100% equipping;*
2. *The ratio of computer to students maintained i.e. 1:10 for secondary schools and 1:30 for primary schools at the end of each Phase;*
3. *The number of schools with usable working Internet connectivity also indicates how successful this initiative can be as the devices would be better utilized with connectivity in place;*
4. *The use of the devices to access resources that aid teaching and learning regardless of levels.*

PROJECT 3.1.2 ESTABLISH INTERNET AND INTRANET CONNECTIVITY FOR SCHOOLS

Internet

As of 2013, 50 public schools including 5 primary schools, 3 lower secondary

schools, 5 middle secondary schools and 36 higher secondary schools are connected by Internet leased line. The majority of the urban schools have broadband (between 51 Kbps and 2 Mbps) and some remote schools use datacards . All private schools are connected to the Internet.

In the 11th FYP, MoE plans to provide Internet connectivity to all the schools including an up-gradation of the leased line bandwidth for the existing higher and middle secondary schools from 256/512 Kbps upto 2 Mbps. The following Internet bandwidth shall be provided to the schools:

1. All higher and middle secondary schools with 2 Mbps bandwidth leased line;
2. 2 Mbps leased line for the lower secondary schools and primary schools exceeding 250 students;
3. Prepaid broadband Internet connection to the schools with capacity of 12GB data download/upload for more than 90 students but less than 250 students;
4. Prepaid broadband Internet connection to the schools and ECRs with capacity of 8GB data download/upload for less than 90 students.

Intranet

DITT/MoIC has implemented National Broadband Master Plan project to harness the benefit of ICT with the objective of establishing a secure, sustainable, affordable and appropriate ICT backbone using fibre optics network to connect all the Dzongkhags and Access network connecting all Gewogs.

The fibre optics network consisting of Optical Ground Wire (OPGW) and All Di-electric Self Supporting (ADSS) is being established leveraging the Bhutan Power Corporation (BPC) high voltage transmission and distribution network.

Currently, all the Dzongkhags and 187 Gewogs have the physical fibres connected, while the remaining Gewogs will be connected by the end of 2014 in tandem with rural electrification project of BPC. The five remote Gewogs of Sombaykha, Soe, Naro, Lunana and Lingshi will be connected by radio technology as these Gewogs do not have the power distribution network to carry the fibre optics. While the OPGW cables form the core backbone infrastructure connecting all Dzongkhags, the ADSS fibre is being extended from this core network and terminated in a strategic location (to be identified) in the Gewogs, from which

Internet Service Providers (ISPs) will serve homes, schools, Basic Health Units (BHUs) and other offices. In collaboration with DITT/MoIC, the fibre optics could be extended to the schools which are located close to the Dzongkhags and Community centers in Gewogs.

DITT also has a plan to set up a government data centre at Thimphu Tech Park in the 11th FYP.

MoE could leverage on these facilities and host all the electronic services in the government data centre and use Intranet (domestic leased circuits) services from ISPs to cut down the monthly recurrent cost to access locally hosted resources at Government data centre. A robust network could be set up in consultation with DITT, ISPs and other relevant stakeholders and also connect to DrukREN for online research databases.

Implementation Plan

2014	2015	2016	2017	2018
All the remaining 21 Higher Secondary Schools will be provided with Internet connectivity	Remaining 57 Middle Secondary Schools	All Lower Secondary Schools	All Primary Schools and ECRs	

The overall proposed budget for school Internet connectivity in the 11th FYP is estimated at Nu.100.0 million with the funds coming from Bhutan InfoComm and Media Authority (BICMA).

Key indicators to track the success of this initiative include:

1. *Number of schools connected to the Internet, eventually connecting all the schools by 2018*
2. *Reliability of the Internet connection such as uptime*

PROJECT 3.1.3 EXPANSION OF NETWORK IN RUB

A well connected university is fundamental requirement for the successful implementation of any ICT initiatives at the university. Over the last few years, RUB has invested significantly into infrastructural projects to establish wired

campuses. These efforts have put the following network infrastructure in place:

- Local Area Network with minimum of 100 Mbps is set up in all colleges and offices of the University;
- RUB Wide Area Network (RUB WAN) is also set up with a speed of 156 Kbps but yet to be operational;
- Internet connectivity provided in all the colleges with bandwidth indicated below:

Colleges	Internet Bandwidth (2013)	Remarks
College of Natural Resources	4 Mbps	Central subscription
Sherubtse College	12 Mbps	Excluding NIIT
Samtse College of Education	4 Mbps	
Jigme Namgyal Polytechnic	4 Mbps	
Institute of Language and Cultural Studies	2 Mbps	
College of Science and Technology	12 Mbps	
Gaeddu College of Business Studies	6 Mbps	Excluding NIIT
Paro College of Education	4 Mbps	
Office of the Vice Chancellor College of Health and Medicine	512 Kbps	

- Set up and use Intranet for communication amongst the colleges. Currently Sherubtse College, Gaeddu College of Business Studies and Paro College of Education use this facility;
- Wireless connectivity is set up in some colleges to provide access to Internet for students and staff using mobile devices.;
- Video conferencing facilities are set up in five colleges namely Samtse College of Education, Institute of Language and Culture Studies, Jigme Namgyel Polytechnic, Sherubtse College, College of Science and Technology and also at the Office of the Vice Chancellor. Currently, it is used for the administrative and management purposes only.

However, in order to support the long-term ICT strategy at the University, the capacity and reach of the network facilities will need to be further enhanced. Over the next five years (11th FYP), the University plans to:

- Set up intranet facility and usage in all colleges;
- Make use of RUB Wide Area Network for various communication services;
- Enhance Internet connectivity with minimum of 10 mbps in each college to enhance reliability and effectiveness of the connectivity;
- Provide wireless connectivity in all the colleges to provide access to Internet for students and staff using mobile devices;
- Provide video conferencing facilities in all colleges for both management and academic purposes.

The funding for these infrastructure projects will come from the overall 11th FYP ICT budget of Nu 126.2 million.

PROGRAMME 3.2 EXPANSION OF MANAGEMENT INFORMATION SYSTEM (MIS) AND ADMINISTRATIVE COMMUNICATION SYSTEMS (ACS)

There are three projects under this programme. These projects are to improve the efficiency of administrative work in the education sector by providing new or improved management information and online systems, as well as to improve communication within the sector.

The three projects under this programme will enhance various MIS and ACS.

PROJECT 3.2.1 REVIEW AND ENHANCE MANAGEMENT INFORMATION SYSTEMS

There are a few existing Management Information Systems (MIS) in MoE. This project is recommended to improve these systems and also develop new systems.

Education Management Information System (EMIS) maintains information on students, schools and teachers to support improved decision and policy making, monitoring and evaluation.

It has three main areas for which extensive data is collected, namely:

1. Organization (which includes schools and Extended Classroom resource): data on sports/club facilities, infrastructures and equipment;
2. Staff (which includes teachers and staff of MoE): Information on promotion, leave, transfer, secondment, trainings, family details, number of teaching hours, subjects taught, and extracurricular activities of staff;
3. Students (including continuing education and regular students): One of the major decisions taken was that EMIS should be able to track a student from class PP up until class 12, which currently has been implemented. Students are given a student code each as a unique identification number that follows them throughout their education journey. Basic details such as guardian information, transfer details, and so on are also captured by the system.

The EMIS is designed to be a web based system. However, as some schools do not have access to the Internet, data is collected using two types of data collection processes:

1. Web interface for those schools that have Internet connectivity (EMIS version 2);
2. Every year, the EMIS team (MoE) collects school/student data through Excel-based data collection tool, which is complied and submitted to MoE (EMIS team) by DEOs. Although the EMIS can handle day to day data collection and updates, the current data collection for the different entities are as follows:
    - Organization: Information on schools and ECRs are collected once a year through the Excel-based tool;
    - Students: Once a year through the Excel-based tool;
    - Staff: On ad-hoc basis when needed, except for co-curricular and subjects taught, which is collected once a year through the Excel-based tool.

There are challenges facing the system. A key challenge is that while a unique identification number is assigned to students to collect data for the record, the system is not capable of tracking down the double assignment of identification number or missing students. This has led to issues like multiple records per student, missing students and other issues.

These issues can possibly be resolved by using a citizenship identity card number

issued by the Department of Civil Registration and Census, Ministry of Home and Cultural Affairs. Since DITT has already established an e-GIF framework for data interoperability across the government agencies, the current EMIS could be revamped to use the civil registration citizenship identity number details for the students.

A review of the system also needs to be carried out to see where improvements to the system can be made to minimize MoE's frequent request for data of the same nature from schools and dzongkhags as highlighted in the surveys and interviews with principals. A budget of Nu 4.8 million has been set aside in 11th FYP for improvement to EMIS and NFE MIS.

QAAD – National Information Centre System

As per the Tertiary Education Policy of the Kingdom of Bhutan 2010, the Bhutan Accreditation Council was constituted through the Executive Order on 14 June 2011. The Council is the national accreditation agency to promote academic excellence and innovation and to ensure the quality of higher learning in Bhutan. Through its secretariat, the Quality Assurance and Accreditation Division (QAAD) of the Department of Adult and Higher Education (DAHE) under the Ministry of Education, the Council has developed two documents, namely Accreditation Principles and Bhutan Qualifications Framework (BQF), which were launched in 9th June 2012 commemorating the World Accreditation Day.

The Accreditation Principles will guide the Council with the accreditation of the tertiary education institutions based on the principles, processes and standards ensuring quality, competitiveness and enhancement of standards for the higher education system. This will enable the Council and the Ministry of Education to deliver efficient and effective accreditation related services. On the other hand, the BQF is instrumental for recognizing all education, training and credit systems based on the validity and intensity of the courses and programmes by the accredited institutions. The framework also facilitates the interpretation of qualifications.

The core functions of QAAD are:

- Quality assurance;
- Accreditation of tertiary education institutions;

- Recognition of qualifications;
- Interpretation of Bhutan Qualifications Framework;
- Monitoring of Education Consultancy and Placement Firms;
- Secretariat to the Bhutan Accreditation Council.

Though some of the services could be offered online, currently, they are not available online. Clients need to visit the office to access the services. However, in the years to come QAAD would like to make the services online in phases. The first service that would likely be offered online is the establishment of Education Consultancy and Placement Firms followed by recognition of qualifications.

Bhutan is under the process of signing the Asia-Pacific Regional Convention on Recognition of Qualifications in the Higher Education. Article IX.3 of the Convention requires the member countries to establish a National Information Centre (NIC). The NIC shall provide information and advice on the Bhutan education system, status of higher education institutions, and recognition of qualifications attained outside Bhutan. However, for a country of the size of Bhutan, it is not economical to establish NIC as a separate body. Instead the Department of Adult & Higher Education is considering strengthening the QAAD to take up the role of National Education Information Centre.

Therefore, it is imperative to develop a system to provide online services through a website for the NIC. This activity was not proposed in the 11th FYP and hence no budget is secured.

NFE MIS

As literacy is seen as one of the key instruments for poverty alleviation and thus supporting the fulfilment of the philosophy of GNH, the government started the Non-Formal Education (NFE) programme in 1991 to provide basic literacy and functional skills to the adult population. The programme has been very effective in improving the literacy rate of the adult population and improving their lives. It has also empowered the communities to participate in developmental activities, decision making and the political process.

In the 11th Plan, the primary focus will be to enhance the adult literacy rate to 70%. The programme will facilitate establishment of new centres, support capacity building of NFE instructors and improve the relevance and quality of

NFE curriculum through inclusion of life skills education and other relevant skills. Opportunities will also be provided through the continuing education programme to those who could not continue formal education and wish to upgrade their qualifications.

While NFE programme has been recognized as a crucial sub-sector of the education system in most countries, national education statistics seldom include information on the scope, outreach and results of non-formal education. However, it is recognized that comprehensive monitoring of the progress made towards policy objectives and management of programmes need to be based on up-to-date and reliable information and situation and context-specific knowledge.

There is no standardized system to obtain data on NFE. The information on enrolment in NFE are obtained from the districts in hard copies and there is no information system in place to provide reliable and timely information and there is thus no subsequent statistical analysis. Therefore, it is important to develop and operationalise NFE-Management Information System, which will help in generating relevant information for monitoring and the implementation of NFE policies, strategies and programmes.

E-Portal

In order to improve and expedite the current service delivery of the MoE, the ministry, in collaboration with DITT of MoIC, has developed an e-portal called 'sherigportal' with financial support from the Government of India. This portal was developed with the following objectives:

- Improve systemic efficiency in the service delivery mechanism;
- Widen access to high quality, relevant and diverse resources and expand learning opportunities to teachers and students;
- Expose all learners, both advantaged and disadvantaged, to richer educational experiences;
- Provide all learners and teachers the opportunity to communicate and collaborate;
- Enhance information sharing, communication and collaboration among agencies.

The e-portal (*sherigportal*) has the following key features:

- Dedicated space for agencies that lead to portal gateways;
- Information regarding all agencies in the Ministry of Education;
- Content management system, information sharing and document management system;
- Vacancy database for HRD, and system to collect requisition for procurement;
- Service Directory for all departments and divisions;
- Event management system with records database of proceedings of events;
- Document archival system for supplementary books, teaching materials with options to download;
- Collaboration tools (forums, discussion boards, etc.) both open and restricted sharing of information in the forums and blogging/wiki tools;
- Teaching learning resource repository hosted on a Moodle system;
- Storage and publication (with download) of media files.

From interviews and feedback, further improvements in usability and features of e-portal (*sherigportal*) can be enhanced. As the portal is still new, the new features can be added to make it more user-friendly. When Project 2.2.2 (E-Learning for Learning Institutions) is launched, there can be rationalisation in the services to move learning for teachers into the common e-learning platform for all schools and use e-portal (*sherigportal*) as the platform to support administrative functions.

The new features for the e-portal (*sherigportal*) will be developed in-house, and therefore, no additional budget is required.

Implementation Plan

2014	2015	2016	2017 - 2018
• EMIS review and upgrade • E-portal upgrade	• EMIS review and upgrade • E-portal upgrade	• Adapting EMIS for use with NFE MIS	• Development and deployment of QAAD

Key measures of success for this initiative are:

1. *Utilisation and adoption rate of MIS systems;*

2. *Accuracy of information.*

PROJECT 3.2.2 IMPLEMENT ONLINE STUDENT ADMISSION AND COMMON EMAIL SYSTEMS FOR RUB

Data collection, management, communications and sharing of resources have always been a challenge for RUB due its history as an institution founded on a distributed model of several colleges all over the country.

ICT has offered enormous opportunities for the university to cut across all physical barriers and develop an effective system of operation in all areas of administrative and managerial services. RUB therefore has no other options but to rely heavily on the use of ICT for governance, management and related services to its staff and students.

Various initiatives have already been started at the University to improve the efficiency of online administrative systems:

- In-house software for online university admission and selection of students has been developed and is operational. This is however limited for programmes that are meant for class XII pass-out students.
- A uniform student e-mail address has also been initiated for the new batch of students from 2013. Within next few years, all students in the University will each have a RUB email address. This emailing service is expected to build a strong base for communication and information sharing, and to bridge the gap between the students and management including faculty for any support services.
- A university-wide electronic mailing system through the use of Google Apps for education has been created. Currently, a uniform RUB email address has been created to all staff of the University. The University is now monitoring the use of this email for communication and providing facilitation services. A common mailing list has been created that can help the managers share information and communicate effectively with all staff effectively.

Over the next five years, RUB plans to enhance these systems to further improve efficiency, standardization and quality of service. In addition, the University also plans to develop or procure a comprehensive software package with modules that can cover major areas of services such as HR, finance, plan monitoring, procurement, property management and research database. Funding for these projects will be met from the overall budget of Nu 126.2 million earmarked for ICT development in the 11th FYP.

PROJECT 3.2.3 IMPLEMENT ONLINE EMAIL FOR ALL MOE EDUCATORS

Currently, MoE is using a free and open source email system. The service caters to just over 300 users for secretariats, Dzongkhag education officers and Thromde education officers. The constraints or issues with the current systems are:

- Security issues, spam etc.;
- Human resources for troubleshooting and maintenance of server;
- Lack of highly qualified security and network engineers;
- Poor quality of service;
- Limitation of hardware like hard disk capacity, performance, etc.;
- Limitation on the number of users in the system;

These constraints and issues have made it difficult to use the existing system to provide email accounts to all the educators and MoE officials.

MoE could place a request-for-proposal (RFP) to identify a suitable replacement for the email system to be used by all teachers and ministry's officials. Alternatively, MoE could use free cloud-based services to provide the email facilities. Requirements that can be considered in the email system can include:

a. Security features:

- Established security policies, which are reviewed on regular basis to ensure continued effectiveness and accuracy;
- Multi-tenant, distributed environment;
- Physical security at the data centre if a hosted model is used;
- Comprehensive disaster recovery programme at all its data centres to minimize service interruption due to hardware failure, natural disaster, or other catastrophes with an agreed uptime guarantee;
- Guaranteed 24x7 access to users' data;
- Back-up of critical data automatically.

b. Privacy

- There should be assurances against threats to privacy, which public mail services cannot provide.

c. Cloud solution versus hosted solution

- With a cloud solution, there will not be a need to buy and maintain dedicated email servers.
- The cloud solution model can be compared against that of a hosted solution model in the government data centre for advantages and disadvantages, as well as cost efficiencies.

d. Others

- Start to use the email as an official correspondence within the ministry so as to minimise the need for physical printing of memos and letters.

The implementation can start from 2015, with full system rollout in 2016.

2015	2016
• Kick start email migration (of the 300 secretariat users). • Introduce email system in phases across departments and schools.	• Continue rollout and monitor usage and progress

In the inital stage, the email system will have 10,000 users comprising mainly teachers and ministry officials. Budget to be finalised based on the RFP submissions from the private sectors. .

Key indicators to track the success of this initiative include:

1. *Number of email accounts created for teachers and students*
2. *Uptime of email system*

PROGRAMME 3.3 ESTABLISH DISTRIBUTED LEARNING SUPPORT INFRASTRUCTURE

Bhutan is a geographically diverse country with unyielding terrains consisting of impassable mountains and dense tropical forest that make travel to and fro certain parts of the country challenging even in this modern era. As such, a centralized model for delivery and support of education is not practical in a country like Bhutan and a more decentralized and distributed structure has generally been adopted here. The three projects under this programme will establish the strategy for distributed mechanisms and facilities to support the education sector.

Education facilities are scattered across the country such as Teacher Resource Centres and Communities Learning Centres that served as facilities for hub for professional development and learning. MoE should continue to build upon these facilities to establish an ICT-enabled learning support infrastructure to benefit a larger population.

In this programme, there are two projects to enhance the learning support infrastructure.

PROJECT 3.3.1 ESTABLISH EDUCATION TECHNOLOGY STANDARDS FOR TEACHER RESOURCE CENTRES

Initially, MoE established five Resource Centres, now renamed as Teacher Resource Centres (TRCs), with the mandate to provide professional development opportunities, particularly for the teachers of remote schools. Over the years, the TRC programme expanded under the assistance of Education Development Project (EDP) and UNICEF. Presently, there are 35 TRCs in 15 Dzongkhags, with the exception of Haa, Sarpang, Tsirang, Paro and Punakha Dzongkhags.

In the recent report "Road Map: Revitalization and Expansion of TRCs in Bhutan" (TRC Report) published by MoE in September 2013, it is envisaged that a TRC shall be "a leading centre for continued professional development of teachers to enhance quality education" and recommends that:

- These TRCs should form the key infrastructural hubs around which INSET delivery will take place. The TRC will be seen increasingly as an institution where teachers can develop their professional and academic competence.
- More widely distributed TRCs are required in Bhutan in order to enable the cascading of INSET training, supporting the ongoing learning of teachers, and enabling teachers from scattered and remote areas of Bhutan to access INSET programmes and resources.
- There is a need to upgrade the existing TRCs and equip them sufficiently for Lead Teachers to use the TRCs effectively to deliver training to others. Some of the existing TRCs may need to be relocated if they are in relatively inaccessible locations.

Based on the needs for additional or new TRCs in the Dzongkhags and Thromde, the tentative list of TRCs are as follows:

Number of existing and new TRCs in Bhutan

SN	Dzongkhag	Existing TRC	New TRC	Total
1	Bumthang	2		2
2	Chukha	3	2 (Thromde=1)	5
3	Dagana	2	1	3
4	Gasa	1		1
5	Haa		1	1
6	Lhuentse	3		3
7	Mongar	3	1	4
8	Paro		2	2
9	Pema Gatshel	3	1	4
10	Punakha		2	2
11	Samdrup Jongkhar	2	2 (Thromde=1)	4
12	Samtse	1	2	3
13	Sarpang		3 (Thromde=1)	3
14	Thimphu	2	1 (Thromde=1)	3
15	Trashigang	5	1	6
16	Trashi Yangtse	2	1	3
17	Trongsa	2		2
18	Tsirang		2	2
19	Wangdue	1	2	3
20	Zhemgang	3	1	4
	Total	**35**	**25**	**60**

In the 11th FYP, Nu 61.0 million has been set aside for the "Support of Teacher Resource Centres".

Need for Establishing Education Technology Standards

Given the geographical challenges of Bhutan, the TRCs serve as good location of choice for the conduct of professional development programmes for teachers. In particular, it is identified under Project 1.1.2 that TRCs should be enhanced as learning centres for professional development of teacher in the use of ICT in teaching whereby instructor-led training can be conducted for in-service teachers and ICT laboratory assistants.

These professional development programmes will be an ongoing endeavour and hence it is crucial that a common education technology standards be established across all TRCs to enable these programmes to be delivered in a sustainable, consistent and reliable manner.

Recommendations and Implementation Plan

The TRC Report proposes list of standard equipment for TRC which include five desktop computers, a laser printer, a dot matrix printer, a photocopier, a scanner, a LCD projector, a laptop, a digital camera and an external storage device. These facilities should address the basic needs of providing a minimum level of access to online and digital resources.

For ICT enabled learning to be effective, it is recommended that each TRC should additionally be equipped as follows:

1. Hardware
    - 1 tablet from the Tablet devices for Learner innitiatives;
    - Wi-Fi connectivity for online mobile learning;
    - 5 web cameras for desktop computers.
2. All PCs should be installed with the common software used for content creation and teaching delivery.
3. All TRCs should have basic Wi-Fi connectivity (for tablets) and reliable Internet access.

All computers, equipment and installed software should be based on the Ministry-wide Standard ICT Operating Environment (SOE) guidelines so that they are consistent with what teachers are familiar with in schools.

Under the 11th FYP, there is already a capital budget outlay of Nu 61.0 million for the "Support of Teacher Resource Centres". In addition, the INSET Master Plan 2012 recommends an operating expenditure of up to Nu 1.35 million for operating TRCs. The tablets will be funded under the Tablet devices for Learners initiative under Project 3.1.1. It is recommended that an additional budget of Nu 1.0 million be set aside for the additional equipping.

The planning for equipping should complete in 2014 and deployment to the existing and planned 60 TRCs should happen in phases over the 4-year period

from 2015 to 2018 with targets stated below.

2014	2015	2016	2017	2018
Develop SOE guidelines (Project 3.1.1) Procurement planning	Procurement of equipment Equipping of 10 TRCs	Equipping of 20 TRCs	Equipping of 20 TRCs	Equipping of the remaining TRCs

PROJECT 3.3.2 EQUIP COMMUNITY LEARNING CENTRES WITH LEARNING TECHNOLOGIES

The Government of Bhutan is committed to providing lifelong learning opportunities to adult learners. The non-formal education (NFE) programme run by the Ministry of Education has gained widespread popularity since its inception in the early 1990s as an effective programme for providing basic literacy and functional skills to the adult population, particularly in rural areas. As of 2013, there were 885 NFE centres and 22 Community Learning Centres (CLCs) in the country providing functional literacy to 9,628 adult learners. Availability of facilities like CLCs helps to provide post-literacy opportunities for continuous/lifelong learning and acquiring ICT and other functional literacy. In collaboration with DITT/MoIC, some of the CLCs could be co-located in CCs to avoid duplication of resources.

Under Programme 1.2, it has been identified that a common e-learning platform should be deployed to all schools under MoE. The same platform should be made available to NFE learners to leverage the scale and reach of technology to benefit a large population across the country. However, an e-learning platform will require the support infrastructure to reach NFE learners who are mostly in remote rural areas. This pose a challenge for the deployment of the infrastructure, especially from the cost-effectiveness perspective.

NFE centres tend to be geographically dispersed and small that caters to adult learners in the local community. Whereas, CLCs are centrally located and equipped with basic learning facilities. Therefore, upgrading CLCs with appropriate advanced learning technologies will be a more viable option. This will not only provide learners and community users with a much more engaging

learning experience but will also be greatly beneficial to the effective delivery of functional literacy and literacy with ICT programmes.

In addition, CLCs are usually well maintained as they are run by a local CLC committee that consists of school principals, village elders, and learner representatives under the chairmanship of village chiefs. This will ensure that the deployed technologies remain secured and continue to be well looked after.

Implementation Plan

The ICT equipment should comply with SOE specifications of CLCs and minimally include:

1. One desktop PC;
2. One tablet;
3. Internet access with Wi-Fi connectivity;
4. Printer;
5. Web camera for web conferencing;
6. Basic learning software that conform to MoE's recommended software guidelines.

Under the 11th FYP, there is already a capital budget of Nu 3.45 million for equipping CLCs with ICT facilities and teaching and learning materials.

The planning for equipping should be completed in 2014 and deployment to the over 20 CLCs should happen in phases over the 4-year period of 2015-2018 with targets stated below. These targets shall be used to track the success of the project.

2014	2015	2016	2017	2018
Develop SOE guidelines (Project 3.1.1)	Equipping of 5 CLCs	Equipping of 10 CLCs	Equipping of remaining CLCs	

PROJECT 3.3.3 STRENGTHEN REGIONAL ICT SUPPORT FOR COMPUTER MAINTENANCE

Under the current administration structure, each Dzongkhag has its own ICT support staff to support the ICT needs of government entities operating within the region. As such, government schools also rely on the regional ICT support staff for their ICT support needs, in particular computer maintenance support.

Due to understaffing of the regional ICT support, schools have generally found it challenging to get adequate and timely support to resolve issues related to ICT equipment and infrastructure in schools. As the result, many equipment are left in a non-operational or poorly serviced state.

Recommendation

- MoE to work with MoIC to establish Standard ICT Operating Environment(SOE) guideline to standardise hardware and software deployment across all schools. This will enable more efficient maintenance support as there will be fewer versions to support. Having a standardised environment will also translate to lower training cost for ICT support staff.
- Based on the number of schools and the progress of school computerisation programme, MoE should earmark budget for maintenance and repair of computers and network devices.
- Train ICT Laboratory assistants in schools with necessary skills to maintain and repair computers and network devices.

Implementation Plan

A comprehensive review need to be carried out to estimate the requirement and the training needs of ICT Laboratory assistants. Laboratory assistants should be recruited (if necessary), trained and deployed in schools as per the school computerization programme over the subsequent four years from 2015 to 2018.

The aim of this project is to ensure timely and quality technical support for schools.

2014	2015 onwards
• Comprehensive review of staffing and training requirements by MoE in consultation with MoIC	• Recruit and train new ICT support staff • Upgrade skills of existing ICT support staff • Monitor service level and customer satisfaction • Yearly review of status

PROGRAMME 3.4 ESTABLISHMENT OF GOVERNANCE AND PROGRAMME MANAGEMENT FRAMEWORK

It is necessary to have proper governance and organisation structure to support the rollout of iSherig over the entire five year period and even beyond. Many of the initiatives are new and require new expertise and skills. The work processes may also be changed. Hence, it is critical that proper governance and organisation structures be put in place to drive and monitor the implementation of projects.

PROJECT 3.4.1 CREATION OF STEERING COMMITTEE AND COORDINATION MECHANISM TO MONITOR ICT PROGRAMMES

With many high impact and critical projects to be executed over the next five years, coordination and monitoring is very important.

Although, Project 3.4.2 proposes to consolidate the various ICT functions within MoE into two divisions, there still remains a need for a higher decision making committee.. There will be many projects that will be initiated over the next five years, and therefore, better coordination would be required amongst departments within the Ministry and other relevant government agencies .

A national level steering committee is proposed to track timely implementation of projects and to resolve any major issues related to budget, planning and decision. Since Government/Cabinet has already approved the eGov Governance Structure to oversee effective implementation of the whole of Government ICT priorities, the National eGov Governance Committee would also be the 1st level

or National Steering Committee for Education ICT Master Plan.

Many of the projects in the iSherig are to be executed within the entities of MoE. Hence, there is a need for a 2nd level committee within MoE chaired by the Secretary comprising senior representatives from:

1. Department of Curriculum Research and Development
2. The to-be-formed Education Technology Division, DCRD
3. Policy and Planning Division
4. The to-be-formed ICT Services Division, MoE
5. Department of School Education
6. Professional Development Division
7. Department of Adult and Higher Education
8. Non-Formal and Continuing Education Division
9. Royal University of Bhutan
10. Royal Education Council

Since most of the projects will be executed at the schools in various Dzongkhags, there should be monitoring at the Dzongkhag level as well. Each Dzongkhag can have its own committee comprising the following members:

1. Dzongdag
2. DEO / TEO
3. Dzongkhag ICT Officer
4. Dzongkhag Accounts Officer
5. Dzongkhag Procurement Officer
6. Selected principals
7. Selected School Heads of ICT
8. TRC Lead Teachers

2014	2015 onwards
• Define scope of steering committee • Form steering committee	• On-going regular meetings to monitor the progress of iSherig

PROJECT 3.4.2 RESTRUCTURING OF THE EXISTING ICT RELATED DIVISIONS

Currently there are various divisions whose roles are all related to ICT. They tend to work in isolation. The ICT unit is currently placed under Policy and Planning Division (PPD) of MOE with two ICT officers and two ICT associates who maintain the networks, application development and system management of the Secretariat. Planning and budgeting, and monitoring of the computers and Internet connectivity and training of teachers in the schools are looked after by the School IT unit under School Liaison & Coordination Division of the Department of School Education (DSE). The Publication and Instructional Media Division under the Department of Curriculum Research and Development (DCRD),located at Paro, is responsible for the school ICT curriculum development and training of ICT subject teachers on the new ICT curriculum.

With iSherig, there will be a greatly accelerated pace in the implementation of projects where coordination may be more challenging if the projects are supervised by separate divisions/ departments MoE will need to look into creating an appropriate structure to manage iSherig and future ICT-related programmes. There are two models that MoE could consider:

Model 1:

Two separate Divisions: Department of Curriculum Research and Development to maintain and confine their roles only to content development and plan training on ICT curriculum. Since the current ICT unit under the Policy & Planning Division is due to

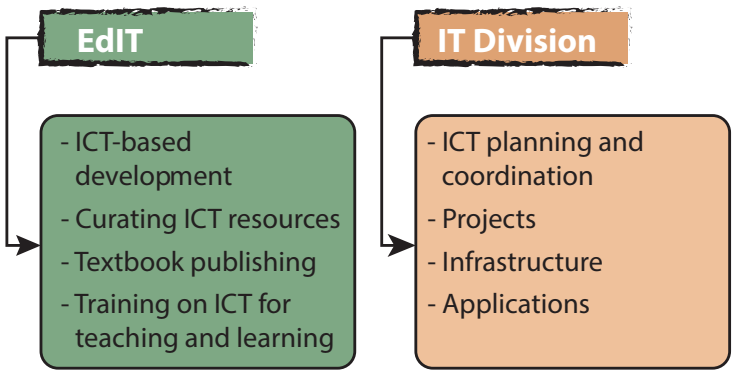


Figure 8: Model 1 with two separate divisions

be upgraded to a Division under the MOIC's ICT Management initiatives, all infrastructure, projects and overall coordination and monitoring can be placed under this division, and completely do away with the school IT unit, which is under DSE as presented below. The existing Publication and Instructional Media Division of DCRD can be renamed as Educational Technology Division (EdIT) and be appropriately staffed to carry out the curriculum and capacity development projects. Additional head count of 20 is projected for EdIT.

Model 2:

New Education Technology Division: Under this model, all ICT functions under the new School ICT Division of DSE and that of ICT unit under PPD can be merged and create a new Education Technology Division that reports directly to the secretary as presented below.

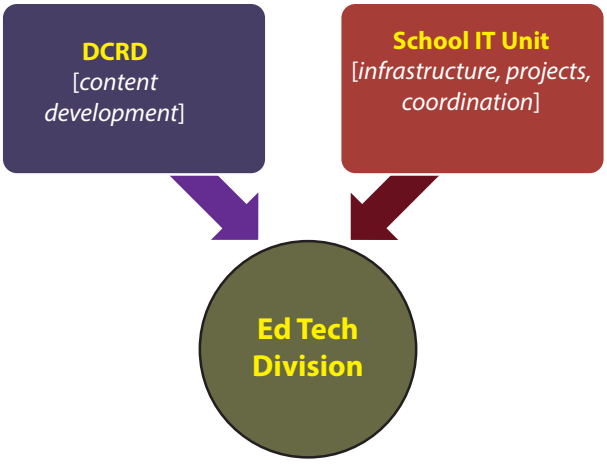


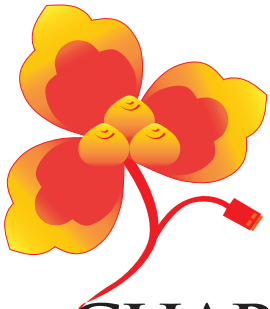
Figure 9: Model 2 with merged functions into one division

The challenge with Model 2 is the different nature of content development and infrastructure and ICT systems projects. The first involve curriculum and pedagogical expertise, which is currently readily available in DCRD. The latter involve ICT expertise, with some ICT professionals seconded from MoIC under the ICT Management initaitive.

Having considered the pros and cons of both models, the core team recommends the adoption of Model 1. This model provides the least disruption to organisational structures that are already in place or have been previously approved. It separates the curriculum/ pedagogical parts of iSherig from the technical ICT execution parts, enabling a better match of the skills of the respective division heads with the expertise of their team members. However,

there has to be strong coordination between both divisions, which will be the critical role to be played by the steering committee established in the Project 3.4.1 above.

2014
• Define functions and staffing requirement for EdIT and ICT Division • Form EdIT and ICT Division • Effect other changes in duties to EdIT and ICT Division and to other units as necessary



CHAPTER 4

SUMMARY

The implementation roadmap, budget and lead agencies for iSherig's 27 projects are summarised below:

'iAble Thrust': Enhance capacity building for educators, students and support staff Key Outcomes:	
Mid-term Goals: • 70% of students from class IV onwards receive regular ICT training • 50% of teachers equipped to use ICT for teaching and learning • 100% of ICT laboratory assistants trained to maintain schools' ICT laboratories and to help teachers with use of ICT in teaching and learning	Five-Year Goals: • 100% of students from class IV onwards receive regular ICT training • 100% of teachers equipped to use ICT for teaching and learning • 100% of ICT laboratory assistants trained to maintain schools' ICT laboratories and to help teachers with use of ICT in teaching and learning

Programme 1.1 ICT capacity development for educators												
Initiatives/Projects	2014		2015		2016		2017		2018		Est Budget (million)	Lead Agencies
Project 1.1.1: Enhance ICT as teaching tool in curriculum in the Colleges of Education											Existing resources	RUB (PCoE, SCoE, YCoE), REC
Project 1.1.2: Enhance professional development of teacher in use of ICT in teaching											2.5	PDD, EdIT
Project 1.1.3: Establish structures to empower and recognise teachers in use of ICT											2.5	PDD, TEO/ DEO, EMSSD
Project 1.1.4: E-learning programme for NFE trainers											2.0 1.0 x 1 yr	

Programme 1.2 ICT Capacity Development for Students							
Initiatives/Projects	2014	2015	2016	2017	2018	Est Budget (million)	Lead Agencies
Project 1.2.1: Review curriculum of Computer Studies subject						3.0	DCRD
Project 1.2.2: Develop comprehensive curriculum for literacy with ICT						6.0	DCRD
Project 1.2.3 Develop Cyber Wellness in students						Existing resources	DCRD with DoIM

Programme 1.3 ICT Capacity Development for Learning Support							
Initiatives/Projects	2014	2015	2016	2017	2018	Est Budget (million)	Lead Agencies
Project 1.3.1: Establish professional development plan for ICT laboratory and other laboratory assistants						30.0	PDD, EdIT
Project 1.3.2: Develop framework for industry capability development						Existing resources + sponsorship	EdIT
Project 1.3.3: Establish educational technology expertise within RUB						0.15 2.4	RUB

'iBuild Thrust': Strengthen ICT integration into curriculum, pedagogy and assessment Key Outcomes:	
Mid-term Goals	Five-Year Goals
• 10% of lessons taught in schools facilitated by use of ICT • Students and educators able to access fully digitized textbooks enriched with interactive learning objects in at least 2 subjects	• 15% of lessons taught in schools facilitated by use of ICT • Students and educators able to access fully digitized textbooks enriched with interactive learning objects in at least 3 subjects

Programme 2.1 Promote Educational Interactive Materials and Software								
Initiatives/Projects	2014	2015	2016	2017	2018	Est Budget (million)		Lead Agencies
Project 2.1.1 Establish a plan for acquiring electronic resources and tools for learning and assessment						26.0		DCRD EdIT, BCSEA
Project 2.1.2 Digitize school textbooks								EdIT
Project 2.1.3 Subscription to online databases						15.0	RUB	
Project 2.1.4 Enhance teaching plans and textbooks with use of ICT						Shared with 2.1.1 and 2.1.2	EdIT	

Programme 2.2 Pervasive use of E-learning in education institutions								
Initiatives/Projects	2014	2015	2016	2017	2018	Est Budget (million)		Lead Agencies Lead Agencies
Project 2.2.1 Establish e-learning platform for learning institutions						25.0	15.0 x 3 yrs = 45	System: ICT Services+ EdIT Content & Impl: DCRD, ECCD, NFE, PSD
Project 2.2.2 Drive adoption of Virtual Learning Environment at RUB						6.5	RUB	

'iConnect Thrust': Enhance nationwide education and learning ICT Infrastructure and systems Key Outcomes:	
Mid-term Goals	Five-Year Goals
• All secondary schools in Bhutan will have computer to student ratio of 1:10 for secondary schools • All LSS, MSS and HSS schools in Bhutan will have Internet access	• All schools in Bhutan will have computer to student ratio of 1:30 for primary schools and 1:10 for secondary schools • All schools in Bhutan will have Internet access

Programme 3.1 Computerisation Programme												
Initiatives/Projects	2014		2015		2016		2017		2018		Est Budget (million)	Lead Agencies
Project 3.1.1 Equip schools with computing devices											351.0 30.0	ICT Services
Computers & N-Computing & LED Televisions in classrooms& inclusive devices												
Tablet-for-Learner pilot												
Project 3.1.2 Establish Internet and Intranet Connectivity for schools											100.0 (funding from BiCMA)	School IT Unit and MoIC
Project 3.1.3 Expansion of network in RUB											55.5	RUB

Programme 3.2 Expansion of MIS and Admin Systems												
Initiatives/Projects	2014		2015		2016		2017		2018		Est Budget (million)	Lead Agencies
Project 3.2.1 Review and enhance Management Information Systems											8.0	ICT Services, PPD, other agencies
EMIS												
QAAD												
NFE MIS												
e-Portal												
Project 3.2.2 Implement online student admission and common email systems for RUB											In-house resources	RUB
Project 3.2.3 Implement online email for all MoE educators											To be determined	ICT Services

Programme 3.3 Establish Distributed Learning Support Infrastructure												
Initiatives/Projects	2014		2015		2016		2017		2018		Est Budget (million)	Lead Agencies
Project 3.3.1 Establish education technology standards for Teacher Resource Centres											1.0 0.25 x 4 yrs	PDD

Programme 3.3 Establish Distributed Learning Support Infrastructure												
Initiatives/Projects	2014		2015		2016		2017		2018		Est Budget (million)	Lead Agencies
Project 3.3.2 Equip Community Learning Centres with learning technologies											3.45	NFE, Local Government
Project 3.3.3 Strengthen regional ICT support for computer maintenance											MoIC Budget	HRD & ICT Services with MoIC

Programme 3.4 Establishment of Governance and Programme Management Framework within MoE												
Initiatives/Projects	2014		2015		2016		2017		2018		Est Budget (million)	Lead Agencies
Project 3.4.1 Creation of steering committee and coordination mechanism to monitor ICT programmes												MoE
Project 3.4.2 Restructuring of the existing ICT related divisions.												MoE, HRD
										Total	**711.6**	**121.75**
											833.35	

Next Steps

Having developed this Master Plan, the next step is to formalise the governance structures and communication plans to proceed with the implementation of iSherig. Hence, projects 3.4.1 and 3.4.2 should be started soon after iSherig is approved by the Government. This will put in place the necessary governance and agencies to carry out the implementation of the projects as well as to monitor the progress regularly.

Each project owner in iSherig should determine the desired outcomes for each project and establish current baseline and track progress yearly. Where projects are executed at the school level, the monitoring should also be tracked and managed by Dzongkhag Steering Committee. It is critical that the implementation plans be developed by each project owner based on timelines in the iSherig.

iSherig can be presented to principals during Annual Dzongkhag Education

Conference to secure buy-in and to set expectations. Leaders in the schools will play a key role in ensuring the implementation of the projects in the iSherig.

Adjustments in the 11th FYP can be made whenever necessary by implementing agencies to ensure smooth execution of the projects. This Master Plan also serves to guide funding support from new donors or from internal sources to prioritize the funding needed for new projects.

CHAPTER 5

CONCLUSION

iSherig is the first ICT Master Plan for the education sector in Bhutan. It builds on Bhutan's first eGov ICT Master Plan launched in 2012. iSherig is designed to support the GNH for Education goals anchored by the MoE, particularly to enable quality education from early learners to adult learners across the country.

To fully realise the benefits envisaged by iSherig, close coordination between agencies involved in the implementation will be crucial. It is also necessary to establish proper governance and monitoring structures, and secure their commitment to implement the projects.

iSherig is a bold step in Bhutan's ongoing journey towards its transformation into a knowledge based society. The country has already made huge investment in terms of ICT and in the education of its people. As Bhutan enters into the global economy, iSherig will transform the education landscape in Bhutan to better prepare Bhutanese for an exciting future in the globalised 21st century.

ANNEXURE

EDUCATION CORE TEAM MEMBERS

Sl.#	Name	Designation/Organization
1	Dorji Wangchuk	Thromde Education Officer, Thimphu Thromde
2	Karma Jigme Lepcha	ICT Curriculum Officer, DCRD, MoE
3	Nyendo	Principal, Dechenchholing MSS, Thimphu
4	Passang Tshering	Teacher, Bajothang HSS, Wangdue Phodrang
5	Pema Chhogyel	Programme Officer, SEN & ECCD, DSE, MoE
6	Pema Choedup	Dzongkhag Education Officer, Thimphu Dzongkhag
7	Rinchen Samdrup	Planning Officer, PPD, MoE
8	Sigay Dem	Asst. Programme Officer, PSD, DSE
9	Sonam Jamtsho	ICT Officer, PPD, MoE
10	Tenzin Dorji	Teacher, Chukha Higher Secondary School
11	Thinley Dorji	Education Monitoring Officer, EMSSD, DSE, MoE
12	Ugyen Dorji	Chief Programme Officer, PIMD, DCRD
13	Ugyen Wangchuk	Sr. IT Lecturer, PCE, RUB

ADVISOR AND CONSULTANTS FROM IDA INTERNATIONAL

Sl. #	Name	Role/ Organization
1	Dr. Koh Thiam Seng	Lead Advisor, IDA International, Singapore
2	Yee Jenn Jong	Lead Consultant, IDA International, Singapore
3	Yee Jenn En	Consultant, IDA International, Singapore

RESOURCE PERSONS

Sl. #	Name	Designation/Organization
1	Nima Damdul	Chief Programme Officer, NFCED, DAHE, MoE
2	Kinley Dorji	Subject Coordinator, BCSEA
3	Kinley Gyeltshen	Sr. Programme Officer, SLCD, DSE
4	Dhendup Tshering	Sr. HRO, HRD, MoE
5	Kinley Rinchen	Sr. Planning Officer, RUB, MoE
6	Dorji Lhamo	Planning Officer, RUB, MoE

FIRST ROUNDTABLE MEETING MEMBERS

(excluding core team members)

Sl.#	Name	Designation	Organization
1	Aum Sangay Zam	Secretary	MoE
2	Kinga Dakpa	Secretary of Examination	BCSEA
3	Tshewang Tandin	Director General	DAHE, MoE
4	Chencho Dorji	Director General	DYS, MoE
5	Kesang Choden Dorji	Director	DCRD, MoE
6	Karma Yeshey	Director	DSE, MoE
7	Phuntsho Togbay	Director	DITT,MoIC
8	Yeong Wee Tan	Director	IDA
9	Ivan Wee	Project Director	IDA
10	Aloysius Koh	Participant	IDA
11	Dechen Zam	Chief Planning officer	PPD,MoE
12	Tshesum Dawa	Offtg.CHRO	HRD, MoE
13	Kinley Gyeltshen	Sr. Programme Officer	SLCD, DSE, MoE
14	Tenzin Rabgyel	Dy.CHRO	HRD, MoE
15	Dorji Wangmo	Dy. CPO	PPD,MoIC
16	Chen Chen Dorji	CEO	RIITM
17	Boaz Shmueli	Co-director, Research lab.	RIITM
18	Galit Shmueli	Professor	RIITM
19	Dhendup Tshering	Senior HR officer	HRD, MOE
20	Dorji Lhamo	Planning Officer	RUB
21	Norbu Tsheten	Sr.ICT Associate	AFD, MoE

SECOND ROUNDTABLE MEETING MEMBERS

(excluding core team members)

Sl.#	Name	Designation	Organization
1	Aum Sangay Zam	Secretary	MoE
2	Tshewang Tandin	Director General	DAHE, MoE
3	Chencho Dorji	Director General	DYS, MoE
4	Kesang Choden Dorji	Director	DCRD, MoE
5	Ivan Wee	Project Director	IDA
6	Yee Jenn Jong	Lead Consultant	IDA
7	Thinley Rinzin	Offtg. Chief Planning officer	PPD,MoE
8	Tshesum Dawa	Offtg.CHRO	HRD, MoE
9	Kinley Gyeltshen	Sr. Programme Officer	SLCD, DSE, MoE
10	Dorji Lhamo	Planning Officer	RUB

FINAL ROUNDTABLE MEETING MEMBERS

(excluding core team members)

Sl#	Name	Designation	Organization
1	Lyonpo Mingbo Drukpa	Hon'ble Minister	MoE
2	Aum Sangay Zam	Secretary	MoE
3	Kinga Dakpa	Secretary	BCSEA
4	Tshewang Tandin	Director General	DAHE, MoE
5	Thubten Gyatsho	Director General	PCoE
6	Karma Yeshey	Director	DSE, MoE
7	Kesang Choden Dorji	Director	DCRD, MoE
8	Phuntsho Tobgay	Director	DITT, MOIC
9	Chen Chen Dorji	CEO	RIITM
10	Karma Dhendup	CEO	Athang
11	Kinley Gyeltshen	Chief	HRD, MoE
12	Dechen Zam	Chief	PPD, MoE
13	Sangay Khandu	Principal	MHSS
14	Dorji Lhamo	Planning Officer	RUB
15	Kinley Rinchen	Planning Officer	RUB

Sl#	Name	Designation	Organization
16	Boaz Shmueli	Faculty	RIITM
17	Prof. Galit Shmueli	Faculty	RIITM
18	Dr. Koh Thiam Seng	Lead Advisor	IDA
19	Yee Jenn Jong	Lead Consultant	IDA
20	Wee Tan	Director	IDA
21	Ivan Wee	Project Director	IDA
22	Namgay Wangchuk	Sr. Programme Officer	REC