Integrated Web Portal
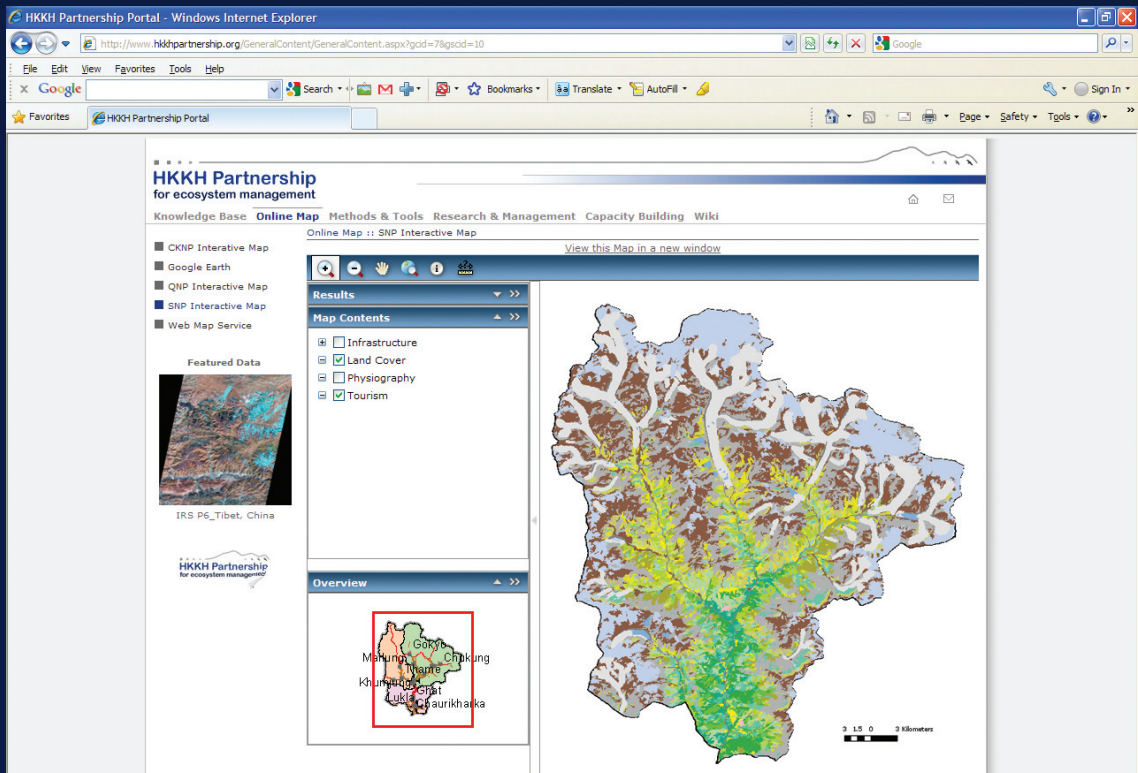
Serving the HKKH Partnership for Ecosystem Management

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cesvi   EvK2CNR   ICIMOD   IUCN   Supported by   Ministero degli Affari Esteri

About ICIMOD

The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush-Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalisation and climate change have an increasing infl uence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.

Integrated Web Portal

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Acronyms

CKNP	Central Karakoram National Park
CMS	Content Management System
DBA	Database Administrator
DNPWC	Department of National Parks and Wildlife Conservation
DSS	Decision Support System
GIS	Geographic Information System
GOP	General Operational Plan
HKKH	Hindu Kush-Karakoram-Himalaya
HTML	HyperText Markup Language
ICIMOD	International Centre for Integrated Mountain Development
ICT	Information and Communication Technology
ISO	International Standard Organization
IWP	Integrated Web Portal
KB	Knowledgebase
KM	Knowledge Management
OGC	Open Geospatial Consortium
QNNP	Qomolongma National Nature Preserve
RDBMS	Relational Database Management System
RSS	Really Simple Syndication
SNPBZ	Sagarmatha National Park and Buffer Zone
SQL	Structured Query Language
UML	Unified Modeling Language
WMS	Web Map Service
XML	Extensible Markup Language

Acknowledgement

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Introduction

1.1 Background

The HKKH Partnership Project aims at consolidating institutional capacity for systemic planning and management of protected area ecosystem over three national parks in the Hindu Kush-Karakoram-Himalayan (HKKH) region. These three national parks are Sagarmatha National Park and Buffer Zone (SNPBZ) in Nepal, Central Karakoram National Park (CKNP) in Pakistan and Qomolongma National Nature Preserve (QNNP) in China. The project is being implemented at multiple scales involving stakeholders from local, national and regional partners in the region, and domain experts from the region and beyond. The project implementation involves various applied research and development works that require integration of diverse data and information, interpretation of various forms of information and knowledge, such as system dynamic models, simulation results, historical databases and technical reports.

The HKKH Partnership Project initiated the concept of Integrated Web Portal (IWP) to promote interdisciplinary collaboration, communication and dissemination of information among concerned stakeholders and general users. This portal adopts the state-of-the-art web-based tools and technologies for improving access, interactive use and exchange of data, information and knowledge. IWP has been built with the capability to integrate a wide variety of data and information resources such as project documents, bibliographic information, geographic information, model data, interactive maps, satellite images and research data. More importantly, all of these data and information are associated with their respective metadata. Access to these information resources by multiple users such as general users, technicians, researchers, scientists

and decision makers enhances collaborative learning and sharing culture among the stakeholders of all three protected areas. IWP is one such platform that caters to these needs and requirements. IWP can be accessed at http://www.hkkhpartnership. org. The objectives behind the development of IWP, its architecture, development, administration and implementation process are discussed in the following chapters of this document.

1.2 Objective of IWP

The IWP for HKKH Partnership Project has varieties of information (data, metadata, text, graphics, maps, images, hyperlinks, and geospatial data) and needs to employ many different technological choices to meet the project objectives. Integration of such heterogeneous technologies is complex in nature. Therefore, in accordance to the General Operational Plan (GOP) of the HKKH Partnership Project, there are some specific requirements that this portal must meet.

In view of this, the main objective of having an IWP is to inform both the general public and the participants of the project activities, which would then evolve as a knowledge management platform to facilitate the exchange of knowledge and achievements in the framework of the project. Having a knowledge management platform such as IWP would also mean that there will be an entry point for accessing and managing the tools, data, information and knowledge developed where thematic contents would be provided by the partners in their specific area of expertise. All documentation (textual documents, hyperlinks, photos and images) useful in supporting the management process of the three national parks of the project will be compiled in a user-friendly Knowledgebase and classified according to the standard metadata.

1.3 Guidelines compliance

Today, the main challenge for information and communication technology (ICT) is delivering the right information to the right person at the right time. The amount of electronically available information doubles or triples so quickly and some even becomes obsolete that it makes the organisation and management of data, information and knowledge more complex making it ever more difficult to manage. To solve these challenges and meet with the objectives of IWP, developers have to cope with several problems starting from the conceptual phase to the development phase and then the implementation phase. In order to clarify more effectively the requirements for developers of IWP, some general guidelines were provided to them. The major points considered in the development of IWP are mentioned below from the perspectives of content, users and management:

Content perspective

The content of the web portal will be entirely database driven, incorporating both spatial as well as non-spatial data. The project emphasises developing a Knowledgebase system in the web portal by adopting a standardised metadata management practices like geographic metadata and bibliography metadata for easy access and sharing. The web portal will incorporate online mapping tools in order to visualise and understand information, problems and solutions for the protected areas of the three national parks within the framework of the project.

Users perspective

In order to motivate users to use web portal functions, only a single login should be required to access or browse all web portal components, if possible. The administrator will define the rights to access these components in the portal to different types of user groups. Identified user groups can be the public, clients, stakeholders and selected stakeholders. There will be no restrictions whatsoever to project staff members in viewing the information in any component of this web portal.

Management perspective

The content management will be structured in such a manner that even a non-specialist can update (add, edit or delete) the page contents and menu items, keeping in view the security management of the site. The web portal will include a workflow management system for the web content development process. Basic navigation structure will have several levels of hierarchy.

2

Requirement Analysis

In order to develop a web portal (i.e., IWP for the HKKH Partnership Project mentioned in Chapter 1) that meets the needs of the users, certain guidelines were developed through assessments by developers in conjunction with project partners and other stakeholders.

2.1 User analysis

During the analysis phase of IWP, use-case analysis was performed to find out how a specific user category interacts with certain types of system components to accomplish a specific action. The action may be as simple as acquiring a defined content, or as complex as developing contents in an online database. From the use-case analysis, the group of end-users who will interact with the web application were identified:

Partners:
Partners are staff members from various partner institutions or organisations implementing the project. They will have the privilege to view entire contents of the IWP system.

Stakeholders:
Stakeholders are those involved at national and local levels who initiate the project activities on the field or who are associated with the project at various capacities. They can view selected contents of the IWP system depending upon the privileges assigned by the 'Content Administrator'.

Guests:

Guests are those users who are registered to the IWP system as non-project members such as researchers, students, academicians from various institutions and universities. By registering as a guest, s/he will have the privilege to view more contents than the ordinary public users. They are also able to post messages in the Discussion Forum. Having such user group allows the administrator to track the number of IWP users and moderate the forum at the same time.

Public Users:

Public users are a group of users who visit the site but do not register. Such users are often able to have access to general information, free contents or functionalities in the portal.

Administrator:

Administrators are a set of dedicated users for managing the web portal. There can be different types of administrators in the IWP system like system administrator or content manager/editor. The system administrator is associated with the entire technical backend of the system. The content manager/editor should have the access to author, and have the authority to approve or publish the content in the portal. There may be different categories of administrators and developers given their rights and roles.

2.2 Content and its management analysis

Information is an asset to an organisation. The management of such information means the management of a document during the various phases of its life cycle. The ability to know what documents exist regarding a particular subject, where they are located, what media they are stored in, who owns them, and when they should be destroyed are very important aspects of information management. Therefore information management encompasses document management, records management and knowledge management systems.

Meeting these objectives for information management is essential for IWP. There are vast amount of data in varieties of forms which need to be managed in a way that should allow users to access or download them wherever and whenever required. Content exists either in the form of text (simple text or formatted text), images (.jpeg, .gif, .png), documents (.doc, .pdf, .xls, .ppt, .zip), and spatial and non-spatial metadata. These contents should also be organised logically so that accessibility and management of these information resources becomes quicker and easier.

For this, we have to organise our content based on standard content life cycle management system. The most well-known content management literatures describe various numbers of stages, or phases, of the content management process and lifecycle. Bob Boiko's *Content Management Bible* (Boiko, 2005) and Gerry McGovern's

Content Critical (McGovern and Norton, 2002) mention three stages. Collect (creating and editing are much more than simply collecting), Manage (workflows, approvals, versioning, repository), and then Publish. Joann Hackos' *Content Management for Dynamic Web Delivery* (Hackos, 2002) argues for four: Authoring, Repository, Assembly/Linking, and Publishing. Ann Rockley's *Managing Enterprise Content* (Rockley et al., 2003) suggests five stages: Authoring, Repository, Assembly, Delivery and Archives. In IWP system, the following stages in Content Management Life Cycle have been considered:

Organisation of content

Without careful structuring, information will be collected haphazardly and put in the wrong places, perhaps never to be found by users who may need to re-create it at a greater expense. More importantly, this is the stage where content strategy needs to be matched with the project strategy by designing it with users in mind, to ensure that they can and will actually use it. Based on types and nature of information, variety of categories and its sub-categories needs to be defined and designed for the organisation of content.

Some of the types of categories to be considered would be news, events, announcement, publication, photo-gallery, quick-links, and thematic contents. This is how categories are created by having controlled vocabularies, designing taxonomic hierarchies and developing faceted classification schemes or databases.

Creation of content

Information is generated at different phases of the project in different forms. Classifying the information into appropriate form and feeding them into the system is the next step in content life cycle. This is the stage that classifies everything into the architectural categories designed in stage one.

Workflow and quality control

Many people may be involved in the content development process. Some will be highly skilled editors and graphic designers while others may be thematic experts or those with tacit knowledge.

For IWP system, the content management process needs to be a role-based system where authorisation can be implemented to allow and restrict content developers while they author, approve or publish contents. The basic level users can simply author the contents. Then, some other advanced level content developer can edit the authored contents as well as approve or send for approval. Such advanced level content developer should be someone like the coordinator of the project from a partner institution. The approved content should finally go to the publisher who will check the content for consistency and its visual identity in the web-portal. After s/he

publishes the content, the finished contents should then be delivered to users directly or based on a schedule. The publish date on content determines when the content should be released publicly.

Storage of content

Content can reside entirely in relational database structures, in file system objects, or a hybrid of both. It can also be stored as unstructured text and binary graphic images, or as EXtensive Markup Language (XML) elements tagged with metadata. Documents and records can be stored in their original physical form as well.

The approach for developing IWP will be hybrid systems where content or metadata is stored in the form of relational database while documents, files and images are stored in file system objects or a flat file structure. Special links among documents and metadata are to be explicitly stored in a relational database so that the users can access the related documents through the respective metadata.

A database-driven system in IWP would mean that the system is capable of taking all the advantages of Relational Database Management System (RDBMS) over flat file structure allowing the content developer a flexibility of not having to upload/download the content as HyperText Markup Language (HTML) file for any small changes.

Archives

After publishing the content, it is necessary to maintain the quality by updating and keeping only relevant contents in the web portal. This is where the publish date and expiry date features become important. Therefore, every content should be given a life cycle by giving the publish date and an expiry date. Even then, not all contents are ephemeral and those contents should not be given any expiry date.

In IWP system, contents must be protected to comply with internal or external requirements of the project, and some eliminated for other reasons. Some may be so valuable that it becomes a part of "the partnership project memory" as they capture the knowledge of the project, allowing it to be shared for future use and thus becoming permanent Knowledgebase. For this reason, all published content should be archived in the database. Even those published content whose dates have expired should be archived but they may not be visible to the front end users.

2.3 System component analysis

The guidelines given for developing the IWP system and assessing the requirements from the user analysis and content analysis make it easier to carry out the component analysis. In order to have different types of user categories and bridge them with content management life cycle process, a concrete Content Management System (CMS) should be developed which will act like a backbone to the IWP system. This should contain three major sub-components for managing various aspects of the web portal like managing the menu items, the user categories and the entire site management. The aspects of workflow process should be imbibed in the site management. Any kind of authoring, approving and publishing of content should be done under the site management only.

Other than the conventional CMS, there may be other unique components that are made under different platforms and languages not compatible with the CMS. These additional and unique components may be anything from interactive mapping applications to discussion forums. The group of such components can be termed as peripheral components.

Architecture, Components and Design

In Chapter 2, the requirement analysis for the IWP system was described. In this process, separate user analysis, content and its management analysis, and system component analysis were carried out. Based on these analyses, the architecture of overall IWP system was developed. The system architecture as shown in figure 3.1 illustrates the major components of IWP.

As per the guidelines compliance described in Chapter 1, and assessing the requirement analysis as mentioned in Chapter 2, several components such as Defined Content, Interactive Web Mapping, Knowledgebase, Collaborative Workspace and Site Administration and Management have been integrated incorporating all required content as deemed necessary by the project to the IWP system. Each of these components is explained in detail under Components of IWP subheading in this chapter.

Accordingly, IWP users have also been categorised into two different types: content users and content developers. As illustrated in figure 3.1, the content users are those users who use these contents for various purposes. They can be anyone from project partners, members of the project, stakeholders, researchers, academicians or students. The access control feature in IWP through CMS defines the rights of these users to access different kinds of information. For example, the registered user can access more level of information than the ordinary public user. The content developers are those assigned with certain roles and privileges to author, approve or publish the content. These users are responsible for generating the content and putting it into the IWP system. The system administrator, the content manager/editor, domain expert/ contributor, or the author, approver and publisher fall under this category.
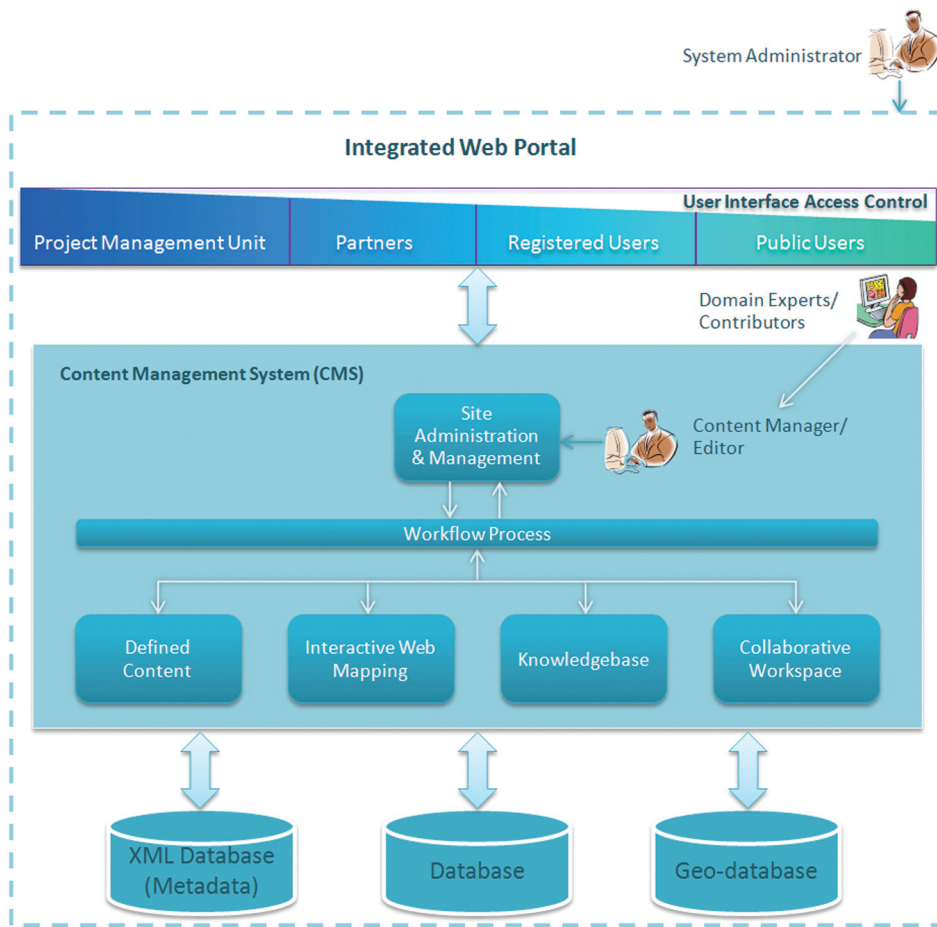
Figure 3.1: The Integrated Web Portal (IWP) system architecture

The IWP system has been made as entirely a database driven system by integrating a CMS. The main objective for developing a CMS is that even non-technical personnel can handle, author, approve and publish the contents of the web portal. The aspect of workflow process has also been considered while designing this CMS. Therefore, all contents of CMS must pass through a content lifecycle of (a) Authoring, (b) Approving, (c) Publishing and (d) Archiving. An ideal CMS will have contents that are appropriately classified and presented to the end users. In IWP, CMS has been developed to bridge different types of user categories with content management life cycle process. This CMS will act like a backbone to the IWP system.

3.1 Components of IWP

In accordance with the architecture of IWP as shown in figure 3.1, there are five major components in this IWP system. The different components of IWP and its sub-systems are mentioned below:

1. Defined Content
2. Interactive Web Mapping
3. Knowledgebase
4. Collaborative Workspace
    a. Discussion Forum
    b. Wiki
5. Site Administration and Management
    - Site Management
    - Menu Management
    - User Management

Defined content

The IWP system has been designed with the capability to create content category based on specific requirements. The content categories such as 'method and tools', 'research and management' and 'capacity building' are user created categories in the IWP for the need of the project.

For instance, 'method and tools' is used to inform about the tools and methods developed in the framework of the project. This category provides up to three menu-levels, the first two on the left side menu and the other directly in the content window. Each of these levels can have text content and further 'detail content' level can be associated with documents, presentations, and images that are downloadable by users of different groups depending upon their user access rights.

However, there can be other kinds of content that are more general in nature. The general content contains the general information about the project and constitutes the first page 'Home' of IWP. Such content are put under the headings such as:

- News
- Announcements
- Events
- Home page
- Quick links

Also, there are times when project partners give input in developing the content and in providing other relevant information resources to that content. For such content development that involves more than one partner, workflow procedures are

undertaken before publishing it in IWP. As such, the user can create more categories and its sub-categories as needed and can tailor its navigation to organise, share and disseminate information resources. This process is elaborated in detail in Chapter 4.

The IWP system has been developed in a flexible way so that category, sub category and topic can be created, deleted and modified simply by the content developer. Developing and designing the page to a topic is made possible by using simple interface through the administrative panel. This simplifies the exchange of information and improves the integrity of the shared information from the partner institutes and stakeholders. This common platform allows the user to invoke a number of topics from sub-categories within the category, as shown in figure 3.2.

Using the CMS, it is also possible to assign access rights for the different types of users depending upon whether they are system administrators, content managers, project partners, stakeholders or the public. For example in figure 3.3, the 'Member Area' category on the top navigation bar is only visible to the registered members and no one else. Hence, only these registered members can access the information in it.

Figure 3.2: User interface screenshot for content based on theme

Figure 3.3 User interface of the content 'Member Area'

Interactive web mapping

Maps are a powerful tool for organisations to display and share data, promote ideas and issues, and plan for ecosystem management under the HKKH Partnership Project. Such online mapping tools can help the park officers, experts and decision makers to visualise and understand information, problems, and solutions for the protected areas of the three national parks within the framework of the project. IWP should incorporate such mapping tools as well.

Many organisations and companies have been providing application services for years. These Internet mapping systems have been implemented as a set of proprietary systems. As a result of this isolated development, online mapping services from different vendors cannot interoperate with each other.

A spatial database has been developed using ESRI's Enterprise Geodatabase technology ArcGIS Server 9.2 (ESRI, 2004) to store spatial data in RDBMS. The ArcSDE, which comes as part of the ESRI's ArcGIS Server, has been used along with Microsoft's SQL Server to store the spatial data of SNPBZ. In addition, a data sharing mechanism has been implemented so that partner institutes can access these data stored in ICIMOD's server through the Internet using client software such as Desktop ArcGIS or a free ArcGIS Explorer.

Apart from creating data sharing mechanism for SNPBZ Geodatabase, a simple web mapping application has also been created using ArcGIS Server to allow partner institutions and the wider public to visualise the spatial data stored in the SNPBZ Geodatabase, as shown in figure 3.4. This application shows GIS data layers for the following four thematic groups:

- Infrastructure
- Land Cover
- Physiography
- Tourism

One can view this application by clicking the respective links in 'Online Map' section of the project's homepage, as shown in the figure 3.4:
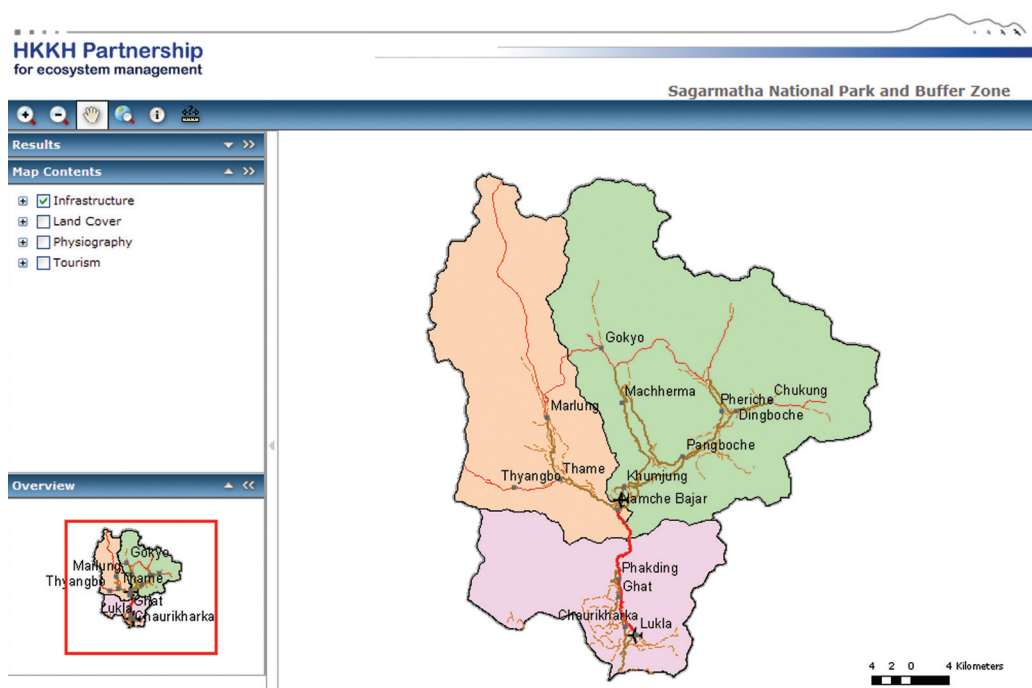

Figure 3.4: Interactive online map of SNPBZ

Knowledgebase

Metadata is a common protocol for sharing and exchanging geographic data and information. The standardised metadata is a common set of terms and definitions facilitating inter-operability by making it easier to find, use and share information. The standardised metadata describe context and characteristics of data and how to collect and organise them in a standardised fashion with flexibility for additional elements to be added to suit the needs of the specialists. Collection of metadata reinforces better data management practices including fitness for purpose assessments and ensures the long-term value of the investment in data creation and collection.

The content in Knowledgebase is represented through standard schemas, where each schema should be driven by adapted metadata standards. The main objective of having a standardised metadata driven system is to systematically catalogue geospatial data and non-spatial metadata for information resource description. Other objectives include bridging the gap between research and management practices by maximising the use of past research and creating a mechanism to avoid duplications. This is achievable by harmonising data and metadata through decentralised and distributed network in the three parks of the project.

Knowledgebase component of IWP system is based on ISO 19115 "Metadata" standards for spatial data and modified Dublin Core for bibliographic data, the most accepted standards worldwide. It is implemented using GeoNetwork open source system developed by Food and Agriculture Organization of United Nations (FAO) (Ticheler, 2008), which is a standardised and decentralised spatial information management environment designed to enable online access to geo-referenced databases, cartographic products and related metadata from a variety of sources, enhancing the spatial information exchange and sharing between organisations and their audience.

The GeoNetwork open source metadata cataloguing platform is capable of providing the objectives of a decentralised environment with distribution services and facilities to exchange information with other catalogues as a part of the network. As HKKH Partnership Project area is located at three national parks of different countries, GeoNetwork helps in organising geospatial information by creating network of catalogues between park offices, which allows users to find information in a single interface.

The GeoNetwork provides:
- Simple and advance search
- ISO standard templates
- Up-and-downloading of geospatial data, documents, PDFs and any other content types
- Online editing of metadata with customisable template system
- Classification of information into categories
- Group and user management and access control
- Synchronisation between the hubs
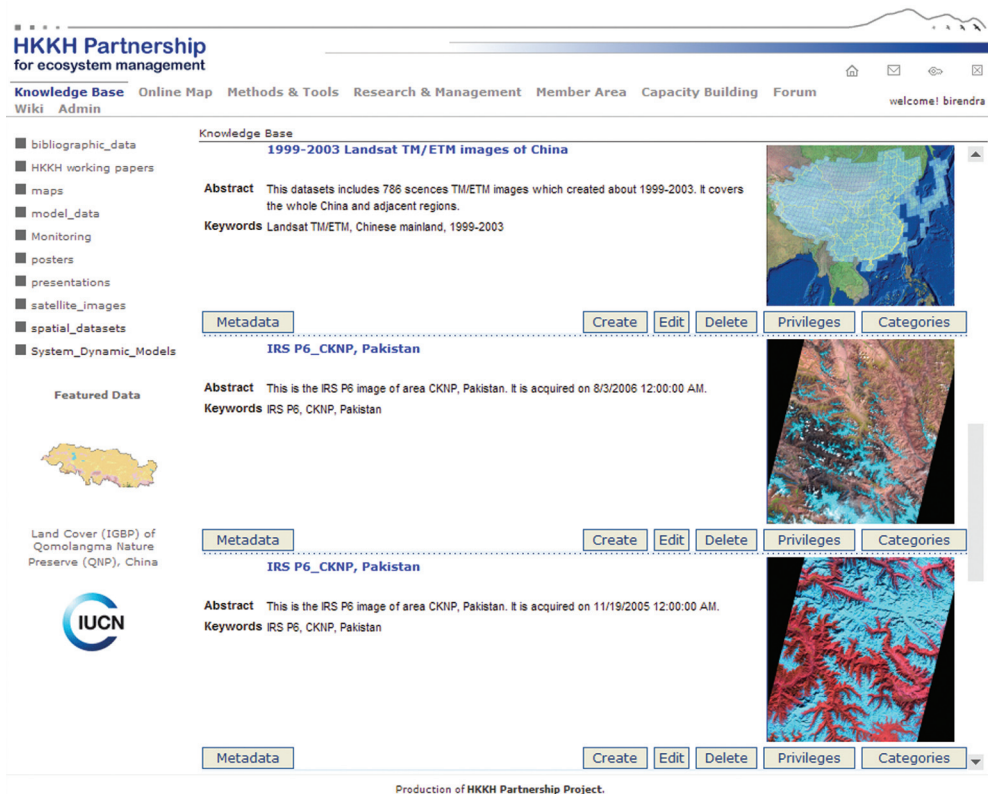
Figure 3.5: Knowledgebase page

Collaborative workspace

The discussion forum has been created as per the requirement of the project to share information and knowledge among the partners and other user groups. It serves as a platform for discussions on issues related to the project content. The forum will also fulfil the objective of revamping the functions of extranet developed during the pilot phase of the project.

The main page of discussion forum displays the main categories with number of topics and posts in each of the forums. One can get further details on topics and posts by clicking on the interested forum headings.

The topics and forum categories can be created from the administrative panel of the discussion such as General forum, Project Partners Forum, Shared Documents and so on. Additional categories and their related topics can be created/deleted/modified depending upon project requirements. The administrative panel of the forum can maintain access right to each categories and topics.

Site administration and management

Figure 3.6: Site Administration and Management
using content management system

As shown in figure 3.6, IWP has been designed and built with a customised CMS focusing on the project contents by establishing a simple and easy management of information resources through a workflow process and a common framework for information authoring, approving, publishing and archiving. This framework provides techniques that assist in the development of ideal information environments (Batley, 2007). The customised CMS is therefore the key component in structuring the Site Administration and Management of IWP which consists of three subsets namely, site management, menu management and user management. Each of these subsets is elaborated further below:
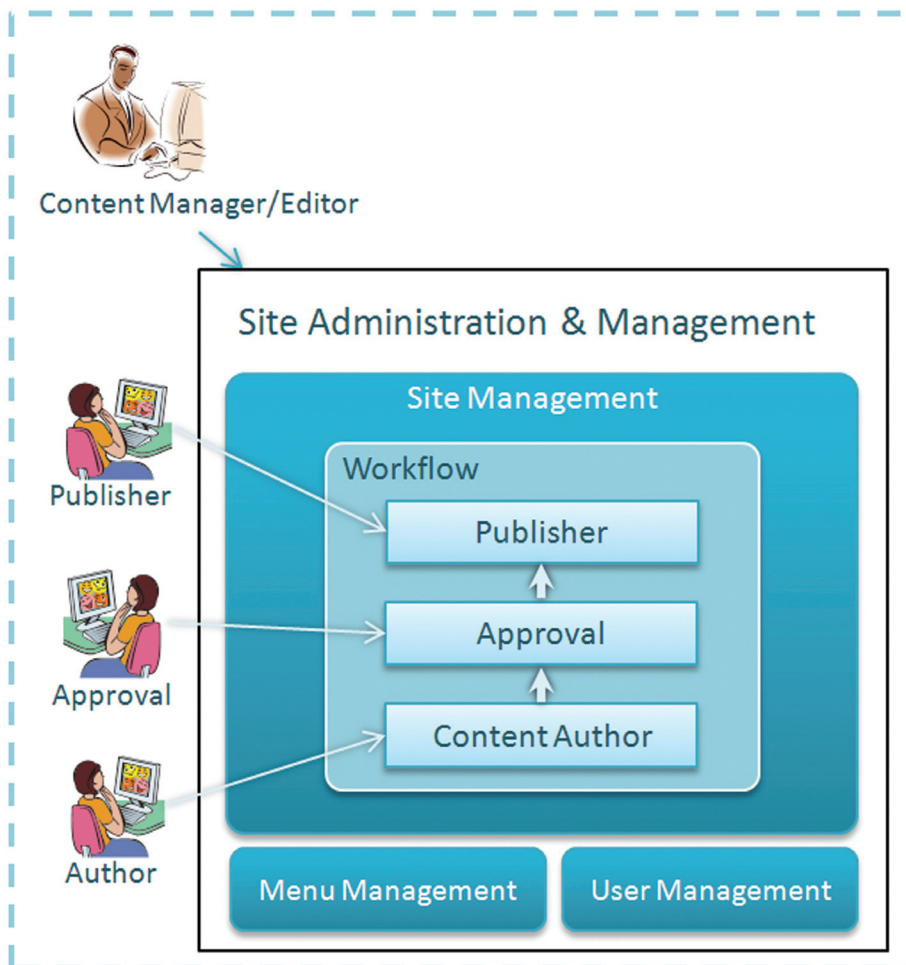
Site management

Site management is the core component of the CMS. This is where content management roles come into practice. The web content management roles provide permissions to the identified user groups to develop and support a website. This allows the partners to manage the online services that help in effectively managing the web contents.

Menu management

The menu management system component has been developed to manage major components such as Home, Thematic Content, Knowledgebase, Online Mapping and Forum and categorised contents like Research & Management, Member Area, Capacity Building as elaborated in chapter 4. This dynamic and database driven menu management exists for the side navigation items as well. It is also flexible enough for creating, deleting, modifying and arranging these menu items.

User management

IWP users have been categorised into two different types: content developers and content users.

The content developers are those assigned with certain roles and privileges to author, approve or publish the content. These users are responsible for generating the content and putting it into the IWP system. When users are registered, they belong to the member group. If such users are content developers, administrator will assign roles and privileges of author, approve, publish rights to each user and in accordance with the content workflow cycle, they will generate the content in IWP.

The content users, on the other hand, are those who use these contents for various purposes. They can be anyone from project partners, members of the project, stakeholders, researchers, academicians or students. Such users can also vary given their rights to access different kinds of information in IWP and whether they can participate and post messages in the discussion forum, or whether they are registered in the IWP system or not, and so on.

In case of Knowledgebase category, the content manager/editor has the exclusive right to enter, edit and publish metadata and set privileges to make it visible to users. Adding/Editing new user is described in the 'Administration and Management' section of this document. All the contents can be managed by administrative or the content developer's rights as explained further in Chapter 4: System Administration and Management section of this document.

3.2 Database design

The IWP database system was designed to meet all the functional requirements. The relational data model that removes any redundancy yet allows retrieving of information easily was implemented. This is accomplished by designing a schema in normalised form.

In addition to the RDBMS, the Knowledgebase (GeoNetwork) database structure is a homogeneously distributed database system with decentralised ownership that can run in multiple locations. Different locations will have identical RDBMS software, and will be aware of one another through automatic synchronisation. This type of database system and software will be extremely useful for the HKKH Partnership Project because of its multiple project sites, stakeholders and organisations.

3.3 User interface design

The first page of the user interface (Figure 3.7) design includes logo and banner to provide a visual identity to the project. This provides a blueprint for the IWP system interface.

The main menu is designed to provide access to the major components of the portal, which are logically grouped together—namely the Thematic Content, Knowledgebase, Online Mapping and Forum. Beside components, categorised contents are logically grouped together in the main menu bar that are all managed via menu management subsystem in CMS.

Navigation menu on the left side is designed as a hierarchical menu with dynamic navigation (i.e., the navigation menu will change according to the selection of components on top menu bar). This is explained in detail in Chapter 4 under the sub-heading 'Menu Management'.

In addition, middle section of the first page in the IWP interface is designed to show a variety of information to the users, such as Recent News, Announcements, Events and its archives. It also provides the most recent addition in the thematic content management and Knowledgebase system. Clicking on a particular heading of these contents will take users to the detailed description of the content. This sort of interface will be beneficial to a regular visitor of the website to view all new information in one window interface.

Figure 3.7: User Interface page

The interface design is embedded with cascading style sheets to make the website look more consistent. The cascading style sheets define the total look and feel of the content presentation, including colours, font sizes and types, and any additional graphics. Styles are also embedded with all the sub-components of the IWP system for the final transformation.

A variety of techniques such as XML, Really Simple [Web] Syndication (RSS), and others are used to make IWP system Interface more user friendly.

Navigation architecture plays a great role in integrating information. With this idea in mind, component integration has been incorporated in the first page view of the IWP system by listing out the recent addition of different components, featured map and poster images of the Knowledgebase. Integration among thematic content subcomponents and Knowledgebase has further enhanced the user-experience by making it possible to view related links of the Knowledgebase from thematic management interface.
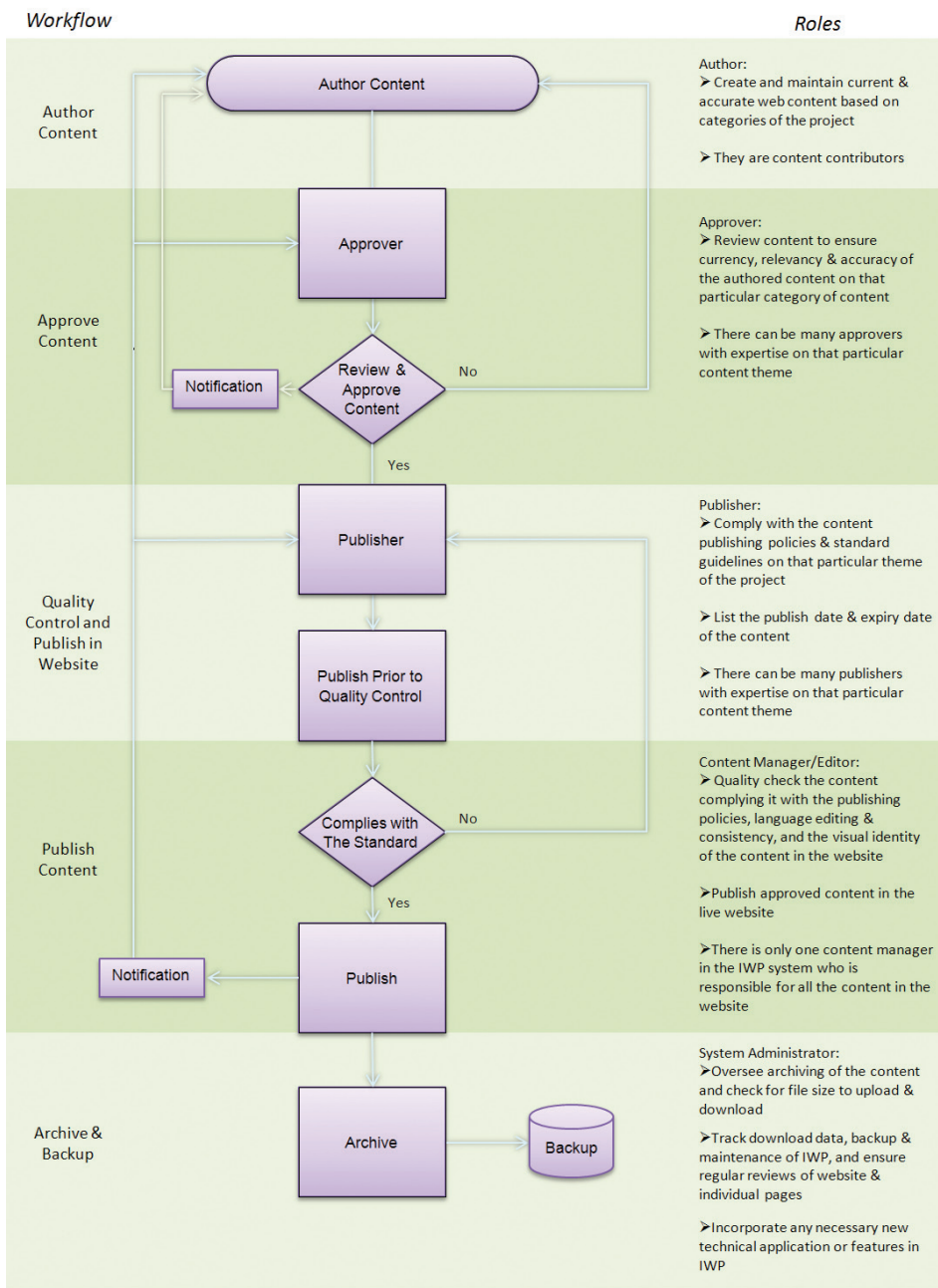
Workflow   **Roles**

	Author:
Author Content	➢ Create and maintain current & accurate web content based on categories of the project
Author Content	➢ They are content contributors

	Approver:
Approver	➢ Review content to ensure currency, relevancy & accuracy of the authored content on that particular category of content
Approve Content	➢ There can be many approvers with expertise on that particular content theme

Notification ← **Review & Approve Content** → No

Yes

	Publisher:
Publisher	➢ Comply with the content publishing policies & standard guidelines on that particular theme of the project
Quality Control and Publish in Website	➢ List the publish date & expiry date of the content
Publish Prior to Quality Control	➢ There can be many publishers with expertise on that particular content theme

	Content Manager/Editor:
Complies with The Standard → No	➢ Quality check the content complying it with the publishing policies, language editing & consistency, and the visual identity of the content in the website
Yes	➢Publish approved content in the live website
Publish Content — Notification ← **Publish**	➢There is only one content manager in the IWP system who is responsible for all the content in the website

	System Administrator:
Archive & Backup	➢Oversee archiving of the content and check for file size to upload & download
Archive → **Backup**	➢Track download data, backup & maintenance of IWP, and ensure regular reviews of website & individual pages
	➢Incorporate any necessary new technical application or features in IWP

Figure 3.8: Web content lifecycle of IWP

4

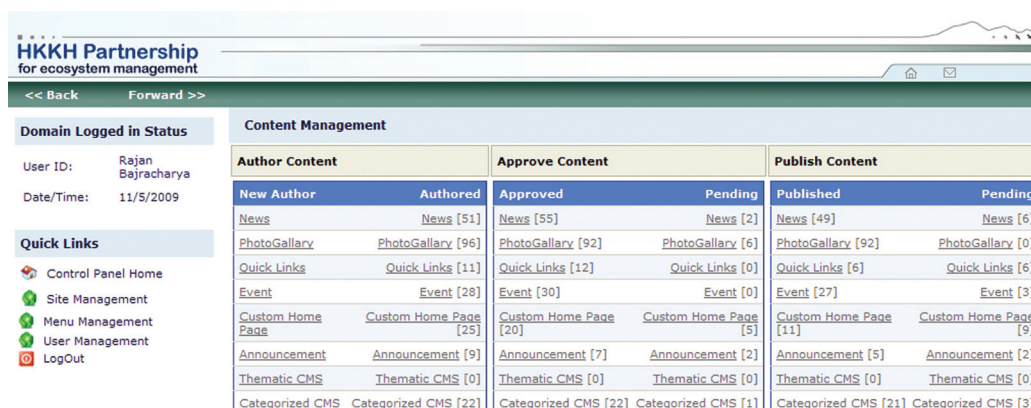# System Administration and Management

The CMS is designed to meet the requirements described in chapter one, which can be summarised as *"CMS should be structured in such a manner that non-specialist should be able to update (add, edit and delete) the page contents and menu items, keeping in view the security management. The content categories are also customisable by a non-specialist"*. With this requirement in mind, a rapid assessment of the most widely used CMS systems was carried out and a fully database-driven CMS was developed to meet the needs of the IWP system. The CMS allows storing, controlling, updating and publishing documentation on IWP such as news, events, announcements, photo gallery, general content and thematic contents. The CMS also manages the administrative part in the IWP system, such as workflow life cycles of the content and it is also accessible to the authorised users. Users with appropriate authorisation can author, approve, publish and archive the contents.

Content types in case of content management (i.e., categories, sub-categories) all have been developed using RDBMS under common framework for all the themes. All components and sub-components of general content and thematic content are managed by the administrative panel of CMS. The Knowledgebase is managed through its administration panel and similarly, discussion forum is maintained through the forum management panel.

4.1 Site management

The administrative interface of CMS is where users can enter the content and then depending upon their privileges, author, approve and/or publish the content. The

system administrator can assign the content developer's role from 'User Management' page of control panel and content developers can assign content viewer access rights from 'Content Management' page of control panel. More detailed descriptions are given in figure 4.1.

Figure 4.1: Administrative panel of CMS to author, approve and publish the content

In figure 4.1 (Content Management page) of control panel, content developers can view three different sets of links, namely author content, approve content and publish content. Author content section has two different columns: "New Author" and "Authored". Similarly, approve content also has two columns "Approved" and "Pending", and publish content has "Published" and "Pending". These sets of links exist to manage content workflow cycle.

This can be best explained by citing one example of the workflow cycle for content, for example, "News". If the user wants to publish news content, s/he has to first author "News" by clicking news link (just below New Author as seen in figure 4.1) in Author Content section. This will navigate the user to a page where s/he can enter details of the news to be authored. S/he can then author news from this page. List of previously authored news can be viewed by clicking on news link (just below Authored) in author content section.

Since the news just authored is yet to be approved, it goes to the next phase of content workflow that is called the approval phase. List of news waiting for approval can be viewed by clicking "News" (just below Pending) in the Approve Content section. To approve any pending news, the user (approver) has to edit the news and approve it. Now this news passes through the next phase of content workflow cycle called the publishing phase.

List of news waiting to be published can be viewed by clicking on news link (just below Pending) of the Publish Content section. To publish any pending news, the content developer (publisher) has to edit particular news and then publish it.

Depending on the operation rights assigned to the user, s/he can author, approve and publish content of particular type, in this case "News". Figure 4.2 shows a page for assigning rights to content developers.

Figure 4.2: Assigning workflow rights to users on content categories

Managing content types

The administrative control panel page leads to the list of different content types, namely News, Event, Homepage, Announcement, Thematic CMS and categorised CMS. On this page, users can add content, like news, regular content in categorised CMS and upload photos. However, only certain users, usually content developers and administrators will have the authority to use this page.

The CMS supports the following administrative features:

- Add, edit, delete contents remotely
- Import and create documents and other materials
- Embedded HTML editor
- Identification of all key users and their content management roles
- Assign roles and responsibilities to different content categories
- Content workflow cycle

- Thematic content management
- Custom home page addition capability
- Dynamic menu management including categorised main menu and side menu navigation
- Access control on contents at different levels
- Integration among different components

By far, the most basic approach to website design would be to author the HTML in a non-WYSIWYG (what you see is what you get) environment and construct the page through trial and error. Authoring HTML in this way is time-consuming and error-prone, as there is no automation to ensure that the HTML conforms to the standards. When the content needs to be changed, the HTML needs to be edited by hand.
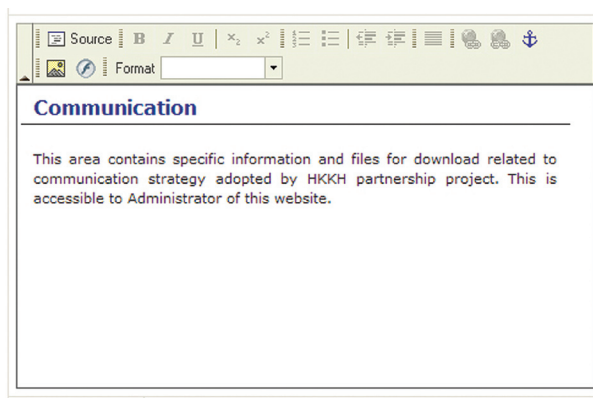
Figure 4.3: HTML Editor

Like majority of corporate websites, the IWP system is also created using dynamically generated HTML, which is then passed through the client browser. The most common way of generating HTML in this way is performed by server-side scripting languages.

HTML editor features:
- Maximise the editor size to full screen
- Various Microsoft Word like features including source code view
- Insert/Edit image with image and text layout
- Insert/Edit anchor, tables, page break, special character, horizontal line

As shown in figure 4.4, HTML editor has been incorporated to allow users to type contents in rich text format.

Category:	Member Area
Sub Category:	Communication
Title	Product templates for partners
MenuText:	Product templates for partners

Description:

Product templates for partners

This page provides the project's document templates for download. For a general instruction please refer to communication. Each product template is located within a zipped folder with an example and a specific instruction. You need a zip-application installed on your computer to open the files. Otherwise download and install win zip or any free-ware application for widows. Mac Os 10.3 and higher has built-in ability to handle zip files. right-click (<control>-click on Macintosh) with mouse and choose 'download to disk' in pop-up menu.

Created Date	5/25/2007

Manage Documents   **Content Images**

Add Content Related Documents:

Title:	
Code:	
Date:	
Description:	
Version:	
Document File:	Browse...

Save

List of Content Related Documents:

Title	File Name	Code	Date	Description	Version	Delete
Meeting summary	meeting_summary.zip			other documents		⊗
Presentation	presentation.zip			presentations and posters		⊗
Workshop note	workshop_note.zip			workshops		⊗
Poster A1	poster_A1.zip			presentations and posters		⊗

Figure 4.4: Administrative panel showing how to add categorized content in 'Member Area' content type

The content in the topic can be custom designed by content developers through the interactive HTML editor, even without having any previous knowledge of HTML tags or any programming language skills. However, the "source" button is added in the interactive HTML editor to view the content as an HTML source code.

In addition to attributes of contents (title, abstract, detail description, images, documents), two new attributes are added as:

- Release date
- Expiry date

Release date attribute is very useful when the content developer would like to input and publish the content in the workflow process prior to the actual event, news or announcement. The expiry date will be useful when the content doesn't have to be served after a certain date.

Figure 4.5: Upload functionality

4.2 Menu management

This component has been developed to manage the major components such as home, thematic content, Knowledgebase, online mapping and forum, and major categorised contents like research & management, member area and capacity building. This dynamic and database-driven menu management system is applicable for the side navigation items as well. This system is also very flexible in creating, deleting, modifying and arranging these menu items, as shown in figure 4.6.

Features:
- Database-driven menu management
- Add new menu
- Change display order of menu items
- Edit/delete menu
- Access rights to the menu items

Figure 4.6: Administrative panel for menu management

4.3 User management

The IWP system architecture illustrated in figure 3.1 shows how a certain class of user group (*called actor*) interacts with the subsystem components of IWP to accomplish a specific action. The action may be as simple as acquiring a defined content, or as complex as developing contents in an online database. The system architecture shows interaction with IWP system from two different aspects: content users (public/registered users) and site administrators (system administrator/content manager/editor).

System Administrator:

S/he is a super administrator having all the access rights in the IWP system. S/he is also responsible for assigning the roles of different users. S/he has the central control over database like backup and maintenance.

Content Manager/Editor:

S/he is usually a project staff involved in conceptualisation and initial development with authority to author, approve or publish the content in the portal.

Depending on the subsystem component of IWP, content manager/editor can have different set of roles. Through CMS, the content manager/editor is able to author, approve or publish the content into the database. The content manager/editor comes from the pool of project partners. S/he can have one or more roles in CMS component as described below:

a) Content author is a special user who authors the content; for example, in thematic content, thematic expert could be one of the authors to provide contents on a specific theme.

b) Content approver is another special user who interacts with administrative panel to approve the author's contents.

c) Content publisher is a content developer having access rights to publish different content types.

In the workflow management process, the content will be visible to the content users only after it has been published. Such users can be of different types as well. For instance:

Guests: They are registered users of the IWP system, who are non-project members, and are allowed to post messages in discussion forum.

Public: They are unregistered users.

Stakeholders: They are registered users from project 'Stakeholders'.

Partners: They are 'strictly staff member'. They will have privilege to view all the contents of IWP system.

Defining roles and access rights of different users
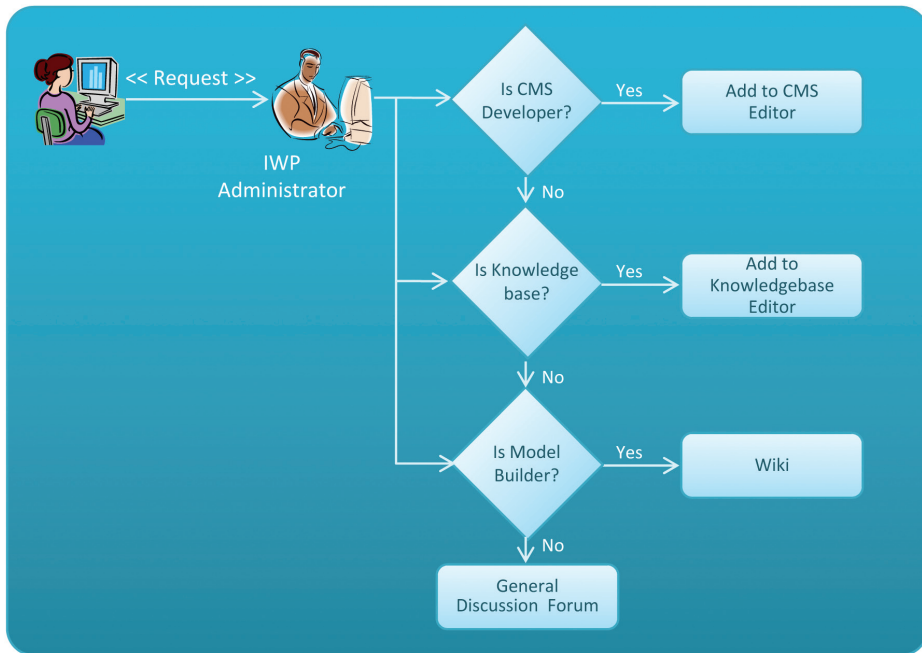
Figure 4.7: State transition diagram for new user

Figure 4.7 shows another representation of the dynamic behaviour of the web application when such an interaction occurs. This diagram shows the access configuration of the system when a new user wants to register into the IWP system. This means that new users will send requests to the administrator and the IWP administrator validates the requests, providing access rights depending upon the requestor's role. In accordance to figure 4.7, the following applies:

- If the new user is a content developer then s/he should be added on the CMS access list with defined roles;
- If the new user is a 'Knowledgebase ' content developer then s/he should be added on the 'Knowledgebase' access list which is different from CMS access list; and
- If the new user is a content viewer as well as a member of discussion forum, then s/he should be added on the 'Registered User' access list. With this, content viewer can view IWP contents and post messages in Discussion Forum. If users are involved in model building exercise then s/he should be added to access wiki as well.

Adding/editing new user

The "user management" hyperlink can be used to create a new user account. However, only certain users, usually administrators have authority to use this page. The page for creating the new user account has been displayed in figure 4.8.

Figure 4.8: Adding a new user account

Once users are created, the administrator can edit the users. By default, a newly created user will be assigned to "member" group only. If a user belongs to other group such as "partner", edit the user and assign to the appropriate group(s). If the user is a content developer, edit the user and click on the hyperlink "Content Developer" and assign privileges to author, approve and publish appropriate content types, as shown in figure 4.9.

4.4 Managing knowledgebase content

Once the users become registered users or privileged users, s/he can have access to much wider services of Knowledgebase. Adding new metadata in the Knowledgebase is one aspect of it, which is explained below.

Figure 4.9: Edit content developer profile

Adding new metadata

To add or edit data and metadata, s/he must have at least Content Developer/Editor or Administrator access rights. This user groups can create a new metadata using the online editor of Knowledgebase. It provides a set of pre-defined metadata templates for the project, as shown in figure 4.10, which is based on the cited standards—ISO 19115 for spatial metadata or modified Dublin Core for non-spatial metadata.

Figure 4.10: Metadata Templates

Besides populating metadata into the system, the content developer scan also add data for downloading, add thumbnails to the metadata and assign to corresponding Knowledgebase categories. At the end, several privileges to metadata can be granted to the user groups depending upon its usage.
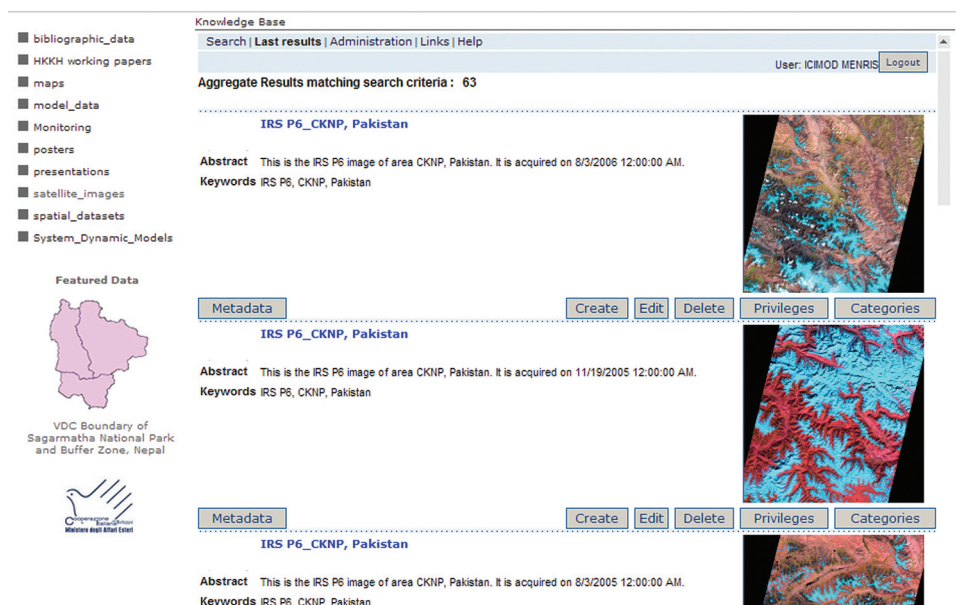
Figure 4.11: Knowledgebase administrative panel

A more advanced procedure to upload a new metadata record in the knowledgebase system is using an XML document. This procedure is particularly useful for users who already have metadata in XML format, for instance, those created by some GIS software. To this regard, user can import this XML file and validate against the standards (ISO 19115, Dublin Core) adopted in the project.

The user with administrator privileges can manage the creation of various categories of Knowledgebase corresponding to the type of content.

4.5 Discussion forum administration

The topics in the discussion forum can only be accessed depending upon user access rights for the group. For instance public users have "read only access" whereas registered users under member group have "access right to discuss", and registered users under project partner group have "access right to the partner related topics". Members can directly post documents and information in the site, which facilitates information sharing and feedback mechanisms.

The administrator has the rights to edit, delete, move or otherwise modify any thread (discussion) in the discussion forum. Administrators also have the ability to close the board, change major software items, change the skin, modify the board, ban, delete or create members. Moderator privileges are delegated to other forum members. Moderators help the administrator (Admin), but have fewer functional roles, but may include editing, deleting, and moving threads, mass pruning, warning members for offenses and changing minor forum details.

Members of the discussion forum have basic rights. They are able to post in threads, edit their posts, start new topics, and change their settings. Members are able to send and receive personal messages to each other. They are considered to be the backbone of the forum since they are the ones who post and respond to each other.

4.6 Database administration

One of the main reasons for using RDBMS is to have central control of both the data and the programs that access those data. The person who has such central control over the system is called a database administrator (DBA). Some functions of IWP DBA include:

- Storage structure and access method definition
- Schema and physical organisation modification–DBA carries out changes to the schema and physical organisation to reflect the changing needs of the project, or to alter the physical organisation to improve performance
- Routine maintenance – Few routine maintenance activities are:
    - o Periodically backing up the database onto a central backup unit located at ICIMOD, and to prevent loss of data in case of any disaster
    - o Ensuring that enough free disk space is available for normal operations, and upgrading disk space as required
    - o Monitoring jobs running on the database and ensuring database performance

As the IWP system is entirely database driven, automatic regular backup of data is possible by scheduling a backup job.

4.7 Security system

'Content developer' in the CMS system enforces permission levels within the workflow processes, namely author, approve and publish content of different content types. In addition, 'content developer' can assign privilege to contents in IWP for 'content users' (groups).

Knowledgebase has an independent security system and is being managed through GeoNetwork environment, like the Knowledgebase content developer.

Collaborate and Communicate

With the web-based portal technologies such as IWP, people are more likely to participate freely in activities and spontaneously share information, engaging in ecosystem management and committing to project objectives. The benefits of such technologies are:

- Establishing collaborative communication tools would provide a platform for connections with different user groups like project partners and its staff members, government officers, stakeholders and other partners.
- Such technology makes project resources available online to all users. People working at remote sites such as park officers or system dynamic model builders (domain experts) can use this web portal to enter project data, domain information, modelling outputs, and questionnaires to keep business information up-to-date, regardless of time zones or geographical barriers.
- The IWP components dedicated for collaboration and communication improves the user's productivity. The developed or adopted tools are simple, familiar, easy to use and interactive, minimising training requirements. In addition, rapid deployment helps reduce IT maintenance and administration costs.

5.1 Shared workspace

The collaborative workspace is a virtual workspace built for different users to collaborate, communicate and coordinate project activities. The workspace provides a platform to work efficiently in a team among project partners from different locations together with the stakeholders and domain experts working towards a common objective and shared vision.

Group modelling exercises, discussion sessions, peer reviews and round table dialogues are some examples of how the collaborative workspace can be used to encourage partnership and team building. This threaded workspace organises postings under topic headings, discussion forums or wiki.

Users who join the network will have access to resources shared by others in exchange for their contribution regarding information about their research and results. For example, forums and discussion lists on selected topics could be developed involving both the researcher and the national stakeholder community. This will also provide the opportunity to establish a direct link between the two. Furthermore, such network will also assist in avoiding duplication and useless overlapping of work among researchers, partners and other stakeholders.

In the framework of the project, the collaborative workspace was extensively used in the following activities:

Team workspace: A platform to work collaboratively towards a common goal/objective like systemic planning and management framework;

Wiki: The wiki system was used for model building exercises on scenario planning and qualitative analysis of various ecosystem dynamics;

Discussion forum: A virtual forum to discuss and debate on various thematic issues like DSS for ecosystem management. This forum is created for the general public.

5.2 Spatial data sharing mechanism

One of the main objectives of the HKKH Partnership Project is to develop Decision Support Toolbox (DST) for management of protected area ecosystems. This requires integration of ever increasing volumes of diverse spatial and non-spatial data, from numerous sources at local, national and regional levels into a manageable whole. Spatial data management has a major impact on DST implementation as it determines how data is organised within the framework of the project. The primary goal of a spatial data management system is to provide the best quality data possible and provide consistent information within acceptable standards.

Realising the benefits of ESRI's Enterprise Geodatabase model, separate ESRI Geodatabase for all three national parks from the available datasets of these areas were built. In addition, a data sharing mechanism has been implemented so that partner institutes can access these data stored in ICIMOD's server through Internet using client software such as Desktop ArcGIS or a free ArcGIS Explorer.

One of the main objectives of developing Geodatabase was to allow the project's partner institutes to access the spatial data directly through Internet using ArcGIS software (ArcCatalog, ArcMap), as shown in the figure 5.1. It also allows usage of a freeware ArcGIS Explorer, Manifold or any other GIS software that has the capability to connect to ESRI's ArcSDE database. Such Geodatabase are password protected. Hence, a user has to be created to access these Geodatabase.
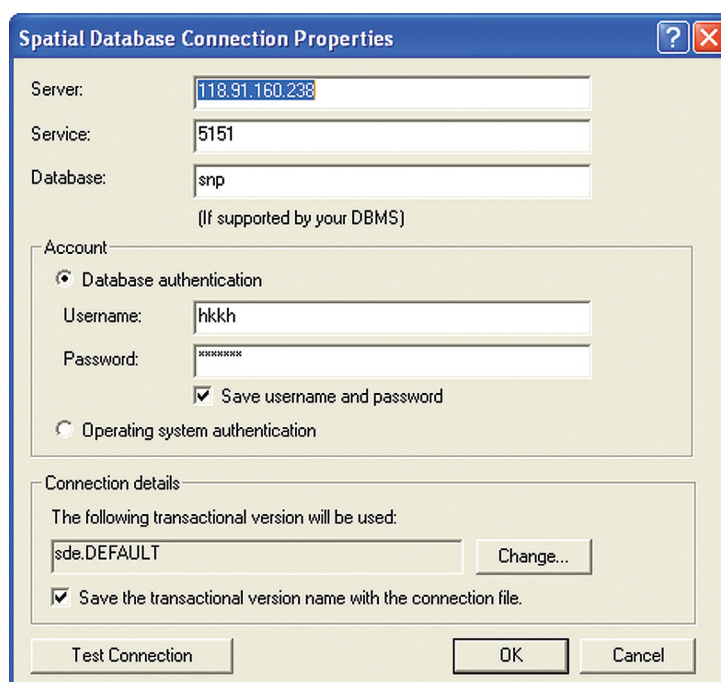

Figure 5.1: Spatial Database Connection dialogue box in ArcCatalog

6

Conclusion

The unprecedented growth of Internet-based application has allowed integrated and innovative solutions to collect, manage and disseminate information and knowledge. In the framework of the HKKH Partnership Project, the IWP has provided a virtual platform to build, share and disseminate information and knowledge resources in a decentralised and distributed fashion. This has been the gateway for project's information resources to the wider audience.

IWP has captured and disseminated diverse sources of data and information in a systematic way by means of promoting collaboration, coordination and communication among multiple users and stakeholders. IWP has been built with a customised content management system by establishing simple and easy management of information resources through a workflow process and a common framework for information authoring, approving, publishing and archiving. This has helped novice users with less or no technical background to operate, manage and maintain the web portal keeping in view of diverse user groups who are in remote locations.

The adoption of international standardisation of metadata in a Knowledgebase module has provided a mechanism for promoting, sharing and exchanging information in regions like HKKH with limited or scarce data resources. The Knowledgebase produced by the project has been the gateway to find relevant resources and carry out current and future research by users involved in the management of the ecosystems without duplicating the effort.

The online mapping solutions have provided users with basic GIS functions and interactive visualisation of spatial information.

IWP provides a framework for data integration and dissemination as demanded by the project's diverse needs for ecosystem management in mountain areas. IWP has proved to be useful in capturing all relevant information during the entire course of implementation of the project and serves as the project's legacy even after completion. Moreover, the innovative tools and technologies developed to realise IWP can easily be up-scaled to similar other initiatives in other mountain regions.

7

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Building partnerships for the HKKH region

The project "Institutional Consolidation for the Coordinated and the Integrated Monitoring of Natural Resources towards Sustainable Development and Environmental Conservation in the Hindu Kush-Karakoram-Himalaya Mountain Complex" (HKKH Partnership project) is a regional initiative aimed at consolidating institutional capacity for systemic planning and management of socio-ecosystems at the local, national and regional levels in the HKKH region. The project, supported by the Italian Cooperation, is implemented by International Union for Conservation of Nature (IUCN), CESVI, Ev-K2-CNR Committee and International Centre for Integrated Mountain Development (ICIMOD).

Web links:
http://www.hkkhpartnership.org
http://www.iucn.org
http://www.cesvi.org
http://www.evk2cnr.org
http://www.icimod.org