

# PROMOTING OF THE GEOSPATIAL METHODS: INTRODUCTION INTO INTERNATIONAL EDUCATIONAL COURSES IN ENVIRONMENTAL PROTECTION AND DISASTER RISK MANAGEMENT

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**Abstract.** Different types of disasters such as draughts, floods, landslides, debris flows, earthquakes, and extreme temperatures have struck the region of Central Asia and other parts of the World as well. Spatial Information Science and Technologies, including Geographical Information Systems, Remote Sensing, and Spatial Data Infrastructures have proven to be crucial for environmental protection and disaster risk management. "Environmental Protection in Central Asia (EPCA): Disaster Risk Management using Spatial Methods (EPCA)" is a European Commission funded project under ERASMUS+: Higher Education – International Capacity Building programme (Project No 585382-EPP-1-2017-1-SE-EPPKA2-CBHE-JP). It began in October 2017 and will run until October 2020. Initiated by the Lund University and partners from the Central Asia countries, the EPCA project is an ambitious project aiming to match labour market needs with geospatial education offer both in Europe and Central Asia countries. The aim of this three-year project is to build capacity using spatial methods for better environmental protection and disaster risk management in Central Asia. The objectives of the project are:

- Developing innovative and blended courses in Spatial Information Science and Technology (SIST) for environmental protection and disaster risk management (EP-Dirim). The developed courses will be taught at the partner universities with the aim of skill formation and filling knowledge gaps. The graduated students will be skilled professionals, who can potentially be employed by relevant stakeholders to develop and improve the application of spatial methods in EP-Dirim.
- Training of trainers: Faculty members at the regional partner universities will be trained on how to teach the developed courses.
- Improving quality of education and teaching: Online learning techniques/tools have revolutionized the pedagogic world. CA partners will be equipped with e-learning and open network learning (ONL) tools.
- System development: Internet-based Information Management System for Environmental Protection and disaster risk management (iMSEP) will be developed and implemented. The aim is to make a GIS system widely available for stakeholders to be able to use it for data collection, storage, analysis, and decision-making.
- Dissemination of the outcomes: Environmental protection and disaster management authorities, at policy-making, planning, and operational levels, will become aware of the advantages and applications of SIST in environmental protection and disaster risk management to support the development and use of SIST in their countries.

In total 3 distance learning courses will be developed jointly by partner institutions in Europe and the Central Asia. The main aim of the network is to promote the use of spatial information and earth observation for environmental protection and disaster risk management and modelling through capacity building and institutional development, via a network in which all partners would contribute from their own positions of strength. All 3 courses to be developed will follow EU higher education standards regarding e.g. ECTS, and learning outcomes. The outcome of the project, in terms of courses, will be freely used among the partners. At the end of the project, all produced material will be evaluated and quality controlled by an external evaluation group.

**Keywords:** higher education, geospatial education, geoinformation system, environmental protection, disaster risk management, distance learning system.

## 1. INTRODUCTION

Most countries in Central Asia (CA) have a history of devastating disasters, having caused enormous human and economic losses across the region. Different types of disasters such as draughts, floods, landslides, debris flows, earthquakes, and extreme temperatures have struck the region. According to the reports from the World Bank, ISDR, and CAREC ([1]), the annual economic losses linked to natural disasters in Uzbekistan and Kyrgyzstan are estimated as 2900 and 2200 Million USD respectively, during the last ten years. An example of human impact is that more than 7 million people in the two countries have been affected by droughts and floods during the last decade.

A majority of the disasters are results of improper monitoring and misuse of environmental resources ([1]). For example, overuse of underground water is a main factor influencing draught and landslides. Overuse of wood resources and exploitation of forests and green lands result in soil erosion, which increases flood risk. Evidently, improved environmental protection is essential in order to reduce risks of disasters ([2], [3]).

Spatial Information Science and Technologies (SIST), including Geographical Information Systems (GIS), Remote Sensing (RS), and Spatial Data Infrastructures (SDI) have proven to be crucial for environmental protection and disaster risk management (EP-Dirim) ([4]). Remote sensing, mainly through satellite images, can be used to e.g. monitor environmental changes. GIS can be used to model and analyse trends of changes and consequent potential disasters. GIS can also be used to e.g. analyse and simulate measures to protect the environment and mitigate the incidence of disasters. An SDI is required to overcome the technical and conceptual barriers in sharing heterogeneous spatial data. Different sources of data, GIS software components, spatial DB, and analysis tools, can be combined in an SDI to provide integrated environmental modelling for Uzbekistan and Kyrgyzstan; web services provided by SDI can be used to e.g. publish results and make them available to policy-makers, planners, and the public. Although SIST has proven to be a very useful tool to improve environmental monitoring, disaster risk analysis, and disaster management planning, it is still a new concept in Uzbekistan and Kyrgyzstan. In Uzbekistan, GIS and RS have only been taught in higher education for less than a decade. Local experts have limited knowledge and experience of SIST. Mainly due to inadequate education in combination with limited financial resources. After independence, only a few international GIS/RS projects, such as UNESCO/ZEFF Khorezm and TEMPUS ([5]), have been conducted. SDI is a totally new concept in the country. The above-mentioned has resulted in a situation where the use of SIST in different fields, including EP-Dirim, is extremely limited and not well realized. Research and capacity building in environmental protection and disaster risk reduction (EP-Dirim) using SIST is highly demanded in Uzbekistan, in order to develop modern and efficient infrastructure, as well as tools for socio-economic and environmental growth and protection. Kyrgyzstan is in a similar situation as Uzbekistan. During recent years, some initiatives have been taken in order to increase knowledge in the field of SIST, focusing on applications in environmental monitoring and disaster management. However, SIST is still not well and deeply integrated in society and curricula of higher education institutes. Kyrgyzstan does not have the critical mass of experts to efficiently apply and use SIST in EP-Dirim, as well as to introduce SIST to policy-makers. The number of emergency and crisis situations in the Kyrgyz Republic is estimated to reach 220-240 cases per year in the next few years. Analysis of the last five years shows (3) a steady increase in the number of emergency and crisis situations due to environmental changes. There is no doubt that proper use of SIST is highly needed for better environmental protection and disaster risk management in Kyrgyzstan. Both Uzbekistan and Kyrgyzstan focus on mitigating environmental threats within the framework of national development strategies, and have thus involved UNDP and Asian Development Bank to improve disaster management. However, the relevant stakeholders (disaster management and environmental protection related organizations in the countries) do not have the required capacity (human resources, systems, and tools) to use SIST for efficient environmental protection and disaster risk management. The European participants in this consortium are universities which have extensive knowledge and experience on teaching and research in SIST. They are also well experienced in applications of SIST for environmental protection and disaster management. The regional partners are from departments of geography that are in charge of teaching, research, and dissemination of SIST in Uzbekistan and Kyrgyzstan. They are aware of the shortages and needs in the countries, linked to EP-Dirim. Associate partners consist of stakeholders in the region, all highly linked to environmental protection and management as well as ministries of higher education. All associate partners are fully aware of the shortages and needs in the region, and are/will be the main users of SIST for environmental protection and disaster risk management. The consortium wishes to carry out capacity building on using SIST for a better environmental protection in Central Asia.

The main aim of this project is to build capacity, using spatial methods, for better environmental protection and disaster risk management in Central Asia (CA). Detailed objectives of the project are:

- Developing innovative and blended courses in Spatial Information Science and Technology (SIST) for environmental protection and disaster risk management (EP-Dirim). The developed courses will be taught at the partner universities with the aim of skill formation and filling knowledge gaps. The graduated students will be skilled professionals, who can potentially be employed by relevant stakeholders to develop and improve the application of spatial methods in EP-Dirim.
- Training of trainers: Faculty members at the regional partner universities will be trained on how to teach the developed courses. The ability of local teachers to teach and update these courses guarantees lifelong learning and continuation of the education and usage of the courses.
- Improving quality of education and teaching: Online learning techniques/tools have revolutionized the pedagogic world. CA partners will be equipped with e-learning and open network learning (ONL) tools. This makes it possible to offer normal SIST courses as well as the developed courses in this project, online. Online programs/courses provide stakeholder employees, who cannot quit the job and start education at the universities, with the possibility to learn about SIST and its applications in EP-Dirim. All courses in this project will be developed based on the Bologna process. Using the Bologna framework helps to introduce the framework and its advantages to the non-EU partners. To use the courses in CA, a conversion between Bologna standards and local standards has to be carried out. For this, the courses will be offered to the ministries of higher education for accreditation.
- System development: Internet-based information Management System for Environmental Protection and disaster risk management (iMSEP) will be developed and implemented. The aim is to make a GIS system widely available for stakeholders to be able to use it for data collection, storage, analysis, and decision-making. The system can be further developed to satisfy further requirements of the stakeholders in future.
- Dissemination of the outcomes: Environmental protection and disaster management authorities, at policy-making, planning, and operational levels, will become aware of the advantages and applications of SIST in environmental protection and disaster risk management to support the development and use of SIST in their countries. They will also get possibilities to gain required skills to be able to use SIST in planning and decision-making for EP-Dirim. This will be achieved through workshops, seminars, and short courses which will be organized.
- Developing HEIs within society: The link between HEI, government, and enterprise is not well established in Uzbekistan and Kyrgyzstan. As a result, students may not find an adequate job after graduation, and they may not be able to deliver good services to the society in their job careers. An aim of this project is to strengthen this link by developing courses, which are required by the governmental sector and the society, as well as making stakeholders aware of the technologies they need to use (where universities can help with) and the educated group of graduates that can be employed to support it. The course material to be developed will build upon existing courses used by the EU-partners, modified to meet the requirements (academically as well as pedagogically) of the Partner Countries. An additional output of the project will be 3 highly relevant blended courses (all together 30 ECTS) to be used by the project partners.

## 2. PROJECT MANAGEMENT

The lead partner, project coordinator is Lund University (SWEDEN). Partner universities are: University of Minho (PORTUGAL), National Technical University of Athens (GREECE), Vilnius Gediminas Technical University (LITHUANIA), Urgench State University (UZBEKISTAN), Kyrgyz State University named after I. Arabaev (KYRGYZSTAN), Osh State University (KYRGYZSTAN), Karakalpak State University named after Berdakh (UZBEKISTAN). The consortium has been formed on the basis of the high quality expertise of the partners/participants within the scope of the project, their geographical distribution, and the already existing, well established and good functioning, cooperation between partners ([6] – [12]). All the European participant universities have departments and/or centers in the field of SIST, environmental protection/management, and disaster risk management. Furthermore, they all have strong research and education backbone (staff, facilities, infrastructure, publications, etc.) in SIST, environmental management and disaster management. They also have many activities in applications of SIST in EP-Dirim. All these knowledge and experiences will be used for the development of courses and also will be transferred to the partner universities, which is essential for capacity building.

The project will build capacity linked to environmental protection in Central Asia. In terms of cooperation mechanisms, the consortium will set up a Steering Committee (SC), with one representative from each partner/participant university, chaired by the project coordinator. The SC is responsible for communication between the partners/participants and reporting. SC also decides upon issues pertaining to the project. Things to be decided by the SC will include the division of tasks between the partners/participants, allocation of resources for each activity, ownership, use of materials, conflicts, etc. This structure ensures democratic decision-making regarding general issues and development, as well as management. A quality control group will be established for continuous control of deadlines, outcomes, etc. during the project life time. The cooperation mechanisms will be formalized in a Memorandum of Understanding/Agreement (MoU/MoA) in order to professionally and satisfactorily involve all the partner/participant universities in the planning and development of the project. All partners/participants will have an active role in the project. Each partner/participant leads an activity, where they have the most appropriate experience and knowledge. National and regional priorities have been considered before assigning tasks to the members. Lund University, as the main coordinator, will be responsible for financial operations and the distribution of funds according to the budget. An overall manager of the program will be assigned by Lund University. She/he will be responsible for all organizational and logistical matters ensuring that program objectives are met. Urgench State University (UrSU) will act as regional coordinator for non-EU partners and takes overall responsibility of management and reporting for the region. The partners/participants involved include 4 EU participants located in the Sweden, Lithuania, Greece, and Portugal, and 4 non-EU partners located in Uzbekistan and Kyrgyzstan (2 from each country). The choice of partners/participants is motivated by competence and experiences. The partner universities are located in major regional centers. Note that there are existing networks linking many of the partners and participants together. The fact that many of the partners/participants already know each other, and have successfully worked together before, makes management much easier.

All EU partners have substantial expertise in management of large educational and international programs, such as Erasmus Mundus, but also other EU programs like LP, Tempus, and ALBAN. All participant universities have experience in international academic cooperation. Moreover, all EU participants are coordinating or participating in multiple EM programs. The international cooperation experience and capacity among the regional partners varies. Thus, the consortium meets the criteria set by the EU to involve the most appropriate and diverse range of regional partners in order to benefit from their different experiences, profiles, and specific expertise, in order to produce relevant and high quality project results. The project also includes an appropriate and diverse range of non-academic, governmental, and nongovernmental associated partners, in order to benefit from their different experiences, networks, and specific expertise, and also to strengthen the links to the labor market and to reinforce the systemic impact of the project

## 3. METHODOLOGY

Three innovative and blended courses are going to be developed in this project: 1) GIS & RS for environmental protection, 2) GIS & Remote sensing for disaster risk management, 3) SDI for environmental protection and disaster risk management. The innovative blended courses will be developed to be taught in campus and e-learning modes as well as in combination. The Addie model ([13]) will be used for the development of courses. The Addie model is the most widely used technique for developing courses and consists of five main phases including: 1) Analysis, 2) Design, 3) Development, 4) Implementation, and 5) Evaluation. The analysis phase determines and clarifies the instructional problems and objectives, identifies the learning environment and learners' existing knowledge and skills. This phase will be conducted by regional partners, with a partner as lead, and the support of European participants. Associate partners play an important role in stating the current situation and needs. Requirement analysis from stakeholders is very important to ensure that the developed courses are in line with the need of the labour market and that the graduate students will be employed by the stakeholders or will be able to establish companies which can sell SIST services to the stakeholders. The result will be documented and presented to the steering committee. Associate partners and stakeholders will be communicated in other phases to receive their feedback on courses. Based on the results of the first phase, the design phase is conducted by stating learning objectives, assessment instruments, content, exercises, lesson planning, and media. For each course a working group consisting of representatives from partners and participants as well as associate partners/stakeholders will be formed to design the courses.

The project steering committee makes the overall management of the design phase, in order to control the link and overlap between courses. The Bologna process will be considered for the design of courses. At the development phase, the content materials are created by the working groups, based on the design. Tools, hardware and software required for implementing the courses are also started to be prepared/bought at this stage. At the implementation phase, a procedure for the training of trainers (ToT) will be developed. The ToT covers the course curriculum, learning outcomes, method of delivery, and testing procedures. It also includes training of the new concepts and tools needed in order to be able to teach the courses. For each course, the working group which has developed the course conducts ToT, with a European participant as lead. Establishing proper learning environment such as lecture rooms, equipping laboratories, installing hardware and software, etc. are conducted by the partner universities.

The Bologna process will be applied at the partner universities, and conversion between Bologna process and current local processes in Uzbekistan and Kyrgyzstan will be formulated. The evaluation phase consists of two parts: formative and summative. The former is present in each phase. It means that the outcomes of each phase are assessed to ensure the quality of the outputs. The latter consists of receiving feedback from students and learners. For this, a pilot group consisting of students, alumni, and learners from stakeholders will be asked to study the courses and give feedback for refinement. The courses will be refined based on the feedback. Improving the quality of education and teaching will be through introduction of the Bologna process as well as establishing and motivating e-learning and ONL methods in the partner universities in Uzbekistan and Kyrgyzstan. Partner universities will receive funds from the project to be equipped with digital and online learning tools. European participants will support the implementation and making the systems operational. This projects aims to go beyond course development and training. Disseminating the use of SIST in environmental planning and disaster risk management in the relevant organizations is also a main aim. To achieve this, an internet-based information Management System for Environmental Protection and disaster risk management (iMSEP) will be developed, led by the project coordinator. iMSEP will be available to the stakeholders in Uzbekistan and Kyrgyzstan. The use of the system will be communicated to the stakeholders as well as to regional partners. With the help of regional partners and associate partners, stakeholders will be motivated to collect data and use iMSEP in practice. The developed system will be tested and bug-fixed through standard procedures for system development. In order to increase the awareness of stakeholders on the application and importance of SIST for environmental protection and disaster risk reduction (EP-Dirim), and also to disseminate the outcomes of the project, four workshops will be held in Uzbekistan and Kyrgyzstan. The workshops will be organized by the partners and the associate partners in the relevant countries. European participants will participate to hold lectures, seminars and to moderate working groups.

Motivating students and stakeholders to use online education will be an objective of the workshops. Presenting iMSEP as well as training and motivating practical use of it for EP-Dirim will be also included in the workshops. Moreover, university-enterprise cooperation will be stressed and discussed in the workshops. Publication in newspapers, conferences and journals as well as live interviews and presentations in TV (if possible) will also be used as means for disseminating the results of the project. Moreover, a website will be created by one of the partners for publishing all information about the project and its outcomes.

Special training on using iMSEP will be conducted, in Sweden by LU, for partner universities to be able to present, disseminate, and support the system in their countries and Central Asia. These types of trainings for partners and associate partners support the sustainability of the project. Since the developed courses are based on the requirements of stakeholders, it is expected that the students are employed by the relevant organizations in environmental protection and disaster risk management, after their graduations. In addition, graduated students may establish private companies to sell SIST services to the organizations. Besides quality control group, who has regular eye on the project and its progress, at the end of the project all produced material will be evaluated/quality controlled by an external evaluator. This will consist of an independent expert relevant to the scope and aims of the project.

## 4. RESULTS

The project has big direct and indirect influences on improving environmental protection and disaster risk management in Uzbekistan and Kyrgyzstan. The major direct and indirect impacts are summarized as follow:

- 1. Improved quality of education at HEIs in Uzbekistan and Kyrgyzstan:
- Innovative and blended courses on Spatial Information Science and Technologies (SIST) and its application for environmental protection and disaster risk management (EP-Dirim) will be developed. These courses are useful for both regional partners and the EU participants to train students in existing programs, short courses or summer schools.
- The training of trainers (ToT) is also very beneficial on improving the teaching capabilities at the partner universities. ToT also supports the sustainability of the usage/updates the developed courses. - The developed courses and the experiences of partner universities can be used by other countries in the region.

- E-learning and Open Network Learning (ONL) will be introduced to the countries and will be implemented in the partner universities. As new educational techniques, based on ICT, these facilitate and make possible the wider access to educational courses on SIST for EP-Dirim, for students and stakeholders. The platforms can be used for making other courses available online in Uzbekistan and Kyrgyzstan.
- The e-learning platforms and laboratories can be used by other departments of the partner universities to offer more courses and education materials to students and relevant stakeholders online.
- Being involved in the process of developing courses and being introduced to the Bologna standards are very beneficial for the partner universities in Uzbekistan and Kyrgyzstan.
- 2. Improving university-enterprise cooperation and increasing the employability:
- The courses and the iMSEP system will be developed based on the requirements of the stakeholders in the field of environmental protection and disaster risk management. The approach used in this project is a good experience on cooperation between universities and enterprises in Uzbekistan and Kyrgyzstan. A good network/experience between stakeholders and partner universities will be formed for further cooperation.
- Being educated on the subjects needed by the stakeholders, the employability of the graduated students is increased.
- 3. Improving environmental protection and disaster risk management in CA:
- Awareness of stakeholders on the applications of SIST for EP-Dirim will be increased. They will also receive training and a system (iMSEP) for immediate and future use.
- Using SIST improves the quality of EP-Dirim in the partner countries.
- Employed students can provide related organizations with innovative approaches based on SIST to further improve environmental protection and disaster risk management.
- Successful experiences by Uzbekistan and Kyrgyzstan on using SIST for environmental protection and disaster risk management can be disseminated and used by other countries in CA.

- 4. International networking:
- A good international network will be created between Uzbek/Kyrgyz universities, Uzbek/Kyrgyz organizations, and European universities for further research and education in the field of SIST, not only limited to EP-Dirim.
- Uzbek/Kyrgyz universities will disseminate the outcomes of this project to Kazakhstan and Tajikistan to form international cooperation. - Existing networks will be used to conduct wider collaborations between EU and CA.

## 4.1 Courses

The following 3 courses will be developed, all together constituting the 21 week programme, 120 ECTS (Table 1).

| Course No | Course Name   | Lead | Partners                              |
|-----------|---|------|---------------------------------------|
| 1         | GIS & RS for environmental protection                         | NTUA | LU, UM, VGTU, UrSU, IAKSU, OshSU, KSU |
| 2         | GIS & RS for disaster risk management                         | VGTU | LU, UM, VGTU, UrSU, IAKSU, OshSU, KSU |
| 3         | SDI for environmental protection and disaster risk management | UM   | LU, UM, VGTU, UrSU, IAKSU, OshSU, KSU |

(LU: Lund University, UM: University of Minho, NTUA: National Technical University of Athens, VGTU: Vilnius Gediminas Technical University, UrSU: Urgench State University, IAKSU: Kyrgyz State University named after I. Arabaev, OshSU: Osh State University, KSU: Karakalpak State University named after Berdakh)

The courses will be developed to cover 10 ECTS in English language, and then will be translated into Uzbek, Kyrgyz, and Karakalpak languages. Courses hours distribution is presented in Table 2.

| Course No | Lectures                                | Exercises (+2hr evaluation) | Self-study | Seminar | Final project | Total |
|-----------|---|-----------------------------|------------|---------|---------------|-------|
| 1         | 5 (video lectures)+25 (other materials) | 83                          | 77         | 14      | 76            | 280   |
| 2         | 30                                      | 154                         | 96         | 0       | 0             | 280   |
| 3         | 5                                       | 164                         | 55         | 16      | 40            | 280   |

(LU: Lund University, UM: University of Minho, NTUA: National Technical University of Athens, VGTU: Vilnius Gediminas Technical University, UrSU: Urgench State University, IAKSU: Kyrgyz State University named after I. Arabaev, OshSU: Osh State University, KSU: Karakalpak State University named after Berdakh)

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| 2         | 30                                      | 154                         | 96         | 0       | 0             | 280   |
| 3         | 5                                       | 164                         | 55         | 16      | 40            | 280   |

### 4.1.1 GIS & RS for environmental protection

The main attention will be given to more recent regional environmental problems and possible solutions, as well as the needs specified by the stakeholders. The course will be composed of theoretical, practical, field works and independent studies. By taking the course, it is expected that students will understand the application of GIS & RS in environmental protection and also can use proper tools, models and methods for environmental protection, e.g. detecting and measuring environmental variations. As mentioned earlier, the course content will be decided, by the working groups, based on the needs analysis and discussions. A modern course shall be developed using innovative methods in GIS & RS.

### 4.1.2 GIS & RS for disaster risk management

The main attention will be given to recent natural disasters caused by improper environmental protection/management and how SIST can help in mitigation and response to these disasters. The course will be composed of theoretical, practical, field works and independent studies. By taking the course, it is expected that students will understand the application of GIS & RS in disaster risk management, and also can use proper tools, models and methods for disaster risk reduction, e.g. detecting and analyzing threats developing mitigation scenarios, forecasting, and response planning. As mentioned earlier, the course content will be decided based on the needs analysis and discussions in the working groups. A modern course shall be developed using innovative methods in GIS & RS. Major disasters in Uzbekistan and Kyrgyzstan such as droughts and landslides will be the focus while developing lectures and exercises.

### 4.1.3 SDI for environmental protection and disaster risk management

Spatial Data Infrastructure (SDI) is essential for environmental protection and disaster risk management. For example, INSPIRE, which is a European SDI initiative, has been established to support better environment monitoring and protection in Europe. The main focus of this course will be on the innovative methods, technologies and standards for sharing and using spatial information required for environmental protection and disaster risk management. The course will be composed of theoretical, practical, and independent studies. By taking the course, it is expected that students will understand the advantages and importance of SDI in environmental protection and disaster risk management. They should also be able to use proper and innovative models, technologies and tools for the storage and management of spatial data (especially Big data) as well as sharing data among producers and user groups in an interoperable environment. Facilitating the accessibility and operational use of spatial data in the planning and decision-making process is the main use of SDI in environmental protection and disaster risk management. As mentioned earlier, the course content will be decided based on the needs analysis and discussions in the working groups. A modern course shall be developed using innovative methodologies in ICT and SDI.

## 4.2 Visibility

We have created a web site for the project (Fig. 1): <http://eu-epca.eu>. VGTU (Lithuania) is in charge of technical implementation and maintenance of the website.



Figure 1. First page of EPCA web site.

The website's content is (Fig. 2):

- 1. Information on the Erasmus Plus in general.
- 2. Information on the EPCA project.
- 3. Information on all the partners of EPCA and links to their websites.
- 4. Activities that has been implemented so far, as well as planned activities.
- 5. Courses; the names of the courses as well as the development process and information about course content.
- 6. Other outcomes of the projects this far.
- 7. How to contact us.

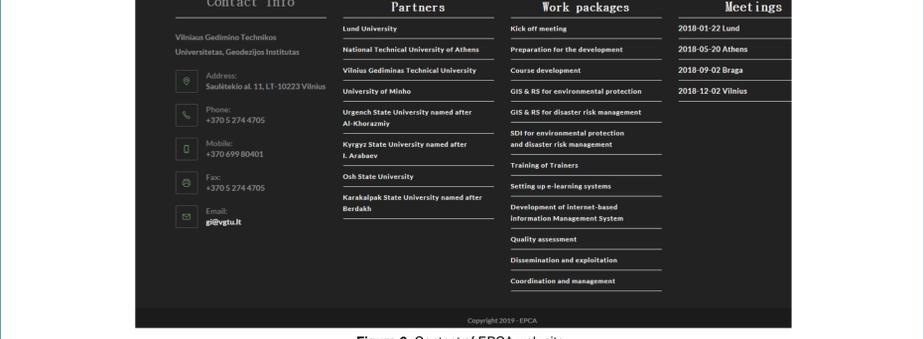


Figure 2. Content of EPCA web site.

The website contains links to the partner universities and the partner universities have link to the project website for visibility. Whenever a project partner, and this is extra important for the partners from CA countries, has a presentation in their own country or outside, they mention the website and the EPCA project.

## 5. DISCUSSION AND CONCLUSIONS

Environmental protection is a global challenge, which has to be coordinated and carried out jointly. Europe will for sure benefit on improved environmental protection in the rest of the World. The EU participants in this project are all experienced and highly skilled in research, applications, as well as education in environmental protection and disaster risk management, in opposite to the partners and stakeholders in Uzbekistan and Kyrgyzstan. So the need for EU cooperation is high. The partner country HEIs are in need of both instruments in the form of equipment and pedagogic approaches and knowledge pertinent to edge cutting research and teaching in the field that this application covers.

The innovating character of the project can be split between regional innovations and global innovations. Spatial Information Science and Technology (SIST) is new in the two non-EU countries, and the use of SIST in environmental protection/disaster management is definitely innovative. Also eLearning is new in Uzbekistan and Kyrgyzstan, reaching vulnerable groups and encouraging vocational training. To summarize, the project has the following main innovative elements within the region:

1. It provides an integrated set of SIST/environmental protection courses and educational resources specifically designed for better environmental protection reducing disaster risks in Uzbekistan and Kyrgyzstan. Investing in such spatial instruments of cross-cutting character builds a durable capacity of students and trainers.
2. It combines formal class-based teaching with flexible informal settings of long distance on-line teaching for students who are e.g. vulnerable or employed, still providing accompanying tools to make learning a really rewarding experience.
3. It interconnects in an interoperative way the educational systems of the non-European partners to the European educational system, providing thus capability of educational exchange between the countries involved.

All these innovative elements will build capacity in the region.

The outcomes of the project is the high level content, new net-based pedagogic method suited for accessing target groups of great diversity as regards pedagogic traditions, access to computers and bandwidth internet. Cooperation between the institutions will, certainly, give higher level courses than the individual institutions could possibly themselves. Apart from this, standardized (ECTS) grading and curricula will increase possibilities for exchange of students and staff between the region and EU, which is a EU priority. So is increased cooperation in higher education, as well as transfer of knowledge and best practice.

Quality of courses will undergo quality assurance from Lund University (LU) in Sweden, in order to be ready to launch at LU. This procedure is thorough and guarantees a high standard. There are no doubts, that project will promote the Bologna system in Central Asia in the future.

Global innovations linked to the project are mainly related to the development of innovative blended courses as well as development of internet-based information Management System for Environmental Protection and disaster risk management (iMSEP). This development includes new technological approaches to collect, analyse, and share spatial data and information between different stakeholders. New solutions to handle very large amounts of data (Big Data) and processes, in a cloud-based environment and in an integrative way, here called Big GIS, is also an innovative part of the project. We are fully convinced that these solutions will play an important role in improving environmental protection globally.

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