Phase II
Research Synthesis Phase
1st May 2010 to 31st March 2012

Center for Language Engineering
Al-Khwarizmi Institute of Computer Science
University of Engineering and Technology
Lahore, Pakistan
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1. Background
The PAN Localization project started with a mission to address the challenge of development and dissemination of multilingual computing, focusing on developing Asia. The project started with a focus on advancing multilingual support for ICTs in several developing countries of Asia. Initially, PAN Localization addressed a three-fold challenge: (i) to develop multilingual ICTs, (ii) to train human resource to develop this technology, and (iii) to advance the policy to bring sustainability and focus to this effort in developing Asia. The planned spectrum of research in Phase 1 (2004-2007) was completed and the intended technology and applications were developed. Phase 2 (initially planned from 2007-2010) of the project followed up with the focus to investigate effective, cohesive and sustainable mechanisms to develop and diffuse local language computing capacity across developing Asia.

Thus, as the technology was now available through the work in the first phase, the focus in the second phase shifted to the deployment and usage of language technology and investigated its associated challenges. The second phase of the project had the following objectives.

1. Examine effective means to develop digital literacy through the use of local language computing and content
2. Explore development of sustainable human resource capacity for R&D in local language computing as means to raise current levels of technological support for Asian languages
3. Advance policy for development and use of local language computing and content
4. Study and develop coherent instruments to gauge the effectiveness of multi-disciplinary research concerning the adoption of local language technology by rural communities

This localized technology was taken to the field where end user groups were trained on its effective use to eventually draw the intended socio-economic benefits of the work. Different partners focused on different end user groups and used different methodologies. For example, Bangladesh used infomediary based approach to disseminate legal and women rights information to rural farmers, Nepal used seed-training approach for instituting sustainable training working with farmers, Cambodia used teach-the-trainer based approach (but more formally than Nepal) for training government staff and Pakistan used direct training to students in rural areas, also training teachers for support and sustainability. Thus, partner countries aimed to institute training programs in a variety of ways for different user groups within their countries.

PAN Localization project further worked to develop sustainable strategies for local content development. The approaches followed by the country partners to develop local content can be broadly categorized as bottom-up and top-down approaches. In bottom-up approach, rural communities were trained on localized technology to generate online content, as done in Pakistan, Sri Lanka and Nepal. In top-down approach, country team developed online content to promote use of local technology, as practiced in Cambodia and Laos. Bangladesh followed a
hybrid model, where requirements were gathered from the end users and then the content was
developed by the partner team.

PAN Localization project continued to carry out technology development in the second phase as
well at two different levels. At regional level, Regional Research Component (RRC) for
Technology covered common research areas across all languages and guided partner institutions
to accomplish combined tasks. These have included research on Internationalized Domain
Names (IDNs) and developing core linguistic resources including tagged Corpora. At national
level, various partner countries worked on different tasks based on their own national priorities.
For example, Nepal worked on enhancing Nepalinux, Sri Lanka worked on developing online
learning resources for Tamil in Sinhala, Bangladesh worked on enhancing Bangla OCR, etc.

A major objective of the PAN Localization project has been to develop sustainable human
capacity for R&D in local language computing and raise current levels of technological support
for Asian Languages. Country teams supported through PAN Localization project played a vital
role to achieve this goal. Project organized extensive and diverse training programs and
workshops during both phases, which have included short term training and longer term mentor
placement programs. Several team members from different countries have been supported to
attend international conferences and present their work. PAN Localization project has also
helped in enhancing technical abilities of team members by providing support for their higher
education.

PAN Localization project has also been looking into policy related issues to promote local
language computing. The representatives of the project have been interacting with policy
makers to develop effective policy for local language technology, training and content across
region, and in many cases, e.g. in Afghanistan, Bangladesh, Cambodia, Laos, Nepal, Pakistan,
Sri Lanka, have participated directly in ICT policy development specifying language computing
development as national goals.

The Regional Research Component for Evaluation has been responsible to provide an objective
and systematic assessment of PAN Localization project. In the beginning of Phase II, the RRC
Evaluation team in consultation with IDRC decided to follow “Outcome Mapping”
methodology for planning, monitoring and evaluation activities of the project, integrating the
gender dimension within this methodology. Many evaluation related workshops of the project
country teams have been conducted to build local capacity. Towards the end of the project
survey forms have been circulated to gather data and compile the findings in an Evaluation
Report.

2. PAN Localization Project Phase 2 Extension Background
Phase II of the project has involved many more partners. With only six partner organizations on
in each partner country, the project expanded to include 20 partners from eleven partner
countries in the second phase. This considerable increased both the national coordination tasks
and the regional management challenges. Further the project moved in the field from the lab environment, where the work becomes less predictable. Thus, in some cases, the project faced delays in completing the work. This required the second phased to be extended to compile the research undertaken in the field. Further, the partners of the project found value in the collaboration and decided to work on finding sustainable mechanisms to continue it. Thus, for compiling the research and for finding mechanisms to sustain the network, the project Phase II was extended from May 2010 till March 2012.

The specific objectives of this phase of the project have been the following:

1. Compile research results on the work undertaken and plan effective measures for the dissemination of this research
2. Devise strategies for research sustainability

Soon, after this project was approved, the Regional Secretariat of PAN Localization project started working towards achieving these goals. During its first year from May 2010 till May 2011 the following activities had been conducted:

i. Conclude Bangladesh and TAR China country components
ii. Re-initiate Laos country component to accomplish its research targets
iii. Hold a Conference on Human Language Technology for Development (HLTD), in collaboration with African Network on Localization
iv. Discuss the development and sustenance of PAN L10n network
v. Development of Localized Flood Relief Website of Govt. of Punjab, in Pakistan, to test the state of readiness of localization technology
vi. Train and support PANDORA Project partners for Gendered Outcome Mapping
vii. Develop initial drafts for the regional research reports on Policy, Training and Evaluation

During the second year of the project extension, from June 2011 till March 2012, the following research activities have been conducted.

i. Organization of Conference on Policy and Sustainability of Local Language Computing in Developing Asia in Pakistan
ii. Development and Publication of Regional Research Reports
iii. Organization of Regional Training on Localization of Mobiles, an emerging platform
iv. Organization of Training on Localization of Mobile Platform in Bhutan
v. Mentor Placement for Research Team from Laos Country Component
vi. Continuation of local language computing research in Nepal, Pakistan and Sri Lanka
vii. Dissemination of project research through public seminar in partner countries

Detailed descriptions about the activities conducted during this phase are presented in the following sections (other details of earlier work have already been reported in the first annual report).

3. Progress in the First Year of Project Extension (2010-2011)

Soon after the project was approved, the Regional Secretariat of PAN Localization project started working towards achieving these goals. This included undertaking both administrative matters and research goals.

The project leader followed through with Bangladesh, China and Laos project teams for sub-contracting the funds from the project to undertake the work in these components. Bangladesh country component project leader, after discussions, showed inability of its team to continue the work, as many of the experience staff in the team are now pursuing advanced education abroad and not available to undertake the work at the time. A trip with IDRC staff was planned for TAR China in February and then again in April. However, due to visa delays and inability of hosts to get the travel documents prepared, both times the trips could not be undertaken.

Scope of work for the Laos country component was defined. The work commenced, with support being provided by staff in Pakistan. Further, two staff members of Laos team were planned to visit the Regional Secretariat for three months in June 2011 for further training, as planned.

An agreement was also signed with Mongolia to re-commence the work on writing a text book on language processing based on the work undertaken by PAN Localization project in Mongolia. The request had been placed by the country project team and approved by IDRC in the project extension.

The research and development activities in the first year of the project are discussed in more detail below.

3.1. Conference on HLTD 2011

Human Language Technology (HLT), including localization, is particularly relevant for addressing access to useable information by disadvantaged communities, including the illiterate, the rural poor, and the physically challenged, especially in the developing countries. Although there are many conferences around HLT, they do not focus on the challenges of building and deploying language technology for effective use in the developing communities. To address this gap, the PAN Localization Project and the African Network on Localization (http://www.africanlocalisation.net/) (through the Zuza Software Foundation, South Africa) co-organized the Conference on Human Language Technology for Development (HLTD) 2011 (www.HLTD.org) in Alexandria, Egypt. The local partner was Bibliotheca Alexandrina (http://www.bibalex.org). HLTD 2011 provided a single platform to engage technologists, social scientists and policy makers in a dialogue over a wide range of relevant issues. It show-cased state-of-practice in HLT and its use in development, and identified needs and priorities of the end-users.
Three workshops, 31 research papers, and two keynote addresses (by Dr. Richard Sites from Google, and Dr. Nabil Ali who is a pioneer of Arabic language Processing) were presented at the conference, attended by about 60 researchers from across the globe, sharing research and experience for more than twenty different languages across Asia and Africa. The conference also included two panels which discussed the current challenges and future directions for better use of HLT for developing communities. The proceedings of the conference have been published and also available online from the conference website. The conference has been supported by NECTEC, Thailand and Asian Federation of Natural Language Processing (www.AFNLP.org).

A significant effort of the team at the Regional Secretariat of PAN Localization project has been engaged in planning, preparing and holding the conference. The team members were engaged in the organizing committee and also led the technical committee. This involved, developing and widely circulating the call for papers, inviting technical review team, subscribing and setting up the online conference software, monitoring the progress of online conference submissions, assigning submitted papers to reviewers and following up with them to enable review process to finish in time, coordinating with authors to provide information and feedback of reviews, ensuring authors incorporate reviews to submit revised papers in desired format, collating the conference proceedings and handing it over for printing. In addition, tasks included developing and maintaining the conference website (www.HLTD.org), coordinating with other organization for support of the conference, budgeting for the conference, inviting attendees, organizing conference logistics in Cairo and Alexandria and coordinating with other organizing partners.

The conference has concluded and now the team in involved in following up with all the partners and attendees to finalize the logistics, re-imbursements and financial matters.

### 3.2. Work on developing and sustaining PAN L10n network

Work has also started in taking concrete steps in formally developing the PAN L10n network of researcher and practitioners. The discussions started with online meetings between potential partners,
which include the PAN Localization project members and NECTEC, Thailand (as per the agreement of the existing project partners). The first meeting was held on 2nd Nov., 2011, and focused the types, commitments and benefits such a formal structure would have for partners, the type of organization the network should develop, the governance structure it should have, and the work and collaborations it should undertake.

The second online conference was held on 22nd Feb. 2011. The discussion by the members focused on limitation on membership per country (or per organization), geographical scope of the organization, scope of work the network would undertake, and who would the network be working for.

Based on these discussions, the network decided to use the opportunity of meeting at the Conference on HLTD to co-locate a face to face meeting. This meeting was organized in Cairo on 30th April, 2011, just before the HLTD Conference in Alexandria.

The meeting was attended by fifteen members of the PAN Localization Network. A day long deliberations focused on academic and administrative matters for make the network operational. Training, linguistic resource development and framework development were discussed as part of the project activities to be undertaken by the network. It was also agreed to develop a common set of terms which all members will sign as a MOU to eventually formalize the network.

Figure 2.2. PAN L10n Network Meeting in Cairo, Egypt

Legal and accountancy firms were selected to draft the MOU and register the network in Pakistan, as decided in Cairo meeting.

3.3. Development of Localized Flood Relief Website of Govt. Of Punjab

Devastating floods have hit Pakistan in 2010, displacing two million people. To provide adequate government support, this has required a lot of urgent coordination and dissemination of information. CLE has been collaborating with the Govt. of Punjab to develop the Urdu version of their official flood relief website http://floodrelief.punjab.gov.pk/urdu/ which includes information on damages and relief efforts for all affected areas in Punjab (parallel English website at http://www.floodrelief.punjab.gov.pk/). This was a very important work for many reasons. Firstly, it was of immense social benefits to manage the relief and rehabilitation efforts for the community that had been severely affected by flood, as the website provides access to daily updated status of relief goods, road conditions, relief camps, relief needs, donation channels, etc. in local language. Secondly, it
provided a significant test case for the work CLE had been doing, with direct implication on policy vis-à-vis technology assessment for deploying local language information and also user access of Urdu vs. English website. This exercise was especially useful in highlighting limitations pertaining to technology localization, e.g. the intricacies of enabling R-L complex script languages on the Internet, analyzing browser support for embedding Urdu fonts, etc. The team supported the website actively until it was needed and the project has been halted since January 2011.

The findings of the challenges and lessons learnt in the process were presented at the 13th Sustainable Development Conference held in Islamabad, Pakistan, and published as a paper titled Technology preparedness for disseminating flood relief and rehabilitation information to local stakeholders online: Lessons learnt while developing Punjab flood relief website in Urdu (http://www.cle.org.pk/Publication/papers/2010/sdpl2010.pdf).

Figure 2.3. Flood Relief Urdu Portal for Govt. of Punjab, Pakistan
3.4. **Research Reports**

One of the main aims of the extension of the project was to write up the research results. This work started late in the second phase and continued in the extension phase of the project. The following sections report the work accomplished in the first year of the project.

### 3.4.1. Research Report on Local language Computing Policy in Developing Asia

The purpose of this study has been to document the current state of localization policies in the region, identify challenges to localization, document successful strategies that promote localization, and examine implementation models to determine if they can be transferred to other countries in the region. The study includes fourteen countries from developing Asia— Afghanistan, Bangladesh, Bhutan, Cambodia, India, Indonesia, Laos, Mongolia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam.

The RS has completed initial draft of its report “Local level Computing Policy in Developing Asia”. Individual country chapters have been developed by the research teams in Pakistan and Singapore working on this module. Though the report was planned to be finished, project leader and Prof. Milagaros Rivera and National Univ. of Singapore in their discussions thought that there were issues in the structure and the team decided to re-structure the report for better composition. First four chapters have since been rewritten. The final chapters will be written and finalized after this review in the second year (more details later).

### 3.4.2. Research Report on Local Language ICT Training in Rural Pakistan

The detailed research report on lessons learnt from “Dareecha”, ICT Literacy training in rural School Student of Pakistan, was compiled by the project team. The report was reviewed by the regional project leader, who did significant re-structuring and re-writing, which delayed the work. However, the final draft was completed and submitted for external review by Michael Gurstein, recommended by IDRC. The external review was received and has proposed further re-structuring of the work. Further details of the work are given later.

### 3.4.3. Research Report on Mobile Computing

Research is continuing on Mobile computing. A research paper on the work accomplished was published in Localisation Focus, an international research journal on localization by University of Limerick. The team at the Regional Secretariat also finished developing training material to conduct training of partners on localizing mobile platform at the next regional meeting being planned. An internal training to test the training material developed was organized at the RS. After the feedback of this training, the materials are being finalized for use in the regional training. In addition mobile application development was also undertaken to enable the trainers to find the relevant solutions and to develop the training platform.
3.4.4. Regional Research Reports on Technology, Training and Content

RRC Technology worked on compiling research conducted on local language computing on languages spoken in partner countries. This is intended to be a technical reference for others who want to do follow up work and also to be used as supplement reading material for university level courses in computational linguistics, with focus on Asian languages. The book covers technical details for Script, Corpora, Lexicon development, Word Segmentation, Part of Speech and tagging, and Spell Checking and other language processing work done by the partners.

First draft of this report had been developed by the research team. Though it was anticipated that the editing will be completed by March for external review, the work was delayed primarily due to extra involvement of the project leader in organizing the Conference on Human Language Technology for Development and focus on finalizing the draft of the book on Dareecha (see details in the relevant sections).

RRC Training report will cover five partner countries involved in end-user training; Bangladesh, Bhutan, Cambodia, Nepal and Pakistan. The report will be a compilation and synthesis of experiences as well as the frameworks and practices of the PANL10n training partners in the conduct of training programs. RRC Training has compiled a first draft of the report, which will be sent to the external reviewer. There have been delays as the previous contract had ended and a new contract was drafted and signed by the partner, after the project extension was approved.

RRC Content report was being written by the partner in Bangladesh. It has undergone delays from the outset and was eventually re-delegated to another partner. However, there does was no progress and therefore the re-contracting was not been done.

3.4.5. PAN Localization Project Evaluation Report

The RRC Evaluation worked on final evaluation of the project. The RRC Evaluation team developed five questionnaires on end users, M & E team, organizational capacity, gender dimension in the project and local language computing policy for the evaluation. The team also collected data from country partners indicating the project results after the successful completion of the projects. Most of the data gathering work was completed.

The evaluation results upon the four aspects of the project were being compiled in the form of a series of publishable research papers on evaluation. In this context, the team had completed its policy influence evaluation paper. At the same time, findings on the research capacity building developed through PAN Localization project was compiled. A conference paper on the evaluation of capacity building through PAN Localization project titled, “Strategies for Research Capacity Building in Local Language Computing: PAN Localization Project Case Study” was published in the HLTD 2011. However its detailed version was being developed.
3.5. **Tools to Gauge Research (OMg and GEM II)**

The evaluation framework which extended Outcome Mapping with an explicit focus on gender, by the regional evaluation team in the second phase, has been put to use in multiple projects beyond PAN Localization project.

The regional evaluation group provided assistance to PANDORA project for developing their gendered outcome mapping framework for the programme through the GenderedOM tool available at [www.genderedom.net](http://www.genderedom.net). The project team has promoted the use of gendered outcome mapping framework in other projects. E.g. in a digital storytelling workshop (Subh-e-Nau project, [www.cle.org.pk/subhenau](http://www.cle.org.pk/subhenau)) conducted by CLE, the regional team facilitated in developing the complete gendered outcome mapping framework for the project through which the project planning, monitoring and evaluation was undertaken. Usage of the GenderedOM tool by other project has promoted the use of this methodology by other local and international practitioners and regular feedback from the tool users help the team in improving the user testing of the tool in a real time scenario.

*GenderedOM tool has been cited as one of the two “excellent applications that are already configured according to OM specifications outlined in the OM book” in the Outcome Mapping Learning Community’s newsletter (2010, Vol.1) article on SW4OM: Software for OM contributed by IDRC, Canada.*

In addition the regional component has reviewed the reports on adaptation of GEMII for localization projects.

4. **Finalization of Work in the Second Year of Project Extension (2011-2012)**

The work continued in the second year to bring the project to a closure, but also to continue the network sustainably into the future. Capacity building and development of technology continued in this year as well, bringing the work to a closure. The following sections sum of this work undertaken and completed.

4.1. **Sustainability of the Network**

Project partners have already developed a shared vision and excellent collaborative environment over past many years of working together through the PAN Localization project. Valuing the advantages of such a network, they have been keen on continuing the partnership in form of a self-sustaining network. This was discussed in the first year and the modalities of creating the network were finalized. Concrete steps were taken in the next year towards this goal, as per the details below.

4.1.1. **Formalization of PANL10N Network**

An international conference on Policy and Sustainability of Local Language Computing in Developing Asia was organized by the project’s regional secretariat at Center for Language
The main objectives of the conference were:

- To formalize the PAN Localization Network
- To develop communication plans for policy influence in the project partner countries
- To present evaluation results on the PAN Localization project’s impact
- To strengthen the support network of country components of PAN Localization project and various researchers and experts related to ICT so that it could facilitate localization efforts in Asia

Detailed schedule of the conference is given in Appendix A.

Twenty two representatives of the PAN Localization partner organizations from across South and South-East Asia had attended the conference and discussed the outcomes of the project (For detailed information of the participants please see Appendix B). Salient events held during this conference are discussed below.

Seeing the value of collaboration which had naturally evolved out of the PAN Localization project, the partners had expressed keenness to formalize the relationship into PAN Localization Network. Work had already started in this context and after a couple of teleconferences, the project leaders met in the first face-to-face meeting for network formalization in Cairo, Egypt (in May 2011), a meeting conjoined with the recent Conference on Human Language Technology for Development (HLTD) at Bibliotheca Alexandrina, Alexandria, Egypt. In the meeting the partners decided to follow a two step process. First a MOU was to be drafted and vetted by the organizations partnering in the network. The partners requested up to three months
for this process, as some of the partnering organizations required such time for internal approvals. Once the MOU was to be finalized and agreed, the regional training and meeting was to be organized, where the MOU would be formally signed among all the partners. This meeting, originally planned for August, was organized as a regional meeting. One of the core objectives of organizing this meeting was to discuss and finalize the MOU between the partner countries for formalizing the PAN L10n Network.

![Figure 4.2: PAN Localization Country Partners discussing the MOU](image)

The MOU was to confirm the intention of the Network partners to formulate the Pan Localization Network (PANL10N) as collaboration to promote scholarly exchange and technical cooperation among the Network Members. This MOU signing ceremony of the PANL10N network was held on 30th January, 2012 during which representatives from all the partner organizations signed the MOU.

![Figure 4.3: PAN Localization Country Partners Receiving a Memento after Signing the MOU](image)

Under this MOU the partner organizations declared to perform the following activities:

- Conducting collaborative activities focusing on the research, development, policy and promotion of local language computing in the developing regions of the world
- Undertaking joint research and development projects
- Conducting training through workshops, seminars, and summer schools
- Synthesizing and publishing research on relevant technology, policy and practice
• Developing specific software, technical, linguistic and policy services, and any other relevant activities for furthering the cause of the network

To further the collaboration, especially in the growing mobile workls, the partners had invited a keynote address by HumanIT network, Sweden, by Dr. Jakob Svensson, Director of HumanIT research network, Karlstad University, Sweden, and the Chair of international conference series on M4D (Mobile for Development) during the opening ceremony of the conference. He presented the keynote address on “Mobile Communication for Development in Emerging Markets”. Future collaboration with HumanIT research network is under discussion.

Regional secretariat also organized the one day recreational tour for the international participants. During the recreational tour participants had visited the historical places of Lahore including Masjid Wazir Khan, Lahore Fort, Badshahi Mosque and Wagha Border flag lowering ceremony. Tour dinner was arranged at the newly established Food Street in Lahore, overlooking the Badshahi Mosque.
4.1.2. Developing a Collaborative Forum Online

Work was also undertaken on developing a new website for PAN L10n partners based on Word Press, an open source content management system. Data from the static site for PAN L10n was ported to this new more interactive site. The current status can be viewed by [www.PANL10n.net/wordpress](http://www.PANL10n.net/wordpress). This website allows all partners to post directly online and registered users to comment on what has been posted, thus providing a much more interactive platform in the longer term.

![PAN L10n Network Interactive Website using Word Press CMS](image4.5.png)

Figure 4.5: PAN L10n Network Interactive Website using Word Press CMS
4.2. Work on Language Technology Development
Work continued on technology development and dissemination research in some partner countries. The following section provides specific details on the applications developed.

4.2.1. Localization Research in Laos
In the previous phases, work had focused on localization of Microsoft platform in Laos. In the second phase the focus shifted in maturing the work into plug-ins and applications, and enabling the open source platforms in Lao language.

4.2.1.1. Lao Encoding Conversion
Initial work on Lao encoding conversion utilities produced a slow application. It had to be redesigned and developed for better efficiency. This version of Lao conversion supports the conversion of Lao ASCII to Unicode with file extension.txt

![Lao Encoding Converter](image)

Figure 4.6: Lao Encoding Converter

4.2.1.2. Lao Word Segmentation
The Lao word Segmentation system was developed based on the Urdu Word Segmentation (http://www.cle.org.pk/Publication/papers/2010/ALR812.pdf) framework. For developing the language model a corpus of 50K words was used. Lao dictionary was also used to check the validity of words. This system was developed using C#.
4.2.1.3. SeaMonkey Localization

For localization of SeaMonkey, word list of unique English strings was extracted. The wordlist translations were performed by Lao researcher in Pakistan and forwarded the chunk of translations to the research team in Laos for verification. These verified translations were further used by localization team. Language pack for Lao language was build and tested on several machines. During this testing phase various issues were identified and fixed. A help manual was also developed for the users.

After translation the following component of the SeaMonkey suite were localized:

1. Navigator (Web browser)
2. Mail and Newsgroup (Email Client)
3. Composer (HTML Editor)
4. Address Book
5. Chatzilla (IRC Chat Client)

These are shown in the figure below.
Figure 4.7: Lao Navigator, Lao Mail & Newsgroup, Lao Composer, Lao Address Book, Lao Chatzilla
4.2.2. Local Language Computing Research at Pakistan

During this final phase of the project, two significant research projects were conducted by the Pakistan country component that included the following.

4.2.2.1. Development of Urdu Dialogue System for Accessing Online Content

Access to online content is essential for socio-economic development of local communities. Pakistani citizens face multiple barriers to the access of this online content, including challenges due to literacy, language and connectivity. With a reported cellular mobile density of 70% in 2011, the solution is to disseminate information through mobile based dialog systems. Through such systems, a user would be able to use a mobile phone to request for information verbally. The information would be retrieved from online sources, and then sent to the user in the form of speech. This revolutionary technology would bypass all three barriers of literacy, language and connectivity, and would therefore provide a simple and efficient access to content for all Pakistanis.

Pakistan country component with additional funding support provided by Asia Pacific Telecommunity, Thailand, have undertaken research and development to develop applications for providing access to relevant online content to Pakistani citizens using Urdu dialogue system with mobile phones, thus surpassing the current literacy, language and connectivity barriers. This project is part of a collaborative venture of the applicant organization, the Center for Language Engineering (CLE) at Al-Khawarizmi Institute of Computer Science (KICS) of University of Engineering and Technology (UET) with the National Institute of Information and Communication Technology (NICT), Japan, which is aimed at realizing multilingual dialog systems in order to facilitate communication within and across speakers of different languages.

The project has been done in multiple phases. In the first phase a prototype simple dialogue based system has been designed for a sample banking application, where a user can call the system and identify his/her desired location, and the system responds with the detailed address of the nearby bank branch and some relevant information about the branch, e.g. whether the branch has an ATM machine. This initial work was more focused on getting all the components of the system in place for the system to work.

In the second phase, a more practical and realistic system is being developed. The system will allow the caller to access weather information through mobile phone. Specifically, this system will enable speakers from various districts of Punjab province of Pakistan to call in to the system and speak the name of the district and the system will respond with the online weather information available for the region in Urdu. The target users of the system are farmers that will help them get timely weather information.
In parallel, a larger system development is also being undertaken as part of the U-STAR consortium, which is focusing on speech to speech translation systems. In the work, currently an initial corpus of English is being translated to develop parallel corpus of Urdu. Vocabulary from this corpus is being extracted, which will be recorded to develop a corresponding speech recognition and synthesis systems.

A working prototype of this system has been developed based on recording conducted for 27 speakers upon which the system is providing 100% accuracy on the district name being called out and the weather information being provided.

4.2.2.2. Prototype of an optical character recognition system for 14 point size

Pakistan country component has developed a working version of an Optical Character Recognition system for 14 font size Urdu text. In this project, basic R&D has been conducted for the development of recognizer of Urdu text images written in Noori Nastalique writing style.

Urdu Optical Character Recognition (OCR) is the process of converting the Urdu document images into computer editable and searchable format with less time and human effort. Most of the Urdu content is available in the form of published books, magazines etc. Urdu OCR system will help to port Urdu content online in editable format and to enable online Urdu search from the scanned images of published books and magazines. In this project, team was working on the following phases of OCR which are discussed in detail in the subsequent sections:

1. Corpus collection
2. Pre-processing
3. Classification and Recognition
4. Post-processing

Most of the text in Urdu books is available in 14 font size therefore the target font size for this project was 14 point size. In the corpus collection phase, books having 14 font sizes for regular text were selected for scanning. Total 100 books have been scanned to have text image corpus. This image corpus has been typed to generate text corpus.

In Pre-Processing, the technique for line segmentation has been implemented using the projection profile method. This approach did not perform well for all 500 pages because of the cursive nature of Urdu, skew in images and joined main bodies of two lines. The line is further segmented into connected components (CCs) where each connected component is assigned a label as either main body or diacritics of a ligature. The diacritics and marks are also associated with main bodies to have the ligature images. The limited level of salt and pepper noise has been handled. While extracting the connected components from image, all connected components having bounding box size within a threshold are removed by considering as noise.
In this project ligature based-recogizer has been developed using Tesseract engine. Tesseract is an open source classifier developed for the multilingual recognition. The complete framework has been designed and implemented for the integration of Tesseract for the recognition of Urdu text. All the connected components have been clustered and trained using tesseract to generate the trained data for Urdu. In parallel the lookup table has also been generated in which the IDs sequence and positions of connected components are stored against ligature string. After the recognition of connected components images, the ID sequence of connected components along with the positioning information is search on the lookup table to return the ligature string. Because of the cursive script and small font size, the accuracy of the recognizer is not up to mark and is still in improvement phase. The figure below demonstrates the flow of recognition of line.

Figure 4.8. Ligature-Based Optical Character Recognition for Urdu

After the recognition of ligature string, next phase is to use the word segmentation system which converts the sequence of ligatures into the best sequence of words. The statistical approach has been developed for the word segmentation system. In order to train the statistical model, a cleaned text corpus is required. Hence, text corpus collection and cleaning tools have been developed. The text corpus having 0.5 million words have been collected and cleaned. The Urdu words segmentation system has been developed using cleaned corpus which converts the sequence of ligatures into best sequence of words.

Integrating with Urdu text to speech system and Braille, it will also enable print disabled (illiterate and blind) community to read Urdu content. This system is developed using Tesseract which is part of the Google’s Open source OCR framework, OCR opus. This system will enable rapid digitization of Urdu content, essential for putting text online.
4.2.3. Sri Lanka

Two of the sub-projects developed by Sri Lanka country component during PAN Localization project phase II were (a) a customizable Language Teaching and Learning Framework based on an experiential learning pedagogy, and (b) developing a Sinhala Wordnet for supporting language processing applications. At the end of the project period, there were two clear extensions that were identified and requested for completion during the current project extension phase, described here.

4.2.3.1. Testing and Evaluation of the Language Teaching Framework

This sub-project activity was designed to obtain feedback from identified stakeholders about the usability of the above framework for purposes of language learning as well as building language learning environments for other languages. Under this activity, two separate groups of stakeholders were surveyed: the learner community, and the teacher community.

The learner community was surveyed to obtain feedback on the effectiveness of the learning environment. Owing to the project adopting an existing pedagogy for the learning material produced, a control group of undergraduates only using the book form will be compared with another group that uses the CD/online material in addition to the textbook. A separate learning community was also surveyed to evaluate the overall suitability of the teaching content in order to propose it to government as a scalable solution to be deployed throughout the country.

The teaching community and the content development community were also surveyed to find out the ease of customizability of the framework to other source languages as well as other target languages.

4.2.3.2. Making the Sinhala Wordnet

One of the most useful linguistic resources developed during the 2nd phase of the PAN localization project was the Sinhala Wordnet. The work consisted of using the 10 million word UCSC Sinhala corpus to determine the 1000 most important word senses of Sinhala to form the initial Sinhala Wordnet. While this work was completed in a linguistic sense, its accessibility by other users and developers was not achieved during the project period. In the extension period, this resource has been encoded in the OpenFST framework, as well as uploaded to the Asian Wordnet. 1,797 elements of 1,075 senses have been entered to the Asian WordNet (AWN) as it can be used for many NLP applications. As a result of joining with AWN, these senses were automatically linked with 12 other Asian languages since it shares the same PWN ID. Then the XML file for these 1,075 senses was created based LMF standards using the AWN. 215 concepts in first five levels of SUMO have been translated in to Sinhala by language experts in order to expand the Sinhala WordNet. Translated senses then mapped with corresponding PWN
sense ID to access to all other information of each sense such as its synonyms, antonyms, hypernym, hyponyms, meronyms and holonyms.

4.2.4. Regional Research on Internationalized Domain Names
The regional project leader has been significantly involved in national and international efforts on Internationalized Domain Names (IDNs). In this context, nationally research has been conducted jointly with Ministry of IT to develop the IDN ccTLD registry for Pakistan. At the regional level, the regional project coordinator is also actively involved in the internationalization of WHOIS. In addition the regional project leader has spearheaded a global study on IDN Variant issues project for the Arabic script conducted by ICANN (www.icann.org) and was also involved in the integrated issues report covering the six cases studies on Arabic, Chinese, Cyrillic, Greek, Latin and Devanagri scripts. This work continues under the umbrella of ICANN.

4.3. Promoting Use of Language Technology
Within the current MGC amendment, the Language Technology Kendra (LTK), Nepal conducted the project on Models of Technology Use (August 1, 2011 – March 2012). Through this project, the team helped establish a Community e-Center at Tangting, a remote village to the north-eastern part of Pokhara, the second biggest city of Nepal.

The general aims of the project were the following:

- Examine the process of learning technology across different end-user groups
- Investigate the effective mechanism for transferring knowledge and technology skills among the end-users of varying capacities and skills
- Assess the impact of the introduction of technology in the individual and social lives of the end-users
- Investigate a sustainable model for technology use
The scope of the project included the following:

1. Conduct a base line study of the infrastructure and technology awareness levels of the end-user in the selected site

2. Develop effective end-user trainings of technology and test their applicability

3. Conduct a study on the perception and learning capacities/skills of technology across the end-users of varying gender, privileged and under-privileged classes, castes, age groups, etc.

4. Suggest a sustainable model for the long term adoption of technology

The site of the current research is Himalaya Milan Secondary School (HMS), a community-run school in Tangting village, under the Namarjung Village Development Committee of the Kaski district in Western Nepal. Under the lab setup and technology deployment, a computer lab of 11 machines was set up that were all connected to a local area network (LAN). Out of the 11 machines, 5 machines were part of the Project’s support whereas 6 machines were contributed by the site. As part of the lab setup, the Project also provided 10 webcams, 5 headphones, 2 digital cameras, 1 recorder etc. The lab was provided internet connection through the locally available V-SAT technology.

The project team installed Ubuntu 11.4 in the lab which was localized by the technical team of the Project with the following localized applications:

- Nepali locale and input
- Nepali Spell checker integrated with Libre Office
- Nepali Sabdakos (offline version)
- School Wikipedia (offline version)
Project team organized the training in two phases; the first one being the Trainers’ Training and the second one being the End Users’ Training. Prior to the Trainers’ Training, a survey was conducted on the competencies and computer literacy of the participants on the site. Following the survey, the Trainers’ Training was conducted for the teachers and the community people focusing on the following skills:

- Using the system and trouble shooting
- Basic networking and system support
- Basic orientation on the applications

The second phase of the training included the Users’ Training in which students were engaged. The students were provided training on the following:

- Typing in Nepali Unicode
- Using Office Applications
- Using E-mail, Internet, Skype, browsing web pages and Googling
- Working with images and videos (recording and basic editing, uploading on the web)

Once the Users’ Training was provided to the students, lab sessions were conducted in two modes:

- Unsupervised sessions, whereby the students were left on their own independently to explore and use the applications as per their own interests.
- Supervised sessions, whereby the students were asked to accomplish certain tasks like working with Office Applications, saving the files, searching the materials on the web etc.

Concurrently with the student’s training, the trainers provided refresher training to the teachers those who had already attended the Trainers’ training.

Three different patterns of learning were observed among the students using the automatic and manual observation methods. In the manual observation method, students’ activities were manually entered into the spreadsheet file like (active versus not so active, eager and asking questions versus quiet and not inquisitive etc.). In the automatic observation method, individual student activities were recorded via Desktop screen capture applications and tracking the web pages browsed by going through the “History” menu of the browser.

The students’ activities in the lab were minutely observed in both the sessions using manual and automatic methods.
Figure 4.10. Pictures from the Training and Installation Sessions at Nepal

Based on the findings the following observations had noted regarding use and perception of technology and their patterns of learning. Three different patterns of learning were observed among the students classified into different group and explained below:

**Group 1:**
The (males and females) in this group were relatively quick to grasp the computer lessons, and were more interactive in the computer class. Those happen to be the good students that also do well in the school exam system.

**Group 2:**
This group comprises of average students, less interactive in the class, but they had became more interactive, more open, shown more enthusiasm, and learned faster in the computer class, their performances being better than expected by their teachers.

**Group 3:**
There were several students from the Dalit community, and some female students below average students who did not have good academic records, earlier hardly asked questions or interacted with teachers in the classroom- who had displayed enthusiasm for computers, and look forward to learn more.

Despite the fact that most of the students were using computers for the first time, and given that initially they found even the handling of the mouse difficult, they expressed joy at being able to type their feelings in the Nepali language. Their initiation of ICT has been a smooth one perhaps Nepali being the language they study in, can understand and speak, contrary to the English language in which they happen to be considerably weak.
Based on the study, observations and analysis of the use of technology in the site, the following model is suggested:

**From a Technological Perspective**

1. In order to maintain a pool of technical human resources capable of looking after the center, the site has to develop a small core team (7-8 members) comprising of at least two smart students from Grades 8-10 under the leadership of a teacher looking after the center. This way, even if one or more of them would leave the site for some reason, the site will not be short of technical people to handle technical problems.

2. The site has to document the technical problems faced and also the possible solutions in the form of “Frequently Asked Questions (FAQs)” and put it somewhere readily accessible to the Users, for example, in the intranet of the site.

3. The site has to use all channels of communication – telephone, SMS, chats, Facebook, emails, mailing lists, forums etc. to communicate with LTK and/or other technical experts regarding any problems that they would face in the sites.

4. The major target audience of the site being the students, the site has to gather more useful content meeting the curriculum needs of the students. They have to be trained on the latest tools for teaching and learning.

5. The site has to arrange for a balanced time allocation for the students in terms of using the center and the tasks or assignment based learning approach has to be encouraged.

6. The site has to arrange the time in the mornings and evenings for the community people and the day time mostly for the students and teachers so that there is no unnecessary conflict on sharing of resources between the school and the community people.

7. The site has to be pro-actively engaged in updating its website so that more and more people both within Nepal and outside get to know better about the site thus potentially leading to its revival as a tourist station.

**From a Financial Perspective**

1. The site has to charge nominal fee or charge to the students and teachers as well as the community people for taking the services from the center.

2. As more tourists flock in to the site in future, the center may also offer internet and other services to the tourists taking some charge or fee.

3. The site has to look for subscription to cheaper internet service providers. In order to prevent its machines from possible damage caused by unstable power supply, the site has to invest on voltage stabilizers.
4. The site has to use the facilities of the center the maximum possible in order to promote and exhibit its local products, culture and other local attractions.

5. The site has to work towards setting up an endowment fund to support the operating costs of the center. The money collected from the center by selling its services could be used as a starter fund for setting up the endowment fund. Additionally, the local governing bodies like the Village Development Committee (VDC), District Development Committee (DDC) should also be contacted for a one-time support contributing to the endowment fund.

6. The site has to possibly start thinking of making it a wi-fi enabled village. In that case, the school could act as a service provider. This way too, some revenue may be generated, which can be put in the endowment fund basket. Once the endowment fund basket attains a considerable size or amount, the operating costs of the center can be managed with the interests earned from the fund.

4.4. Work on Language Technology Capacity Building

The project has been actively engaged with developing the technical capacity of its partners. This work has continued in the current extension phase, as per the details below.

4.4.1. Mentor Placement Program for Laos Country Component

Laos country component was unable to complete its research objectives as planned in Phase 2. One of the major reasons being, that the experienced researchers from the team had gone for higher studies and the newly formed team required training. Thus to achieve the project goals, the Regional Secretariat had invited researchers from Laos research team to Pakistan, for attending localization training for three months in order to accomplish the project tasks. Laos had sent Ms. Kitthisack Pasomsouk, a linguist and Mr. Khamphay Inthara, a software developer to Pakistan for attending the training.

The main purpose of this placement was to provide training on localization of SeaMonkey in Lao, and develop line-breaking and sorting utilities for Lao. During the three months stay in Pakistan Laos participants had completed their training on the following and developed the tools also:

1. Lao Encoding Conversion
2. Lao Word Segmentation
3. SeaMonkey Localization

Two mentors from Pakistan team, Huda Sarfaraz and Farah Adeeba were involved in their training. During this mentor placement, the software developer from Laos’s team was responsible to develop the following:

- Encoding Conversion utility
• Software Documentation including:
  o Functional Specification
  o Design
  o Test Plans
• Testing of software

The linguist from Laos was responsible for the following:

• Overall localization of SeaMonkey that specifically included
  o Translation of Word List
  o Specific application RS identify
  o Build Specific Application RS identify into the Software for final localization of the Application

During their three months stay in Pakistan, the Regional Secretariat had also organized recreational tour to historical places of Lahore (Lahore Fort, Badshahi Mosque, Shalimar Gardens etc.). Lunch cum hi-tea was also arranged for the Laos trainees at the end of the successful training completion

![Figure 4.11. Laos Trainees during the Recreational Tour, Pakistan](image)

**4.4.2. Regional Training on Localization of Mobile Platform, Pakistan**

In parallel with the conference on Policy and Sustainability of Local Language Computing in Developing Asia, the training on **Localization of Mobile Platform** was also held from January 29th - February 3rd, 2012 at UET, Lahore.
Figure 4.12. Mobile Localization Training Participants from Partner Teams

The training was arranged to build capacity for research in Localization of Mobile. Through this training the participants had provided a step by step approach for localizing mobile phones in order to facilitate access and retrieval of information in the native languages.

Primary objectives of the training were the following:

- Introduce audience to fundamentals of software development for mobile devices.
- Introduce audience to the localization support on existing mobile platforms and techniques to improve localization capabilities.
- Train audience on using Pango to enable localization on Symbian platform. During the course of the training, trainees were given necessary background knowledge and hands on exercises which further enhanced their skills in developing localized applications on mobile platforms in general, and Symbian platform in particular.

To execute this international training, the regional secretariat completed the following arrangements to prepare the training environment:

- Set-up a dedicated lab for executing this hands-on training
- Develop workspaces for participants, by providing chairs, tables, machines, multimedia facilities, and other utilities
- Install the following specific software required for training on each of the machines:
  - Windows 7
  - ActiveState Active Perl version 5.6.1.635.0
JRE version 1.6 or newer.
S60 SDK 3rd Edition Feature Pack 2
Carbide.c++ IDE v 2.3

- Acquire four Nokia E51 hand phones enabling trainees to install and test the localized applications live on the mobile devices.

The trainers also prepared specific hand outs, exercises, and supplemental training material to facilitate the training participants. This training material included:

- A book titled “Localization of Mobile Platforms” authored by the regional training team on mobile localization that illustrated the complete process for localization on mobile platforms. Trainees consulted this book frequently throughout the training.
- Microsoft PowerPoint slides were prepared for all the lectures
- Detailed training plan was prepared and distributed to trainees. This training plan included schedule of lectures and exercises for each day of the training (complete training schedule is attached in Appendix C)

The Mobile Localization training was attended by almost 20 participants across the region including Pakistan, Indonesia, Laos, Nepal, Mongolia, Sri Lanka, and Thailand. Among trainees were software developers, system implementations managers, university teachers and ICT consultants. Trainees were given both theoretical and practical exposure of techniques for localization of mobile platform.

During the training, trainees were able to configure keyboards for their own languages, load fonts of their choice, and execute localized application that enabled them to input text in their own language on a mobile device. The exercises were done on both mobile device emulators and actual mobile devices.

After attending this training, trainees were able to develop SMS application in their own languages. The screenshots of applications in each language are shown below:
ayo.indonesia
Figure 4.14. Screenshots of SMS Application Developed in Local Languages of the PAN Localization Country Components
4.4.3. Training on Localization of Mobile Platform at Bhutan

After the successful completion of Training on Localization of Mobile Platform in UET, Lahore, Department of Information Technology (DITT), Government of Bhutan requested the regional secretariat to conduct a similar type of training in Bhutan to train their government officials and IT professionals on Android and Symbian technologies. Responding enthusiastically to this request, regional secretariat sent its training team to Bhutan led by Waqar Ahmad. This training was held at Thimphu, Bhutan in collaboration with the Department of Information and Technology and Telecom (DITT), Bhutan, from 12th March – 24th March, 2012 at DITT.

The training was hosted and organized by DITT Bhutan, however, financial assistance was provided through PAN Localization project. Officials of various ministries and IT professionals from the local industry participated in this training.

The training consisted of two modules.

1. Overview of Localization on Android
2. Localization on Symbian

During first one week long session on overview of Android development, training was given on the development of activities, games and data configuration after which participants were able to do various exercises and hands on practice these different applications. During the next week long session, training was provided on localization of Symbian platform.

4.4.4. Advanced Training on Mobile Application Development in Bhutan

Based on the success of the mobile localization training in Bhutan, the Bhutan country team had requested for another two week long advanced training on application development on mobile platforms. The training is facilitated by Mr. Wasif Tanveer from KICS-UET, Lahore.
The focus of this advanced training was to develop end-user applications like data collection (through Android and MySQL) and SMS-based applications. The DITT, Govt. of Bhutan had provided the complete financial support for this training.

4.5. Disseminating Project Outputs

Though there has been significant work done on developing and disseminating language technology through the project, it was realized that still the work has not been properly advertised to the relevant stakeholders, including policy makers and civil society members. For this purpose a series of dissemination seminars were planned in each partner country for presenting the project outputs. In this context, the information seminars had conducted in Bhutan, Indonesia, Nepal, Cambodia, Sri Lanka and Mongolia. Proceedings of the information seminars held in Bhutan, Indonesia and Nepal are given below.

Before these seminars, a regional training was also organized to train the partners to develop effective communication plans.

4.5.1. Communication Planning Workshop

A key event organized during this conference was the workshop on Communication for Policy Influence. The foremost objective of this workshop was to train PANL10n country partners for strategic dissemination of their research in order to influence local language computing policy in their respective countries. This workshop was also organized as a preparatory activity for the partner organizations to develop their communication plans before they conduct the information seminars in their respective countries (which had been planned toward the end of the project).

Figure 4.16. Dr. Angelo Coordinating during the Workshop on Communication for Planning

The workshop was facilitated by Dr. Angelo Ramos, Executive Director of Molave Development Foundation. He delivered three lectures on communication for policy and provided a detailed overview on research communications, role of research in policy, issues in
understanding of research outcomes by the policy makers and strategies to communicate for research outputs with policymakers.

![Participating Country Partners Developing Communication Plan during the Workshop](image)

Figure 4.17. Participating Country Partners Developing Communication Plan during the Workshop

At the end of this workshop, each partner country developed its research communication plan for the target audience. Communication objectives were developed for each target audience followed by the strategies to attain these objectives. Moreover, an evaluation plan was also set to appraise the effectiveness of research communication.

4.5.2. National Conference on Use of ICTs in Rural Nepal

The Nepal country component organized a national conference on “Use of ICTs in Rural Nepal”, by bringing together relevant stakeholders; the policy makers, implementers, fund raisers, users and site managers, in one place and let them share their experiences, success stories and cases of failure.
This conference was deemed necessary as it was believed that while government and non-government agencies have compiled statistics on the active and non-active tele-centers, there have not been any efforts towards gathering data on the possible problems, challenges faced and/or success stories on changes that would have been brought about by the introduction of technology in the lives of the people in the sites. Thus through this conference ICT4D researchers had an opportunity to share their stories of change, interviews on best practices, experiences of the site people (both success stories and cases of failure) as an outcome of the conference.

This two day conference was organized on 22nd and 23rd March 2012. It included invited speeches on the need and significance of local language computing for the eminent localization ICT4D researchers in Nepal. The detailed schedule of the conference is attached in appendix D.
Figure 4.20. Kanak Mani Dixit and Rabi Karmacharya during the Conference on Use of ICTs in rural Nepal

The welcome note was provided by Mr. Kanak Mani Dixit, the Director of Language Technology Kendra, who gave a brief introduction about the research conducted by Language Technology Kendra in the field of Localization and Information Communication Technologies. He also remembered how the necessity of cataloguing books and collections of Madan Puraskar Pustakalaya had led to the invention of the Devanagari Nepali Unicode. As of today, the foundation led by Nepali Unicode has opened enormous doors of opportunities for Nepali Language Computing.

The first invited talk was presented by Mr. Mahabir Pun, the President of E-Networking Research and Development (ENRD), Nepal. Mr. Pun in his talk shared his experiences on connecting the rural villages of Nepal to the Internet through the Nepal Wireless Project.

He informed that as of 2011, a total of 125 villages in 13 districts of Nepal have been connected
to the wireless network. The clients of the network are mostly schools, health clinics, hotels, individuals and community centers. He also talked about Nepal Research and Education Network (NREN), its primary goal being to maximize the benefit of the Information Communication Technology (ICT) to the rural population.

The second session was conducted by Mr. Rabi Karmacharya, currently the Executive Director of the Open Learning Exchange (OLE), Nepal. In his talk he provided an introduction to E-Pustakalaya. Mr. Karmacharya shared the primary goals of the E-Pustakalaya being to promote the reading culture among students, to encourage the students to carry out independent research, to provide the tools necessary for students to explore and learn among others. The major benefits of the E-Pustakalaya are the possibility of sharing the same resource material to limitless number of users, easy access to thousands of books and learning materials among others. The next session was conducted by Prof. Patrick Hall, the scientific advisor of LTK. Prof. Patrick A.V. Hall in his talk focused on how languages have influenced computing. In this regard, he gave a short overview of the history of how and for what purpose computers were first brought to Nepal. With the invention of some hack fonts, Nepali began to be possible to type in computers, display and print but still a full-fledged use of the computer for processing Nepali text had not been possible until the Nepali Font Standardization Project which helped to develop Unicode compliant Nepali fonts and keyboard driver software (Nepali Unicode Romanized and Nepali Unicode Traditional).

Prof. Hall further added that quite a few Projects came to Nepal basically focused on Localization. These Projects include NepaLinux, MS Windows Localization, development of Natural Language Processing (NLP) utilities like the Spell checkers, Text-to-Speech, Nepali Dictionary, Corpus Development etc. Clearly, the need to incorporate Language in Technologies has been felt and realized by all. With the recent changes in Nepal, languages have become a prominent issue and a matter of identity. There is a growing demand of wanting to have the technologies developed for each set of languages, the only question remaining how to do it appropriately and amidst the current technological constraints. Prof. Hall concluded his talk by saying that it would be important to empower the different languages with the emerging and ever changing technologies and hence language technologies are certainly areas of not just national importance but carrying global significance.

Mr. Bal Krishna Bal in his talk focused on the consolidation of the three components – Localization + Natural Language Processing + Use Models in an effort to make the sustained use of ICT possible and at the same time to address the sustainability of any ICT initiatives. Mr. Bal started his talk by giving an overview of the major Localization Projects and Initiatives followed by the discourse about how NLP applications could complement Localization. Bringing into light the third component, i.e., Use Models, he explained how without a properly designed or home worked Use Model, all efforts on Localization and NLP could result in vain. Mr. Bal ended his talk by providing few examples of technologies whereby the three components were possibly incorporated.
Following the talks next session was moderated by Mr. Kedar Sharma in which the team discussed the information and results of the Use Models of Technology Project executed by the Language Technology Kendra with the support provided by International Development and Research Center (IDRC), Canada.

The next session on, “Technology Influences and Stories of Change – Experience sharing session: Meet the Local heroes” was conducted by Mr. Rajendra Poudel. In this session local heroes from four districts of Nepal came to the conference to present their personal stories about the changes that were brought about after the introduction of ICT in their personal lives as well as in the society.

![Image](image1.png)

**Figure 4.21. Presentation on Stories of Change during the Conference on Use of ICTs in Rural Nepal**

The conference saw the participation of around hundred participants from different spheres. There was an overall active participation in all the sessions of the two day conference.

![Image](image2.png)

**Figure 4.22. Participants and Guests during the Conference on Use of ICTs in Rural Nepal**

The attendees and participants were seen to be vibrantly discussing and sharing their knowledge and views about ICT, the latest status in Nepal and how it could be further improved and leveraged. The conference gave the opportunity to meet with people, who, despite being located
in the same city, had been communicating virtually through emails and other social networking media in the Internet.

### 4.5.3. Dissemination Seminar in Paro, Bhutan

On March 26 to 30, 2012, the Department of Information Technology & Telecom, Ministry of Information & Communications in Thimphu, Bhutan conducted a seminar based on PAN Localization Project outputs in Paro, Bhutan.

Specifically, the seminar focused on disseminating information on:

- Usage of Dzongkha Linux software and its applications
- Dzongkha Language resources and its importance

The seminar followed a sequence of presentations, debates and discussions. In order to encourage discussion and a more focused exchange of information, practical sessions were scheduled for the later part of the day by providing the participants with live demonstrations and engaging them in learning by way of exploring the software and applications. The seminar brought together representatives from various agencies and institutions, other relevant stakeholders and representatives from media agencies. The seminar had a total of 14 participants from relevant agencies including translators/reporters from various media houses.

The following section provides an overview of discussions throughout the seminar:

**Usage of Dzongkha Linux Software and its Application**

The Dzongkha Linux Operating System and its related software developed by the team were discussed. The participants were also provided with take-home installation CDs, printed manual books and Live CDs of the Dzongkha Linux to allow the participants to try out Dzongkha Debian Linux without making changes to their computer's existing OS, hard drives or files during the course of the seminar.

The availability of open source Dzongkha Debian Linux and its related software as an alternative to proprietary software were discussed at length. The speaker also addressed about the importance and benefits of localized software, particularly emphasizing on how:

- these software will help non-English speakers in rural areas
- these localized software’s can help increase computer literacy
- it can help to solve the issue of digital divide
The participants were also trained on basic knowledge and skills on how to install and operate Dzongkha Linux, using open office applications, using Firefox and Thunderbird and other applications. With this, it was also informed about the number of Dzongkha Linux end user trainings conducted by Bhutan country component to raise awareness on Dzongkha Linux and open source software in general.

**Dzongkha Language Resources and its Importance**

The major outcomes, deliverables and research findings of the Dzongkha related language processing and language resources listed below were explained briefly, like its working, accuracy, further research works, etc. to the participants.

- Optical Character Recognition
- Text-to-speech Synthesis
- Text Corpora Database
- Word Segmentation
- POS Tag Sets
- IDN
- Dzongkha Lexicon
- Wordnet for Lexical Database
- Content Development in Local Language

Research reports and links such as [http://www.panl10n.net/english/OutputsBhutan2.htm](http://www.panl10n.net/english/OutputsBhutan2.htm) and [http://www.dit.gov.bt/research-papers](http://www.dit.gov.bt/research-papers) containing those research reports were also shared with...
the participants. More importantly the importance of this research work was discussed with the participants.

4.3. Dzongkha Technical Terminologies

The seminar also took the opportunity for doing the following exercises:

- Editing selective Dzongkha Computer Terms from the existing Dzongkha Computer Terminology book
- Discussing technical Dzongkha Terminologies used in Media
- Standardizing the technical Dzongkha Terminologies used in daily life

This led to an agreement on common standards on the technical terms that would ensure uniformity in the usage of these terms in future.

The dissemination seminar ended successfully and the participants expressed their delight at the work accomplished through the efforts of PAN Localization. Some of them were not aware of PAN Localization work so it was a perfect opportunity to create awareness and promote PAN Localization outputs. Although they had fewer participants than expected, they represented the end-user group that would best fulfill their intended purpose.

4.5.4. Dissemination Seminar held in Jakarta, Indonesia

The PANL10n dissemination workshop was organized by faculty of computer sciences – University of Indonesia (UI) and Agency for the Assessment and Application of Technology (BPPT). They invited their colleagues from different universities and institutions in Jakarta and other cities. Thirty people attended this workshop.

![PANL10n Dissemination Workshop Participants in Indonesia](image_url)
UI & BPPT gave presentations about the PANL10n projects (Indonesian components). The UI team presented the result of developing Part-of-Speech Tagger (POSTAG) and Penn-Tree Bank Corpus of Bahasa Indonesia. The BPPT team presented the result of developing English-Indonesian Machine Translation and Indonesian corpus.

The participants were very interested in the topics and they asked if the tools and resources could be accessed by others. Moreover, there were a lot of discussions regarding the language resources and tools for Bahasa Indonesia. The participants further discussed their intentions for collaborating with the teams in future research in language processing, developing other language tools and resources for Bahasa Indonesia and local languages.

### 4.6. Synthesis and Publication of Regional Research Reports

During this phase the regional secretariat has finalized publication of the following research reports:

1. Localization of Mobile Platform
2. Dareecha ICT Training Program for Public Schools in Rural Punjab
3. User’s Training Experiences in Local Language Computing Across Developing Asia
4. Evaluation Findings of PAN Localization project
5. Research report on Mongolian Language Processing
6. Local Language Computing Policy in Developing Asia

Details are given below. These reports are available for download from [www.PANL10n.net](http://www.PANL10n.net).
4.6.1. Localization of Mobile Platforms

This research report on localization of mobile platforms has been published by regional secretariat during the regional training on localization of mobile platforms in January 2012.

![Figure 4.26. Research Report on Localization of Mobile Platforms](image)

This book presents the relevant background and details of Localization of Mobile Platforms specifically covering the following sub topics:

- Overview of Software development,
- Symbian Operating System Architecture
- Setting up Development Environment
- Symbian Application Framework
- Developing a Hello World Application
- Localized SMS Application
- Pango: A Viable Open Source Font Rendering Engine for Smartphone Platforms

It describes a detailed methodology to enable complex scripts on mobile devices and discusses how to enable localization support and localization process. This book is freely downloadable from [http://www.panl10n.net/english/LOCALIZATION_OF_MOBILE_PLATFORM.pdf](http://www.panl10n.net/english/LOCALIZATION_OF_MOBILE_PLATFORM.pdf).

4.6.2. Dareecha ICT Training Program for Public Schools in Rural Punjab

This research report is focused on the research finds of the Dareecha project, executed by Pakistan country component of PAN Localization project that aimed to investigate aspects
related to ICT literacy in rural schools, focusing on the cultural constraints due to language and gender.

![Figure 4.27. Research Report on Dareecha, ICT Training Program for Public Schools in Rural Punjab](image)

This book focuses on the following topics.

- Gives the objectives of the project, summarizing the related literature
- Presents the methodology of the project
- Presents the findings of the project for ICT capacity building in rural schools
- Discuss the data on preference for and impact of language for learning the use of ICTs by the school children
- Discuss the role of the gender in ICT adoption
- Sums up the experiences of the Dareecha ICT training program and presents recommendations based on the lesson learnt for further implementation, in the context of National Education Policy

The first complete draft of this report was reviewed by an external reviewer, Dr. Michael Gurstein who found the report as “well written”. The arguments as well presented and well linked into the data, the charts and figures to be appropriate and illustrative and the writing overall to be good.” Based on his feedback, the book has been re-organized and thematic chapters have been developed. Content within each chapter has also been re-structured. In addition his valuable feedback regarding the inclusion of more extensive recommendations (or at least suggestions for further research or practical development/experimentation) based on the findings of the project; and to anchor these recommendations in a more elaborate discussion of the current state of the art within the rural education context in Pakistan with respect to the various issue areas has been adopted, and in the light, the book has been revised and finalized. This book is freely downloadable from: [http://www.panl10n.net/?page_id=953](http://www.panl10n.net/?page_id=953)
4.6.3. User's Training Experience on Local Language Computing

The regional research component on training led by Dr. Emmanuel Lallana and research officer Mayette Macapagal, from IdeaCorp., have synthesized the research report on “Users’ Training Experiences on Local Language Computing.” This book presents cases of selected countries that had conducted computer literacy training in the PAN Localization Project, in line with their respective country national ICT development plans. The case studies have been documented by the country teams who have aptly described and illustrated their experiences in local language computing training programs.

Figure 4.28. Research Report on User’s Training Experiences in Local Language Computing across Developing Asia

The main purpose of the book is to draw good practices and lessons learned from the training process and consequently offer framework guidelines toward an effective training program for ICT localization programs.

The book is organized in chapters and sections (based on country inputs). Aside from text, space is also provided for photo documentations. The introductory chapter (Chapter 1) serves as a backdrop of the PAN Localization initiatives. Chapter 2 discusses and offers a review of literature on the importance of Literacy, Training and Language in the context of ICT for Development. It also provides an overview of the Instructional Design Framework and the RRC-Training conceptual framework. The succeeding Chapters 3 - 6 focus on the country initiatives and experiences of Nepal, Pakistan, Cambodia, and Bangladesh. It provides a discussion on each country’s National ICT Development Strategy and how localization fits into the ICT strategy. Each country also presents their training strategy and how they conducted and implemented the users training for local computing applications. An assessment of what worked and what did not work in their users training programs will also be disclosed leading towards a discussion on lessons in the field. Also included is a discussion on what lies beyond the project, where the authors explain the continuing imperatives for improvement and sustainability of their localization initiatives. Country experiences gave light on how gender
considerations were addressed in the training programs. The final chapter (Chapter 7) covers the common and differentiating experiences and a synthesis of the research experiences of the countries discussed in the book. It also provides a framework that could be used to meet the challenges and future implementation of training programs on localization, which include opportunities where gender considerations can be harnessed in the training on localization of ICT initiatives. This book is freely downloadable from http://www.panl10n.net/english/outputs/userstraining.pdf.

The first complete draft of this report has been reviewed by an external reviewer, Usha Reddy, who found the case studies mentioned as “fascinating to read because they dealt with realities—policy and budgetary deficiencies, poor infrastructure, connectivity, and access; human capacity building; and gender issues which form major constraints to the wide spread of using ICTs”. Her comments and feedback has been helpful in including a final section on the training achievements necessary for teasing out the major aspects of training, capacity building and localization, by pulling together the commonalities and identifying the differences for understanding ICT training within the larger context of localization.

### 4.6.4. Evaluation Findings of the PAN Localization project

This book covers the synthesis made by the regional evaluation team on four aspects of PAN Localization project. These four aspects are research capacity building through PANL10n, end users training on localized ICTs, PANL10n influence on local language computing policy across South Asia region and gender mainstreaming in PAL10n projects.

*Figure 4.29. Research Report on Evaluation Findings of the PAN Localization project*

To investigate project on these four aspects, regional team collected data from each participating country and analyzed this data by using various framework related to each aspect.
This book contains six chapters including an overview on the need of PAN Localization’s evaluation and then, in next four chapters, the aforementioned aspects are discussed in detail and findings have been presented. In the last chapter, the discussion has been made on the lessons learned and the strategies proposed for similar future interventions.

Findings presented in this book were also disseminated in regional meeting in order to get feedback from the partner countries and to discuss the lesson learned during the project. A separate session was organized in this regard for each aspect and feedback collected during these sessions has now incorporated in the book. Draft version of this book is downloadable from http://www.panl10n.net/english/outputs/evaluation.pdf

The first complete draft of this report has been reviewed by research team at TechBridge Connect, led by Dr. Bernardine Dias at Carnegie Mellon University, USA. Based on the suggestions and feedback specifically on further elaborating the research tools used for gender and policy analysis and addition of further quantitative description regarding measurement of impact of the project due to the use of local language technology, the report has been updated and finalized.

### 4.6.5. Research Report on Mongolian Language Processing

The researchers from InfoCon, MUST and NUM have been involved in developing a complete discourse on Mongolia Language processing. The final camera ready version of the book has been prepared and is being sent for publishing. This research report consists of complete chapters on the fundamentals of language processing and presents Mongolian language specific frameworks researched through the project.

1. Mongolian Phonetics
2. Speech Processing
3. Speech Recognition
4. Text to Speech
5. IT terms dictionary

The report is being finalized for publication by the Mongolian country team.

### 4.6.6. Local Language Computing Policy across Developing Asia

The regional project leader in collaboration with the head, Department of Communications and New Media, National University of Singapore, is compiling a regional research report on the local language computing policy in developing Asia.
This book illustrates the challenges of localizing ICTs in developing Asia that are broadly cited as the lack of funding, lack of technical expertise, lack of coordination among the numerous agencies and ministries in charge of localization, lack of national initiatives to make local language computing a priority, lack of an actual local language computing policy, lack of technical standards, lack of an appropriate regulatory and legal environment, lack of education opportunities, lack of literacy, lack of access to computers, lack of an adequate IT infrastructure, lack of funding for R & D and lack of respect for intellectual property.

Recognizing that localization is very important for greater ICT adoption in developing Asia, the purpose of this book documents the current state of localization policies in the region, investigate challenges slowing localization, document successful strategies that promote localization, and examine successful implementation models in more detail to determine if they can be transferred (in whole or in part) to other countries in the region or elsewhere in the world, e.g. African countries. This book provides an overview of developing Asia, including basic demographic information, languages spoken, literacy levels, information, communication technologies (ICT) indicators and an overview of local language computing, its definitions and processes. It also covers a discussion of the components of Standards and Basic Localization, as well as Advanced Applications. Part four will discuss the policy considerations for localization, which include ICT access, linguistic diversity, human-resource capacity, funding availability, and licensing considerations. Further, it discusses the factors involved in crafting a local language computing policy and will provide a snapshot of the status of localization in developing Asia, covering technological capacity, process, and diversity status. Finally, it provides an analysis of current LLC policy and its future impact and recommendations. This work is currently being reviewed for publication.

As discussed earlier, an international conference was organized on Human Language Technology for Development in 2011. The conference attracted research papers in a various relevant areas. These papers were peer reviewed, formatted and published. The proceedings are also available online at [http://www.hltd.org/program.htm](http://www.hltd.org/program.htm).

4.8. Evaluation of PAN Localization Project Impact

The regional evaluation team presented the initial findings of the PAN Localization project’s impact. These results were presented for the four specific evaluation themes:

1. Impact of language in bridging the digital divide
2. Research capacity building through PAN Localization project
3. Impact of local language computing research on country policy
4. Gender mainstreaming in PAN Localization project

Sessions were organized to discuss the project achievements, lessons learned and way forward for future activities. Some of the specific points discussed are mentioned below.

4.8.1. Impact of Language in Bridging the Digital Divide

In PAN Localization project, seven partner countries developed and executed outreach programs to deploy localized ICTs to see the impact of localized ICTs in enabling access and use of ICTs for the digitally divided population. These outreach programs were conducted at grass root level in rural communities by taking diverse user groups including students, teachers, farmers, monks, government officials etc. Country partners adopted various approaches to execute and disseminate the localized ICTs. For instance, few countries adopted “train the trainers” approach for training and disseminating the localized ICTs to rural communities. These projects were monitored and evaluated through the regional teams. It was found that localized ICTs significantly contributed across the countries in enabling local people to use information for their social development.

Training on localized ICT significantly enhanced the capacity of end-users to use ICTs. The findings reveal that after training on localized ICTs, non-users of the computer were not only using the computers for routine tasks but also provided trainings to others. This is worth mentioning that this ability and confidence to train others was developed after a short period of training program on localized ICTs. As in Nepal, the team adopted the “train the trainers” approach for training program. Following this approach, the team conducted a 10 days training
on localized ICTs from 25th November to 4th December 2007 and provided training to only five participants. Each trainee after 48 days of training program prepared his/her own training content and trained five rural dwellers (including farmers, students, teachers, women etc.) in their respected participated village. Then, each participant further provided training to five persons and prepared his/her own training material to impart trainings to them. The monitoring and evaluation officer of the Nepal team reported, “end-users are “highly (ranked 4 on 1-5 scale) convenience in learning a software that has been localized versus the one available in a foreign language and localizing the software has significantly (ranked 5 on 1-5 scale) helped end-users to use software”. Similar training approach was adopted and similar findings were observed in Cambodia. One of the contributing factors which enhanced the skill and confidence of trainees to train others is “local language”.

### 4.8.2. Research Capacity Building

PAN Localization project aimed at building the requisite capacity in Localization of Information and Communication Technology. Under this project various strategies based on the six principles laid down in the Research Capacity Building framework (RCB) were devised to build the capacity of the local professionals of the partner countries in local language computing. The performance indicators to assess the accomplishment in various tasks to be carried out by the country components were determined by the regional secretariat of the PAN Localization project.

![Figure 4.31. Participants during Evaluation Workshop during the Regional Conference](image)

Findings show that seven out of eleven country teams have been able to develop the required localized software as per the contract. Four countries which could not achieve 100 % target are Bhutan, Mongolia, China and Laos. However, the first two countries have been able to develop most of the required localized software and thus accomplish the larger objective of the project plan. Laos and China have not been able to develop localized software as per the contract.
However, an additional training was imparted to the team members from Laos to build their capacity to complete their incomplete tasks.

Partner teams were encouraged to establish collaboration with institutions that had more expertise in a specific field. These collaborations enabled the partners to collectively plan the technical and financial details, exchange data and technology and discuss and formalize shared intellectual property regimes, building institutional capacities in the context. In this regard, Pakistan made maximum number of collaborations. Similarly, for sustainability and continuity of the research capacity, a significant numbers of technical developers, linguists and social scientist have been trained. Cambodia, Pakistan and Nepal had maximum number of trainers. Maximum numbers of the people were trained in computer science discipline.

PAN Localization project significantly contributed in developing the capacity of local language computing in each partner institution. Each country component had started to develop the technology in local languages. This transformation would contribute a lot in effective utilization of technology in national development.

4.8.3. Influencing Local Language Computing Policy

Influencing local language computing policy was one of the core objectives of PANL10n. In this regard, various activities were carried out by each country components to develop or influence local language computing policy. PANL10n contributed towards initiation of local language computing projects across the region. A good example of this direct influence on policy was the project for Language Interface Package (LIP) for Microsoft Windows Vista and Microsoft Office. In this project, Microsoft Corporation supported the country teams in Cambodia, Laos, Pakistan and Sri Lanka to develop local language interface for Microsoft Vista operating system. The project generated interest among public sector agencies to develop more local language computing projects. The project also influenced the governments to develop action plans to give out local language computing projects. There have also been contributions in policy decisions/ decision making process. The project made significant progress towards shifting focus of governments on language issues in ICTs. Two good examples are Pakistan and Nepal.
The project has also been successful in introducing changes in policy development process in terms of inclusion or exclusion of certain organization, criteria, membership and representation. In Pakistan, public participation in policy development process can be considered one of the most significant achievements. Pakistani team was actively involved in developments taking place in IDNs. This work invited public participation. A workshop was organized in 2008, gathering participants representing the various languages spoken in Pakistan. This was an initial attempt to draft character sets for different languages through this workshop. A follow-up workshop on IDNs was arranged on behalf of the Ministry of IT Pakistan in May 2009, to build on the earlier work for Pakistani languages. An open discussion was also arranged where general public was invited through newspaper advertisements. The final workshop on policy for implementing IDN ccTLD in Pakistan went a step further, in not only organizing a public event, on behalf of Ministry of IT, but also developed a detailed online survey form to gather this policy feedback online for those who could not attend in person.

4.8.4. Gender Mainstreaming in PANL10n

To attain gender equality in the PAN Localization project, special attention was paid to the women integration in the project. For this purpose, on the principle of gender mainstreaming, a framework was developed to integrate gender perspective and appraise project on gender basis. On this framework, project teams were appraised on five point Likert Scale.

Findings depict that there has been a higher level of gender mainstreaming in end-user training projects versus lower level of gender mainstreaming in the localized technology development projects. The end-user training teams included country teams in PK, BT, NP-ENRD and BD-D.Net which presented “high” gender mainstreaming across the projects while the remaining
teams where focused more on localized technology development that could only attain “satisfactory” level gender mainstreaming in the activities. The major reason for this result is the attribution of technology as gender neutral by most of the project teams developing localized technology. No stories of change are available to present how the local language application development has been an enriching experience for women involved in the project. More research thus needs to be concentrated in defining the literature on how gender dimensions could be explicitly considered in the software requirement gathering, design and quality assurance.

Figure 4.33. Training and Conference Participants

5. Conclusion
PAN Localization project had aimed to address the language barrier in the use of information and communication technology for the benefit of millions of people across developing Asia. The project was consisted on the two phases phase I and phase II. After the successful completion of phase I, phase II of the project was planned to achieve the following tasks:

- Institute the research and development capacity for future needs
- Research the dissemination of the technology for use by the relevant communities
- Explore online content development strategies for the technology intervention to be worthwhile
- Influence policy makers to appreciate the need to continue the work in the future Evaluation
- PANL10n Network
- Integrate the technology to provide tangible benefits to the end users
- Build information and communication channels in specific domains to derive concrete benefits for these communities
- Integration of localized technology into e-government services, education, health, food and nutrition, and other sectors
- Provide new opportunities currently not accessible to the end users due to technology barriers
At the end of PAN Localization Project the project members have decided to incorporate it as a collaborative entity with the name of PANL10N Network. The collaborative activities of PANL10N will include: undertaking joint research and development projects; conducting training through workshops, seminars, and summer schools; synthesizing and publishing research on relevant technology, policy and practice; contributing to and developing relevant standards and linguistic resources; developing specific software, technical, linguistic and policy services, and any other relevant activities for furthering the cause of the network.

The journey of PAN Localization project has now ended but all PAN Localization country components will continue their work in localization for the developing Asia and will continue to collaborate to achieve these goals.

The work achieved so far and the work which will continue in the future will remain available at www.PANL10n.net.
## Appendix A: Schedule of Conference on Policy and Sustainability of Local Language Computing in Developing Asia

### Day1: Monday January 30, 2012

<table>
<thead>
<tr>
<th>Time</th>
<th>Talk/Event</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-11:00</td>
<td>PAN L10n Network Structure Formalization</td>
<td>PAN L10n Network Partners</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>11:30-1:00</td>
<td>PAN L10n Network Current Resources</td>
<td>PAN L10n Network Partners</td>
</tr>
<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>2:00-3:30</td>
<td>PAN L10n Network IPR</td>
<td>PAN L10n Network Partners</td>
</tr>
<tr>
<td>3:30</td>
<td>Tea and Coffee Break and Close of Day</td>
<td></td>
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</tbody>
</table>

### Keynote Ceremony & Dinner

<table>
<thead>
<tr>
<th>Time</th>
<th>Talk/Event</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00-6:05</td>
<td>Welcome and Introduction</td>
<td>Dr. Sarmad Hussain, Professor and Head, CLE, KICS-UET</td>
</tr>
<tr>
<td>6:05-6:15</td>
<td>Welcome Address by the Director, KICS</td>
<td>Dr. Waqar Mahmood, Director, KICS-UET</td>
</tr>
<tr>
<td>6:15-6:25</td>
<td>Promotion of Local Language Computing by IDRC</td>
<td>Ms. Maria Ng Lee Hoon, Senior Program Specialist, IDRC</td>
</tr>
<tr>
<td>6:25-7:00</td>
<td>Mobile Communication for Development in Emerging Economies</td>
<td>Dr. Jakob Svensson, Director, HumanIT, Karlstad University</td>
</tr>
<tr>
<td>7:00-7:10</td>
<td>PAN L10n Network: Past, Present and Future</td>
<td>Dr. Ruvan Weerasinghe, Professor, University of Colombo School of Computing</td>
</tr>
<tr>
<td>7:10-7:30</td>
<td>Signing Ceremony of MOU for PAN L10n Network</td>
<td>PAN L10n Network Partners</td>
</tr>
<tr>
<td>Time</td>
<td>Talk/Event</td>
<td>Speaker</td>
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<tr>
<td>7:30-7:40</td>
<td>Address by the Vice Chancellor, UET, Lahore</td>
<td>Lt. Gen (R) Muhammad Akram Khan, VC, UET, Lahore</td>
</tr>
<tr>
<td>7:40-8:00</td>
<td>Address by the Chief Guest: Vision of ICT R&amp;D Fund for Local Language Computing Development in Pakistan</td>
<td>Dr. Syed Aun Abbas, CEO, ICTR&amp;D Fund</td>
</tr>
<tr>
<td>8:00-9:00</td>
<td>Dinner</td>
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**Day2: Tuesday January 31, 2012**

<table>
<thead>
<tr>
<th>Time</th>
<th>Talk/Event</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-11:00</td>
<td>PAN L10n Network Next Project(s)</td>
<td>PAN L10n Network Member</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
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</tr>
<tr>
<td>11:30-1:00</td>
<td>Workshop on Communication for Policy</td>
<td>Dr. Angelo Juan Ramos</td>
</tr>
<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>2:00-3:30</td>
<td>Workshop on Communication for Policy</td>
<td>Dr. Angelo Juan Ramos</td>
</tr>
<tr>
<td>3:30-3:50</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>3:50-5:30</td>
<td>Workshop on Communication for Policy</td>
<td>Dr. Angelo Juan Ramos</td>
</tr>
<tr>
<td>5:30</td>
<td>Close of Day</td>
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**Day3: Wednesday February 1, 2012**

<table>
<thead>
<tr>
<th>Time</th>
<th>Talk/Event</th>
<th>Speaker</th>
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</thead>
<tbody>
<tr>
<td>9:00-11:00</td>
<td>Policy Influence by PAN Localization</td>
<td>Ms. Sana Shams</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>11:30-1:00</td>
<td>Panel on Localization Policy: The Way Forward</td>
<td>Dr. Ruvan Weerasinghe, Mr. Batpurev Batchuluun, Ms. Dechen Chhoeden</td>
</tr>
<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
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<tr>
<td>Time</td>
<td>Talk/Event</td>
<td>Speaker</td>
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<tr>
<td>2:00-3:30</td>
<td>Communication for Policy Country Plans</td>
<td>Dr. Angelo Juan Ramos</td>
</tr>
<tr>
<td>3:30-3:50</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>3:50-5:30</td>
<td>PAN Localization Stories of Change</td>
<td>Regional Evaluation Team</td>
</tr>
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<td>5:30</td>
<td>Close of Day</td>
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**Day4: Thursday February 2, 2012**

<table>
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<tr>
<th>Time</th>
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<th>Speaker</th>
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<tbody>
<tr>
<td>9:00-11:00</td>
<td>PAN Localization Stories of Change</td>
<td>Country Project Leaders</td>
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<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
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<tr>
<td>11:30-1:00</td>
<td>Capacity Building in Localization</td>
<td>Ms. Sana Shams</td>
</tr>
<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>2:00-3:30</td>
<td>Panel on Capacity Building: The Way Forward</td>
<td>Mr. Valaxay Dalaloy, Mr. Rajendra Prasad Poudel, Mr. Noy Shoung</td>
</tr>
<tr>
<td>3:30-3:50</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>3:50-5:30</td>
<td>Gender Mainstreaming through PAN Localization</td>
<td>Ms. Sana Shams</td>
</tr>
<tr>
<td>5:30</td>
<td>Close of Day</td>
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**Day5: Friday February 3, 2012**

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<th>Time</th>
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<th>Speaker</th>
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<tbody>
<tr>
<td>9:00-11:00</td>
<td>Celebrating PAN L10n Impact: Capacity Building, Technology Development, Dissemination and User Adoption for Local Language Computing Across Developing Asia</td>
<td>Bangladesh, Bhutan, Cambodia, Indonesia</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>11:30-1:00</td>
<td>Celebrating PAN L10n Impact: Capacity Building, Technology Development, Dissemination and User Adoption for Local</td>
<td>Laos, Mongolia, Nepal, Pakistan</td>
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<tr>
<td>Time</td>
<td>Event</td>
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<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>2:00-3:30</td>
<td>Celebrating PAN L10n Impact: Capacity Building, Technology Development, Dissemination and User Adoption for Local Language Computing Across Developing Asia</td>
<td></td>
</tr>
<tr>
<td>3:30-4:00</td>
<td>Closing Ceremony</td>
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<tr>
<td>4:00-4:30</td>
<td>Tea and Coffee Break and Close of Day</td>
<td></td>
</tr>
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</table>
# Appendix B: List of Conference Participants

<table>
<thead>
<tr>
<th>S/N</th>
<th>Names</th>
<th>Country</th>
<th>Organization</th>
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<tbody>
<tr>
<td>1</td>
<td>Chea Sok Huor</td>
<td>Cambodia</td>
<td>Ministry of Education, Youth and Sports (MoEYS)</td>
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<tr>
<td>2</td>
<td>Noy Shoung</td>
<td>Cambodia</td>
<td>National Information Communications Technology Development Authority (NIDA)</td>
</tr>
<tr>
<td>3</td>
<td>Sochenda Khem</td>
<td>Cambodia</td>
<td>Ministry of Education, Youth and Sports (MoEYS)</td>
</tr>
<tr>
<td>4</td>
<td>Phuttapong Sertsri</td>
<td>Thailand</td>
<td>National Electronics and Computer Technology Center (NECTEC)</td>
</tr>
<tr>
<td>5</td>
<td>Bal Krishna Bal</td>
<td>Nepal</td>
<td>Language Technology Kendra (LTK)</td>
</tr>
<tr>
<td>6</td>
<td>Amar Gurung</td>
<td>Nepal</td>
<td>Madan Puraskar, Pushtakalaya</td>
</tr>
<tr>
<td>7</td>
<td>Vijay Kumar Shrestha</td>
<td>Nepal</td>
<td>Language Technology Kendra (LTK)</td>
</tr>
<tr>
<td>8</td>
<td>Rajendra Prasad Poudel</td>
<td>Nepal</td>
<td>E-Network Research and Development (ENRD)</td>
</tr>
<tr>
<td>9</td>
<td>Oskar Riandi</td>
<td>Indonesia</td>
<td>Agency for the Assessment and Application of Technology (BPPT)</td>
</tr>
<tr>
<td>10</td>
<td>Mohammad Teduh Uliniansyah</td>
<td>Indonesia</td>
<td>Agency for the Assessment and Application of Technology (BPPT)</td>
</tr>
<tr>
<td>11</td>
<td>Samuel Louvan</td>
<td>Indonesia</td>
<td>University of Indonesia</td>
</tr>
<tr>
<td>12</td>
<td>Indra Budi</td>
<td>Indonesia</td>
<td>University of Indonesia</td>
</tr>
<tr>
<td>13</td>
<td>Batpurev Batchuluun</td>
<td>Mongolia</td>
<td>InfoCon Co. Ltd</td>
</tr>
<tr>
<td>14</td>
<td>Altangerel Ayush</td>
<td>Mongolia</td>
<td>Mongolian University of Science and Technology (MUST)</td>
</tr>
<tr>
<td>15</td>
<td>Munkhnasan Choinzon</td>
<td>Mongolia</td>
<td>School of Information and Communication Technologies</td>
</tr>
<tr>
<td></td>
<td>Name</td>
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<td>Institution</td>
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</tr>
<tr>
<td>16</td>
<td>Dr. Ruvan Weerasinghe</td>
<td>Sri Lanka</td>
<td>University of Colombo School of Computing</td>
</tr>
<tr>
<td>17</td>
<td>Welgamage Viraj Welgama</td>
<td>Sri Lanka</td>
<td>University of Colombo School of Computing</td>
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<td>18</td>
<td>Randil Pushpananda</td>
<td>Sri Lanka</td>
<td>University of Colombo School of Computing</td>
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<td>19</td>
<td>Dr. Chai Wutiwiwatchai</td>
<td>Thailand</td>
<td>National Electronics and Computer Technology Center (NECTEC)</td>
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<tr>
<td>20</td>
<td>Angelo Juan Ramos</td>
<td>Philippines</td>
<td>Molave Development Foundation, Inc.</td>
</tr>
<tr>
<td>21</td>
<td>Jakob Svensson</td>
<td>Sweden</td>
<td>Karlstad University, Sweden</td>
</tr>
<tr>
<td>22</td>
<td>Ms. Maria Lesley Ng Lee</td>
<td>Singapore</td>
<td>Information and Networks, Science and Innovation Program Area International Development Research Centre</td>
</tr>
</tbody>
</table>
Appendix C: Schedule of the Regional Training on Localization of Mobile Platforms

Day 1: Monday January 30, 2012

<table>
<thead>
<tr>
<th>Time</th>
<th>Talk/Event</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-11:00</td>
<td>Fundamental Concepts in Mobile Application Development</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>11:30-1:00</td>
<td>Overview of Mobile Platforms from Localization Perspective</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>2:00-3:30</td>
<td>Homework Explanation: Fill up Keyboard Map Table, Identify letters and their Unicodes</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>3:30</td>
<td>Tea and Coffee Break and Close of Day</td>
<td></td>
</tr>
</tbody>
</table>

**Keynote Ceremony & Dinner**

<table>
<thead>
<tr>
<th>Time</th>
<th>Talk/Event</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00-6:05</td>
<td>Welcome and Introduction</td>
<td>Dr. Sarmad Hussain, Professor and Head, CLE, KICS-UET</td>
</tr>
<tr>
<td>6:05-6:15</td>
<td>Welcome Address by the Director, KICS</td>
<td>Dr. Waqar Mahmood, Director, KICS-UET</td>
</tr>
<tr>
<td>6:15-6:25</td>
<td>Promotion of Local Language Computing by IDRC</td>
<td>Ms. Maria Ng Lee Hoon, Senior Program Specialist, IDRC</td>
</tr>
<tr>
<td>6:25-7:00</td>
<td>Mobile Communication for Development in Emerging Economies</td>
<td>Dr. Jakob Svensson, Director, HumanIT, Karlstad University</td>
</tr>
<tr>
<td>7:00-7:10</td>
<td>PAN L10n Network: Past, Present and Future</td>
<td>Dr. Ruvan Weerasinghe, Professor, University of Colombo School of Computing</td>
</tr>
<tr>
<td>7:10-7:30</td>
<td>Signing Ceremony of MOU for PAN L10n Network</td>
<td>PAN L10n Network Partners</td>
</tr>
<tr>
<td>Time</td>
<td>Talk/Event</td>
<td>Facilitator</td>
</tr>
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</tr>
<tr>
<td>7:30-7:40</td>
<td>Address by the Vice Chancellor, UET, Lahore</td>
<td>Lt. Gen (R) Muhammad Akram Khan, VC, UET, Lahore</td>
</tr>
<tr>
<td>7:40-8:00</td>
<td>Address by the Chief Guest: Vision of ICT R&amp;D Fund for Local Language Computing Development in Pakistan</td>
<td>Dr. Syed Aun Abbas, CEO, ICTR&amp;D Fund</td>
</tr>
<tr>
<td>8:00-9:00</td>
<td>Dinner</td>
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</table>

**Day2: Tuesday January 31, 2012**

<table>
<thead>
<tr>
<th>Time</th>
<th>Talk/Event</th>
<th>Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-11:00</td>
<td>Symbian Platform Overview</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>11:30-1:00</td>
<td>Setting up Development Environment for Symbian Platform</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>2:00-3:30</td>
<td>Create Hello World Application</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>3:30-3:50</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>3:50-5:30</td>
<td>Practice Session: Import Existing Project, Identify Places for Modification to Enable Localization Homework Explanation: Design Complete Keyboard Keys in Resource File</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>5:30</td>
<td>Close of Day</td>
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</tbody>
</table>

**Day3: Wednesday February 1, 2012**

<table>
<thead>
<tr>
<th>Time</th>
<th>Talk/Event</th>
<th>Facilitator</th>
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</thead>
<tbody>
<tr>
<td>9:00-11:00</td>
<td>Localized Application—Application Scope, Definition &amp; Installation of Keymap, and Installation of Custom Fonts</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>11:30-1:00</td>
<td>Localized Application—Application Scope,</td>
<td>Mr. Waqar Ahmad,</td>
</tr>
<tr>
<td>Time</td>
<td>Talk/Event</td>
<td>Facilitator</td>
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</tr>
<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>2:00-3:30</td>
<td>Practice Session: Draw Keyboard Layout</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>3:30-3:50</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>3:50-5:30</td>
<td>Practice Session: Draw Keyboard Keys Using Pango Library</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td></td>
<td>Homework Explanation: Complete Keyboard Map</td>
<td></td>
</tr>
<tr>
<td>5:30</td>
<td>Close of Day</td>
<td></td>
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**Day4: Thursday February 2, 2012**

<table>
<thead>
<tr>
<th>Time</th>
<th>Talk/Event</th>
<th>Facilitator</th>
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</thead>
<tbody>
<tr>
<td>9:00-11:00</td>
<td>Localized Application—Localized Application Architecture Definition and Development</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>11:30-1:00</td>
<td>Pango Installation</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>2:00-3:30</td>
<td>Practice Session: Use Keyboard Map to Draw Character in Rich Text Editor</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>3:30-3:50</td>
<td>Tea and Coffee Break</td>
<td></td>
</tr>
<tr>
<td>3:50-5:30</td>
<td>Pango Modifications</td>
<td>Mr. Waqar Ahmad, Ms. Farah Adeeba</td>
</tr>
<tr>
<td>5:30</td>
<td>Close of Day</td>
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**Day5: Friday February 3, 2012**

<table>
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<tr>
<th>Time</th>
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<th>Speaker</th>
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<tr>
<td>9:00-11:00</td>
<td>Celebrating PAN L10n Impact: Capacity Building, Technology Development, Dissemination and User Adoption for Local Language Computing Across Developing Asia</td>
<td>Bangladesh, Bhutan, Cambodia, Indonesia</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
<td>Location</td>
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</tr>
<tr>
<td>11:00-11:30</td>
<td>Tea and Coffee Break</td>
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</tr>
<tr>
<td>11:30:1:00</td>
<td>Celebrating PAN L10n Impact: Capacity Building, Technology Development, Dissemination and User Adoption for Local Language Computing Across Developing Asia</td>
<td>Laos, Mongolia, Nepal, Pakistan</td>
</tr>
<tr>
<td>1:00-2:00</td>
<td>Lunch Break</td>
<td></td>
</tr>
<tr>
<td>2:00-3:30</td>
<td>Celebrating PAN L10n Impact: Capacity Building, Technology Development, Dissemination and User Adoption for Local Language Computing Across Developing Asia</td>
<td>Sri Lanka and Regional Research Components (RRCs)</td>
</tr>
<tr>
<td>3:30-4:00</td>
<td>Closing Ceremony</td>
<td></td>
</tr>
<tr>
<td>4:00-4:30</td>
<td>Tea and Coffee Break and Close of Day</td>
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</tbody>
</table>
Appendix D: Schedule of the National Conference on Use of ICT in Rural Nepal

Day 1, March 22, 2012

9:30 A.M – 10:00 A.M Registration & Tea

Opening – Inaugural session

10:00 A.M – 10:10 A.M Welcome note by Mr. Kanak Dixit, Director, Language Technology Kendra –

Talks (4 presentations) – Moderator: Mr. Kedar Sharma

10:10 A.M - 10:40 A.M Talk 1: Mr. Mahabir Pun, E-Networking Research and Development (ENRD: Connecting the villages of rural Nepal to the Internet through Nepal wireless Project - Experience, Challenges faced and Road ahead.

10:40 A.M: 11:10 A.M Talk 2: Mr. Rabi Karmacharya, Open Learning Exchange (OLE) Use of E-Pustakalaya – A Digital Library, Integrating Digital Materials to Enhance Classroom Teaching and Learning

11:10 A.M - 11:30 A.M Tea break

11:30 A.M - 12:00 P.M Talk 3: Prof. Pat Hall, Language Technology Kendra Languages and writing and computers in the development of Nepal

12:00 P.M - 12:30 P.M Talk 4: Mr. Bal Krishna Bal, Kathmandu University On Localization, Natural Language Processing Tools and Use models of Technology for increasing the use of ICT in rural Nepal

12:30 P.M - 13:30 P.M Lunch

Results Dissemination Workshop : Moderator: Mr. Kedar Sharma


Ethnographic framework - observation parameters, social scientists' perspectives on the Project

13:50 P.M - 14:20 P.M Mr. Deepak Aryal and Shamik Mishra : Technology Deployment and Use in the site - Manager's perspectives
14:20 P.M - 14:35 P.M  Mr. Prakash Gurung, Head, Himalayan Milan Secondary School, Tangting,

Technology Deployment and Use in the site- Trainer's perspectives

14:35 P.M - 14:50 P.M  Mr. Sangam Bhusal, Teacher, Himalayan Milan Secondary School, Tangting,

Technology Deployment and Use in the site - User's perspective

14:50 P.M - 15:00 P.M  Students, Himalayan Milan Secondary School, Tangting

15:00 P.M - 15:10 P.M  Question Answering Session

15:10 P.M - 15:30 P.M  Tea -

Stories of Change (about 4 presentations) - Moderator: Mr. Rajendra Poudel

15:30 P.M - 16:30 P.M  Technology Influences and the Stories of Change - Experiences sharing session, Meet the local heroes

Changes brought about by use of digital library in classroom teaching learning

15:30 P.M - 15:40 P.M  Mr. Gokul Prasad Aryal, Head, Laxmi Ni Ma Vi, Hetauda, Makawanpur,

Sharing the stories of change

15:40 P.M - 15:50 P.M  Mr. Kajiman Shrestha, Head, Keshavtar Higher Secondary School, Tanahun,

Reaping the benefits from ICT-integrated classes in shared-model environment

15:50 P.M - 16:00 P.M  Mr. Laxmi Kanta Mishra, Head, Siddha Beni Ni Ma Vi, Belbas, Tanahun,

Sharing the story of change - the story of a mathematics teacher turned computer operator

Mr. Narayan Adhikari, Himalaya Secondary School, Tolka, Kaski.

16:00 P.M - 16:20 P.M  Question Answering Session

Day 2, March 23, 2012
9:30 A.M - 10 A.M Tea

**Stories of Change (about 4 presentations) - Moderator: Mr. Shamik Mishra**

(10:00 A.M - 11:00 A.M) Technology Influences and the Stories of Change - Experiences sharing session: Meet the local heroes

**Effects of using local digital content in classroom teaching learning**

10:00 A.M - 10:10 A.M Ms. Sangyani Thapa, Program Focal Teacher, Navin Pra Vi, Khanalthok, Bhakunde, Kavre
Sharing the story of change

10:10 A.M - 10:20 A.M Shivaram Bhatta, Rasuwa, Dandagaun

**Promoting women literacy with the help of ICT**

10:20 A.M-10:30 A.M Ms. Poonam Rana, Program Focal Teacher, Pancha Ni Ma Vi, Baijalpur, Kapilvastu
Sharing the story of change

10:30 A.M - 10:40 A.M Mr. Tek Bahadur Pun, Salija-2, Okhreni, Parbat,

10:40 A.M - 11:00 A.M Question Answering Session

11:00 A.M - 11:20 A.M Tea

11:20 A.M -12:20 P.M : **PARALLEL SESSIONS**

**Parallel session 1: How to make the unsustainable sustainable? Sustainability issues on ICT Deployment and Use , Moderator: Mr. Kedar Sharma**

Panelists: Mr. Tikajit Rai – Magnus Consulting Pvt. Ltd., Mr. Binod Dhakal – Computer Association of Nepal (CAN), Mr. Ananda Raj Khanal, Nepal Telecommunication Authority (NTA), Mr. Krishna Prasad Bhandari – Nepal Telecom.

**Parallel session 2: Dreaming the ICT enabled rural Nepal: Defining each of our roles, Moderator: Mr. Rajendra Poudel**

Panelists: Dr. Bharat Pahari, Dean, Institute of Engineering, Pulchowk, Mr. Deepak Shrestha – Subisu, Mr. Pavan Shakya – Worldlink, Mr. Manohar K. Bhattarai – former vice chairman former HLCIT, Nepal

Parallel sessions: