SASEC RESEARCH AND TRAINING NETWORK:

LETTING THE LIGHT OF KNOWLEDGE SHINE

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Foreword

In 2005, the Southeast Asia Subregional Economic Cooperation (SASEC) Information Communication Technology (ICT) Working Group of the Asian Development Bank (ADB) developed a master plan, outlining the strategy, framework, and priorities for regional cooperation in ICT for enhancing direct cross-border connectivity, expanding rural access to ICT services, and developing the people skills required to maintain the infrastructure, train users and technical personnel, and sustain operations into the foreseeable future. To address these needs, the four original SASEC countries (Bangladesh, Bhutan, India, and Nepal)[1] established the SASEC Information Highway project funded by the ADB to deliver and facilitate modern broadband information, communication, and knowledge services within and across borders to governments, businesses, research institutes, and rural and remote communities.

In November 2006, ADB approved the project with the objectives of enhancing the benefits of ICT, cooperating regionally for inclusive growth and poverty reduction, and participating more fully in the global information economy. With sustainability in mind, key goals included increasing the supply of affordable broadband communication links, developing skilled ICT manpower, and creating local content and online applications with a special focus on the needs of the poor, including the means of paying for services electronically.

The three main components comprising the project are:

- A Regional Network (RN) to establish high-speed fiber optic links among the four countries through direct peering arrangement in India;
- A Village Network (VN) to expand broadband ICT access to 110 rural communities in four countries, thereby enabling local networking and information sourcing;
- A Research and Training Network (RTN) to promote cooperation and knowledge sharing among the ICT researchers and developers in the four countries and to build technical and business skills in ICT, particularly by developing local content and online applications designed to meet the needs of the poor.

In December 2007, to implement the RN and VN components, the ADB approved total assistance of $16.8 million, comprising a loan of $3.1 million to Bangladesh, and grants of $4.7 million to Bhutan and $9.0 million to Nepal, to expand their respective backbone fiber infrastructures and develop Community e-Centers (CeCs). Concurrently, the Government of India committed to use its internal resources to enhance its existing fiber network across the borders to facilitate a peering arrangement and allow efficient data exchange among the four countries. For the RTN component, ADB approved an additional complimentary grant-financed regional technical assistance of $4.4 million encompassing the four countries.

The project is now largely completed with the final deadline planned for 31st December 2017. Fiber optic cables have been installed

1 There are two additional SASEC countries, The Maldives and Sri Lanka, that are not part of this project.

between the peering center in Siliguri, India and the Research and Training Centers (RTC) in Bangladesh and Nepal. The fiber network is also nearing completion between the RTC in Thimphu, Bhutan and the connecting point in Siliguri, India. The network is ready to go live upon obtaining final government approvals for the Regional Network, the latter expected by mid-2017. The CECs in each country are also linked to their respective either by high speed fiber optic links in Bangladesh, Bhutan, and Nepal or by Internet access in India. While Bangladesh's CeC network is already operational, the networks in Bhutan, India, and Nepal await final approvals.

Most importantly, critical applications have been developed and hundreds of people have been trained to provide needed services to rural communities in a sustainable manner. We are particularly proud of the development in each country of e-payment gateways with integrated accounting systems that are critical to achieving sustainability. In the final analysis, the sustainability model developed for this project is its crowning achievement. While the technologies are obviously necessary for this project to succeed, the knowledge and skills that were developed by the software and systems engineers, along with the training that they provided to the CEC operators and to the first phase of end users in the rural communities, will turn out to be the most important part of the project.

At this writing, only about half of the world's population has access to the Internet. The SASEC Information Highway project is destined to make a significant contribution towards increasing that number in Bangladesh, Bhutan, India, and Nepal in a sustainable and cooperative manner.

[Signature(s) to be added upon ADB approval]

Acknowledgements

This Knowledge Book is the product of a substantial amount of teamwork encompassing the national consultants in the four SASEC countries, photographers who traveled with them to do interviews with Community eCenter (CeC) operators and end users, and the overall Team Leader and project manager, Angel Diez, and the international consultant, Stephen Caswell, and the government officials who cooperated with the project, including [add names].

The national consultants are Naimul Islam, Bangladesh; Sangay Wangchuk, Bhutan; Navneet Agarwal, India; and Dipak Shrestha, Nepal, who died tragically in a terrible accident on his way to interview the operator and end users at the CeC in Hetauda, Nepal. Sharad Baidya, the photographer for the trip, was severely injured in the accident, while Dipak's wife, Anuja, who was riding with them to visit relatives in the area, was also killed in the crash. This terrible tragedy has placed a sad cloud over the book. Our prayers and deepest regrets go out to their families, and to the spirits of Dipak and Anuja. We also wish Sharad the speediest of recoveries.

We also would like to acknowledge the photographers who took the photographs and videos of the interviews at the various CeCs: Imran Hossain, Bangladesh; Leki Dorji, Bhutan, and Vijay Verma, India. Without them, both the Knowledge Book and the attending video would not have been possible.

Finally, we want to thank the videographer, Sashul Shrestha, who worked with us to take the video clips and photographs from the various countries and craft them into a 12 minute video that tells the story of the SASEC RTN in min-documentary format.

Abbreviations

ADB	Asian Development Bank
BCC	Bangladesh Computer Council
BDB	Bhutan Development Bank
BGP	Border Gateway Protocol
BTCL	Bangladesh Telecommunications Company Ltd.
C-DAC	Centre for Development of Advanced Computing
CeC	Community E-Centre
CSC	Community Service Centre
DITT	Department of Information Technology and Telecom
DOT	Department of Telecommunications
ICT	Information and Communication Technology
IUB	Independent University, Bangladesh
KU	Kathmandu University
LMS	Learning Management System
MOIC	Ministry of Information and Communication
MoICT	Ministry of Information & Communication Technology
MTTR	Mean Time to Repair
MPLS	Multiprotocol Label Switching
NOC	Networks Operations Centre
RTC	Research and Training Centre. It holds and maintains a NOC.
RETA	Research and Education Technical Assistance
RTN	Research and Training Network
RUB	Royal University of Bhutan
SASEC	South Asia South-Regional Economic Cooperation
SCA	Service Centre Agency
SOP	Strategic and Operational Plan
TTS	Text To Speech
UPS	Uninterruptible Power Supply
USD	United States Dollars
VLE	Village Level Entrepreneurs
VPN	Virtual Private Network

Executive Summary

The SASEC Research and Training Network (RTN) is a key component of the overall SASEC Information Highway (IH) project, which was officially created in 2007. The project was established in order to make Information and Communications Technology (ICT) "more accessible, affordable, inclusive, sustainable and useful to remote and rural communities, entrepreneurs, and research and training institutes in the SASEC region."[1] There are three overall components to the project:

- Regional Network (RN) – The RN's main function is to connect the RTC's NOCs (Network Operation Centers) together in a private fiber optic network that will allow information sharing across the four countries via the central NOC in Siliguri, India.
- Village Network (VN) – The VN's main function is to link a total of 110 CECs in the four SASEC countries to each country's RTC via high speed links. In Bangladesh (VN has 30 CeCs), Bhutan (30 CeCs), and Nepal (25 CeCs), the links are dedicated fiber optic cables, while in India (25 CeCs), the links are via high speed Internet connections.
- Research and Training Network (RTN) – The RTN's main function is to provide needed applications that will benefit the people in rural communities who are typically not served by any such activities today. The RTN logically connects the four RTC's NOCs (Network Operation Centers) while the RN connects the same NOCs physically via the central NOC in Siliguri, India. There are a total of four RTC's, with one each in Bangladesh, Bhutan, India, and Nepal. These centers provide data center support for the CeCs and also are responsible for the application and content development.

Key Accomplishments

The following are key accomplishments of the RTN project:

- The overall system was built with long-term sustainability in mind.
- A partnership agreement was established amongst the organizations developing the services and applications, so they worked together to share their developments, thereby avoiding duplication of effort.
- Operators were trained to manage the CeCs and train end users, and have attended several capacity building sessions as part of the process.
- More than 5,000 end users were trained to use their local CeC.
- Three highly-needed services for rural areas were developed: video-based distance learning courses, the Village Bazaar e-commerce system, and a telemedicine system, including a special diagnostic telecart at rural locations.
- An interface for mobile phones was developed in Bhutan to allow long-term access for mobile devices.
- An e-payments system was developed in Nepal for each SASEC country that

1 ADB. 2011. Briefing Report II. Progress Update. SASEC Research and Training Network Project. TA-6433 (REG)

allows rural users to pay small increments for the various online services.

- An accounting system was developed in Bangladesh and later integrated in each country with the e-payments system to keep track of revenues and expenses.
- CeC operators were given special accounts for the accounting system so they can enter revenues from local services as well as all their expenses in order to track the revenues and expenses at each CeC.

Key Services

The major services accessed from the portal include:

- E-payments system, where customers may pay for portal DL courses and other services as well as receive funds from other registered users with their mobile phones, through the portal interface.
- CeC Accounting System permitting the automatic allocation of Revenues and Expenses for all CeCs and RTCs in local currency.
- Distance Learning courses, such as farming, computers and networking, business and accounting, tourism, and hotel management. Many of these courses are delivered both in English and in the local language.
- Certificate programs, consisting of a set of specific DL courses that registered students are required to pass.
- Village Bazaar e-commerce application where customers may buy and sell their products at local and SASEC markets.

In addition to these online services, there are also special services that will be available at each CeC as follows:

- Browsing, reading, printing, and sending government forms as required
- Internet and VoIP access for a fee paid to the CeC operator.
- Printing, faxing, and scanning of documents.

Use as a Platform

The SASEC RTN and underlying information highway have an importnt value to the communities as a platform for additional services.

In Bhutan, for example, a telemedicine service is already operating between Gelephu and the rural community of Umling that uses the underlying fiber optic cable. The Development Bank of Bhutan also uses the underlying network to deliver banking and government to citizen services that are provided by the operators at the CeCs.

Future Potential

The SASEC RTN has created a model for providing ICT services to rural communities that encompasses education, e-commerce, and needed offline services like printing and scanning in a sustainable manner because of the integrated e-payments and accounting system.

This model has enormous potential to be expanded from the 110 CeCs that have been interconnected in the four SASEC countries to more than 1,000 community centers that operate in these countries, most of which do not yet have online services.

In addition, the SASEC RTN is at the leading edge of international ICT development projects and can serve as a good model for the design of future projects.

The SASEC Research and Training Network (RTN) is part of long-term project to develop the Information, Communications, and Technology (ICT) sector in Bangladesh, Bhutan, Nepal, and Northern India. The web portals and applications that have been put in place will not just impact adults in both cities and rural areas, but they'll have a bigger impact on the children as more and more people in these countries gain access to the Internet in the coming years.

Chapter 1 - Introduction

The last frontier of the Internet is rural communities who presently have minimal or no Internet access. At this writing, Internet Live Stats estimates that there are 3.46 billion Internet users worldwide[1] . Given that the Internet had under 500,000 users in 1990, growth has been absolutely phenomenal. Nevertheless, since the earth's population is estimated at 7.3 to 7.5 billion[2], slightly less than half of the world's population uses the Internet. While many of these non-users are still in industrialized nations or in cities globally, McKinsey & Company estimated in a 2014 study that about 64% of non-Internet users lived in rural communities around the globe.[3]

The ICT Sector

ADB has a major focus on building up the ICT sector because of its critical importance to international trade[4]:

> We live in a digital age in which business and societal interaction increasingly takes place online. Ever faster and cheaper, when it is not entirely new, ICT allows people to seek, acquire, and share expertise, ideas, services, and technologies locally, nationally, regionally, and around the world. It boosts efficiency and productivity; reduces risks, transaction costs, and barriers to entry; provides the means for sweeping reorganization of business; and generally makes governments, markets, and networks work better. Nevertheless, success does not come out of nowhere: everything points to the need for enabling policy and regulatory frameworks in line with well thought-out investments in ICT infrastructure at local, national, and regional levels; development of applications; and capacities and skills for development, implementation, and sustainable operation and maintenance.

To foster this development, the ADB has extended 402 ICT-related loans, grants, and technical assistance projects to the value of $11.9 billion from 2000 to 2015[5], including:

- ICT infrastructure, e.g., telecommunications networks, mobile and wireless networks, broadband cable networks, data centers, last-mile internet connectivity, etc.
- ICT industries, e.g., ICT centers of ex-

1 InternetLiveStats.com publishes a live estimate of the number of Internet users globally. There are also other organizations making the same estimates, which vary from about 3.5 to 3.7 billion users.

2 There are two primary world population clocks, http://www.census.gov/popclock/ from the U.S. Census Bureau and www.worldometers.info/world-population/, which gets its data from both the U.S. Census Bureau and the United Nations.

3 http://www.mckinsey.com/industries/high-tech/our-insights/offline-and-falling-behind-barriers-to-internet-adoption.

4 https://www.adb.org/sectors/ict/overview

5 Ibid.

cellence, research/computer laboratories, ICT-enabled industries such as business process outsourcing, knowledge process outsourcing, software parks, ICT incubators, etc.
- ICT-enabled services, e.g., ICT applications for education, finance, governance, health, etc.
- ICT policy, strategy, and capacity development, e.g., ICT policy and strategy, telecommunications policy reform, universal access and service, ICT road maps (national and local), ICT regulations and laws, ICT skills training and capacity building, etc.

The SASEC Program

For the SASEC program, these statistics are profound. The SASEC program "brings together Bangladesh, Bhutan, India, and Nepal in a project-based partnership that aims to promote regional prosperity, improve economic opportunities, and build a better quality of life for the people of the subregion. SASEC countries share a common vision of boosting intraregional trade and cooperation in South Asia, while also connecting to Southeast Asia through Myanmar, to the People's Republic of China and the global market."[6] Because Internet access has become so important for such international trade, however, building an Internet infrastructure is a critical part of developing and fostering such trade.

SASEC Information Highway Project

In 2007, the ADB funded the SASEC Information Highway project as one of its ICT initiatives. The overall project has three components:

- An RN in each of the four SASEC countries in the project (Bangladesh, Bhutan. India, and Nepal) that are connected together by fiber optic cable.
- A VN in each country that connects a total of 110 rural communities (25, 25, 30, and 30) in the four countries to the requisite regional network node in each country.
- An RTN encompassing the four SASEC countries that builds technical and business skills in ICT by developing and sharing content and e-applications for the needs of the rural poor.

The overall objectives of the project are:

- To improve ICT connectivity amongst the four SASEC countries in the project.
- To provide modern, affordable and reliable broadband communication, information, and knowledge services to universities, businesses, and to rural areas in the four countries.
- To expand ICT accessibility in rural communities.

Research and Training Network (RTN)

The SASEC RTN, which is the subject of this report, has developed community web portals that interlink major cities in Bangladesh, Bhutan, Nepal, and Northern India with rural communities in order to promote applications like distance learning, e-payments, telemedicine, and e-commerce.

In a Needs and Readiness Assessment Report issued by the RTN project in 2011,[7] it was

6 https://www.adb.org/countries/subregional-programs/sasec

7 ADB 2011. SASEC Research and Training Network Project Needs & Readiness Assessment Report.

found that:

- Video content was necessary towards improving the knowledge of rural people
- Sharing of Distance Learning courses and applications was necessary in order to improve sustainability for all the countries' rual communities.
- High speed access using a private network connecting the four RTCs was the best means to improve sustainability. This would give CeCs the speed and the low cost that is needed.
- ADB was ready to invest several millions of dollars in fiber networks and CeC construction in order to provide this required project infrastructure required for sustainability.

In fact there was no need to introduce the Internet in this equation as high speed Internet in rural communities is expensive. Further, the Bilateral Interconnection Agreement does not permit mixing Internet traffic within the RN. CeCs and their rural customers are able to access the RTC content via the free high speed VN.

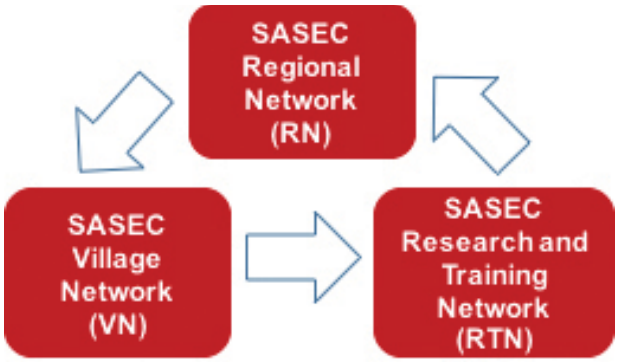
While the applications are robust and ready to be implemented, since the Internet users in the four countries are concentrated in the major cities, many potential users in rural communities do not yet have sufficient Internet bandwidth to take advantage of them from their homes. As a result, the RTN's full potential will await the general availability of high speed Internet access in rural communities. In the interim, the RTN program's applications are available for use in major cities in the region as well as from 110 CECs that are being developed to make the applications available from a central location in rural communities.

While the technologies associated with the SASEC Information Highway and Research and Training Network are important, the real goal of the project is to make these technologies available to people in rural communities to enable them to better their lives. In short, the project is really all about people and what they need to thrive in today's increasingly-interconnected world.

Chapter 2 - Project Overview

The SASEC RTN is a key component of the overall project, which was officially created in 2007. The project was established in order to make ICT "more accessible, affordable, inclusive, sustainable and useful to remote and rural communities, entrepreneurs, and research and training institutes in the SASEC region."[1] There are three overall components to the project as shown in Figure 1.

Figure 1. SASEC Information Highway Components



The functions of the components are as follows:

- **Regional Network (RN) –** The RN's main function is to connect the RTC's NOCs (Network Operation Centers) together in a private fiber optic network that will allow information sharing across the four countries via the central NOC in Siliguri, India.
- **Village Network (VN) –** The VN's main function is to link a total of 110 CECs in the four SASEC countries to each country's RTC via high speed links. In Bangladesh (VN has 30 CeCs), Bhutan (30 CeCs), and Nepal (25 CeCs), the links are dedicated fiber optic cables, while in India (25 CeCs), the links are via high speed Internet connections.
- **Research and Training Network (RTN) –** The RTN's main function is to provide needed applications that will benefit the people in rural communities who are typically not served by any such activities today. The RTN logically connects the four RTC's NOCs (Network Operation Centers) while the RN connects the same NOCs physically via the central NOC in Siliguri, India. There are a total of four RTC's, with one each in Bangladesh, Bhutan, India, and Nepal. These centers provide data center support for the CeCs and also are responsible for the application and content development.

Sustainability, Building Capacity, and Collaborative Development

The strategies used by SASEC RTN project component can be defined as follows:

- Collaborative development. Content developed by one RTC is shared at no cost by the other RTCs. In this way each RTC has four times the number of DL courses

1 ADB. 2011. Briefing Report II. Progress Update. SASEC Research and Training Network Project. TA-6433 (REG)

and applications available for its rural communities. This is a win-win situation for all partner institutions or RTCs.

- The operating cost of the network connecting the CeCs and the RTCs, partially funded by ADB, has been waived by the respective governments in order to enhance sustainability for rural communities.
- Sustainability of both the RTCs and CeCs happens when DL courses and Village Bazaar application are made available to everyone in each country and particularly in rural communities, so that students are willing to pay small amounts for quality training. This is now happening and it is exciting to see the interest in both RTC and CeC communities about the prospects.
- Electronic payments and electronic accounting of financial activity are an essential corner stone of the SASEC RTN. Rural users have realized that these are fundamental elements of the sustainability model.
- The development of the DL courses and applications has been carried out from the ground up by faculty members and local developers. We can say that these applications are "made in SASEC".
- High speed sharing of content between RTCs is done through a fiber optic network with a center point in Siliguri, India.

Furthermore, collaborative development has been a critical principle underlying the project, which is at the heart of the original SASEC concept.[2] As such, the project is as much, if not more, about the people and how the developers have cooperated together to complete the project than it is about the technologies that are being used to develop each part of the overall system.

The importance of capacity building cannot be overstated. It is far too easy for technology experts to come into an environment and install sophisticated computer and networking equipment than it is to train hundreds or even thousands of people how to use the technology. The RTN project has taken a long-term approach in which the RTCs hired local people to develop the software and content and to then create a help desk at each RTC to provide support to the CeC operators and to individual users in rural communities.

Distance Learning is a key keystrategic element as defined in the Needs and Readiness Assessment[3], which has led to the development of 31 streaming video courses developed in English that have been shared amongst the four countries, so that they may be customized for local differences as well as translated into each country's primary language. These video courses should go a long way towards building long-term capacity in the rural areas.

Finally, the project has developed a sustainability model based upon e-payment and accounting systems that allow people in the rural communities to pay for DL courses and Village Bazaar using credit instead of cash. While this may seem to be no big deal to someone reading this report from a credit-based society, it is a major accomplishment of the RTN project, which has developed the first e-payment capability in many of these communities. This will allow banks in the SASEC countries to provide bank accounts that allow users to both make and receive payments using the RTN, which has explosive growth potential as people are trained to use these systems, and Internet availability

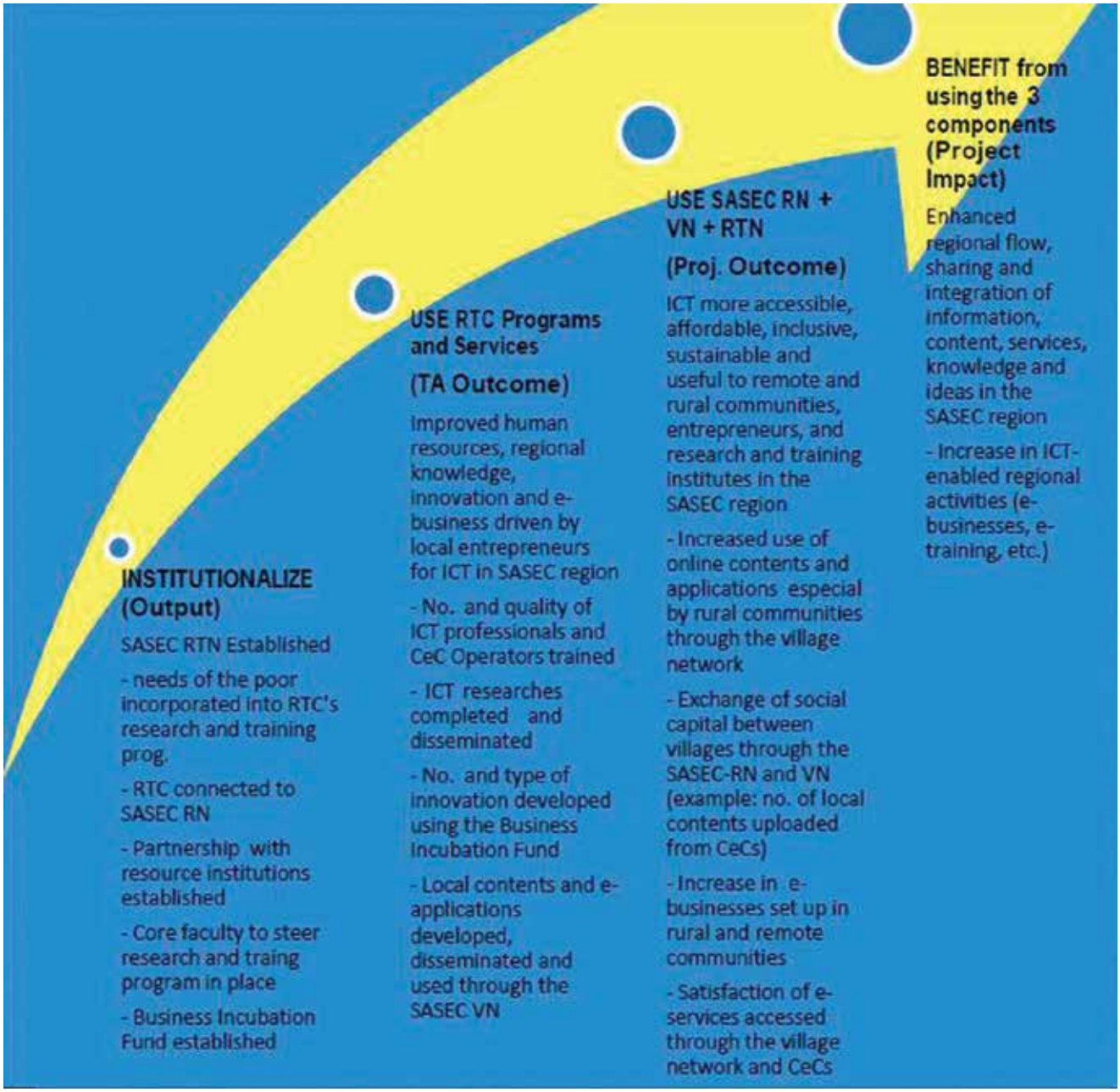
2 It is all too easy to use the acronym SASEC without remembering that it stands for South Asia Subregional Economic Cooperation.

3 ADB 2011. SASEC Research and Network Training Project. Needs and Readiness Assessment.

becomes more widespread. The RTN project triggered the need for Internet-based payments in Bhutan and the Bank of Bhutan agreed to build a proper interface to the RTC server system in Phuentsholing. The system now works with major credit cards and debit cards.

The overall goals of the project are primarily focused upon making "ICT more accessible, affordable, inclusive, sustainable, and useful to remote and rural communities, entrepreneurs, and research and training institutes in the SASEC region." (Figure 2)

Figure 2. Overall Goals of the SASEC Information Highway and Research and Training Network project.



The Regional Network (RN)

Map 1 below shows a diagram of the RN, which is designed to connect the four RTC server NOCs (Network Operation Centers) via fiber optic cable in a connecting point in Siliguri, India.

The RTCs are each located in:

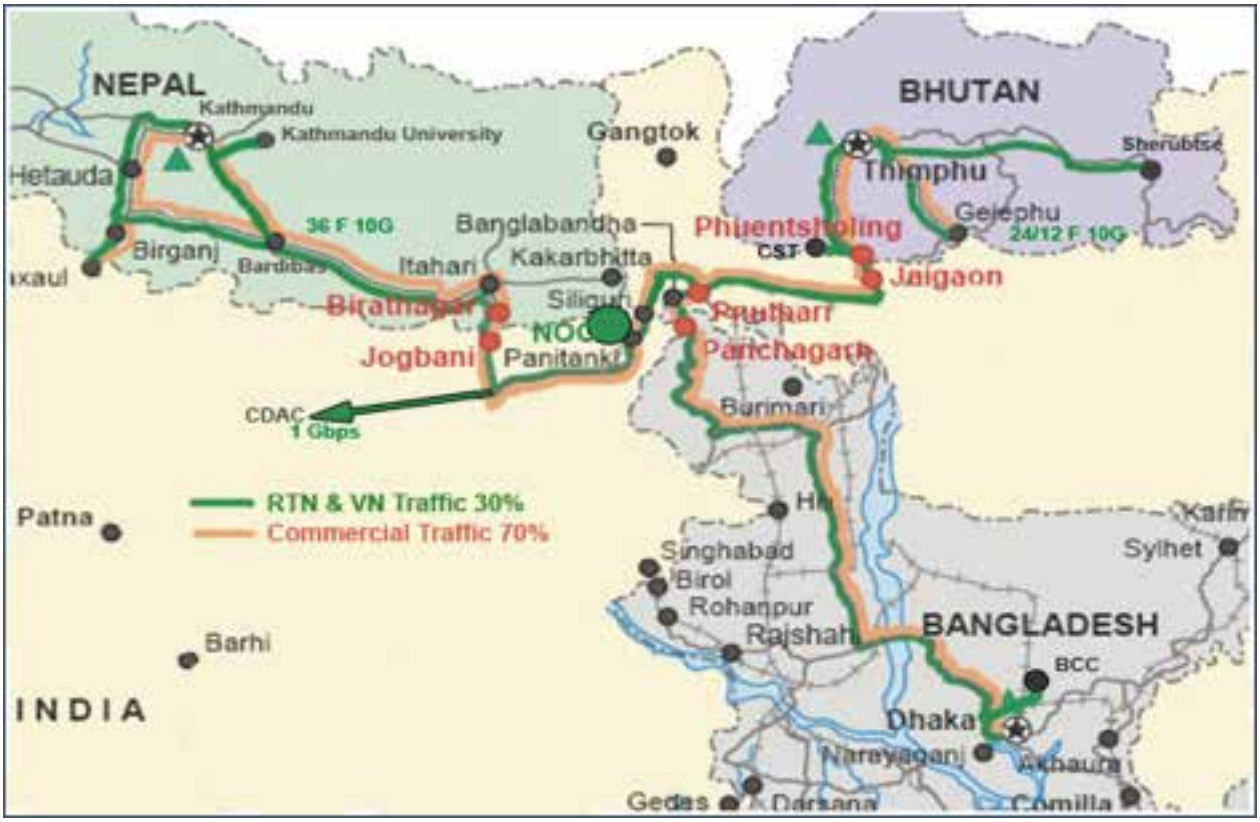
- Dhaka, Bangladesh. Bangladesh Computer Council or BCC
- Phuentsholing, Bhutan. College of Science and Technology, or CST
- Noida, India, Centre for the Development of Advanced Computing or CDAC
- Kathmandu, Nepal. Kathmandu University.

While each RTC functions independently, they have all agreed to cooperate in the development of the various applications, so that one RTC will develop a specific application or DL course and share it with the other RTCs, who will add customization for their specific country.

The RTC in Dhaka, Bangladesh is the BCC, which is a government body whose role is "encouraging and providing support for ICT related activities, formulating national ICT strategy and policy, creating standards and specifications of ICT tools for government organizations according to their necessity, working for human resource development in ICT sector. The BCC developed the CeC Accounting System that is used by all the RTCs

The RTC in Bhutan is the CST in

Map 1. Regional Network Diagram. The RTCs in Bangladesh, Bhutan, India, and Nepal are linked by fiber optic cables that interconnect in Siliguri, India.



Phuentsholing, Royal University of Bhutan, which is considered the leading university in Bhutan. The university consists of nine separate colleges covering a diverse set of majors, including engineering and computer science. CST designed a mobile phone interface that is being used in all the SASEC countries to allow mobile phones to access the RTN's primary applicationsand distance learning courses.

The RTC in India is CDAC, which is a major technology institution offering a variety of Master's Level degrees in computer science and ICT. CDAC developed the e-commerce Village Bazaar application.

The RTC in Nepal is Kathmandu University, which has a strong department of Computer Science and Engineering. Kathmandu University has played a major role in the development of the telemedicine application as well as in the development of the e-payment system used by all four RTCs. The e-payment system implements the revenue sharing model that is explained later in this report.

The Village Network (VN)

Because high speed Internet access is not widely available in rural areas within the SASEC countries, the RTN project needed to equip newly built CECs so that people in the rural areas would have a place to go to access the applications at the required high speed. These villagers may also access the applications from their homes using Internet, but the quality may vary depending on the location. A CeC is essentially a small building with atleast one room with computers, printers, copiers, and other related devices that is interlinked to the RTC via a private network, the VN. Each center needs to be large enough to support at least six computers and the printing and fax equipment and also needs to be equipped with sanitary facilities and be located close to a major road so that it has access to electricity and water services at a minimum. In all, there are 110 CeCs spread across the four countries.

CeC Services

The services that the CeCs are designed to provide are[4]:

- Distance Learning courses among rural villagers, These courses are being delivered both in English and in the local language.
- Local computer training by CeC personnel, already trained by the RTC.
- Use of e-mail, VoIP, blogging
- E-commerce application where customers may buy and sell their produce at local and SASEC markets.
- E-payments system, where customers may pay and receive funds from other registered users with their mobile phones, through the portal interface, linked to a suitable banking institution. The CeC operator becomes a de-facto Bank agent, earning commission fees for every new customer.
- Browsing, reading, printing and sending government forms as required
- Internet and VoIP access for a fee paid to the CeC operator.
- Printing, faxing, scanning as it is customary with current services.

CeC Operators

The CeC operators play a critical role in the VN by operating the Centers and providing critical training capabilities to end users in

4 ADB. 2016. Research and Training Network TA-6433 (REG) Contract Number: 100164-S41691. Final Report. Pages 8-9

the rural communities. These operators are at the heart of the sustainability model because they are expected to act a entrepreneurs in promoting the CeC in their community and by helping the rural users to meet their needs while using the various applications.

Because of the critical role played by the CeC operators, their training and development is an important part of the overall project. Each country has held workshops at each RTC to train the operators as well as rural workshops at each CeC, the latter organized by the CeC operators themselves, to talk with members of each community about the project and show them the benefits of the SASEC portal.

Community workshops are very popular and the result is that rural villagers get training on how to use the SASEC portal. To understand the importance of the CeCs in many of the rural areas, only two of the participants in these CeCs had their own computers at home and none have high speed Internet. They do, however, have access to mobile phones with limited Internet access. In general, this is the situation in Bhutan

In Bangladesh rural workshops were populated by a larger number of people than in other countries. Unlike the workshops in Bhutan, which typically had in the range of 20 to 30 attendees, the workshops in Bangladesh had much greater attendance, primarily because of the disparity in population size. Bangladesh has about 170 million people, while Bhutan has about 750,000. At the Babugonj workshop, 75 people attended. About one third of the attendees said they had home computers, while 90% said they had access to the Internet.

During the rural workshop at Satkania, attended by 400 people, only 18 of the attendees said that had home computers and only 16 said they had Internet access. In all, the workshops demonstrated the need for the CeCs based upon the small number of home PCs and people with Internet access.

Research and Training Network (RTN)

The third component of the SASEC Information Highway Project is the RTN. This is a Technical Assistance established by ADB where Caelis International, Canadian consulting consortium, has been given the responsibility of implementing it in the four countries.

In 2011, Caelis International established the main design framework of the RTN, based on four website portals, one per RTC, to hold the various DL courses and applications that were found essential to rural communities in the four countries. A Needs and Readiness Assessment in-depth study identified the requirements for all countries. The Strategic and Operations Plan identified the sharing elements of each RTC and defined a budget as provided by the RETA.

In 2012, a SASEC IH Business Operation Plan identified the sustainability Model and technical details of the four-country networks (VN and RN). The SASEC RTN portals are based upon the Joomla Content Management System (CMS) and the Moodle Learning Management System (LMS) for distance learning courses.[5]

This is particularly important because as more people are trained in the use of these products, they will then have CMS and LMS web development skills that they can use for their own projects without incurring substantial upfront costs for the underlying software. Also the e-Payment and Village

5 Both Joomla and Moodle are popular open source software products that can be downloaded and used for free.

Bazaar applications were made open source using PHP and MySQL, both used with Joomla and with Moodle. In this way there was a common ground for development of these web applications.

Originally the portal called the Village, was developed to provide a model to be used by each country. Over the ensuing years, this model has been customized to meet the needs of each country.

While each portal is operated separately by people within each country, they all have similar applications. The following list shows what is available across the various portals:

- English distance learning courses in agriculture, computers and telecommunications, business and tourism.
- Translations into each country's main language of selected English courses.
- Electronic payment application that allows people located anywhere in each country with Internet access to pay on-line for distance learning courses and e-commerce entries.
- Village Bazaar e-commerce application that allows anyone to sell goods and services on-line in each respective country.
- CeC Accounting System that permits all CeCs to learn on-line the status of their account balance as revenues are automatically updated. The CeC accounting system is critical to the overall operations of the CeCs. It was developed by BCC in Bangladesh and is shared amongst all the RTCs for the use of every CeC as well as RTCs in the four SASEC countries.
- A list of most important sites available on Internet regarding agriculture, health, business and online training.
- Each portal has bilingual capabilities so that it can be formatted in English or in one of the country's native languages.
- Text to Speech capability whereby text can be spoken aloud by the system, which is useful for people with difficulty reading their native language or English.

Accomplishments of the RTN

The following are key accomplishments of the RTN project:

- The overall system was built with long-term sustainability in mind.
- A partnership agreement was established amongst the organizations developing the services and applications, so they worked together to share their developments, thereby avoiding duplication of effort.
- Operators were trained to manage the CeCs and train end users, and have attended several capacity building sessions as part of the process.
- More than 5,000 end users were trained to use their local CeC.
- Three highly-needed services for rural areas were developed: video-based distance learning courses, the Village Bazaar e-commerce system, and a telemedicine system, including a special diagnostic telecart at rural locations.
- An interface for mobile phones was developed to allow long-term access for mobile devices.
- An e-payments system was developed in each SASEC country that allows rural users to pay small increments for the various online services.
- An accounting system was integrated with the e-payments system to keep track of revenues and expenses.

- CeC operators were given special accounts for the accounting system so they can enter revenues from local services as well as all their expenses in order to track the revenues and expenses at each CeC.

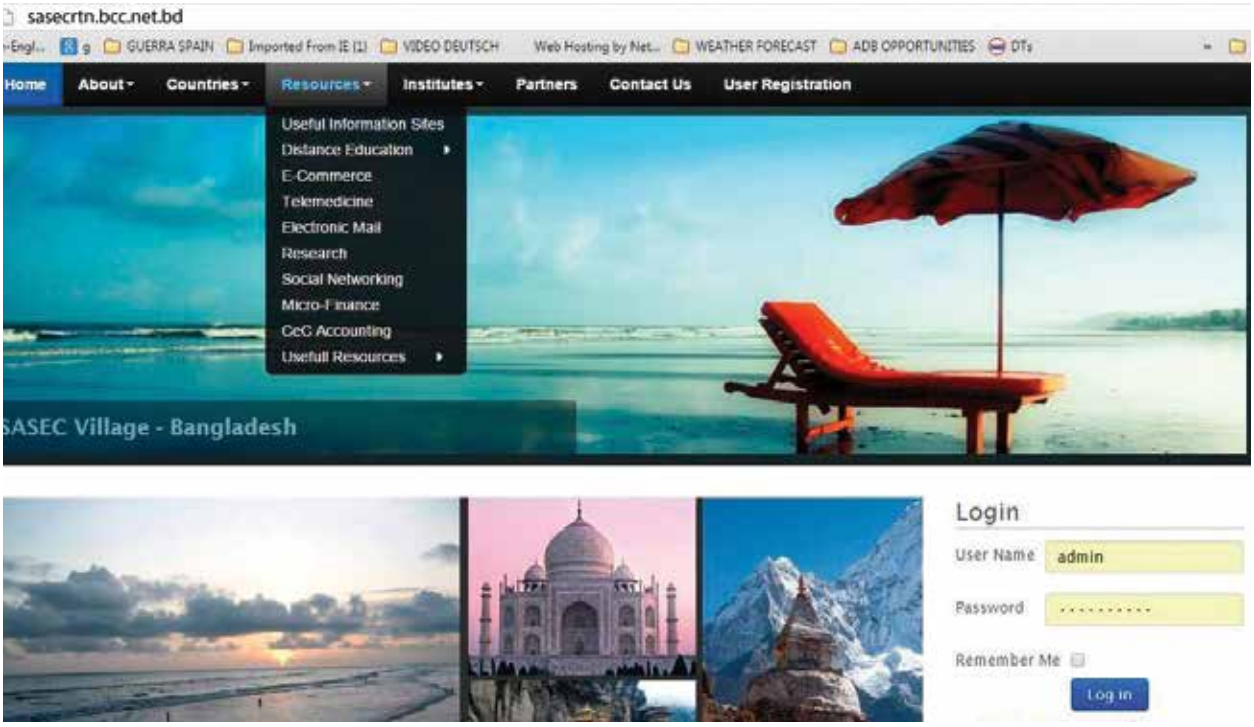
1. Villagers from the Hilley CeC in the Sarpang District in Bhutan on May 11, 2016

2. Villagers from the Samtenling CeC in the Sarpang District in Bhutan on May 10, 2016

3. Villagers from the Babugonj CeC workshop in Bangladesh on August 24, 2016

4. Villagers from the Satkania CeC workshop in Bangladesh on August 14, 2016

5. The RTN portal in Bangladesh.



6. The RTN portal in Bhutan.

7. The RTN portal in India.

8. The RTN portal in Nepal.

In order to meet the goal of making 'ICT more accessible, affordable, inclusive, sustainable, and useful to remote and rural communities, entrepreneurs, and research and training institutes in the SASEC region," several key applications were developed that will lead the way to a more prosperous future.

Chapter 3 - Changing Lives

While the SASEC RTN project is technical in nature and seems to be dominated by its technologies, it is important to remember that the technology is merely a means to an end. The main goal of the project is to change the lives of all of its participants through increased education and interconnectivity. It is also important to understand that lives are being changed at three separate levels, consisting of:

- The people who developed the software applications and the distance learning courses.
- The CEC operators who will act like small business entrepreneurs in their local communities.
- The end users in local communities whose lives will be improved by the RTN and its various uses.

To accomplish the projects goals, it is critical provide training for everyone involved, including its system developers, CeC operators, and end users. In all, more than 2,000 people have been trained at capacity building sessions held throughout the four SASEC countries. In particular, the CeC operators have undergone multiple training sessions as have the system developers.

Developing the System

The overall SASEC RTN system consists of three major subsystems: the community web portal, the e-payments and integrated accounting applications, and the DL website. While the three subsystems perform distinctly different functions, they are well-integrated so that they work closely together.

Community Web Portal

The community web portal is based upon the Joomla Content Management System (CMS). Joomla is a popular open source software application that can be downloaded and used for free. Quite literally, there are several million websites now using Joomla worldwide. As such, all of the developers who learned Joomla while developing the web portals have learned a valuable skill that can be applied to general web development.

As a CMS, Joomla's major benefit is that it allows content to be created directly by authorized end users without having to learn how to program. Joomla also has thousands of extensions that function similar to cell phone applications. These extensions add additional capability to Joomla's base configuration and typically can be installed with no programming skills. An initial version of the portal, the Village, was developed at the project manager's server in Vancouver, Canada. The Village was then installed on a server at the RTC in each country. In this way, Bangladesh, Bhutan, India, and Nepal all started with the same version of the Village and have each customized it to meet the needs of their respective countries. The headers for each portal are shown in Pictures 8–11.

Each portal provides general information about the community that it serves and also provides links to the various services provided through the portal. As such, the community portal is a central organizer that serves as a central switching point for users to gain access to various services of the overall system.[1]

The major services accessed from the portal include:

- E-payments system, where customers may for portal DL courses and other services as well as receive funds from other registered users with their mobile phones, through the portal interface, linked to a suitable banking institution. The CeC operator becomes a de-facto bank agent for setting up such accounts and earning commission fees for every new customer, while the RTC may earn a percentage of every transaction.
- CeC Accounting System, which allows for the instant allocation of funds to CeCs and RTCs bank accounts. Both CeCs and RTC may verify the status of their accounts at any date.
- Distance Learning courses, highlighting video streaming for better comprehension and retention, on subjects of interest to rural communities, such as farming, computers and networking, business and accounting, tourism, and hotel management. Many of these courses are delivered both in English and in the local language. These courses have a minimum of instructor interaction and are mainly self-contained, including on-line tests and a basic pdf (downloadable) certificate per course.
- Certificate programs, consisting of a set of specific DL courses that registered students are required to pass, provide a valuable set of skills. Instructors, guiding students online through chatting and VoIP exchanges, represent a means of boosting employment opportunities for young people in rural areas. As an example a Certificate in Multimedia Design may consist of five DL courses in Photoshop, Web Multimedia, Basic Computer Skills, Graphics Design and Video Editing with Premiere. Examinations are done on-line with videoconference facilities.
- Village Bazaar e-commerce application where customers may buy and sell their products at local and SASEC markets.

In addition to these online services, there are also special services that will be available at each CeC as follows:

- Browsing, reading, printing, and sending government forms as required
- Internet and VoIP access for a fee paid to the CeC operator.
- Printing, faxing, and scanning of documents.

The Partnership Agreement

In order to develop the services envisioned for each portal, collaboration and cooperation was critical in order to avoid each RTC duplicating the various services that are supposed to be common across the SASEC countries. As a result, the various organizations developing the portals took the time to first create a shared development plan that was established through a Partnership Agreement, which was created initially in October 2014 and later updated in 2016[2]. Five organizations participate in the plan:

1 The links to each community portal are: Bangladesh – http://sasecrtn.bcc.net.bd; Bhutan – http://sasecrtn.bt; India – http://sasecrtn.in; Nepal – http://sasecrtn.edu.np.

2 ADB 2014. SASEC Partnership Agreement.

- Bangladesh Computer Council (BCC);
- College of Science and Technology (RUB, Bhutan);
- Sherubtse College (RUB) Bhutan;
- Centre for Development of Advanced Computing in India (C-DAC); and
- Kathmandu University in Nepal (KU)

An RTC develops content and holds and maintains a server NOC (Network Operations Centre). An RTN Partner is a university or technical institute that develops content and uploads the same to the RTC NOC portal.

The RTCs, furthermore, coordinate their activities with their respective Ministry of Information and Communications Technology (MOICT), which is outlined in a Memorandum of Understanding (MOU) between the RTC and MOICT in each country.

As part of the agreement, the partners agreed to share free of charge all portal applications developed by the partners as part of the project, including[3]:

- E-payment, which was developed by KU;
- E-commerce, which was developed by C-DAC;
- CeC Accounting system, which was developed by BCC;
- A Mobile Interface, which was developed by RUB;
- Text to Speech, developed by KU for Nepali; and
- Language localisation developed by CST and KU as well (Dzongkha and Nepali).

The partners also developed a revenue sharing agreement for distance learning courses and the Village Bazaar that apportioned the revenues amongst the CeC associated with the end user, the organization that developed and/or translated the course, and the RTC in the respective country where the course was sold.

Based upon the Partnership Agreement, the various RTCs all worked together to develop the various applications and to then customize them so that they operated properly within each respective country. The Partnership Agreement also included coordinating which RTC was going to develop specific distance learning courses, so that they too could be shared amongst the partners in order to avoid duplication.

Appendix A provides a detailed list of the various applications developed by each partner.

The E-payment and Integrated Accounting Systems

Getting credit is one of the major problems facing people living in rural areas in the SASEC countries. Typically, most transactions that take place are done in cash, barter, or informal credit, such as a merchant giving some extra time for someone to pay in cash. Essentially, the system of credit cards and online payments used in much of the world does not exist in many of these rural areas.

As such, one of the most important achievements of the SASEC RTN project is the development of an e-payment system that can be implemented in all of the various countries, so that people in rural communities can establish accounts that allow them to make online payments. The e-payment system, furthermore, is integrated with the accounting system, so that revenues can be properly split amongst the various participants, and CeC operators can track both their revenues and expenses as an independent profit center.

3 ADB 2014. SASEC Partnership Agreement., page 7.

Both systems took several months to develop and implement and are good examples of cooperation amongst the SASEC countries. The e-payment system was developed initially in Nepal by Kathmandu University (KU), while the CeC Accounting System was developed by BCC in Bangladesh. The two applications were then shared with the other RTCs for further customization in order to implement them within their own countries. For example, KU worked with eSewa, a small private company that had developed an e-payment gateway for Nepal in order to complete the process of taking payments, while the Royal University of Bhutan worked with the Bank of Bhutan to implement their electronic payment system, which is the first of its kind within Bhutan. The RTCs in Bangladesh and India also implemented their e-payment systems using existing payment gateways in their respective countries.

"The Village portal and its applications and services are very important to disseminate the information needed to uplift business activities. But sustainability depends on how we can update the information, train the CeCs, and give support if any problems or difficulties arise."

-- Vijay Shresthra, Officer
Kathmandu University

Maita Rani Rai, the CeC operator at the Shompangkha Gewog in Bhutan said, "The e-payments and accounting systems are extremely useful in our community, especially the accounting system, which allows me to keep track of my revenues and expenses without having to use a separate system."

Revenue Sharing and Sustainability Model

The e-payment system allows end users to purchase distance learning courses and to buy and sell products using the Village Bazaar e-commerce system within each country. One of its major achievements is that it allows the revenues from distance learning courses to be shared amongst the various partners responsible for generating portions of the revenues. Since the different distance learning courses were developed by different partners and because they are typically sold and supported by the CeC operators, it was important to allow them to share in the revenues that were generated. As such, when an end user purchases a specific distance learning course, the e-payments system books three transactions. The first is booked by the RTC in the country where the course is purchased. The RTC then pays 40 percent of the amount it booked to the CeC selected by the end user and 50 percent of the revenues to the RTC where the course was developed if it's in English or it splits the 50% in half if the course was translated into the native language of the respective country. Finally, the e-payments system shares the transactions with the accounting system, which keeps track of all the revenues for all the parties. The revenue sharing agreement is detailed in Table 1[4].

It is estimated that each RTC will receive an average of $1,500/month for a volume of 320

4 Ibid, page 6.

enrolled courses. (80 enrolments per RTC per month). The other factor in this sustainability model is that CeCs do not have to pay for the private network as this has been graciously donated by ADB and the governments. Therefore, as long as the RTC may recover its expenses of course development and Internet access from the course revenues, the model should be sustainable.

The Accounting System

The Accounting System was developed by BCC and is used by all the partners as well as the CeCs to keep track of all of their revenues and expenses. While the accounting system keeps track of revenues distributed to the various partners, it has a special module that allows CeC operators to use the system to determine the revenues, expenses, and profit at each CeC. Each CeC operator has a special online account that allows booking transactions for receiving revenues from faxes, printing and other services and for paying expenses like rent, utilities, and supplies. When combined with the revenues from distance learning courses, this allows each CeC to keep track of its revenues, expenses, and net income on a regular basis and to print routine accounting statements.

Two Critical Applications for Sustainability

Both the e-payments and the CeC Accounting System are the pillars of sustainability of the RTN. First, the e-payment system not only required that it be integrated with the distance learning course system operating under Moodle and also to the e-commerce application, but it also had to pass information to the accounting system and to an e-payment gateway in each country. Furthermore, while established gateways existed in both Bangladesh and India, Nepal only had a small company developing a payment gateway, while Bhutan had no payment gateways at all. As a result, the RTCs in both countries were required to do some pioneering work to make e-payments a reality. This was particularly significant in Bhutan and required complex negotiations with the Bank of Bhutan to have the gateway developed. Developing the e-payment system in each country is a huge accomplishment of the SASEC RTN project.

Without these systems, sustainability of both RTCs and CeCs would be an almost impossible task.. Without e-payments, rural users would have to go to the CeCs and pay in cash for all of the available services, and the CeC operators would have to then create accounts for the distance learning courses

Table 1. Revenue Splitting Agreement for Distance Learning Courses

DL COURSES	CeC (associated to registered user)	RTC Network Operations Center	Developer RTN Partner Institute	Translator/ Customizer RTN Partner Institute
English courses	40% of registration fee	10% of registration fee	50% of registration fee	N/A
Course translations	40% of registration fee	10% of registration fee	25% of registration fee	25% of registration fee

and the e-commerce application. All revenue distribution would then have to be done manually on a CeC by CeC basis, which would be extremely difficult from both accounting and management perspectives. In short, without e-payments, there would be no way for the Village Network project to thrive and operate in a sustainable manner.

"The e-payments and accounting systems are extremely useful in our community, especially the accounting system, which allows me to keep track of my revenues and expenses withhout having to use a separate system."
-- Maita Rani Rai, CeC Operator
Shompangkha Gewog, Bhutan

The accounting system was equally important, especially for the CeC operators, who need an accounting system in order to operate as a sustainable profit center. Without the accounting system, there would be no way to track CeC performance on an on-going basis.

Distance Learning Courses

One of the highlights of the SASEC RTN program was the development of 31 distance learning courses that cover a wide range of practical subjects designed to provide needed skills in rural communities. Distance Learning Courses were designed according to the requirements expressed by rural communities, the latter outlined in the Needs and Readines Assessment Rreport. Rural people are mainly interested in receiving training and obtaining certificates in the following major areas: a) Computers and ICT; b) Farming c) Tourism d) Business and ManagementThe full list of courses is provided in Table 2.

The distance learning courses are all standardized, so that there is a consistency amongst the courses in terms of their length and configurations. This allows each course to be priced in a similar manner.

Table 2 lists the specific distance learning courses, along with the organizations where each course was developed. Figure 3 shows an advertisement developed to promote the distance learning courses in each country.

Distance Learning System

The distance learning system is based upon the Moodle Learning Management System (LMS), which is separate from the Joomla-based Village portal. There is a Joomla extension, however, which allows users to sign up on for courses on the Joomla site, with the user IDs and passwords passed to Moodle for course implementation. This extension greatly simplified user registration for courses.

The courses themselves have a wide variety of potential uses, according to Bimal K. Chetri, a professor at Sherubste College at the Royal University of Bhutan and one of the course developers. He said, "Middle, secondary, and high school students would be benefitted by taking these courses during their winter and summer vacation, while it would open up opportunities for village youth and small entrepreneurs to run small businesses. For example agriculture and business related courses would definitely help them to establish agri-business and to market their

9. CeC Operators at Capacity Building Workshop in India

From left to right: Apurba Jyoti Paul (from Assam), Nilmani Das (from Tripura), Anup Das (Assam), Sashwat Tantubay (Trainer From CDAC Noida), Anup Kumar Das (from Tripura), Quamrul Hoque Choudhury (from Assam), Habib Kazi (from Assam), Dharmendra Deb (from Assam), Soumava Bhattacharjee (from Assam)

10. CeC Operators at a Hands-On Capacity Building Session

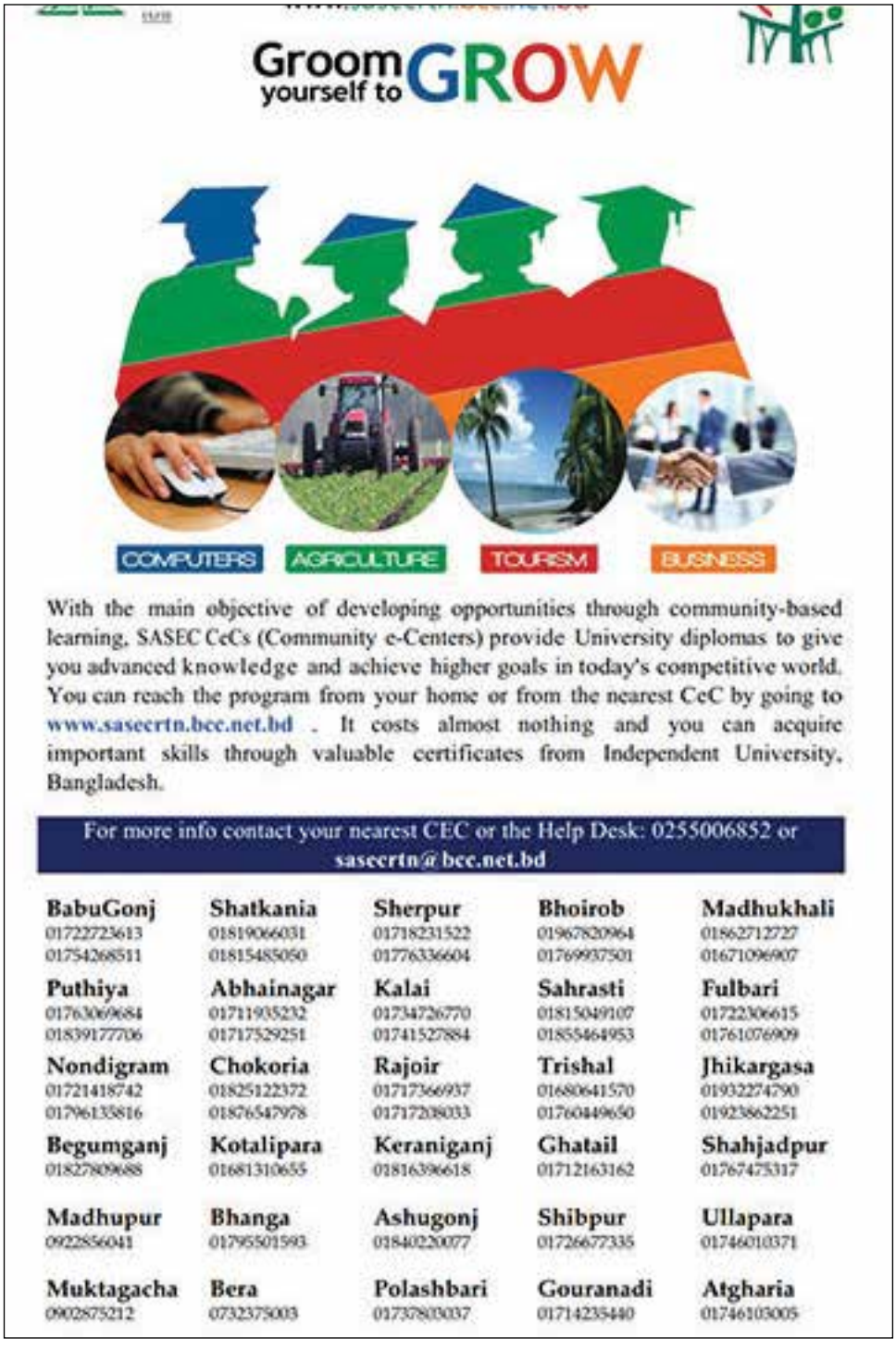
Table 2. Distance Learning Courses

Course	Developer
Basic Internet and Access Technologies	BCC
Farm Machinery	BCC
Eco-Tourism &Social Tourism	BCC
Graphics Design	BCC
Soil Management	BCC
Fashion Design	BCC
Video Editing for the Web	BCC
Entrepreneurship	BCC
Digital Publishing	BCC
Mobile Networks and Devices	BCC
Basic Accounting	RUB
Photoshop CS	RUB
Basic Multimedia	RUB
Operating Systems (Windows and Linux)	RUB
Organic Farming	RUB
Basic Web Design & HTML	RUB
Joomla Basics	RUB
Computer and LAN Troubleshooting	KU
Basic Computer Skills	KU
Flash CS	KU
Farm Management	KU
Hotel Management	KU
PHP & MYSQL Basics	KU
Basic Electricity	KU
Earthquake and Disaster Management	KU
Visual Basic Programming	C-DAC
LANs and TCP/IP	C-DAC
Information Security	C-DAC
Basic Marketing	C-DAC
Creating a Business Plan	C-DAC
E-Commerce	C-DAC

Bangladesh Computer Council (BCC)
Royal University of Bhutan (RUB)
Centre for Development of Advanced Computing in India (C-DAC)
Kathmandu University in Nepal (KU)

Note: Bangladesh has translated seven courses; Bhutan has translated seven courses; Nepal has translated nine courses.

Figure 3. Groom Yourself to Grow Distance Learning Course Advertisement. This ad was designed for all four countries both in English and local language. Posters and pamphlets were distributed to all CeCs.



farm products. Other courses like Photoshop and basic ICT courses would also help them run small shops and services in a vriety of industries."

RTC Partnership Agreement and Distance Learning

"Agriculture and business related courses would definitely help small entrepreneurs to establish agri-business and to market their farm products."

-- Bimal K. Chetri, Professor
Sherubse College

The partnership agreement also was critical to the overall development of the courses. Each course developed in English is shared amongst all the RTCs, who are free to implement any of the courses they believe are relevant for their users. The RTCs are also free to translate any of the courses into their native language. As part of the agreement, furthermore, the specific course titles were agreed upon and parceled out to the various partners. Appendix B provides a list of the courses and the developer.

As discussed above and shown in Table 1, revenue generated from the distance learning courses is shared amongst the partners. This assures that as usage develops for the courses, the developers will continue to receive royalties, which is an important element in keeping the courses relevant and up-to-date.

The Courses

Distance Learning courses have been standardized so that RTCs produce contents with a high level of quality and with consistent length and configuration. The complete standard for Quality Assurance consists of 26 rules with the first five being as follows:

1. A DL course consists of 12 hours of multimedia content, including 8 hrs. (67%) of video and 4 hrs. (33%) of interactive test. Some courses may specifically be designed for shorter duration (case of BAN 104.10. Mobile Networks and Smart Devices).
2. Video, audio and captions files shall be produced as three separate files so that proper reproduction and changes can be carried out independently.
3. A Course has several UNITS (each unit is 45 minutes or less of multimedia content) and a unit contains one or more LESSONS.
4. Each unit shall have a minimum of two lessons (15 min. per lesson) and a maximum of ten lessons (3 minutes per lesson).
5. There will be a short Course Introduction video that will describe the outcomes of the course and how to use the course materials.

The Village Bazaar

The Village Bazaar was developed by C-DAC in India in order to provide an online marketplace for rural community members to sell their wares or to buy products. Like the distance learning courses, the Village Bazaar is also integrated with the e-payments system.

According the Sanjay Saxena, one of the developers, "The Village Bazaar can be very useful in generating revenues for the CeCs. Also it will help rural communities to showcase their products and services."

Case Study: The Educational Alternative

While the distance learning courses are just starting to develop, one of the early trends is that they represent a distinct alternative to the traditional education system in the various countries. Three students at the Shompangkha Gewog in Bhutan are good examples.[1]

The three students -- Mani Kumar Rai, Roshan Rai, and Mon Kumar Rai -- have all completed their free public school education and have not qualified for government subsidy to go to college, meaning they would have to pay for college on their own, which they cannot afford.

As a result, they now travel about two hours a day to take distance learning courses at the Shompangkha CeC. Mani Kumar Rai and Mon Kumar Rai are both taking basic accounting in order to set up their own business selling oranges and cardamum, while Roshan Rai is taking the course in basic electricity so that he can help out his family and local community members maintain the electrical systems in their homes and farms.

Mani Kumar Rai said, "The courses are really important for the many youths in our community who have completed their school and cannot afford to go further. They will benefit us by teaching skills we need to open businesses or to gain other employment. We hope to serve as examples that other people in our community will follow when we become successful."

Tenzin Wangchuk and Yeshi Choden from the Samtenling Gewog are also good examples of how the distance learning courses are impacting the lives of its early adopters. Tenzin said that he is an elementary school teacher taking the Photoshop course in order to learn skills that will allow him to produce visual lessons for his students, while Yeshi is taking the basic accounting course as a way to help her gain skills that will better help her prospects for employment. "I am not planning on opening my own business," she said, but plan to find employment at private businesses in my community who have a need for someone with accounting skills."

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1 In Bhutan, a gewog consists of several villages, while a district consists of maybe 10 gewogs. The CeCs operate within the system of gewogs

"The courses are really important for the many youths in our community who have completed their school and cannot afford to go further. They will benefit us by teaching skills we need to open businesses or to gain other employment."
-- Mani Kumar Rai, Student
Shompangkha Gewog, Bhutan

Eliza Begum, who uses services at the CeC in Keraniganj, Bangladesh said "The Village Bazaar is important because a farmer sells products today through middlemen who sell to the end level customers and make more money than the farmers. If the farmers have their own market place, they can sell directly to the end level customer. In this scenario the middle men will be abolished and the end level customers could buy products at a cheaper price."

"The Village Bazaar can be very useful in generating revenues for the CeCs. Also, it will help rural communities to showcase their products and services."

-- Sanjay Saxena
Senior Technical Officer
CDAC, India

At this writing, the Village Bazaar is installed in all the RTNs and is available to community members. However, it's use is minimal because it needs a growing installed base of users to become effective.

Telemedicine

Telemedicine is one of the most promising services because of a shortage of qualified physicians living in rural areas. Telemedicine would not be offered at the CeCs, but would use the underlying SASEC information highway. In a typical telemedicine service, a telecart with diagnostic equipment at a rural health center is linked to a workstation used by the doctor at a hospital in a remote city. To date, there has been a full telemedicine trial in Bhutan in which about 100 patients have been treated in its first six months of operation and one equipment testing trial in Nepal.

The test in Nepal took place in September 2015 using a fiber optic link between Dhulikhel Hospital and Kathmandu University. All tests using the devices on the telecart were successful, including a digital stethoscope, digital ECG, digital blood pressure monitor, digital thermometer, and close examination camera. The telemedicine application in Nepal is fully functional at Kathmandu University and is expected to go live at the Baluwa Primary Health Center, which is located about three kilometers from the Panchkhal CeC.

The telemedicine trial in Bhutan commenced in April 2016 via a fiber optic cable link between the Gelephu Hospital and the primary health center in Umling, a rural community of 2,000 people is about 30 kilometers away. Umling is accessible only by a very rough road that takes about 1.5 hours to traverse on a good day, and it can be unpassable during the monsoon season To understand its significance in Bhutan, the inauguration of the system was celebrated on national TV and the Minister of Health attended in person. The Bhutan telemedicine trial was very successful and became fully operational in September 2016. At this writing, four health assistants in Umling are operating the telemedicine telecart, which includes a digital stethoscope, digital ECG, digital blood pressure monitor, vital signs monitor, and close examination camera.

Sonam Tenzin, the lead health assistant at Umling, is enthusiastic about the system and said, "The telemedicine system is extremely valuable because it prevents patients from having to go to Gelephu, which takes from 1.5 to 3 hours, depending upon the weather, and on some days during the monsoon season, they

may not be able to get there at all." He also added, "The system will be even more effective when we add an ultrasound attachment and an ear, nose and throat attachment."

Picture 17 shows a picture of the telecart in operation with a test patient.

The Information Highway, RTN, and CeCs as a Platform

Telemedicine is an example of the SASEC Information Highway (IH) being used as a platform. The telemedicine service uses the underlying fiber optic connections to provide its services. As Internet capability expands, applications like telemedicine may be able to stand on their own. For the moment, however, the IH is a valuable commodity for potential services that will developed independently from the SASEC RTN project.

"The telemedicine system is extremely valuable because it prevents patients from having to go to Gelephu, which takes from 1.5 to 3 hours, depending upon the weather, and on some days during the monsoon season, they may not be able to get there at all."

-- Sonam Tenzin, Health Assistant
Umling Health Center

Platform Capabilities

The platform encompasses all of the SASEC capabilities in a specific country, including the IH, RTN, and the CeC. It is possible, for example, to have services developed independently of the overall project by third parties that take advantage of the infrastructure created by the IH, RTNs, and CeCs. An example of such potential services is now in operation in Bhutan.

The Bhutan Banking and Government Services Project

Bhutan has a network of 205 CeCs, only 30 of which are participating in the SASEC RTN project. These 30 CeCs, however, have created a roadmap for how fiber optic cables might be installed in many other CeCs. At present, the CeCs are being managed by the Bhutan Development Bank (BDB), whose main charter is to develop banking and related services to rural areas in Bhutan. So the BDB is using the IH and CeCs as a platform to provide banking and government services to their rural communities. While it also has versions of these services operating in all of the 205 CeCs in Bhutan, they are limited in their abilities because they must use existing Internet capabilities, which can be as slow as 128K bps compared to the IH's speed that reach 1G bps.

At present, there are several dozen individual services that are being provided. In particular, community members can use the CeC as a mini-bank to open savings accounts and receive smart cards that can be used to withdraw cash, make deposits, and to pay any microfinance loans made by the bank.

The BDB has also partnered with the Bhutan government to provide practical Government to Citizen (G2C) services that may have previously necessitated travel to regional communities. For example, the CeCs can

11. Telemedicine Service in Umling, Bhutan. Health assistant B. B. Gurung takes the blood pressure of a test patient, which is communicated to Dr. Puru Bhandari at Gelephu Hospital in Gelephu, Bhutan.

now serve as agent for the Department of Civil Registration and Census for registering key records required in Bhutan, including births, deaths, census transfer required when people move, and for additional household information. The CeCs can also act as an agent for six other government agencies providing a variety of registration and clearance services, including rural timber permits, micro trade registration, an audit clearance system, online registration of job seekers and profiles, online registration of available jobs, and the issuance and renewal of work permits.

Tsewang Dorji, the General Manager of IT/MIS services said, "The CeC is playing a critical role in providing a wide variety of banking and government services, and the SASEC information highway platform allows us to provide numerous services without having to install expensive telecommunications channels or to hire separate personnel. The CeC operators make ideal employees to provide these services."

Maita Rani Rai, the operator at the Shompangkha Gewog CeC said that she already had hundreds of community members who had bank accounts and took advantage of the G2C services. "By having these services here," she said, "community members no longer have to travel hours to a bank in Gelephu or to district headquarters or even

days to go to Thimphu. It is a huge benefit whenever they need one o these services."

A Working Model

The bottom line is that using the SASEC IH, RTNs, and CeCs as a platform for other services is a very powerful capability that not only can expand the services available to people in the rural areas, but also can help the CeCs become sustainable by expanding the range of services that generate revenues.

"The CeC is playing a critical role in providing a wide variety of banking and government services, and the SASEC information highway platform allows us to provide numerous services without having to install expensive telecommunications channels or to hire separate personnel."

-- Tsewang Dorji,
General Manager IT/MIS Services
Developmnt Bank of Bhutan

Mobile Phone Portal Interface and Text to Speech

The final two services developed as part of the RTN project are a mobile phone portal interface and text to speech (TTS) capability. The Royal University of Bhutan developed the mobile phone portal interface, which allows mobile phones to access the services provided by the portal, while Kathmandu University developed a TTS capability in Nepali for Nepal portal, which allows text in both English and the country's native language to be spoken instead of read.

12. One of the CeCs in Thimphu, Bhutan. The CeC is on a major street and has a store front that lists many of the available services. The CeC's operator, Passang Zangmo is shown in front of the CeC storefront.

13. The Karimganj CeC in India. The users are lining up in front of the CeC operator, Quamrul, to take advantage of the various services.

14. Women at the computers in the Katigorah CeC in India. They are using services including distance learning courses or general Internet access.

15. A Meeting at the CeCs in Trishal, Bangladesh. Villagers attend a meeting at the CEC in Tristal, Bangladesh, to discuss the distance learning courses provided.

16. Accessing Distance Learning Courses in Abhainagar, Bangladesh. Villagers alearn how to access the distance learning courses at the Abhainagar CeC.

The SASEC Information Highway project is part of a developing global effort to bridge the digital divide by extending the Internet to rural communities. The Asian Developing Bank is one of the organizations leading this effort by not just focusing on the technology, but by also focusing on implementing its ICT strategy with sustainability and inclusiveness.

Chapter 4 - The Future

The SASEC RTN is part of the SASEC IH project in which 110 CECs in rural areas in Bangladesh, Bhutan, India and Nepal are being interlinked by fiber optic cable or high speed Internet to four RTCs, one in each SASEC country. The RTCs themselves, furthermore, are being interlinked by fiber optic cables. Specifically, the four RNs have installed fiber optic cable to their connecting point in Siliguri, India, but final connection still needs to be completed by BSNL, India.

While the information highway portion of the overall project awaits final connectivity in Siliguri so the highway is fully operational, the RTN portion of the project has had some substantial successes and has largely met its development goals since its inception in 2011. While the successes are significant, this is only the very beginning of what will be a lengthy process to meet the ADB's long-term goal of developing the ICT capability in these rural areas.

First, the SASEC Information High project must be fully completed so that the RTCs are connected by high speed links via Siliguri, India. Second, high speed Internet connections must be extended into rural areas. Third, end users will need to overcome the natural resistance to change and fear of technology though capacity building to be trained in using the various services made available.

Need for Long-Term Capacity Building

During the RTN project, workshops were held at the CeCs in all four countries to gather information and to introduce the services to people in the rural areas. The overall results were very illuminating in that they demonstrated the reality of how far these areas must develop in order to take advantage of the RTN services.

It was demonstrated during the rural workshops that took place at CeCs that most villagers can access the SASEC RTN portal via mobile phones albeit not many have smartphones. Few had computers at home. Capacity Building of rural communities is now possible using the RTN services available either from the CeC itself or from mobile units and computers at home. Capacity Building of CeC operators proved to be essential as these operate as trainers and guides to the villagers that visit the CeCs. Both CeC operators and rural peoples are most enthusiastic about the prospects of steadily increasing the level of services and the number of Distance Learning courses available through the RTN.

CeCs play an essential role in training rural communities towards the use of SASEC RTN services at high speed. Users are taught how to register on the portal, enroll in DL courses, and pay using an electronic payment system. Once the services are understood, the users may go

back home and access the services from their home computers or smart phones if Internet access is of sufficient speed.

The great advantage of CeCs access to the RTN is its high bandwidth at minimal cost, allowing for the sustainability of this essential center in rural communities. CeC operators are supposed to be agents empowered to opening pseudo-bank accounts for rural users. This is also an important aspect that allows for rural users to be introduced to e-payments in a local setting.

According to Vijay Shrestha, an Officer at Kathmandu University, "The Village portal and its applications and services are very important to disseminate the information needed to uplift business activities. But sustainability depends on how we can update the information, train the CeCs, and give support if any problems or difficulties arise."

Expanding Village Network Access

In Bhutan, the Department of Information and Telecommunication Technology (DITT) realized early in the SASEC IH project evolution, that expansion of the VN concept to a larger number of CeCs in the country was a required factor towards the long term success of such endeavor. Using the same funds, DITT expanded the number of CeCs connected by fiber optic network to 205. The new network called DRUKREN connects all the CeCs with institutes that are potential providers of services to all rural communities. The 205 CeCs do not need high speed Internet to access RTN services. The expanded VN Network is already providing high speed at minimum cost to RTC and CeCs, therefore guaranteeing sustainability in the long run.

It will be expected that governments in Nepal and Bangladesh follow a similar path in order to expand the CeC Village Network for the benefit of the rural communities. Future will tell about the evolution of the VN Networks in these countries. In India, CeCs are accessing RTN services through Internet at speeds that vary between 1 Mbps to 10 Mbps for the complete CeC.

Expanding Regional Network Access

The Regional Network within each country links the RTC to the Siliguri NOC and to other SASEC RTCs. It would be extremely beneficial if other institutes of higher learning in each country were to obtain very high speed access to the RN under a program to participate in the development of Distance Learning and Research for the benefit of rural communities. These are RTN Partners and one existing example is Sherubtse College in Bhutan that has been providing contents to the RTN and distributing it via the RTC at CST Phuensholing in Bhutan.

In Bhutan, DITT has decided to expand the RN to other institutions that may provide additional content for the benefit of rural communities and CeCs. How this inclusion process is going to unfold and its sustainability model remains to be seen. But the long vision of the Government of Bhutan is very clear and commendable.

Other RTN Partners may join the effort if the model of SASEC RTN were to be championed and expanded by the respective governments. In Bangladesh the master plan of Digital Bangladesh is being supported by the SASEC RTN and BCC, the RTC in that country. In Nepal, Kathmandu University is using the services and the model of SASEC RTN for other Distance Learning endeavors. For now, it is important to take stock of what has been achieved so far and optimize enrolments from remote users in order to achieve sustainability of both the RTC and the CeCs.

Expanding Internet Access

Internet access is the most important factor that will drive usage of the RTN's services over the long-term. Without such access, it will be hard for any of the RTN's services to penetrate deeply into these rural areas as users would have to rely on walking to the nearest CeC for accessing the RTN services.. But high-speed Internet access comes at a price that often rural people cannot afford. The process starts by rural communities having the possibility of reaching out to the services open by SASEC RTN at the CeCs. These services are provided at a very low cost and high speed at CeCs. Rural users may take advantage of the plethora of DL courses, Village Bazaar and other services offered at each CeC. The more villagers use the services of the CeC the more interested they will be in demanding Internet access at home. Eventually these rural communities will have a demand that will allow Internet operators to provide high speed Internet at a profit. In this way everyone will win. The SASEC RTN is therefore a first step in bringing the required knowledge to the rural communities so that Internet services will successfully be available.

The bottom line is that despite the best of intentions, it will likely be a number of years before Internet access is widespread in the rural areas in SASEC countries. This is where the proven benefits of SASEC IH RTN can play an essential role in bringing important ICT services to rural communities while mobile operators decide on the cost-effectiveness of providing 3G and 4G access at affordable prices to rural areas. In short, the SASEC RTN project needs to focus primarily on developing sustainability by bringing users to the local CeCs to use its services and by providing capacity building and basic ICT services for the relatively small number of local users who have home computers and high speed Internet access.

Managing Change and Developing Sustainability

Managing change is another important factor associated with developing each CeC's sustainability. To cite one example, the distance learning courses were launched in a free trial in early 2016 within each country.

During the trial, several hundred users signed up to take various courses with very interesting results. First, the 31 courses in English were a lot more popular than the 22 courses that were translated in native languages. Second, most of the users who did have adequate access did not finish the courses. Finally, when the free trial was over and users had to pay between $1-$2 per course, sign-ups decreased substantially. A survey sent to users clarified that in many cases users had difficulty with accessing the e-payment gateway. In other cases they were concerned about paying by e-payment method, new in Nepal and Bhutan. The interesting aspect was that users found the low prices (average of $1.5 per course) not a factor in enrolling for a course. Marketing strategies have to be initiated by RTCs in order to motivate users towards enrolling in the RTN DL courses.

The bottom line is that it is far too early to tell how well the distance learning courses will do from a marketing standpoint. Some strategies are being tried right now: free courses each week, advertised to the whole population of registered users, splitting a course in two in order to reduce the completion time, advertising free courses but charging only for the certificate, etc. The results of these strategies will be known over the next few months.

It is important to adopt strategies to keep the CeCs sustainable until high speed Internet usage becomes more widespread in rural areas. This means that the CeC has to become

a popular community training and learning center. CeC operators will have to develop new users by promoting the positive changes that can come from using technology and by helping new users overcome their natural resistance to change. Factors such as providing a nurturing environment and developing a good reputation for being helpful and accessible will be as important as the technology itself in order to get people from the rural areas to want to come to the CeC. Finally, it also means that the RTCs may have to take innovative steps to develop additional revenue streams that might help the CeCs during the transitional period before high speed Internet access in rural communities is readily available.

Use as a Platform

Another important trend for the SASEC RTN is its use as a platform. Bhutan is already using the RTN and its underlying network for a successful telemedicine service, while the Development Bank of Bhutan, which has responsibility for the country's CeCs, is using the RTN and the CeC operators to provide banking and government services to citizens.

Kathmandu University is using the SASEC RTN portal and attached applications to promote other Distance Learning programs within the university. KU has also initiated research at the graduate level regarding optimum ways of providing ICT services to rural communities. Also Dhulikhel Hospital, a Teaching Hospital associated with Kathmandu University, is engaged in carrying Telemedicine research using the current pilot that has been installed at the Hospital.

The ability to serve as a platform for adding new services will be an important factor for the SASEC RTN in the coming years and could potentially become a model for use in developing countries worldwide.

Accelerating the Process of the Two Transition Periods

A number of highly useful services have been developed in the SASEC RTN project, including the Village portal, the distance learning courses, the Village Bazaar, the e-payments system, and the CeC Accounting system. However, there are going to be two transitional periods until the services can go into full-scale operation. The first is a short-term period until the high speed links that connect the RTCs together, centered in Siliguri and Kolkata, India are operational. The second is a longer-term period until high speed Internet is available in rural areas.

The first transition period threatens the sustainability of the RTCs, as RTCs will be reluctant to share content via Internet at relatively low speeds. This situation may threaten the continuation of the project unless additional funds are forthcoming to keep the project operational. For a period of several months, CeCs have access to existing content already developed at RTCs and, therefore they have the chance to develop sustainability within each rural community. Users will at least be able to go to the CeCs to learn about using the new technologies, to take distance learning courses, to buy and sell on the Village Bazaar, and to use email and the other available services. At this writing, all four countries have a fully operational RTC and connected CeCs.

The second transition period will be a lot longer and will likely prevent the widespread availability of the SASEC RTN's services in the rural areas supported by the CeCs as well as other areas of the country. During this transition, the distance learning courses might be used in urban areas reached by the RTNs to generate revenues for the project, and strategies for a sustainable expansion are to be defined and addressed by RTCs.

The Bottom Line

The SASEC RTN project is a significant achievement that goes a long way towards meeting the ADB's ICT development goals. There is no question, furthermore, that the project is ahead of its time because the underlying communications infrastructure required for total success and global sustainability is still not available. As a result, it remains to be seen whether the project can meet its ultimate goal of sustainability without additional funds to keep the project in operation for making the marketing strategies and communications infrastructure available.

Appendix A

Shared Portal Application Development

Application	Developer RTN Partner	Description of development effort	Completion Date
Mobile Phone Portal Interface	Royal University of Bhutan	Smart Phones to be able to use the SASEC portal transparently	Oct 2013
Automatic Course Certificate	Royal University of Bhutan	Basic procedure to implement the creation of automatic certificates at completion of each DL course	Sept 2015
CeC Accounting System	Bangladesh Computer Council	PHP, MYSQL application. Allows logging all daily transactions both manual and from RTN e-payments.	Dec 2013
E-Payments	Kathmandu University	PHP, MYSQL application. Interfaces with Moodle and with Village Bazaar to create payments online. An API with the payment gateway is customized.	April 2014
Moodle Configurable Reports	Kathmandu University	Enrolments. Completion reports are produced filtered by selected period.	Oct 2013
E-Commerce / Village Bazaar	C-DAC	PHP, MYSQL application. It advertises articles for sale by portal users. Any visitor can contact the seller and buy the item.	Aug 2014
Language Localization	C-DAC	upgrading local language use within the portal.	Sept 2015
Text to Speech Tool (TTS)	Kathmandu University	Verbalizes the text aooearing on the screen in Nepal	Sept 2015
Telemedicine	Kathmandu University	Establishing a private system using a dedicated fiber optic line to connect the Referral hospital	Sept 2015

Appendix B

Shared Distance Learning Courses (English)*

COURSE TOPIC	RTN Partner leading	Description of content. All courses are 12 hrs. 45 min/module on average. (Note 1)	END DATE
Basic internet and access technologies	BCC	Structure of the global Internet. TCP/IP basics. IP addresses. IP4/IP6. Domains. Searching, buying, job-searching, banking.	Jan 2015
Farm Machinery	BCC	Basics of Farm machinery. Purchase, renting, use and maintenance.	Jan 2015
Eco-Tourism & Social Tourism	BCC	Advertising and implementation of eco and social tourism operations.	Jan 2015
Graphics Design	BCC	Designing graphics for the web and for media enterprises. (TV, Cinema, Magazines, Web) Basic course.	Jan 2015
Soil Management	BCC	Basics of soil management	June 2015
Fashion Design	BCC	Garment Design. How to create a business designing and producing well designed garments.	Mar 2015
Video Editing for the Web	BCC	Basics of Adobe Premiere. You-Tube. Video publishing.	Mar 2015
Entrepreneurship	BCC	Basic skills on starting an enterprise and making it grow.	Jan 2015
Digital Publishing	BCC	Document structure. Word, Publisher. Adobe Acrobat. Graphics enhancements. Web publishing.	Dec 2015
Mobile and Smart phone technology	BCC	Current developments in the field of Mobile communications. How to use software and equipment.	Jan 2016
Photoshop CS - Medium Level	RUB	Photoshop advanced functionalities.	Oct 2014
Organic Farming	RUB	Organic crops. Means of growing organic products. Economic aspects. Marketing.	Oct 2014
Basic Web Multimedia	RUB	Basic graphics design. Working with photos. Working with video. Photoshop, Premiere.	Oct 2014
Operating Systems (Windows and Linux)	RUB	Operating systems basics. Multitasking. Memory management. Windows and Linux	Oct 2014
Basic Web Design & HTML	RUB	Basic course on HTML, DHTML. Dreamweaver.	Oct 2014
Joomla Basics	RUB	Links to Joomla Tutorials. Media collection. Installation. Configuration.	Nov 2014

COURSE TOPIC	RTN Partner leading	Description of content. All courses are 12 hrs. 45 min/module on average. (Note 1)	END DATE
Basic Accounting	RUB	Bookkeeping. Accounts Payable, Receivable. Using Excel to produce Financial Statements.	Mar 2015
Visual Basic Programming	C-DAC	Basic course on Visual Basic programming.	Feb 2015
LANS & TCP/IP	C-DAC	LAN and WAN basics. Hardware/software. TCP/IP. Basic routing.	Jan 2015
Information Security	C-DAC	Cryptography, Encryption. Authentication. Security Certificates. Tunnels. Virtual Networks. Defense strategies/software.	Jan 2015
Basic Marketing	C-DAC	Surveys. Offer and demand. Advertising. Sales campaign. Measuring results.	Feb 2016
Creating a Business Plan	C-DAC	Structure of a Plan. Marketing analysis. Revenues and expenses forecast. Negotiating with the bank.	Feb 2016
E-Commerce	C-DAC	Functionality of a web-based rural bazaar and e-payment system.	June 2015
Hotel Management	KU	Basics of Hotel management.	May 2015
PHP & MySQL basics	KU	Database principle. Tutorials from Internet. Practical examples.	July 2015
Basic Electricity	KU	Basic knowledge of electricity and electrical installations.	June 2015
Computer and Lan Troubleshooting	KU	PC Hardware. Windows 7. Troubleshooting tools & methods.	Nov 2014
Basic Computer Skills	KU	Basic Hardware, Windows, Word, Excel, Power Point. Assignments and on-line tests.	Nov 2014
Flash CS	KU	Functionality of Flash. Use in a web multimedia development system.	Nov 2014
Farm Management	KU	Basics of Farm Management.	Jan 2015
Earthquake and Disaster Management	KU	Basic relief and preventive measures to defend rural communities in the event of natural disasters.	Jan 2016
* Course contains a minimum of 8 hrs. video lessons plus 4 hrs. interactive tests. Each course also includes reference text material equivalent to 8 hrs of reading time. The development of each course requires a preliminary study to define the exact content and expected outcomes. A course certificate will be automatically be sent to the student at the end of course completion.			

Appendix C

Distance Learning Course Translations Into Local Languages*

COURSE TOPIC	RTN Partner leading	Description of content. All courses are 12 hrs. 45 min/module on average. (Note 1)	END DATE
Farm Machinery	BCC	Bangla	July 2015
Eco-Tourism & Social Tourism	BCC	Bangla	July 2015
Hotel Management	BCC	Bangla	Dec 2015
Organic Farming	BCC	Bangla	Dec 2015
Basic Electricity	BCC	Bangla	Dec 2015
Soil Management	BCC	Bangla	Dec 2015
Fashion Design	BCC	Bangla	Dec 2015
Organic Farming	BCC	Dzongkha	Sep 2015
Basic Accounting	BCC	Dzongkha	Sep 2015
Farm Machinery	RUB	Dzongkha	Sep 2015
Eco-Tourism	RUB	Dzongkha	July 2015
Basic Electricity	RUB	Dzongkha	Sep 2015
Soil Management	RUB	Dzongkha	Sep 2015
Hotel Mangement	RUB	Dzongkha	Sep 2015
Mobile Networks	RUB	Dzongkha	Sep 2015
Organic Farming	KU	Nepali	Dec 2015
Farm Machinery	KU	Nepali	Dec 2015
Farm Management	KU	Nepali	Dec 2015
Basic Electricity	KU	Nepali	Dec 2015
Hotel Management	KU	Nepali	Dec 2015
Eco-Tourism	KU	Nepali	Dec 2015
Basic Accounting	KU	Nepali	Dec 2015
Soil Management	KU	Nepali	Dec 2015
Basic Computing Skills	KU	Nepali	Dec 2015
* Translations may also be made available to other RTCs by download.			

Appendix D - CeCs by Country

Bangladesh		
Abhainagar	Fulbari	Polashbari
Ashugonj	Ghatail	Puthiya
Atgharia	Gouranadi	Rajoir
BabuGonj	Jhikargasa	Sahrasti
Begumganj	Kalai	Shahjadpur
Bera	Keraniganj	Shatkania
Bhanga	Kotalipara	Sherpur
Bhanga	Madhukhali	Shibpur
Bhoirob	Madhupur	Trishal
Chokoria	Nondigram	Ullapara
Bhutan		
Chang, Thimphu	Gakiling(Hilly), Sarpang	Samtenling, Sarpang
Chimung, P/G	Gelephu	Sershong, Sarpang
Chokhorling, P/G	Genekha, Thimphu	Shumar, P/G
Chongshing CC	Jigmecholing, Sarpang	Singye
Chuzagang,Sarpang	Kawang, Thimphu	Sompangkha, Sarpang
Chuzom (Dovan), Sarpang	Khar, P/G	Tarathang, Sarpang
Darkala, Thimphu	Mewang, Thimphu	Thimphu CC, Thimphu
Dechenling, P/G	Naja	Umling, Sarpang
Dekiling, Sarpang	Nanong, P/G	Yurung, Pemagatshel
Dungmin, Pemagatshel	Norbugang, P/G	Zobel, Pemagatshel
India		
Basdroni	Jubarajnagar GP office.	Laboc
Bhabani Kotha	Karimgang Town(M)	Niz- Katigorah-Ii,
Bijli Ghat	Karimganj Town	Noul
Braja Ballavpur	Karimganj Town (F)	Padmapukur Road, 19D
Chandipur GP Office.	Katigorah 1	Paikan Digorkhal
Dakshin Kalamchura GP	Katigorah Iii	Purahuria
Deganga	Khadinan	Singirbond Pt- Iv
Hatgobindapur	Kheda Cherra Tehsil Office	Vidyasagar GP Office
Indiranagar GP Office	Kshirgram	

Nepal		
Bardibas	Hathileind	Mahuli
Bastipur	Inaruwa	Methinkot
Bhardaha	Jhumka	Nala
Chakraghatti	Kalapani	Nepalthok
Chaughada	Kanchanpur	Padam Pokhari
Cheru	Kanpur	Panchkhal
Chhatrebanj	Katunjebesi	Phatepur
Daraune Pokhari	Khanar	Ratomate
Dhalkebar	Khopasi	Riyale
Dumraha	Khurkot	Sitapur