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**RECOMMENDATIONS OF THE BIOSAFETY CLEARING-HOUSE REGIONAL ADVISORS
FOR THE CENTRAL PORTAL: EXPERIENCES OF ONE YEAR AS REGIONAL ADVISORS**

Note by the Executive Secretary

1.   The Executive Secretary is pleased to circulate herewith a report submitted by the Biosafety Office of the Division of Global Environment Facility Coordination of the United Nations Environment Programme (UNEP-GEF). The report includes comments and suggestions by the regional advisors for the Biosafety Clearing-House and users who have had the chance of using the central portal of the Biosafety Clearing-House during the workshops and interaction with the different countries.

2.   This report aims at putting together thoughts, suggestions and recommendations gathered over the past few months to enhance the central portal of the Biosafety Clearing-House and its user-friendliness and to point out some concerns. It could be a starting point for further discussions with all stakeholders in the Biosafety Clearing-House (users, developers, national developers, regional advisors).

3.   The report is being circulated in the form and the language in which it was received by the Convention Secretariat.

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*   UNEP/CBD/BS/BCH-IAC/2/1.

**RECOMMENDATIONS OF THE BCH REGIONAL ADVISORS FOR THE CENTRAL
PORTAL: EXPERIENCES OF ONE YEAR AS REGIONAL ADVISORS**

Introduction

The report has been compiled to include comments and suggestions by the BCH Regional Advisors and users who have had the chance of using the BCH central portal during the workshops and interaction with the different countries. It is understood and appreciated that managing and developing the BCH portal is a complex process, maybe not in-terms of the technical complexity but from the fact that the requirements of the users are very diverse in nature. This ranges from users having little or no information technology knowledge to regions where a dial-up internet connection is a luxury.

Having said the above and in preparing the report, it must be emphasized that collaboration with the SCBD has been excellent and both Kirsty Galloway-McLean, Programme Officer, BCH and the BCH developer, Philippe Leblond, have been helpful, cooperative and extremely supportive; also, they have always been receptive to users comments and recommendations making the interaction between countries, the SCBD and the UNEP-GEF project seamless.

The aim of this report is to put together some thoughts, suggestions and recommendations gathered over the past few months to enhance the BCH Central Portal, its user-friendliness and to point out some concerns. It could be a starting point for further discussions with all BCH stakeholders (Users, developer, National developers, Regional Advisors).

After a brief introduction on software development (overview), we will describe a few points where we think improvement could be done and propose some constructive solutions.

Overview

The topics or background given on the software development process is to provide an overview of the process and by no means can do full justice to the process of software development, which is a specialized field.

The complexity of the project is judged not only by the fact that it has thousands of "lines of code" or that the database stores millions of records. This is only one aspect of the project, the other aspect is the *environment* in which an application is designed, developed, tested, used and maintained.

Software programming is just one of the many tasks or processes that are carried out in developing a software system and is in fact considered the simplest or the most straight-forward one. The software programming is moving towards tools which generate code automatically.

Other fundamental software development processes include ***Requirement Analysis, Architecture and Application Analysis & Design, Testing, Configuration Management, Deploying and Updating/Continuous Maintenance***. These activities are influenced by the different factors and forces in which they are carried out; these are taken in the broad sense, accounting for available resources and constraints, availability of tools, available users and stakeholders, testing area, testing data and trial scenarios etc.

The "environment" or framework within which the BCH System has been developed can be considered quite "harsh" for almost all the activities except programming (which can be carried out inside closed doors).

The complexity of the BCH Project can be judged from the fact when we look at *Requirements analysis*. *Requirements analysis* needs to be carried out in consultation with all or most varied of the target users and stakeholders, in order to get a clear and real picture of **what needs to be done to satisfy customer needs**. This is almost impossible for the BCH as one cannot reach a minimum amount of potential users, not to mention the diverse needs, interests and concerns of the potential users. This would no doubt require a huge amount of resources and time.

Architecture and application design is a must; programming is a consequence of this activity. Bad architecture leads to bad application and the application does not get better unless it is totally re-designed. On the other hand, good architecture means good interpretation of the (prior and bullet-proof) requirements analysis and conceptualization steps. This is further enhanced by the use of modern tools and methodologies. It is critical that the application knowledge is communicated properly. It is almost impossible to understand a whole application by reading thousands of lines of source-code, but it is possible to understand it from the abstract models that are generated from this activity.

Testing phase is conducted after the initial steps have been accomplished. This will help to discover the bugs in the system, but more importantly, to check if the deployed application fulfils the users' and stakeholders' requirements. Any deficiencies are fed back into the "production line" in order to correct them before the live system is implemented. This would require a large resources and time to accomplish: test users of different levels from a good sample of users, dedicated team to use and check the application and report errors and other issues of usability, performance, robustness etc.; in-house manpower to collect and process these reports, follow-up action to be taken and so on.

Configuration management is a basic discipline of software development and deployment. As the application evolves and gets more complicated (introduction of new functionalities), the need to track changes and the possibility to undo them, increases exponentially. This is compounded further when the system is a multilingual one. The BCH is such a system.

Deploying of the software and updates in a varied environment of users, geographically and culturally distributed, is under great risk of not being noticed by all the users in time. This imposes great requirements of documentation and communication, which go much beyond the effort of software updating, making the process much more complicated, expensive and time-consuming. The same applies for updating and software maintenance.

All the changes made to the software should reflect changes in the users/stakeholders needs and requirements. The software house would try to do an ***impact analysis***, before developing a new/improved version of an application in order to clearly understand the relationship between costs and benefits, in order to make an informed decision and to assign the required resources and time to the change process. This would be recommended for the BCH as well since the impact of ever change needs to be studied carefully and it would have a direct impact on costs and time required to carry-out any change.

Based on the above the most important point for the BCH is documentation, which includes basic documentation for the user to software documentation, data models and diagrams and so on. This affects the full range of potential users, from the simple user (general public, regulators and so on) to national application developers (who need to know several standards in order to make their applications interoperable – and maintain them being so – with the Central Portal).

1. Search Tools

The portal should provide tools to allow searches in simple and complex forms. At the moment searches are possible by country, region, LMOs and so on. This means that the data can be queried to look for basic information that is posted on the BCH portal.

Since the BCH will be used by various parties to look-up information. For a user of the information, there is a need to have cross-reference searches.

For example, (*Case Study 1*)* if a trader wants to move a shipment of cotton from US to Mexico for a particular purpose, like food/feed/processing, s/he has to first look-up the information on cotton under the country US. A copy of this search information needs to be kept by the user, whilst s/he searches for information for Mexico. The results from the query of Mexico will then have to be cross-referenced with the US results to find out what can/cannot be imported and for what purpose.

The whole process could be made simpler by being able to search for information on an LMO under both US and Mexico for example. This would show the results relevant to the trader in one simple step.

The developer could carry out a survey from a random set of users, where they would suggest the various types of (cross-referenced) searches which might be useful to the users. One way could be an online survey to be completed by NEAs. Another option would be allow a general query generator which could be used to generate specific queries. There are various ready-made tools available to do this.

Right now when a search is done on the BCH Central Portal, the rule to sort the results is not clear (at least by Country seems to be one of the rules) which sometimes messes up different type of information. We recommend adding the possibility to sort the data by column or at least by type of data. The "field ID" should not be used to sort data automatically.

2. Translations in other UN Languages

The portal has translations in the six UN languages. There are sections of the translation which are either wrong or incorrect. An example is shown under the *Capacity Building* Section of the website, where the titles are wrong in French and Spanish (see figure 2 and 3).

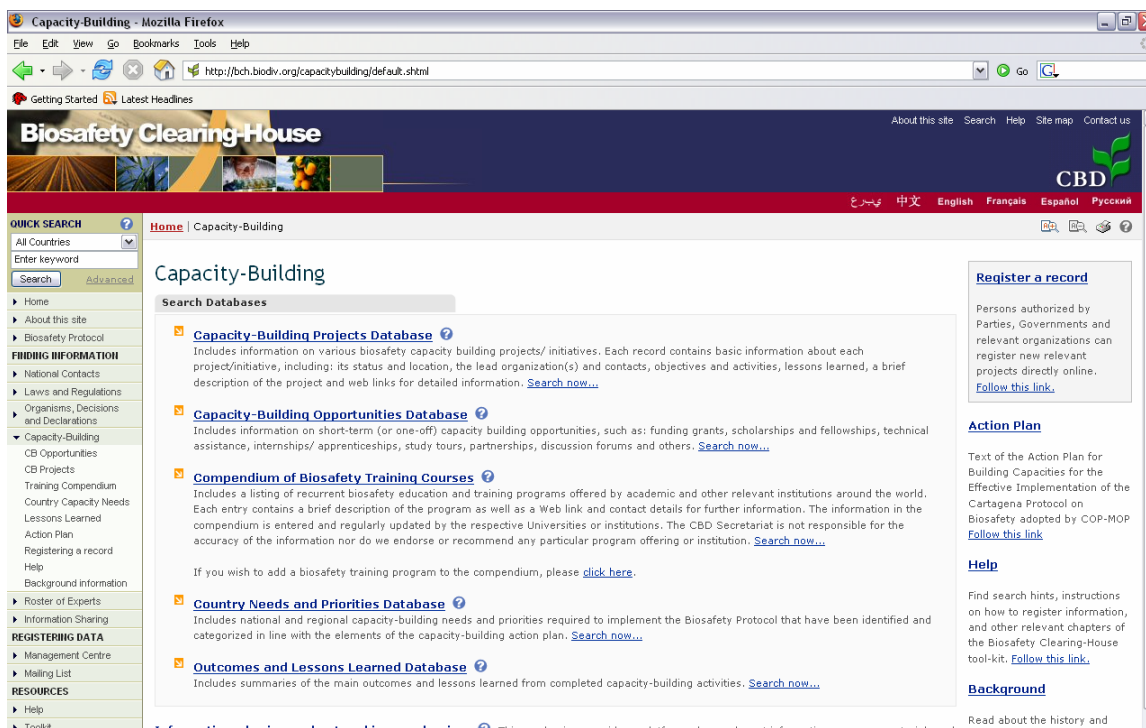* This refers to Case Study 1 developed by UNEP-GEF for training on the BCH.
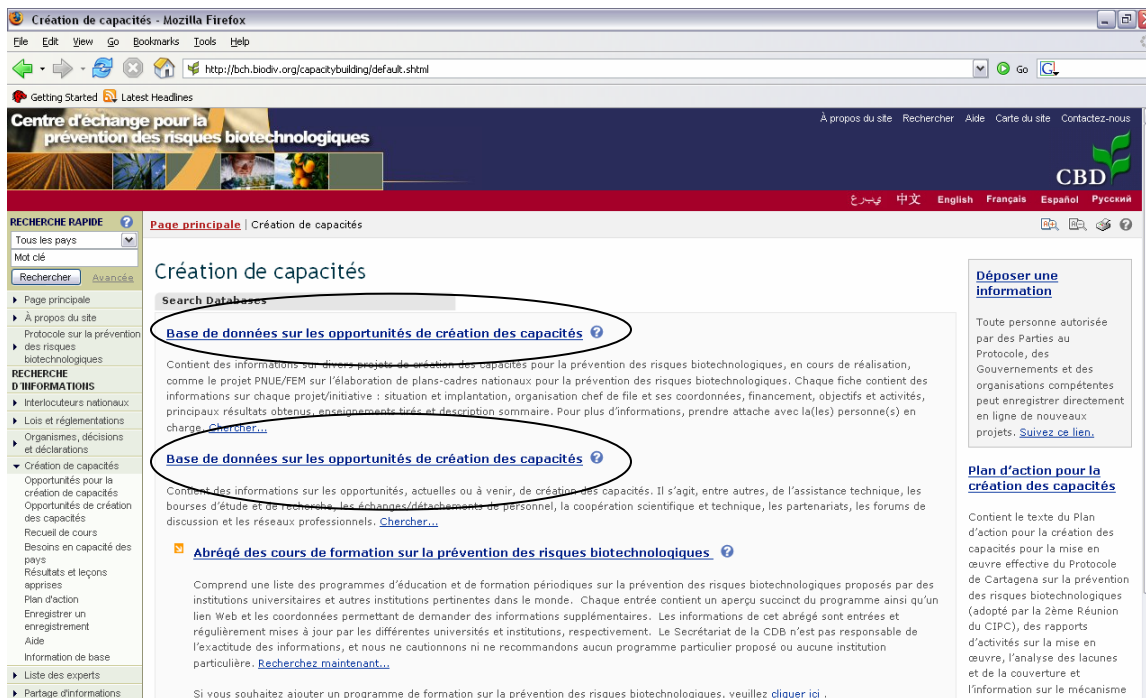
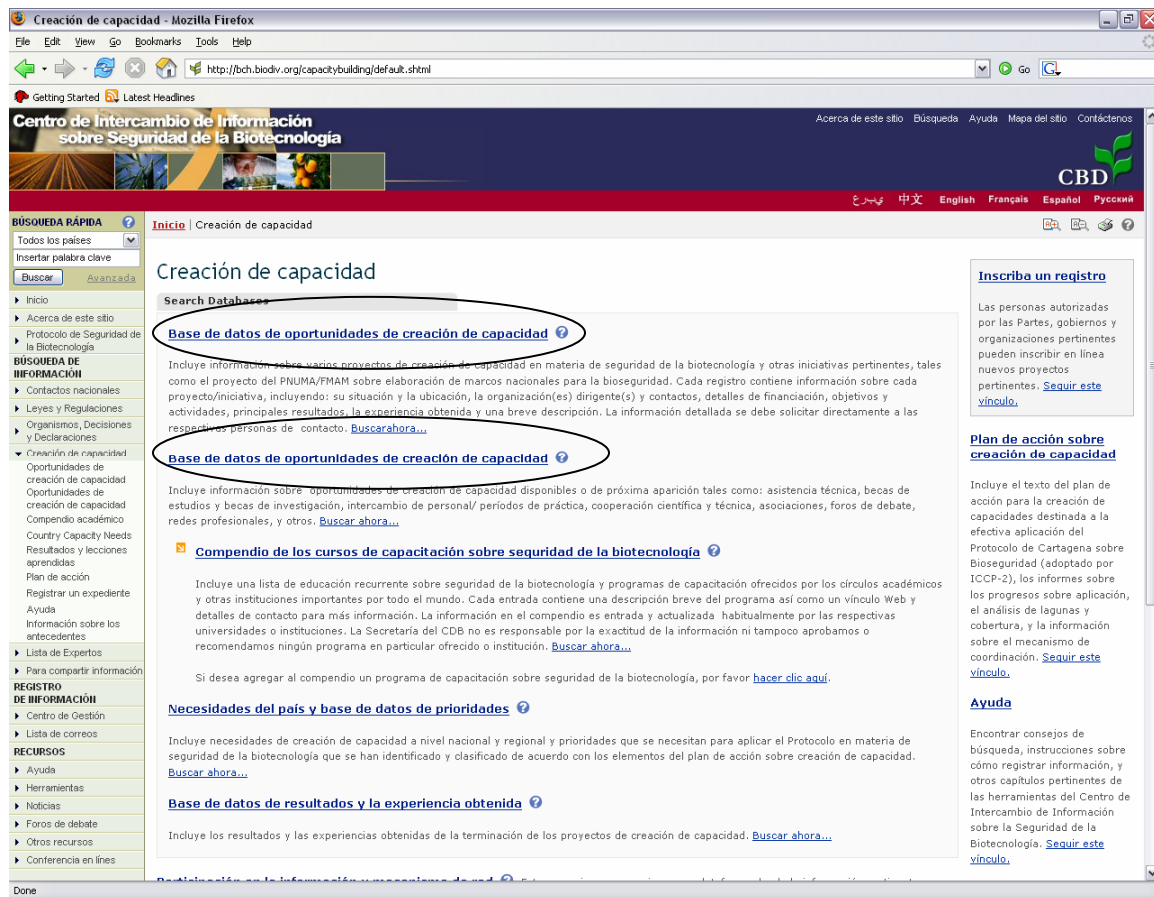*Figure 1- English Page*

Figure 2 – French Page

Figure 3 – Spanish Page

Another problem is that the translations sometimes link to the English pages. Under the section *Other Resources* the translation for the link "*Examples of integration of information requirements into existing documentation*" links to the same title on the French page and Spanish page. See figure 4, figure 5 and figure 6.
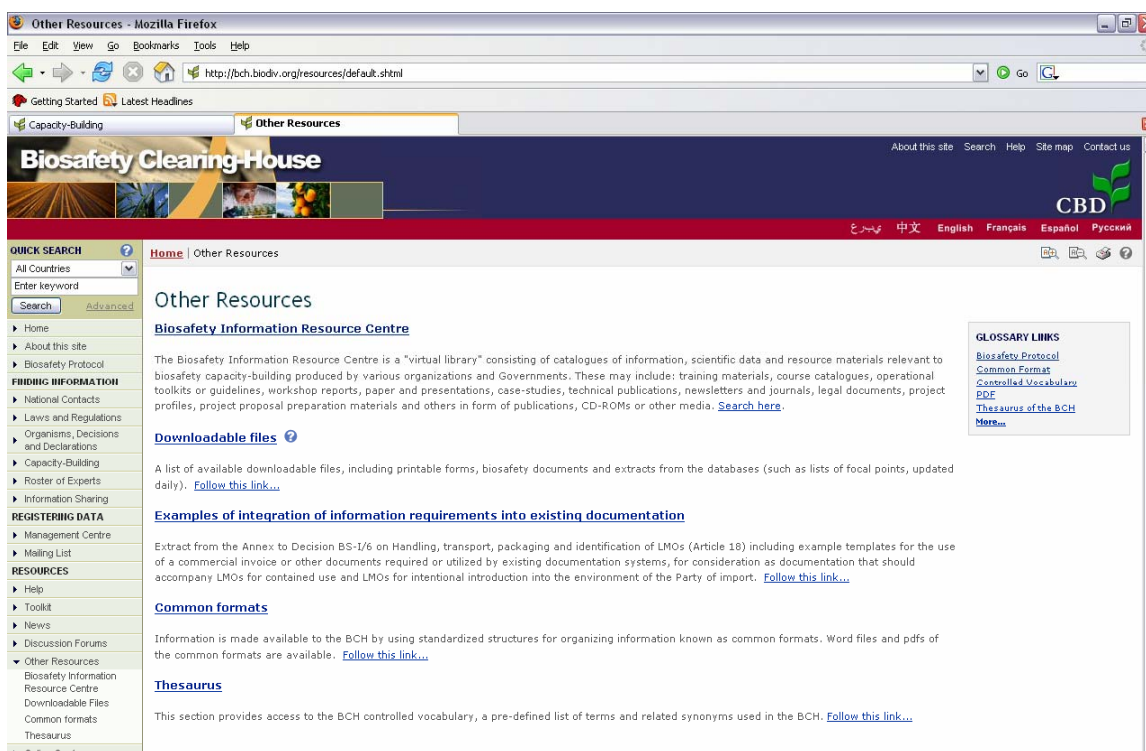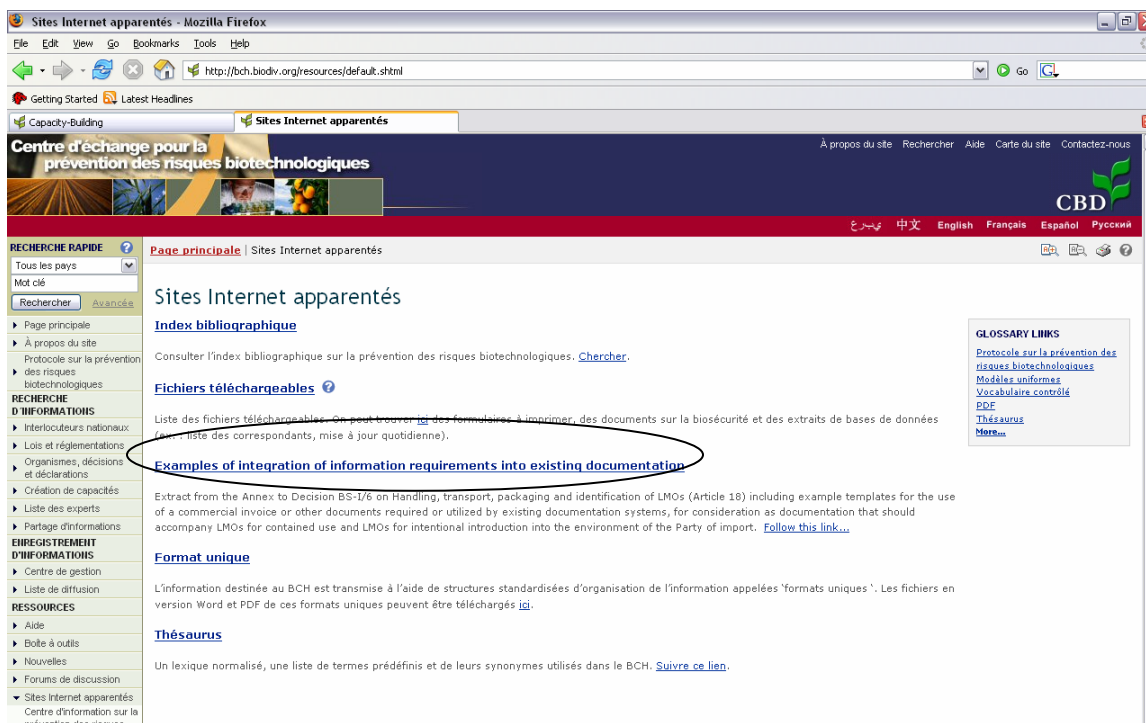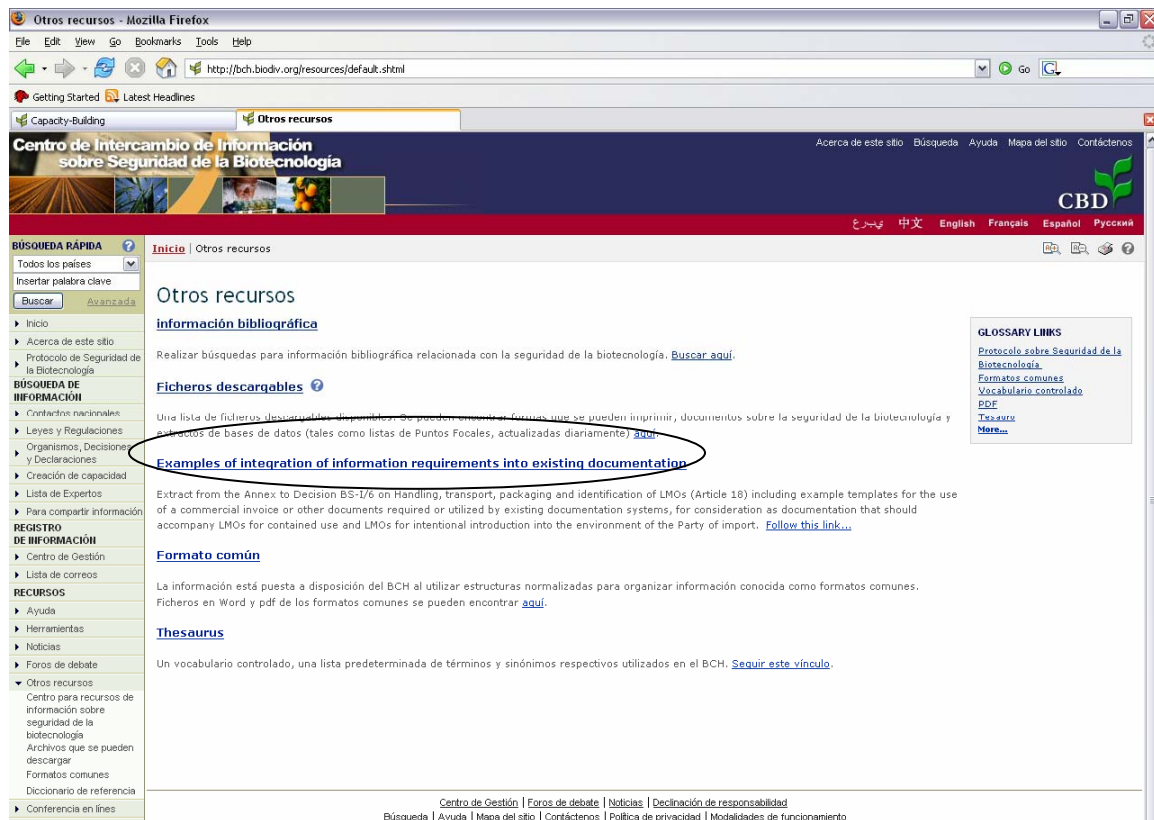
Figure 4 – English Page

Figure 5 – French Page

Figure 6 – Spanish Page

There are some more errors that have been spotted in the Spanish pages for example.
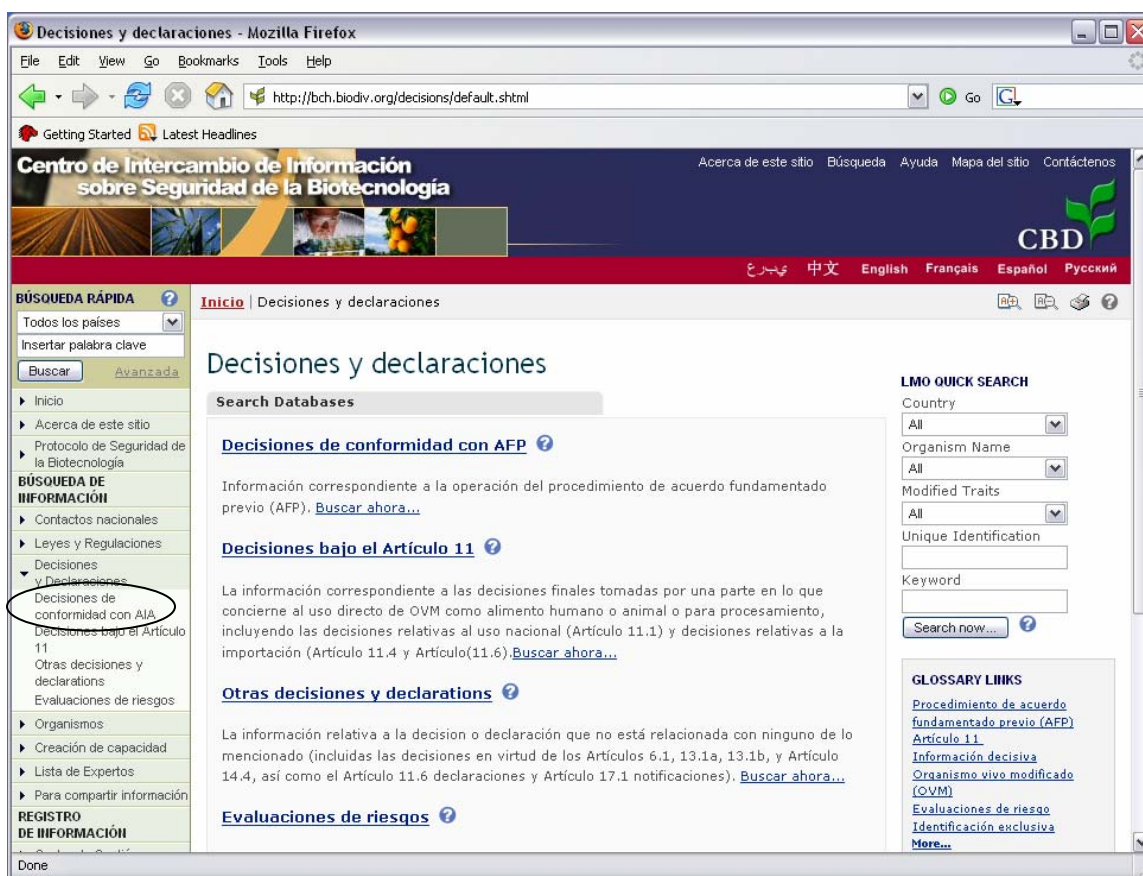
Figure 7 – Decisions & Declarations (Spanish)

The phrase "Decisiones de conformidad con AIA", should read "Decisiones de conformidad con AFP".

The translations should all be verified for their correctness and validity.

As far as we know, there are no tools available which would automate this process, therefore it is recommended to port the environment suitable for multi-lingual application development as the situation will get more complex with time. It is worth pointing out that this would be a major change and would involve a major investment in human resources and time, and should be done in parallel with the actual production system until a stable version is available to deploy. Nowadays, every software development can be tailored to develop this type of applications.

3. Training website

a.   The training website should be available on a CD with a complete image of the server. The training on the BCH is carried out in areas where there is sometimes un-reliable Internet connectivity and the duration of the training is limited.

If an image of the training website could be available then this could be deployed and available for the participants. The training could then be carried out even when there is limited connectivity or during outages.

The data on the image does not have to be absolutely up-to-date as this will only be used for training purposes.

b.   The training website should resemble the live-site exactly and there should be no differences. This is a big problem when the user is trained on an interface or website which does not resemble the live website. It has to be borne in mind that most of the users are not very computer savvy and therefore will have problems when the interface does not match.

4. Email address Harvesting

The email addresses of the users can be harvested quite easily from the BCH portal. This was demonstrated in Bangkok during the second Training of Trainers workshop for the UNEP-GEF BCH Project, when we did the exercises. It would be advisable to verify how secure the data to ensure that this information is not available to spammers.

5. Blank Database

The BCH Central portal database should be available at least for the *Regional Advisors*. The database would have a different set of security credentials to ensure that there are no security breaches.

The *Regional Advisors* can then use the database to familiarize with the structure of the BCH and use it to test solutions provided by donor countries. This would also assist the countries in testing for inter-operability with the *Regional Advisors*, if required.

It is important to have the Data models and Database Schemas for the BCH. If the data structure was available this could be used to reverse engineer and generate a Physical Data model and perhaps taking a step further to develop a Physical Data model.

These data models have already been requested by a few countries and would be required by software engineers.

6. Software Evolution & Maintenance of BCH Central Portal

The BCH Central Portal is upgraded at regular intervals due to various reasons like bug-fixes, improvements in technology, new decisions by MOP and so on. However, with every upgrade, new bugs (errors) are introduced in the system. This is normal for any system and therefore extreme care needs to be taken whenever an upgrade or update is carried out. When fixing a problem, it is important that new errors should not be introduced in the system. This leads the system to be perceived as unreliable and unstable.

Once the confidence of the user is shaken on a system due to a system being in-correct, unreliable or un-available, it takes a long time to rebuild this trust.

It is imperative that the upgrade process is monitored carefully and the system deployment takes place in controlled manner. This implies a system of extensive checking with a set of tools and processes is developed to carry out this process. This could be done by having a test-server

where the upgrade or fixes might be applied by the developer and extensive tests carried out before applying the changes to the live website. This would ensure minimal downtimes on the live portal.

Whilst the developer carries out testing at the component and integration levels, the system testing should generally be carried out by independent testers. This ensures that the whole system is validated by exercising the architecture through the functional and system requirements.

The testing of the system is an ongoing process and should be *integrated* into the development methodology of the system.

The system testing should provide 100 percent coverage of all functionality, including error handling and recoverability.

It would be important to document the revisions in a form either "History of revisions" or "Release notes" which would document clearly how and what changes are done on the BCH Central Portal.

7. *National BCH applications and Interoperability with the Central Portal*

The central portal is designed to be interoperable with the parties national BCH systems, where the information is posted on the local portal and updated automatically on to the central portal by either using the "pull" or "push" methods.

Figure 8

The parties will be developing their systems using a diverse set of tools based on the needs of the country, available
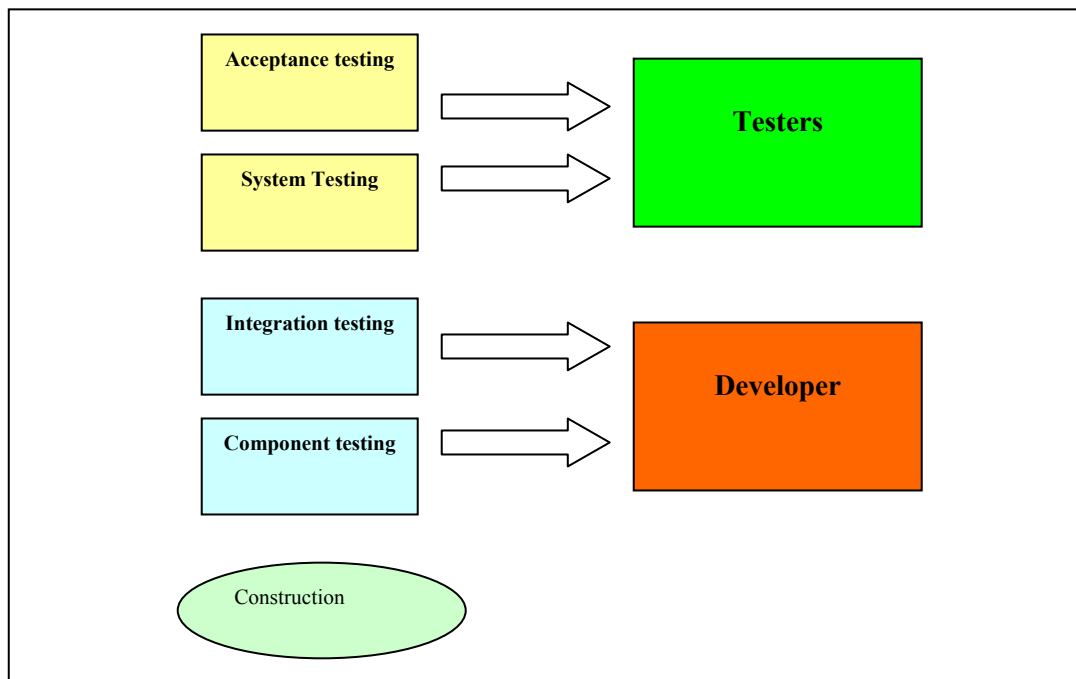
Resources, funding and so on. At the moment the documentation available to build such an application and make it interoperable is very limited. This puts a "de facto" barrier on the countries that would try to implement a national, interoperable solution with the central portal.

Documentation needs to be developed which would describe the outline structure of the central BCH, standards that need to be implemented to make a system interoperable with the central portal. The documentation should contain information on the XML Schema to be used, for example, along-with some examples of code snippets to show how the interoperability will work.

This document will obviously be not a static one, as the BCH portal is constantly being developed and upgraded. However, any documentation will have to be updated on a regular basis to fall in-line with the developments of the central portal. This information needs to be accurate and not have any discrepancies as parties/countries will be relying on this to manage and implement their systems.

The first aim when we proposed the research work to a panel of software engineer bachelors of the Catholic University of Uruguay was to create documents to later export to the Central Portal. As transferring information using the crawler or the BCH web service is a very trivial task, we got to the problem of constructing the correct files for transferring. At first, this appeared to be a very easy task, as long as we knew HOW to construct them.

For a country that has decided to have its own national BCH system, there can be two situations facing them on interoperability issues.

1 – the country has already developed its national application, and the data types used do not comply (completely or partially) with the common formats specification

2 – the country still does not have an application, and is ready to start designing it.

In the first case, country would need to translate its data to a suitable common format, before constructing the XML files to be transferred.

In the second one, it is best for the country to design the application from the beginning based on the published common formats.

In both cases, the country needs complete specifications to write the XML files and comply with the common formats.

A research task was proposed about how to develop middleware components, in different platforms (JAVA and .NET), using different components, techniques and tools, to allow the easy construction of BCH applications based on the published information that could automatically generate correct XML transfer files and interoperate with the BCH Central Portal both via the Crawler (option 3) and using the BCH Web Service (option 4).

As currently the BCH Web Service 3.0 is being developed and we were told that it would be released soon, we understood that this version should be the target of the research.

There were 10 research groups, analyzing several different alternatives.

The working groups were formed with 4th year software engineering bachelors, all of them with one or two years working experience in leading software industries.

Under normal circumstances, this should have been a very easy task: extracting software classes from published XSD schemas (which reflect the required structure of the XML files to be transferred) can be quickly accomplished using existing well-proved tools.

But the problem is that these files contain several nested complex structures, not well documented, and in some cases it is not possible to even know how to fulfill them. In other cases, the published information (XSD files) is incorrect. These errors were reported to the SCBD. Students also put some questions in the interoperability forum. Recently, Colombia developers have also posted the same questions on the forum.

Many documentation problems were encountered that made it impossible in several cases to produce the correct registers.

- In Header field (all XSDs), missing DATE and SOURCE fields. When trying to transmit a record validated against this schema, the server throws an error. Server is not validating data against the schema. Adding those fields manually resulted in the file being accepted, which is incorrect (in sight of the published schema).

- Lack of XSD diagrams made it difficult for the developers to understand the whole picture, as there are many cross-relationships between the different records and between these and many other internal data types.

- In many XSD specifications, the cardinality options are not fulfilled by the existing databases (typical example: UniqueIdentifier in Modified Organism is declared as mandatory but we can see that there are many LMO records (?) that lack this field. So the XSD schema does not reflect the corresponding database structure, if it did, there could be no record with no UniqueIdentifier in the database ("not null" column).

- In all the XSD files there are some references to BCH database internal identifiers that are not documented, or their documentation is not linked to the definition, making it impossible to know how to link them, leading them to the impossibility of creating and transferring the document.

- When carrying out a deeper analysis of the implicit relationships, the BCH Central Portal makes extensive use of Common Formats and Controlled Vocabularies (Thesaurus). Both of these are documented in the website; but not from the point of view of a software developer acting as a "consumer". For example, if a country's software team is developing their national BCH application, they will have to refer to controlled vocabularies entries in almost every record or object class designed into the system. How do they get (using software to query, and not manually) the corresponding controlled vocabularies in order to use them in the application? The development team needs the current controlled vocabularies data bases in order to be able to integrate them in their software. This is one of the things that makes using option 3 very limited, as the local application will always need to be fed with these kind of data FROM the Central Portal (something that cannot be achieved using just option 3).

Using the Web Service allows an application to send data to the BCH but also to receive data from it. Normally an application will have to be fed with several information that will reside in the Central Portal in order to provide the user lists of choices, identifiers that would be used in other records, etc.(like LMOs identifiers referenced in a risk assessment record). These kinds of data will be continuously changing, so the national application will have to be updated with it. If the application just uses Option 3 to communicate with the Central Portal, this process will have to be done manually. Using the web service query function provides a very easy and straightforward way of doing it automatically. Again, detailed documentation about how to construct the query should be made available.

Common Formats and Controlled Vocabularies should be provided in a structured database, perhaps in two or three of the most common relational database engines available. These databases (a set of related relational tables) should be properly "normalized", and the databases' structure published, along with corresponding DDL SQL sentences for creating the database's structure. There is also a need for a method that allows for an automatic update of local common formats and vocabularies databases from the Central Portal, as these can change over time.

Here are some conclusions about national application development and interoperability with Central Portal:

- It has been demonstrated beyond any doubt that using the crawler (option 3) or the web service (option 4) are both very simple tasks.

- The difficulty comes at the time of generating the correct XML files (that would be transferred using either option) because there is a very important lack of documentation, or it is very sparse and can't be found, and in some cases the documentation is not correct.

- The research groups created several applications that generate XML files based on published schemas, over different platforms and languages, and using several different components and plug-ins available for software developers, demonstrating that building a simple national application and making it interoperable with the Central Portal should be a simple task, given that the complete and correct documentation were available for software developers. There are also some sample applications that demonstrate how to publish (for example in the same SCBD server) a service that can construct the XML files based on XSD schemas maintained at BCH level, thus isolating the country application from the need to be updated if these schemas are changed by SCBD – a common maintenance task – and other sample web- based applications that encapsulate all the transferring functionalities.

- It is almost impossible to figure–out all the complex relationships related to the controlled vocabularies just reading the definition of each entry. And to make matters worse, not having these vocabularies available as a whole unit (with documented diagrams / data model based information) to be imported by an application, it is almost impossible to build one that complies automatically with all the stated requirements.

Based on our research and conclusions we would highly recommend the SCBD develop a comprehensive set of documentation specifically oriented to application software developers, containing all the required data and documents (models, diagrams, schemas, etc., and sample code in different platforms and languages), assembled in a meaningful way.

8. Security

An analysis needs to be carried out to assess areas of the BCH central portal which are necessary for any system. These are the areas of *long-term sustainability*, *continuity planning and disaster preparedness*.

Long term plans for the BCH portal would have a complete analysis of the steps and procedures that should be taken to ensure the sustainability of the system. This is very important since countries and parties would be relying on the system and would develop their systems to work with the central portal.

Continuity planning and disaster preparedness will have plans and systems in place for steps/actions to be taken in the case of unforeseen disaster. This would involve systemic redundancies, availability of communication networks, and should include testing mechanisms to verify the viability and effectiveness of this preparedness system.

This would be required only in case such systems & procedures are not already in place and would require an in-depth study of the existing systems. As pointed out earlier, it is imperative that the system is tested on a regular basis to ensure that all systems and procedures are tested to check all recovery strategies are reliable and effective.

The availability is a characteristic of the information system which can be quantified by using parameters like *uptime, downtime, mean time between failures and mean recovery time*, among others, involving all the system components, like different pieces of hardware, software, communications and accessories.

Depending upon the requirements for system availability and what is considered as tolerable to have the system out of service, these parameters should be analyzed and the required values incorporated as targets in the system, becoming *non-functional* requirements.

Extremely critical systems have different levels of redundancy built-in (double/triple systems, automatic changeover and so on), but all these solutions have direct implications on cost and complexity. A *risk and cost-benefit analysis* would be advisable to decide the most suitable solution.

9. Biosafety Information Resource Centre

The Biosafety Information Resource Centre (BIRC) is accessed from the home page of the portal under the Resources Section (see black arrow – figure 9).

The user is taken directly to the search page of the BIRC and there is no description or explanation on the BIRC (see figure 9). It would be advisable to have a description on this page, like clicking on a button, "What is BIRC". The description is actually available under the Other Resources section (see red arrow – figure 9).
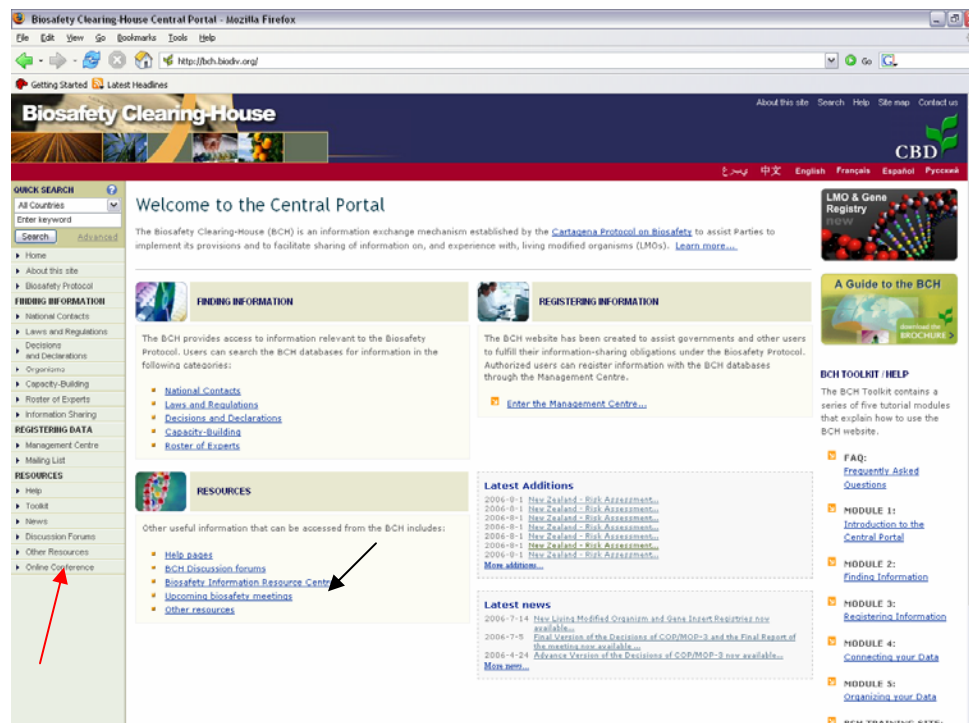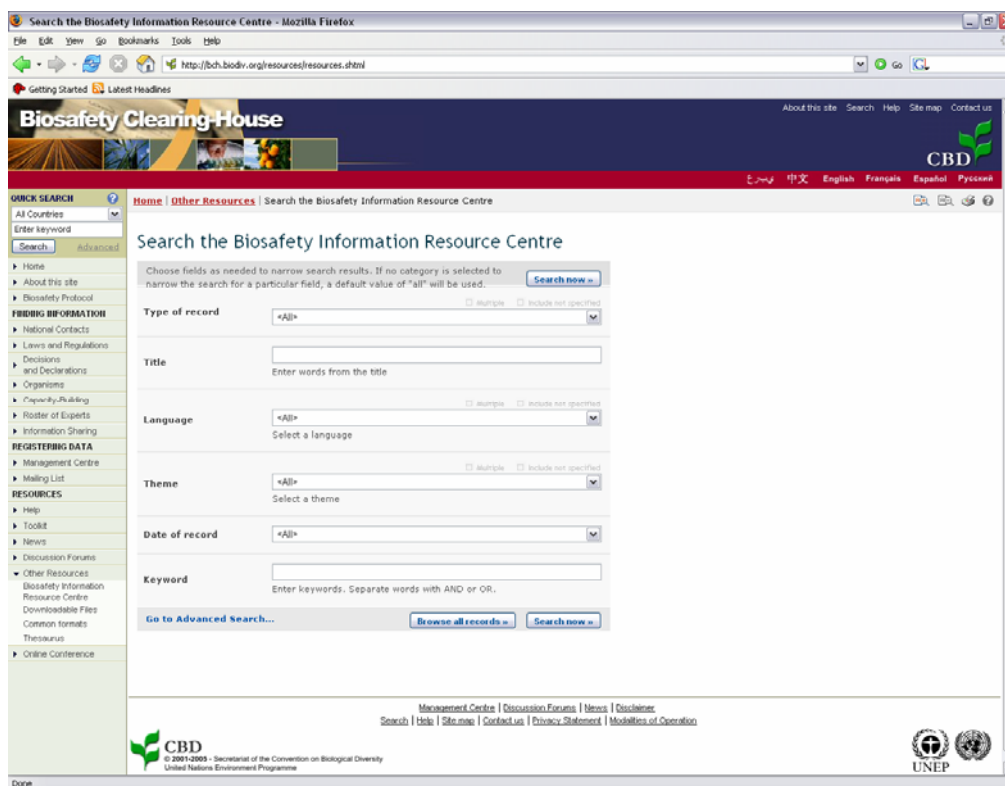
Figure 9 – BCH Home Page

Figure 10 – BIRC Search Page

The description of the BIRC does not give a clear understanding of how this resource is compiled and/or validated. It would be advisable to specify what criteria are used for publishing and whether there is a public invitation to submit the resources to BIRC or if it is identified by the SCBD only.

Biosafety Information Resource Centre

The Biosafety Information Resource Centre is a "virtual library" consisting of catalogues of information, scientific data and resource materials relevant to biosafety capacity-building produced by various organizations and Governments. These may include: training materials, course catalogues, operational toolkits or guidelines, workshop reports, paper and presentations, case-studies, technical publications, newsletters and journals, legal documents, project profiles, project proposal preparation materials and others in form of publications, CD-ROMs or other media. Search here.

BIRC Advanced Search

The BIRC Advanced search has a field to select the source of the publication and this is a free-format text field, a pop-up menu could be better suited. It does not work when searching for records from a particular source. For example, if you select source ICGEB or BCH-CP or OECD or any other source it produces 0 results.

However, if the user searches for all the records, the result shows documents with the source "ICGEB", BCH-CP and so on. See Figure 12 and 13.

Figure 11 – BIRC Advanced Search Page

Figure 12 – BIRC Advanced Search Results

Figure 13 – BIRC Advanced Search – All Records

In the BIRC advanced search "Language" entry field a suggestion has been made to include "Other", if this is a possible option, in order to make it easier to select non UN language postings.

Figure 14 – BIRC Advanced Search – Language Option

10. Online Help

Getting help directly when browsing the BCH is a very useful feature. Unfortunately, the website is in constant evolution and help documentation (including toolkits) are not updated regularly. On top of this, all help files need to be regularly translated in the 6 UN languages. To maintain the Help files correctly demands a huge time & resource investment.

To simplify the updates of help files and toolkit a simplified solution should be found so that help files editors (in house or external) can access and edit those files directly within the website. This requires that any changes on the BCH website is clearly and historically documented (see Migration of BCH Central Portal), allowing the editors and translators to roll back and modify the help files accordingly.

Concerning the toolkits section, a neat solution should be found to extract and put together all help files in one toolkit. We would take the help files as source files of the full toolkit and not the other way round which is the case today.

Generally a discussion/brainstorm needs to be done with users, developers and editors on ways to streamline the creation and maintenance of help-files.

11.   Management Center

When a user enters into the management centre, s/he has two possible actions:

- Add a new data or
- Manage existing data.

It would be more practical and convenient to show the list of all data s/he owns. Next to the titles you would have the different possibilities: edit, copy, un-publish and the status (published, draft, etc). All documents should be ordered by type (CNA, decisions, laws, etc). In front of type category, you would have a "new" link to add a document of this type. At the end the whole management of data is done from one page only instead of two.