Evaluation of

Environmental Management In the Middle East (EMME): Spatial Methods

Project Number - 598189-EPP-1-2018-1-SE-EPPKA2-CBHE-JP

Carried out by:

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EXECUTIVE SUMMARY

The *Project Environmental Management in the Middle East (EMME): Spatial Approaches* was designed and developed by a consortium of universities located in the EU, Iran and Yemen, and two associate universities in Iraq.

Lund University, Sweden, acted as the Coordinator of the project. The idea of the project was formulated and submitted as an application to the EU supported programme Erasmus+ and subsequently given financial support under project number 598189-EPP-1-2018-1-SE-EPPKA2-CBHE-JP.

The project has significant direct and indirect impacts on improving environmental management in the Middle East. Major direct and indirect impacts are summarised as follows:

1. Improved quality of education at Higher Education Institutions (HEIs) in Iran and Yemen

- Innovative and blended courses on Spatial Data Infrastructures and underlying Technologies (SDI-T) and its application for environmental management will be developed. These courses are useful for both ME 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 for improving the teaching capabilities at the partner universities. ToT also supports the sustainability of the usage/updating of the developed courses.
- The developed courses and the experiences of the partner universities can be used by other countries in the region.
- E-learning will be introduced to the countries and will be implemented in the partner universities. As new educational techniques, based on information and communication technology (ICT), these facilitate and make possible a wider access to the educational courses on SDI-T for environmental management, for the students and the stakeholders. The platforms can be used for making other courses available online in Iran and Yemen.
- The e-learning platforms and laboratories can be used by other departments at 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 ME.

2. Improving university-enterprise cooperation and increasing the employability

- The courses and emGeo will be developed based on the requirements of the stakeholders in the field of environmental management. A good network/experience between the stakeholders and the 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 management in the Middle East

- Awareness of the stakeholders on the applications of SDI-T for environmental management will be increased.
- Using SDI-T improves the quality of environmental management in ME.
- Successful experiences by Iran, Yemen and Iraq on using SDI-T for environmental management can be disseminated and used by other countries in the ME.

4. International networking

- A good international network will be created between Iran/Yemen/EU universities/organizations for further research and education in the field of SDI-T, not only limited to environmental management.
- Iran/Yemen universities will disseminate the outcomes of this project to other countries in ME to form international cooperation.
- Existing networks will be used to conduct wider collaborations between EU and ME.

In the main sections of this report we show how these impacts are being achieved.

A general statement about the project is that the impacts promised in the application have been achieved despite certain negative impact on the project due to SARS-covid-2 and the longtime war in Yemen.

1. Introduction

This report comprises an attempt to give an independent appraisal of the quality of the Erasmus+ project Environmental Management In the Middle East (EMME): Spatial approaches, supported by the European Union's Erasmus+ program for higher education.

The project is a collaborative effort between five (5) universities based in European Union countries, three (3) universities in Iran, and two (2) in Yemen. The universities in EU countries are Lund University (Coordinator, Sweden); Lisbon University (Portugal); National Technical University of Athens (Greece); Vilnius Gediminas Technical University (Lithuania); and Ecole nationale des sciences géographique (France). The middle eastern universities are University of Tehran (Iran); Imam Khomeini International University (Iran); Bu-Ali Sina University (Iran); Sana'a University (Yemen); and Taiz University (Yemen).

The Middle East region faces several environmental challenges. The annual cost of environmental degradation e.g., in Iran is currently at US$8.4 billion (equal to 7.4% of GDP), and keeps increasing. The negative influences of environmental issues on the health and lives of people are undeniable. Climate change, misuse of environmental resources (e.g., overuse of groundwater) and environmental interventions (e.g., dam construction without proper environmental impact assessment) and uncontrolled use of dinking water are important challenges that need solutions. Furthermore, the deteriorating situation for fresh water, sanitation and waste treatment, and the effects on health and food security, are increasing the demand for international aid to the region.

Spatial Data Infrastructures and underlying Technologies (SDI-T), including Geographical Information Systems (GIS) and Remote Sensing (RS), have proven to be crucial for environmental management (EM). RS, mainly through satellite images, can be used to monitor environmental changes like land degradation and water levels. GIS can be used to model trends, identify hotspots, analyse and simulate measures to protect the environment and mitigate the effects of crisis. An SDI is required to overcome the technical and conceptual barriers in sharing heterogeneous spatial data to support collaborative decision making. Different sources of data, GIS software components, spatial databases and analysis tools, can be combined in an SDI to provide integrated environmental modeling for the Middle East. Although SDI-T has proven to be a very useful tool to improve environmental management, it is still not used by the authorities in the Middle East, largely because of lack of capacity and knowledge.

EMME is prepared as a sequel to an earlier project, GeoNetC. The significant added values are:

- Establishing an e-learning system in Yemen and implementing the GeoNetC program in the country.
- Developing three new applied blended courses on SDI-T which can be used by experts in environmental management authorities.
- Development and implementation of an environmental management Geoportal (emGeo) for Iran, Iraq (Iraq is an associate partner in the project) and Yemen, based on novel technologies to facilitate the sharing of spatial data, planning and decision-

making for environmental management. Iraq is an associate partner in the project. emGeo will be accessible to Iraq, through our existing network, to be used for better environmental management.

- Expanding the existing European-Middle East Network by including new European, Iranian and Yemeni participant universities in the consortium.
- Introducing Open Network Learning (ONL) tools to the partner countries that can considerably improve the quality of education and teaching.
- Improving HEIs role within the society by improving the linkage between HEI, government and enterprise in the partner countries.

The project is, as all EU supported projects, divided into Work Programmes - in this case 10 Work programmes. They are listed below and the sections below are dealing with each individual Work Programme.

- WP01: Kick-Off Meeting
- WP02: Course Design
- WP03: Equipping Laboratories
- WP04: Course Development
- WP05: Training of Traineers
- WP06: Setting-up e-Learning System
- WP07: emGeo Development
- WP08: Quality Plan
- WP09: Dissemination and Exploitation
- WP10: Management

2. WP1 - Kick-Off meeting

A meeting which is used to gather all project participants to a meeting for mutual acquaintance, discussing the organisation of the project work, dissemination (publicity) activities and more. The Kick-off was held in Lund, Sweden at the end of February 2018. The aim of the Kick-off meeting was to have most of the key contact persons that will be actively involved in the project meet each other and discuss details concerning preparation, tasks, responsibilities and execution. They are expected to express their opinions and generate a consolidated work plan and status report. The results of the meeting are normally to prepare basic documents like a Consolidated work plan, establish the steering committee, a Quality Control group, a list of actions in the project and the person responsible for each of the action and produce the draft of a Memorandum of Understanding. Also, the requirements regarding data and functionality of emGeo were discussed.

3. WP2 - Course Design

The main goal of the project is to design a number of courses (3 courses) which will be used in in-situ learning and online learning on aspects of Environmental Management. The courses have been designed based on requirements defined by the stakeholders in Iran and Yemen.

This design was carried out by designing a number of questionnaires to be worked through by different groups of stakeholders - staff at the cooperating universities, employees at government institutions dealing with investigation of, and practical work with, the environment and other stakeholders like landowners etc.

These questionnaires were evaluated and used as the basis for the development of the courses. The result of this exercise is documented in the report Requirements Analysis Report, which can be found under URL https://emme.ensg.eu/en/outputs.html.

Also, due to the fact that existence of, and access to, geographic data was very limited a simple system for sharing and discovery of geographic data, as well as in-field data collection and analysis was requested in the course of this same process. The system is called emGeo and can be run in the field using a mobile phone as a form of a mobile GIS and it can also be used as a geoportal integrated in iMSEP. Requirements related to emGeo was also analysed.

Three courses, each with an academic weight of 10 ECTS were planned to be developed and implemented. The syllabi for the courses can easily be accessed by clicking on the respective link below.

4. WP3 - Equipping Laboratories

For implementing the project and running the blended courses, including exercises, laboratories in the partner universities should be equipped with the required hardware and software, including servers, computers, printers, and technical software.

Risks:

- Problems transferring money to the partner universities due to, e.g., political reasons.

Under this work programme, the equipment deemed necessary to carry out the project was purchased. The type of equipment was already specified in the application, and purchased according to the EU rules for equipment purchase. Just one university did not manage to purchase half of the equipment.

5. WP4 - Course Development

1. Innovative campus, e-learning, and blended courses on SDI-T for environmental management.
2. Translated versions of the courses to the local languages.

In this particular Work Programme, the three courses were developed according to the criteria found in Work Programm 2. The project members will develop the innovative blended courses focusing on needs and requirements of stakeholders related to environmental management in the Middle East. The regional partners and the European participants assigned the most qualified staff at the universities and other required facilities for the best possible development of the courses.

For the development of courses, existing course material, recent research publications, knowledge and experiences of the developers, etc. were used to get the most proper and innovative results. Course development groups were in continuous contact with each other, through the course coordinators, to discuss procedures and issues. This was mainly done through communication channels such as Skype and e-mail. Course developers attended meetings to discuss course development face-to-face as well as presenting the outcomes and results.

The following courses have been developed during the project:

- SDI-T for environmental change monitoring
- SDI-T for environmental impact assessment
- SDI-T for collaborative environmental management

A working group was created for the development of each course. Each group consisted of 10 academic staff, one from each partner and participant universities. Representatives from associate partners (no cost) and pilot students (assessment) were added to the groups. In each group, a participating university was assigned acting as the course coordinator.

There were no identified major risks for the development of courses. A minor risk might have been relevant related to the information gaps concerning the environmental conditions of the Middle East. However, regional course developers were able to find reliable data and information, which were useful/necessary for the course development.

Additionally, accreditation (permission of the university bureaucracy to use the courses inside the regular curricula) of the courses was believed to take much time due to bureaucracy.

6. WP5 - Training of Trainers

The main tasks in this work programme were identified

1. High quality Teaching of Teachers (ToT).
2. Improved capacity of teachers.
3. Improved capacity of experts on application of SDI-T

Three ToT programs have been considered in this project. Having ToT in the partner countries, in a way, ensures the active attendance of teachers and also helps in reducing the costs. However, due to the unstable situation and security issues in Yemen, organizing ToT in Yemen was impossible. So two ToT's were organized in Iran, in which Iranian and Yemeni partners attended, and one ToT will be organized in Lisbon, specifically for Yemeni partners. Equal opportunity, gender balance issues, is mostly controlled in the project.

After the development of the innovative and blended courses, teachers in the partner universities and associate partners will be trained. This work package improves teaching skills capacity of teachers and also guarantees lifelong learning and continuous education. ToT for courses will be organized in two ways:

a. ToT by EU participant universities for partner universities.
b. ToT by partner universities for other universities in the region (later and upon agreement between them).

After the development of the environmental management Geoportal (emGeo), a ToT is required for partner universities to be able to support stakeholders.

Partner universities were given detailed information about the Bologna process and its advantages, to be able to convince HEIs in the region to use the framework.

A minor risk might be relevant to the language skills of the local attendees in ToT. Some teachers at the partner universities do not speak English well. It may be difficult to communicate with them. This is a small risk, since there are also English speaking teachers in the partner universities who can help with translation (note that technical language is also required). Also, Persian and Arabic speaking persons are available at European universities which can help with language issues, if needed.

The reality was looking much different. The project was unfortunately carried out in the height of the pandemic (Sars-Cov-2) which in reality during parts of 2019 and more or less all 2020-21 made international travel for training purposes impossible. Training of the trainers was therefore carried out only using video connections. Thus in the training carried out online for Yemen and Iran a total of 28 Trainers were trained (Yemen 9 and Iran 19). In Yemen the partners had a ToT for other faculties and trained another 10 Trainers.

7. WP6 - Setting-up e-Learning System

1. Up and running e-learning system.
2. Trained staff.

For the partner universities to be able to offer the developed courses online, an e-learning system will be set up in each university. This system can later be used for offering other courses, online, by the partner universities. In this way, one of the regional priorities of using ICT based practices is also met. The system will consist of one Learning Management System

(LMS), and one administrative system, linked together. Lund University already has a student – teacher communication and administration (AC) system which will be installed for free as self-contribution. The LMS to be installed is Moodle, open source software, which will be set up at no license cost.

One technician from the Lund University GIS Center will travel to University of Tehran, Iran to set up the system as well as how to use the e-learning system.

Some circumstances external to the project could have had affect on settiing-up the e-learning system.

The partner universities have prepared (from equipment's budget of the project) required equipment (server, camera, software, etc.) for setting up the e-learning systems.

Due to pandemic, e-learning system was installed remotely for the Yemani partners. Iranian partners sat up the systems by themselves with the help of Lund University.

8. WP7 - emGeo Development

1. emGeo system.
2. User guide for emGeo.

Spatial data and analyses are essential for reliable planning and decision-making on environmental issues. As mentioned earlier, environmental issues in the Middle East are transboundary. It means that access to the spatial information describing environmental situations in the neighboring countries, i.e. Iraq and Yemen is essential for environmental planning and management in another country i.e. Iran. Besides that, environmental management needs cooperation and collaboration and hence information sharing between several authorities such as the ministry of industry, ministry of energy, and ministry of environment, whose activities influence the environment. However, primary studies showed that there is no reliable system and/or mechanism for sharing spatial information (inter- and intra- nationally) in the Middle East to be used for reliable and collaborative planning and decision-making on environmental issues. Besides that lack of information, a major challenge is that calls for the need of special tools and skills for data collection and dissemination.

This work package aims to develop a web-based Geoportal, called emGeo, to facilitate the sharing of environmental related spatial data between organization, both intra- and inter-nationally.

There was a risk

- that the big lack of digital base maps could prevent the use of the system. This was solved by using existing open maps at the beginning.
- that old technical staff would show resistance against using new technologies, thus Culturing and motivation was[1] required.

- there could have been issues for sharing spatial data due to, e.g., national security reasons.

Geological map of Taiz Governorate in Yemen Republic

Geological map of Taiz Governorate in Yemen Republic

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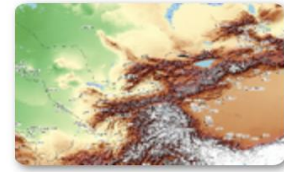
Example of a map stored in emGeo

emGeo is developed as a Geoportal that is based on international standards, mainly Open Geopatial Consortium (OGC) standards and specifications. It has been integrated with iMSEP and existing Web GIS system. It facilitates the use of data which has been received from Geoportal as well as publishing the maps which have been produced in iMSEP.

In addition, a Mobile GIS App has also been developed for in-field data collection and sharing. This was based on the request of Yemeni partners.

9. WP8 - Quality Plan

1. Quality-enhanced innovative course materials.
2. Modern and applicable Geoportal for the collection and sharing of environmental data (emGeo).
3. Overall quality report.

Quality control group (QCG) continuously took responsibility for all project activities, processes, deadlines, outputs, etc. The report of the quality control group would be discussed in the Steering Committee meetings. It should be noted that a part of the management responsibilities of the project coordinator and regional coordinator (LU and UT) were also relevant to the quality control of processes and activities.

Beside QCG and the coordinating institution, the responsible person of each participant and partner universities (NTUA, UL, VGTU, IGS, BASU, IKIU, SU, and TU) controlled the quality of the project activities for 1 day in each month.

Students were the main users of the courses, so they needed to be satisfied with them. Their insights were used for developing course materials.

Experts and alumni were good resources for evaluating the developed courses, since they are aware of the general concepts and can provide useful feedback.

The partner universities knew about the emGeo requirements. So they could evaluate emGeo from functional and technical perspectives.

Overall outcomes/outputs of the project needed to be evaluated by an external international evaluator.

Small risks might be relevant to:

- Poor language skills of pilot students.
- Poor language skills of stakeholders to evaluate emGeo.

Under the circumstances given above, the staff of the partner universities evaluated emGeo and experts/alumni from the different universities evaluated the courses. This was completed by October 2020.

The partner universities also accredited the courses, which means that they by now are used as parts of the regular curriculum, in the courses that are consequences of this project.

10. WP9 - Dissemination and exploitation

This Work Programme dealt with a number of aspects of the dissemination and exploitation, see list below.

1. Project website and Facebook page.
2. Improved capacity in higher education.
3. Improved capacity of environmental management.
4. Improved capacity of employability.
5. Improved culture of university-enterprise cooperation.
6. Improved international cooperation and created international network.
7. Improved quality of education and teaching.

At the initial stage of the project the following dissemination activities will be conducted:

- After the kick-off meeting, regional partner universities were visiting and meeting associate partners and stakeholders, to perform needs analysis (see WP2). In these visits/meetings, the aim and objectives of the project and their importance of the Middle East will be explained. Also, the innovative character of the project will be described and disseminated.

- The project website was created by ENSG-IGN in the second half of January 2018. Project description, as well as the progress and outcomes of the project, were disseminated through the website. This means that it was to be continuously updated. In addition, a Facebook page was created. This will be used not only for dissemination purposes, but also for expanding the network and keeping the network even after the project. They are also mirrored at the project website. One technical staff from ENSG-IGN had the responsibility to maintain the website. One day per month was spent for this task.

Dissemination and exploitation activities were carried out:

- A dissemination workshop was held were more than 120 persons were reached.

- The courses have been accredited in all universities associated with the project, meaning that the courses and/or parts of them could be used inside the regular curriculum.
- The courses are being used as part of the existing programs in Yemen and Iran.
- The e-learning platforms and materials were used during thepandemic.

11. WP10 - Management

Management is an important task in most projects co-financed by the European Union, due to the number of participating organizations and/or the total amount of financing.

1. A well-managed and organized project
2. Clear/correct financial status of the project, up to date book-keeping.
3. Democratic decision-making.

The steering committee with the representatives of all partners lead by the project coordinator made decisions for the management of the project. A Quality Control Group monitored the progress of the project and quality of outputs.

- A project coordinator made management and coordination activities.
- A steering committee, chaired by the project coordinator, guarantees the democracy in decision-making and project management.
- A financial manager was responsible for financial operations and distribution of funds according to the budget, also responsible for all organizational and logistic matters.
- A regional coordinator from partner universities was assigned to ensure the overall management, communication, reporting, and organizational arrangements in ME.

The management of the project was carried out according to the general guidelines for Erasmus+ projects.

12. Concluding remarks

This section tries to summarise the achievements of the project.

- As described in section 11, it is considered that the project was well managed with the necessary controls implemented early in the project, i.e., management plan, Quality plan (sect. 9) and dissemination and exploitation plan (sect.10).

- The work for the preparation of the course design was well organized and well executed.

- The requirements on the contents of the courses were collected and investigated in a joint effort of members of the consortium, associated HEI in the Middle East and

stakeholders in the society, e.g. authorities whose mandate is to ameliorate the influence on climate change on the landscape, the land use and more. Example of such authorities (stakeholders) are Ministry of Energy and its provincial branches, Natural Environment Management Agency and provincial branches and the Management and Planning organization and provincial branches.

- Equipment was purchased and installed in the participating universities in Iran and Yemen, with exception the University of Tehran , which already had some of the needed equipment. The university could not also purchase some part of the assumed equipment due to internal political issues.

- Three courses were developed with an academic weight of 10 ECTS, each. Courses could be either an integral part of a MSc program with special emphasis on environmental Management; the fact that the courses were accredited by the universities implied that as a whole or parts thereof could be used as parts of course programs in other subjects.

- Trainers were trained by the EU universities and the participating universities. Most of the in situ training was changed to distance training due to restrictions during the SARS-Cov-2 pandemic. In Iran and Yemen 39 Trainers were trained in total.

- Upon completion of the courses, they were test-run and evaluated by students. And a small computer and mobile phone based Geodata portal. When run on the computer emGeo is imbedded in iMSEP which has well developed help functions; for the mobile version, instructions for use are presently under development.

- In conclusion, I would like to state that the project implementation delivered what was promised in the application with good theoretical parts and advanced possibilities for experimental work in close relation to real world problems.