GeoServices - 4 - Sustainability (GeoS4S) An International Collaboration Framework for Geospatial Education

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Abstract
The applications of Geospatial science are expanding rapidly and increasing demand of high quality Geospatial education is exerting pressures on educational institutions for producing fit-for-job graduates. It is not easy for individual institutions to change their curricula and teaching materials frequently to keep up the pace with the fast changing dynamics of job markets. International collaboration provides opportunities of pooling resources and sharing know-how which help in tackling these ever emerging challenges efficiently and effectively. GeoS4S project presents a framework for enhancing the role of international collaboration to serve educational needs of the students in various fields of Geospatial sciences. The project consortium is composed of ten universities located in Europe, China and Thailand. The experts involved in the project have a range of disciplinary backgrounds adding strength to the consortium. The major objectives of project are to develop teaching/learning materials of 20 interdisciplinary modules, organise international summer schools for testing the quality and applicability of these modules and integrate these in an eLearning platform facilitating worldwide open and free access for benefitting the potential learners internationally. A number of activities have been designed for achieving the objectives as well as for quality assessment and dissemination of the project outcomes. The consortium will complete the activities in a duration of 3 years of the GeoS4S project.

Key Words: ERASMUS+ Project, GeoS4S project, Geospatial Education, Interdisciplinary Education, International Collaboration.

1. Introduction

Ensuring continuous social, economic and environmental sustainability is a fundamental aim of all the countries but priorities and processes appear different from place to place and from time to time. Some fast growing economies (e.g. China, India and Thailand etc.) have been attracting a significant proportion of Foreign Direct Investment over the last decades and this has boosted their economic and developmental prospects unprecedentedly. However, this change is not without side effects that reflect through a number of social and environmental challenges. Growing cities, expanding industry and increasing pollution of air, water and soil are big challenges in such countries and ramify in several adverse effects on the society, environment and sustainable development. Increasing gaps in income levels and living standards, multiplying changes in land use and land cover, expanding epidemics and respiratory diseases, increasing incidence and magnitude of natural disasters etc. are making the society and environment more vulnerable to the loss of life and property. Most of these unwanted problems are Geospatial in nature which can be controlled and minimised if the relevant authorities adopt spatially aware decisions for implementation and monitoring processes.

In depth understanding of Geospatial patterns of various natural, social and economic phenomena require a variety of sophisticate analytical methods and efficient technologies to perform various processes. Geospatial technologies have developed highly sophisticate equipment and effective methods for capturing, processing, analysing and visualising various types of spatial information as well as has the tools to develop Geospatial models for re-presenting the present, re-constructing the past and projecting the future of various phenomena.

The applications of Geospatial approach and their added analytical advantages in a large number of fields have been well established during the recent decades, somehow, these capabilities are not equally developed in all parts of the world.

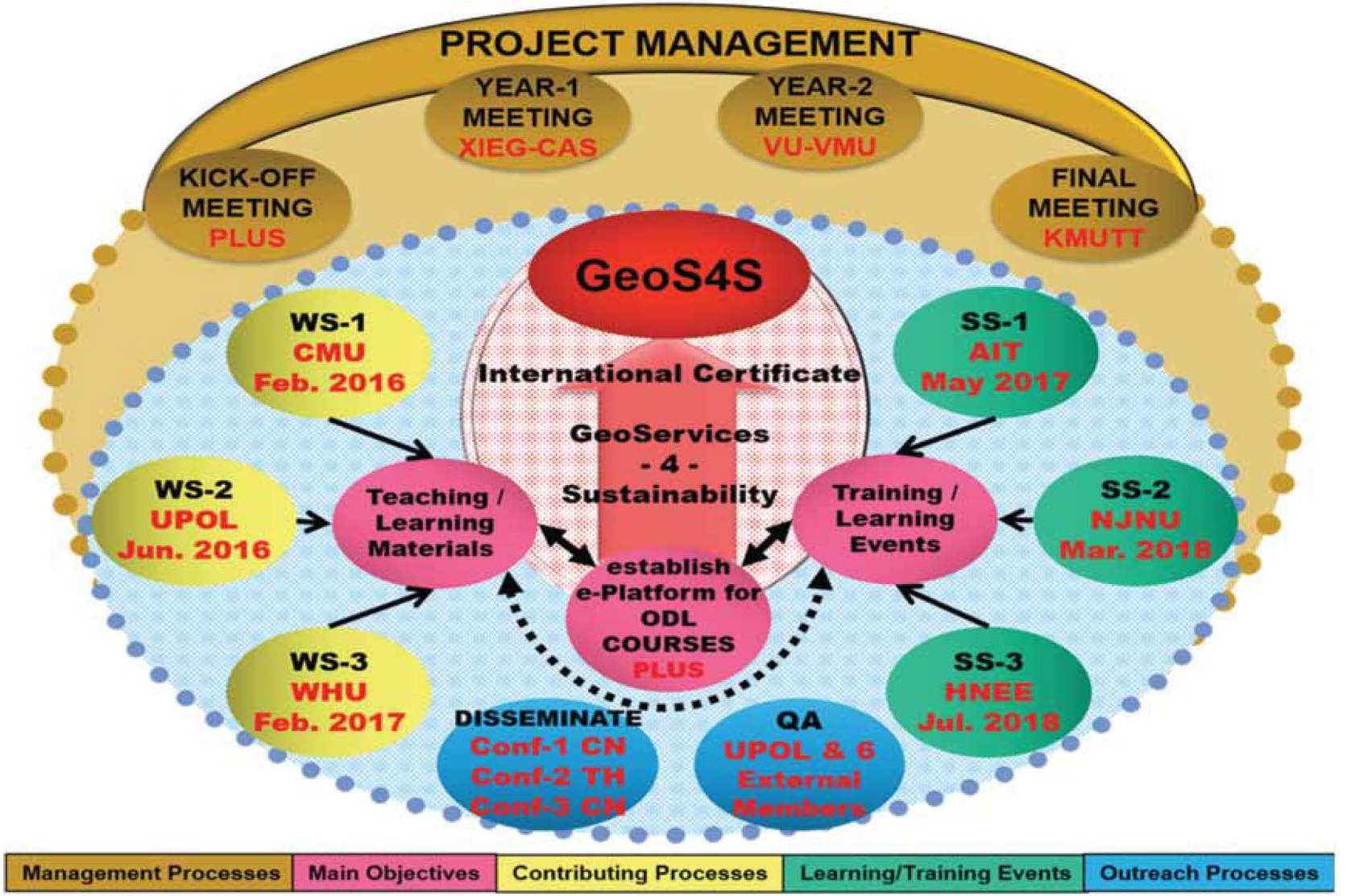

Figure 1: Components of GeoS4S Project and their interlinkages

There is a need of international collaboration among a number of academic institutions for contributing their expert knowledge and practices with other institutions for faster Geospatial capacity building and GeoServices - 4 - Sustainability (GeoS4S) project is an effort in this direction.

2. GeoS4S Project Aim and Objectives

The overall aim of the project is to establish an international collaborative framework for jointly awarding 'International Geospatial Qualification Certificate' to the university level students according to the international competitive standards (see Figure 1 for details). This will be achieved by enhancing the capacity of Higher Education Institutions (HEIs) in conducting Geospatial education and research according to jointly developed curricular structures and widely accepted innovative teaching / learning practices. Such a certificate will be awarded to those completing 24-30 Credits in the European Credit Transfer System from various teaching / learning modules developed by the GeoS4S Consortium.

The project has defined three major objectives for achieving the overall aim:

i. Develop case study based teaching / learning materials.
ii. Impart 'hands-on' practical training of delivering and working with the teaching / learning materials.
iii. Launch an e-Learning platform for open and free access to the teaching / learning materials.

The objectives of the project have been defined in consultation with all the partners following bottom-up approach. This means that each partner HEI had done needs-assessment of their students in relation to the Geospatial skills required in the regional job-markets. This feedback was consolidated to form a strategy fulfilling the needs of individual HEIs as well as serving the common broader interests.

3. GeoS4S Project Consortium

The HEIs constituting GeoS4S consortium have been carefully selected from many other potential partners. The major reasons for this decision are some similarities and some dis-similarities in their expertise complementing each-other which are required for achieving the objectives of the project. Geospatial science provide a common denominator among all the partners as all of them are implementing Geospatial methodologies and technologies in education and research at their home institutions. The individual experts involved in the project teams present a variety of disciplinary backgrounds that provide strong multidisciplinary capabilities to the consortium for achieving the overall aim of developing an international and interdisciplinary collaborative framework for Geospatial education and research.

The ten HEIs member in the consortium located in six countries and the specialties of about 25 experts involved in the project are following:

i. Austria - University of Salzburg (PLUS): OpenGIS, SDI and Real Time GIS
ii. Czech Republic - Palacky University Olomouc (UPOL): GeoVisualization and GeoApp Development.
iii. Germany: Eberswalde University of Sustainable Development (HNEE): Advanced Remote Sensing Methods and Forest Biomass & Carbon Stock Quantification.
iv. Netherland - VU University of Amsterdam (VU): GeoDesign and Indent & Crisis Management.
v. China - Nanjing Normal University (NJNU): Digital Terrain Analysis and 3D City Modelling.
vi. China - Wuhan University (WHU): Smart Cities and Intelligent Transportation Systems.
vii. China - Xinjian Institute of Ecology and Geography, Chinese Academy of Sciences (XIEG-CAS), Urumqi: Arid Ecosystem Analysis and Climate Change Analysis & Adaptation.
viii. Thailand - Asian Institute of Technology (AIT): GIS for Health and Marine & Coastal Resources Management.
ix. Thailand - Chiang Mai University (CMU): Disaster Risk Analysis and Commercial Plantation Modelling.
x. Thailand - King Mongkut's University of Technology Thonburi (KMUTT): Community & Participatory GIS and Geospatial Analysis of Food Security & Sustainability.

4. GeoS4S Project Activities and Outcomes

The consortium has designed number of activities for fulfilling the three major objectives of the project which form a base for achieving the overall aim of the project. The international collaborative environment was generated by organizing at least one activity at each partner HEI as per their willingness and feasibility and experts from all the partner HEIs participated in those activities.

4.1 Objective-1 Activities and Outcomes

The first objective was to jointly develop case study based 'Teaching / Learning Materials' and it was important to decide the type, structure and volume of the materials. This aim was fulfilled by organising three faculty development workshops for the consortium members.

- *Faculty Development Workshop-1: Module Structure and Syllabi Design*
  The first workshop was organised at the Department of Geography, Chiang Mai University, Thailand from February 21st to 24th, 2016. It was decided that teaching/learning materials will be developed in a modular structure. The student learning effort of each module will be equal to 6 ECTS. Each of the 10 partner HEIs agreed to developed teaching / learning materials of two modules according to their expertise and in this way the consortium targeted to develop a total number of twenty modules. About 25 participants did various exercises of developing the structures and syllabi of various modules and one format was finalised for all the modules which has been adopted by all the partners.

- *Faculty Development Workshop-2: Module Structure and Content Design*
  A week-long workshop was organised at the Department of Geoinformatics, Palacky University, Olomouc from June 19th to 23rd, 2016. This workshop focussed on designing the content of the teaching / learning materials in way that it facilitates self-guided geospatial education because these will be made available for open and free access through an e-Learning platform.

- *Faculty Development Workshop-3: International Summer Schools - Structure and Content Design*
  The final workshop was organised at the Department of Geoinformation Science, School of Resource and Environmental Science, Wuhan University, China February 20-24, 2017. focused on enhancing the planning, organisational and managerial capabilities of the consortium members in conducting international academic events like summer schools, intensive workshops etc. The objective was achieved by actually planning the start-to-end process of the 1st International Summer School to be organised by the GeoS4S consortium in Thailand.

4.2 Objective-2 Activities and Outcomes

The second objective was to jointly impart 'Training / Learning Events' for testing the quality, relevance and standard of the 'Teaching / Learning Materials' for the university level students internationally. This objective was fulfilled by conducting three International Summer Schools (ISS) for the selected number of students (maximum 5 students) from each partner HEI making a total of 50 students from 10 partner HEIs. Each ISS had two weeks duration and each partner offered one module in the ISS. Five modules were offered during week-1 and five modules during week-2. Each module had one student from each partner HEI. This means a total 10 students from different countries and institutions attended each module which made it a truly international group of learners. In this way, all the partners could offer one module in each ISS to the international students and different students of each ISS could benefit from participation in two different modules. All the partners offered their two modules in one or the other ISS and collected feedback from attendees for improving the quality of the 'Teaching / Learning Materials'.

- *International Summer School-1*
  Asian Institute of Technology (AIT), Pathumthani, Thailand from May 22 to June 2, 2017
  Total Participants = 51, Male = 29, Female = 22. Total Nationalities = 20

- *International Summer School-2*
  Nanjing Normal University (NJNU), Nanjing, China from March 5 to 16, 2018
  Total Participants = 50, Male = 30, Female = 20. Total Nationalities = 17

- *International Summer School-3*
  Eberswalde University of Sustainable Development (HNEE), Germany from July 9 to 20, 2018
  Total Participants = 48, Male = 25, Female = 23. Total Nationalities = 15

A total number of 149 university level students and young faculty members participated in the three International Summer Schools organised in Thailand, China and Europe. Out of these, 84 (56%) were male and 65 (44%) were female participants. In terms of nationalities, the participants originated from 33 countries with highest number of 45 participants from China followed by 32 from Thailand 32 and 14 from Czech Republic (Figure 2).

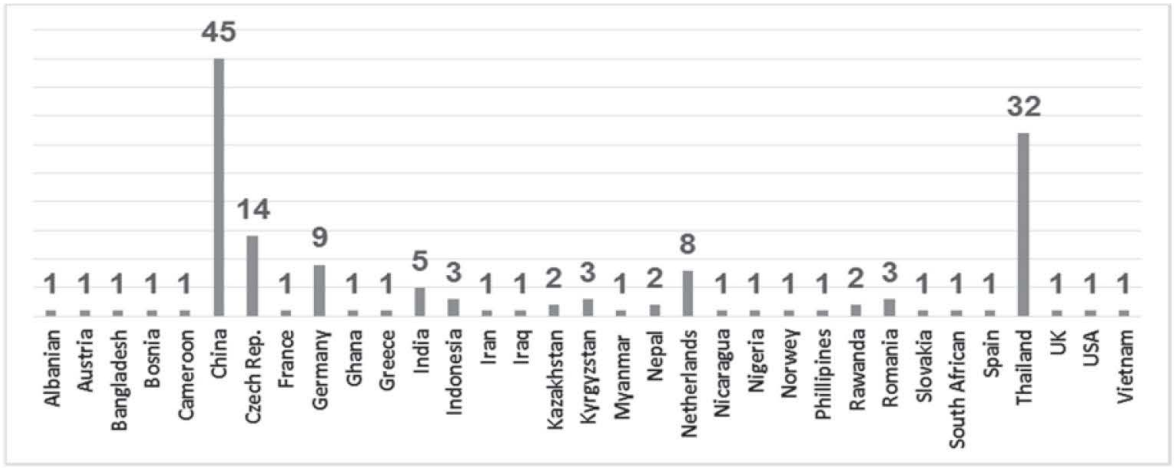

Figure 2: Nationality of the Participants in 3 GeoS4S International Summer Schools

4.2 Objective-3 Activities and Outcomes

The third major objective was to launch an e-Learning platform for open and free access to the teaching / learning materials. This necessitated setting up an eLearning environment on a cloud based system so that the potential users from various parts of the world can benefit from the 20 case study based innovative 'Teaching / Learning Materials' developed by the GeoS4S consortium. However, setting-up a standalone platform or environment for a single project was not a viable choice so an existing platform 'edu academy' (www.eduacademy.at/zgis/course) which is an eLearning Service in Austria was utilised for this purpose. Some of the modules have been already integrated in the platform and these are being tested for their access from various parts of the world as well as for observing any technical issues that may restrict their utilisation.

5. GeoS4S Project Outreach Activities

The project consortium has also designed some outreach activities for enhancing the quality of the project and for disseminating the outcomes for wider visibility as well as for attracting larger groups of potential users of the 'Teaching / Learning Materials'.

5.1 Quality Assessment (QA)

An international QA board of 6 experts (2 from China, 2 From Europe and 2 from Thailand) has been constituted which has the responsibility of assessing the quality of the project activities from the documents and reports as well as through regular monitoring. The QA board provided feedback on the quality of the activities, sets bench marks for achievements and advises for further improvements.

5.1 Dissemination Conferences

These short events are organised for attracting larger audiences outside the partner HEIs and familiarising them with the project outcomes so that they can amass the academic products of the project. There is a provision of organising three conference within the project period.

- *Dissemination Conference-1*
  Nanjing Normal University (NJNU), Nanjing, China on March 10 and 11, 2018
- *Dissemination Conference-2*
  Asian Institute of Technology (AIT), Pathumthani, Thailand on September 13 and 14, 2018
- *Dissemination Conference-3*
  Wuhan University (WHU), Wuhan, China, on September 19 and 20, 2018

6. GeoS4S Project Consortium Meetings

These are organised for discussing administrative and budgetary aspects of the project, formulating implementation plans and devising strategies for generating multiplier effects. One major task entrusted on the

consortium members for the concluding meeting is to set-up a board to monitor the delivery of the modules for awarding an 'International Geospatial Qualification Certificate' to those fulfilling the requirements.

Conclusion

Constituting an international consortium of a large number of institutions working in different socio-economic environments and educational systems is an ambitious and challenging task. Also generating a common interdisciplinary understanding among the experts having different disciplinary backgrounds requires extra efforts for channelizing their strengths. It is essential to organise some intensive events like faculty development workshop for identifying individual strengths and setting common goals. On the other side, it is important to get the project products evaluated by the user groups as well as by the external experts for improving their quality and making these widely acceptable and sustainably useable.

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