Abstract

The evolution of the SDI, especially in spatially enabled societies, focuses on society and not solely the traditional users of geospatial information.

The dramatic growth and availability of geospatial data, products and services through the Web requires that people have a basic knowledge of ICT skills and Web 2.0 tools in order to make the most of them.

In summary, thinking of society in a broad sense, and considering that people have basic knowledge of ICT and Web2.0 tools, with the aim that they benefit from improved data, products and services that SDI provide, necessitates that issues such as the following are considered:

- The integration of society from the point of view of digital literacy.
- Contributions that can be made by formal, non formal and informal education.
- The principal features of the places where the intention is to undertake certain strategic actions.

This paper focuses on the Latin American context and discusses some initiatives that are developing or have developed, while referring to the following:

- The creation of the Latin SDI Community, which brings together researchers from Argentina, Bolivia, Chile, Colombia, Costa Rica, Ecuador and Peru, collaborating in academic and scientific aspects on Spatial Data Infrastructure.
- The principal results of training activities undertaken in the context of Project A/024521/09 "Training and knowledge management with Web 2.0 tools for university education, administrative and educative management, and continuing professional development in Argentina, Chile and Ecuador".
- The creation of a Research Group "Information and Communication Technology and Geospatial Information" at the National University of Patagonia San Juan Bosco, Argentina.

The paper concludes with the contributions, results and reflections achieved to date through the described initiatives and proposes courses of action for the future.

**Keywords:** SDI community, ICT, Web2.0 tools, no formal education, informal education

1 INTRODUCTION

The fast evolution of the Internet and the Information and Communication Technologies is highly superior to the ability of the people to get used to it and to understand it.

Many people, such as professionals, technicians and members of the society in general, may have a very valuable knowledge, but it remains hidden. The use of the Internet and the Web 2.0 tools is still an obstacle.

To think about the Internet as a tool for seeking information, but not as a Web 2.0 environment with interaction, is a handicap for many people.

This situation can be seen in many environments, including the Spatial Data Infrastructures (SDI) and related issues, taking into account the fact that the whole society is participating in the SDI when it is considered in a wide sense.

Therefore, the situation mentioned above was considered to develop a Project, including researchers from: Universidad Nacional de Educación a Distancia (UNED) from Spain, the Universidad Nacional de la Patagonia San Juan Bosco (UNPSJB) from Argentina, the Universidad de Concepción (UdC) from Chile and the Escuela Politécnica del Ejército (ESPE) from Ecuador. This Project A/024521/09 is titled: “Training and Knowledge Management with Web 2.0 tools for University Teaching, Administrative and Educative Management and Continuing Professional Developement in Argentina, Chile and Ecuador”- CGCweb2.0.

The project was supported by the participating universities and funded by the Spanish Agency for International Development Cooperation (AECID).
In (Alvarez et al, 2010a; Rosanigo et al, 2011) this project is described in detail and partial results are mentioned. This paper details the final results of the developed courses through distance education.

The evolution of the Internet has given rise to Web 2.0, having expanding the ways of interaction and collaboration in the context of the network.

According to (Castells, 2000) networks constitute the new social morphology of our societies.

The evolution of the Web has increased the means of communication with significant impact on social Networks. Considering social networks, according to the definition given by (Castells, 2001), these networks are, at present, one of the most powerful and innovative social structures for online work.

(Alvarez et al, 2012b) considers that in the beginning, social networks were used mostly for informal communication. They were thought as applications to be used in spare time. But, an important potential was hidden. They could be used with many other objectives, for example the creation of new opportunities. These opportunities are very attractive for many purposes, but, there are still some obstacles like the digital gap. This digital gap gathers the connectivity limitations and the minimum of digital culture knowledge that is necessary for using these technologies.

In terms of contributing to the formation of people in order to achieve a basic digital culture, different experiences have been seen through projects involving universities, one of which is the Project A/024521/09.

(Goodchild, 2007) considers that Web 2.0 has changed the way we engage with information online. Users are no longer relegated to being mere consumers but now simultaneously interpret and produce information.

In the Web 2.0 information and content is produced and shared directly or indirectly by users. (Coleman et al, 2009) mention that “What is different with Web 2.0-based contribution initiatives is the more influential role assumed by the community”.

Regarding to Web2.0 and SDI, (Delgado et al, 2009) mention that Web 2.0 has allowed to see SDIs under other paradigm when, additionally to the standardization and the uniformity inherent to top down development, the incremental contributions and the heterogeneity and diversity become crucial.

Concerning geospatial data and services (Honsrud, 2010) considers that: to spatially enable all sectors of society to better address immediate and long-term
challenges related to transportation, housing, disasters, health, energy, climate, water, weather, ecosystems, agriculture, and biodiversity, there is a need to greatly enhance ready ability to find and use relevant geospatial data and services.

The initiative Latin SDI is the result of an enterprise that began locally at the University of Cuenca, supported for four years by the Spanish Agency of International Cooperation for Development (AECID) which has since its inception marked an academic perspective to be implemented directly in the University (http://www.aecid.es). The natural growth of the initiative was subsequently framed using the capacities of the advanced national network of Ecuador, CEDIA (http://www.cedia.org.ec). In this way we obtain an additional feature, unstudied so far, which was the strengthening and the commitment of higher education institutions in placing at the disposal of researchers and academics, all information produced internally in the institution.

This work, in partnership with and supported by the National Research and Education Network (CEDIA) becomes so relevant that a model for the implementation of SDI's is established with enough success that it can be followed closely by the country's public institutions. Therefore, at no time are initiatives duplicated in creating sub national SDI's since the setting up of the RedCEDIA SDI could be considered, although other similar model in South America not unknown, one of the few that is strengthened so that CLARA drives to be the community to promote the creation of similar models in other countries of the CLARA network in South America. Thus, Latin SDI becomes a one of the communities of RedCLARA with the most participation of members and achieving a wide circulation among the academic community in South America on issues of SDI.

2 UNDERTAKEN INITIATIVES

In terms of the initiatives undertaken, described below is the creation of Latin SDI, the principal results of training activities in context of Project A/024521/09, and the creation of a Research Group "Information and Communication Technology and Geospatial Information".

2.1 Creation of the Latin SDI initiative

The Special Data Infrastructure – UCuenca SDI project, started in 2008 at the Centre for Research & Development & Innovation leaded by Villie Morocho at the University of Cuenca, when they presented to the Spanish Agency of International Cooperation for Development - AECID, project "D/012932/07 Local Development Portal for the Commonwealth of Jubones River Basin as an SDI
Regional Node ", University of Cuenca SDI - IDE UCUENCA. This project was presented in conjunction with the Polytechnic University of Catalonia - UPC, and with the successful European project Spatial Data Infrastructure of Catalonia - IDEC, to be developed from February 2008 to January 2009. The main objective of the project was to place geographical information within reach of those in need such as for planning and development, mainly in the centres, laboratories and programs of the University of Cuenca, etc. (http://ide.ucuenca.edu.ec Figure 1).

Figure 1: Geoportal SDI UCUENCA

In 2009, due to the good development of the project, support was received from the AECID for a second part, with the "D/017397/08 Creation of the SDI Support Centre at the University of Cuenca" with the support of UPC and IDEC. This project ran from February 2009 to January 2010, to provide training to technicians in the creation of new SDIs at national level. (http://ide.ucuenca.edu.ec/index.php?option=com_content&view=article&id=51&Itemid=60, Figure 2).
In the same year, seeking the support and advantages of the National Research and Education Network (Ecuadorian Consortium for Advanced Internet Development - CEDIA), the institution integrated with the proposal and includes approximately two dozen universities nationwide in Ecuador. In this way began the project "IDE REDCEDIA" becoming one of the projects with greater capacity to integrate new members, although initially it would only include three nodes. The project then received support from AECID in a third stage, where also NREN joined the project "D/024038/09 - Creating the Inter-university SDI's Network in the context of CEDIA". By then there were more than seven universities with developed geoportals integrated and among the internal nodes were: Salesian Polytechnic University, Bolivar State University, Autonomous University of the Andes, Technical University of the North. (http://ide.cedia.org.ec, Figure 3).
In 2011, AECID undertook the final phase of the project IDE REDCEDIA AECID under the project "Creation of the Inter-university SDI's in the CEDIA context" D/030676/10, that obtains as a result a study of the impact of the use of Spatial Data Infrastructure. Due to this AECID grant the project the maximum number of years of funding, due to its success.

In 2011 the project LATIN SDI that comprise seven Latin American countries: Ecuador, Bolivia, Chile, Colombia, Argentina, Peru and Costa Rica was presented to the Communities of the Latin American Cooperation Network of Advanced Networks - COMCLARA 2011 program. This project is led by the same group working at the University of Cuenca. In this way the recognition and support of RedCLARA was gained as one of the winning communities in a contest at South American level.

The community plans to end in May 2012 outlining information that will help identify ways to support search in metadata indices introduced to facilitate the search for natural disaster relief, in context of both prevention and management. This would mainly allow access to updated and organized information of the main generators of academic information in those countries. Looking back, this information could be made available to any government entity that requires identification of digital files in cases of natural disaster prevention, and when they happen, they would have a tool capable of supporting the identification of information pertaining to the devastated areas.
This is the growth of the UCUENCA SDI (Local Area) to LATIN SDI (Latin American Area), confirming that with perseverance and dedication an internal project of the University of Cuenca, can grow to be a replicated large-scale project (Figure 4)

Figure 4: growth of the UCUENCA SDI to LATIN SDI

2.1.1 Development of the UCUENCA SDI into the Latin SDI

The LATIN SDI community has its roots in the first meetings in preparation for proposals launched by CLARA in Peru in 2009. In this manner relationships were established between researchers and national networks of Argentina, Bolivia, Colombia, Costa Rica, Chile and Peru, but consolidation was realized in 2010 with the work the University of Cuenca was conducting with CEDIA. Thus, in the call for the creation of the CLARA communities, acceptance of this community was gained which has has among its objectives:

- Promote the implementation of sub national SDIs of academic nature in each of the participants.
- Reuse geographic information generated in a project for other different purposes.
- Display geographic information in an effective, convenient and easy way.
- Organize geographic information generated by the universities with the help of metadata.
- Train and update members of the community in technology transfer and generation of lines of inquiry about SDI's.

The community formally established in May 2011 with the participation of thirteen institutions from Ecuador, Peru, Colombia, Costa Rica, Chile and Argentina (Figure 5).

In the course of the activities of the community, the national members of Ecuador have increased to 15, and on international level are included not only academic interests but the interests of national governments. The latter come from Bolivia, Argentina, Mexico and Uruguay.

2.2 Principal results of training activities undertaken in the context of the Project A/024521/09

In order to increase knowledge of Web 2.0 tools with interested groups: university teaching, continuing professional development and educational and administrative management of rural communities, five types of courses were designed, developed and delivered. The courses are detailed below:
- **Enhancing social interactions through Web 2.0**: Introductory Course based on the use of Web 2.0 tools for interaction in social networks. Duration 5 weeks, 40 hours.

- **One approach to the use of Web 2.0 tools for professional development**: Introductory Course based on the use of Web2.0 tools for online edition of texts, spreadsheets and forms. Duration 5 weeks, 40 hours.

- **Project Management through Web 2.0**: Introductory Course to use groups and calendars for Collaborative Project Management through the Internet. Duration 5 weeks, 40 hours.

- **Introduction to Design and Administration of Moodle virtual classrooms**: Course oriented to the acquisition of skills to manage virtual classrooms on the Moodle platform. Duration 8 weeks, 64 hours.

- **Editing digital photos with the Picasa tool**: Introductory course in digital photo editing, for improving images, send them by email, create online albums and much more. Duration 5 days, 40 hours.

The courses were focused to the recipients, following the three action strategic lines of the project, accompanied by practical tasks in order to optimise the teaching-learning process.

Admission to the courses was realised through the project web site and data collection was done through a Web form that built a database of participants with relevant information, so that later data such as level education, country of origin, institution where he works, and so on could be obtained.

The courses were designed, developed and taught by members of the CGCWeb2.0 project, with an University being responsible on each occasion. All courses were taught by distance learning using Moodle. Participating students were from different backgrounds and culture, mainly from the following countries: Chile, Argentina, Ecuador and Spain and to a lesser extent from other Latin American countries.

The course "Enhancing social interactions through Web 2.0" was developed by a team of professionals from the Polytechnic School of the Ecuadorian Military and was repeated on two occasions, covering an enrolment of 247 students.
The course "Approaching the use of Web 2.0 tools for professional development" was developed by a team of professionals from the University of Concepción in Chile and was repeated twice, covering an enrolment of 494 students.

The course "Introductory Course to Moodle", "Editing digital photos with the Picasa tool" and "Project Management and Web 2.0" were developed by a team of professionals from the National University of Patagonia San Juan Bosco with an enrolment of 411 students (139, 118 and 154, respectively).

In addition to members of the CGCWeb2.0 project team, advanced students and academic staff from the participating universities in Latin America also collaborated as tutors and reviewers of material.

Over a thousand students were enrolled, 61% from Chile, 20% from Ecuador, 15% from Argentina, 3% from Spain and the remainder from different Latin American countries. The courses "Introductory Course to Moodle", "Editing digital photos with the Picasa tool" and "Project Management and Web 2.0" were developed by a team of professionals from the National University of Patagonia San Juan Bosco with an enrolment of 411 students (139, 118 and 154, respectively).

Table 1 shows the distribution of enrolled students by course and country of origin and Table 2, the academic formation of students.

### Table 1: Distribution by course and country

<table>
<thead>
<tr>
<th>Course</th>
<th>Argentina</th>
<th>Chile</th>
<th>Ecuador</th>
<th>Spain</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Design and Administration of Moodle virtual classrooms</td>
<td>10,1%</td>
<td>60,4%</td>
<td>24,8%</td>
<td>4,0%</td>
<td>0,7%</td>
<td>100,0%</td>
</tr>
<tr>
<td>Editing digital photos with the Picasa tool</td>
<td>37,1%</td>
<td>47,6%</td>
<td>13,7%</td>
<td>1,6%</td>
<td>0,0%</td>
<td>100,0%</td>
</tr>
<tr>
<td>Project Management through Web 2.0</td>
<td>8,3%</td>
<td>58,6%</td>
<td>21,7%</td>
<td>8,3%</td>
<td>3,2%</td>
<td>100,0%</td>
</tr>
<tr>
<td>Enhancing social interactions through Web 2.0</td>
<td>15,5%</td>
<td>55,0%</td>
<td>26,7%</td>
<td>1,2%</td>
<td>1,6%</td>
<td>100,0%</td>
</tr>
<tr>
<td>One approach to the use of Web 2.0 tools for professional development</td>
<td>12,2%</td>
<td>67,8%</td>
<td>16,3%</td>
<td>2,3%</td>
<td>1,4%</td>
<td>100,0%</td>
</tr>
</tbody>
</table>
Table 2: Distribution by course and academic formation

<table>
<thead>
<tr>
<th>Course</th>
<th>Post-graduate</th>
<th>Graduate</th>
<th>Tertiary</th>
<th>Secondary</th>
<th>Primary</th>
<th>No Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Design and Administration of Moodle virtual classrooms</td>
<td>2,0%</td>
<td>84,6%</td>
<td>9,4%</td>
<td>2,7%</td>
<td>1,3%</td>
<td>0,0%</td>
</tr>
<tr>
<td>Editing digital photos with the Picasa tool</td>
<td>2,4%</td>
<td>74,2%</td>
<td>12,1%</td>
<td>7,3%</td>
<td>0,8%</td>
<td>0,0%</td>
</tr>
<tr>
<td>Project Management through Web 2.0</td>
<td>3,8%</td>
<td>86,0%</td>
<td>8,3%</td>
<td>1,3%</td>
<td>0,0%</td>
<td>0,6%</td>
</tr>
<tr>
<td>Enhancing social interactions through Web 2.0</td>
<td>3,1%</td>
<td>80,2%</td>
<td>4,3%</td>
<td>7,8%</td>
<td>4,7%</td>
<td>0,0%</td>
</tr>
<tr>
<td>One approach to the use of Web 2.0 tools for professional development</td>
<td>3,1%</td>
<td>77,9%</td>
<td>9,7%</td>
<td>5,8%</td>
<td>3,5%</td>
<td>0,0%</td>
</tr>
</tbody>
</table>

Each course syllabus was organized into thematic modules where the conceptual contents were distributed and various practical activities were provided, where the students were required to work in groups and to use all the tools of communication that were at their disposal.

The training material was developed modularly as learning objects, in "pdf" format for printing and "html" for navigation.

The concepts presented throughout each course were associated with a variety of practical activities, so as to ensure proper management of studied Web 2.0 tools.

In order to be better acquainted with students, all curses had a common activity, an introductory module which established formal ties and informal communication and unveiled in detail the course content, mode of work, develop activities, assessments, deadlines, etc. Also during the period set aside for that module different initial activities were contemplated in order to better learn about the students, stimulating and improving the participation throughout the course.
2.3 Creation of a Research Group "Information and Communication Technology and Geospatial Information"

The National University of Patagonia San Juan Bosco, Argentina, by way of Ordinance C.S No. 131, 2009, established the legal framework for the creation of Research Groups.

Under the Ordinance C.S. No. 131 "Laboratories or Groups are units of scientific research and / or specialized technology in a discipline or branch of knowledge ". Through this Ordinance it was possible to present to the Faculty of Humanities and Social Sciences at the University of Patagonia San Juan Bosco the project for the creation of the Research Group "Information and Communication Technology and Geospatial Information". The project was approved by the Faculty in 2010, concluding the corresponding procedure at the University in 2011.

2.3.1 Objectives and research lines

The Research Group aims to develop the following issues and actions:

**Research Subjects**

- Information and Communication Technologies
- Application of ICT in teaching, research and communication.
- Spatial Data Infrastructures.
- Land Information Systems.
- Geographic Information Systems.
- Land Management.
- Information and knowledge management.

**Type of actions to be carried out**

- Research Projects.
- Development projects and applications.
- Creating synergies among projects.
- Production of content for teaching, research and communication with the aim of diffusion, dissemination and popularization of science.
- Contributions in different virtual spaces: Distribution lists, social networks and virtual communities.
- Organization or participation in live and / or virtual events. Publications aimed at scientific events, journals and books, among others.
- Contribution to the formal, non formal and informal education. Training of human resources.
- Contribution to capacity building and talent management. Management of financial resources for projects or other activities.
- Enhancement of collaborative work in network. Participation of members of the Group in activities aimed at their training and its application in activities of the Group.
- Organization of videoconferences, online courses or other actions.
- Contribution to management for the signing of Agreements with Institutions related to the objectives and lines of research of the Research Group.
- Interaction with academic, scientific, and nongovernmental organizations, private sector and civil society on issues concerning the objectives of the Research Group.

Some members of the Research Group have been working together for several years before the Group was formally created.

3 CONCLUSIONS

Mentioned below are the main results with respect to each of the initiatives described.

3.1 Latin SDI initiative

It should be noted that the model followed by the Red CEDIA SDI that was the result of two years experience with the UCuenca SDI, has created a model of implementation and appropriation highly suitable to South America.

It should be considered that the main problem for the establishment of a sub IDE in Ecuador had always been the impossibility of "imposition" without a rule, regulation or law on geographical information generated by the institutions. However, the Ucuenca SDI project (funded by the AECID for 4 years), continues to grow and integrate new nodes, becoming a model for other countries. The same interest aroused interest at the government of Ecuador, as in the case of SENPLADES (National Secretariat of Planning and Development), attest to the capacity development undertaken and achieved in this project.

On the other hand, considered as one of the successful projects which have combined the capabilities that Advanced Networks have to enable the strengthening of relations within the sphere of research, and also technologically, perhaps the capacity for high availability and advanced network speed causes the use of geospatial information is seen in better light by scholars and scientists from the universities that conform RedCLARA and its members such as CEDIA.
With the Latin SDI community in place and work carried out with its researchers, this allows for the implementation of SDI, based on the model adopted from Ecuador, in the hope of repeating the same success.

The peculiarity of the implementation of the Red CEDIA SDI lies mainly in that it was not based on a mandate issued by the State or an international body such as is the case of the rules issued in Europe by INSPIRE. Obviously, INSPIRE has enabled the SDI's in Europe to continue in unstoppable growth. However, in Ecuador, for several reasons related to Latin reality, this was not possible. In fact a proposal for national SDI in Ecuador had been submitted in 2005 but had too many problems to be effectively a national SDI because it was planned in a centralized manner, from within the Military Geographic Institute. The problem of wanting to make a top-down model lies in the inability of management to integrate information. However, the empowerment from a bottom-up model, and especially the possibility that the primary actors are universities that are not intended for profit, has managed the implementation of SDI's in these institutions, is welcome.

Another important point is that in many cases, the SDI's implementation was conditioned by high training costs or certain private initiatives even more "profitable" that were obviously out of context. Therefore, as this is a project that was funded by AECID and in achieving training and dissemination of non-profit SDI solutions, it has made this initiative grow exponentially becoming what is now RedCEDIA SDI and what is hoped that will be replicated in LATIN SDI.

3.2 Project A/024521/09

Through the collaborative group work of the four countries, a framework of partnership for this project with projection to other strategic actions raised in the future was established.

The execution of the project has contributed, within the thematic content, to:
- policies for development in Science, Technology and Innovation;
- a general objective to promote the generation, appropriation and use of scientific and technological knowledge to improve living conditions, economic growth and social equity.

3.3 Research Group

The creation of the Research Group "Information and Communication Technologies and Geospatial Information ", is considered a vital step taken to make contributions to the formal, non formal and informal education in the fields of competence of the Group.
The Research Group has been conceived as the umbrella under which its members can give flight to their ideas, innovative proposals, projects and other strategic actions that contribute to their personal growth and production in the research lines of the Group.

The fact that the Group covers the two main areas, Information and Communication Technologies on the one hand and Geospatial Information on the other gives way to ICT applications as well as the Spatial Data Infrastructures and related issues.

Regarding new opportunities, the Research Group that has been formally created make it possible to carry out a wide range of future actions.

As a final thought in this work, which has included the development of three initiatives that contribute to the SDI from Latin American Universities, a special mention should be made of Latin SDI for both its contribution to the development and implementation of SDI, also Project CGCWeb2.0 for its contribution to training in Web2.0 tools, and the ICT and geospatial information research group for the broad range of actions that enable its research lines.

REFERENCES


