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BESTSDI – Western Balkans Academic Education Evolution and Professional's Sustainable Training for Spatial Data Infrastructures

With the support of the Erasmus+ program:

Higher Education – International Capacity Building
N° 574150-EPP-1-2016-1-HR-EPPKA2-CBHE-JP

Task Report

Task T1.5: Specification of adapted Project Curriculum on Spatial Data Infrastructures

Version 1.0

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Work Package / Task:

WP1 – Preparation / Task 1.5 – Specification of adapted Project Curriculum

References:

Project Management Plan / Work Package 1 Work Plan / Task Group 1.5 Adaptation of Project Curriculum

Short Description:

This report is a deliverable of Task Group 1.5 – Specification of adapted Project Curriculum. It is derived from data collected in T1.5 and based on the analysis of the outcomes of T1.1, T1.2, T1.3 and T1.4.

Keywords:

Report, SDI, Project Curricula adaption, analysis.

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Revision History:

Revision	Date	Author(s)	Status	Description
V0.1	3/03/2018	Z. Bogdanovski Z. Srbinoski	Draft	First outline and method
V0.2	10/03/2018	Z. Bogdanovski Z. Srbinoski	Draft	Lessons learned from D1.4
V0.3	12/03/2018	Z. Bogdanovski Z. Srbinoski	Draft	Method for the adaptation of the Project curriculum
V0.4	14/03/2018	Z. Bogdanovski Z. Srbinoski	Final Draft	Consolidation
V0.5	25/03/2018	Z. Bogdanovski Z. Srbinoski	Final Draft	Final review
V0.6	26/03/2018	Z. Bogdanovski Z. Srbinoski	Final Draft	Add conclusions and references

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1. Introduction

The specific BESTSDI project objectives are to develop, test and adapt new curricula, courses, learning material and tools within the field of SDI. By the incorporation of SDI and other modern concepts based on spatial data and information, students of the new courses will provide efficiently spatial data and services to SDI users when entering the job market. In parallel, the project also introduces SDI and related concepts in undergraduate and graduate study programs of academic institutions which professional profiles are well recognized as SDI users, raising awareness among the students and professionals about the relevance of SDI and advantages of well-organized, harmonized and accessible spatial data.

In this context, the specific objective of the project is to develop appropriate curricula, courses and their content for both target groups (SDI providers and SDI users) of academic institutions, as well as for vocational LLL training initiatives. This includes the development of:

- SDI compulsory course for undergraduate study programs in geodesy;
- SDI modules for graduate study programs in geodesy and geoinformatics;
- SDI user course components (not necessary full courses) for undergraduate study programs of partner faculties;
- SDI elective courses for graduate study program of partner faculties (SDI users);
- Development of sustainable training courses (life-long education) of broad scope of professionals.

The goal of **Work Package 1 (WP1): Preparation** is to specify the content of the curricula to be developed (project curriculum and adapted curricula). The project curriculum is a general curriculum addressing the needs of the consortium as a whole (it is a sort of baseline curriculum based on existing Best Practices). Each partner university may then select appropriate parts of the project curriculum and include it in their own adapted curricula.

The WP1 is subdivided into five tasks:

Task 1.1 – Current curriculum status

Task 1.2 – Current learning material status

Task 1.3 – Requirements analysis

Task 1.4 – Specification of project curriculum

Task 1.5 – Curriculum adaptation specification

The initial activities as part of T1.1 and T1.2 focused on the collection of information on the current curriculum status in the partner countries (D1.1) and current learning material available in the program countries (D1.2). The collected material from these two initial tasks

and a detailed requirement analysis (T1.3) guide and adapt, together with developments on European level, the specifications of the project curriculum (T1.4).

Due to the fact that substantial differences exist among the current curricula of partner universities/faculties and due to the different national conditions in which SDI is developed certain adaptation to the national conditions are necessary (T1.5). With the intention that this adaptation process is kept limited and well organized, so that the essence of the developed project curriculum remains the same or similar in all partner study programs, the specification for curriculum adaptation are developed.

Milestones for WP1 are:

- Project Kick-off meeting held, foreseen documents approved (M1)
- Project dissemination tool implemented (web site) (M3)
- Stakeholder survey in order to identify key requirements for the development of curricula (M6)
- Regular PMP meeting held, foreseen documents approved (M6, M12)
- Summer school executed (M7)
- Regular evaluation and reporting established (M6, M12)

In task **T1.5 – Curriculum adaptation specification** was necessary to be identified the specific needs of the partner university and their possibilities for implementation of the new SDI contents. The analyses in this task group are directly connected with surveys carried out from T 1.1 till T 1.4, where the main input of the data for the actual analyses is block concept of SDI contents which is defined in T 1.4 - Specification of project curriculum.

A Special questionnaire was prepared for needs of the analyses in this task group, which main goal was determination of the needs of the individual project partners that are connected with introduction of new SDI contents in their existing or new curriculums.

The results of the survey in this task group are fundamental as input data in analyses that will be implemented in next work package WP2A DEVELOPMENT – Development of curriculum, especially in T 2.1 - Development of project curriculum and T 2.2 - Development of Life-long learning (LLL) courses for professionals.

The persons dealing with the execution of this task are the task leader, task co-leader, the task deputy leader and all partners contributing to the deliverable. The contact information of these persons is as follows:

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TABLE 1: TASK LEADER, DEPUTY TASK LEADER AND CONTRIBUTORS OF TASK GROUP 1.5

The report is structured as follows. Section 2 briefly introduces the relevant task deliverables and associated indicators while section 3 is about the communication within the task activities. In section 4 the methodology is described. Considering the fact that in the Report of T 1.4 - Project Curriculum on SDI are summarized the results of the surveys implemented in T 1.1, T 1.2 and T 1.3, in section 5 are represented most important results of T 1.4 which are key input data in analyses of T 1.5 - Curriculum adaptation specification. Section 6 provides information about the questionnaire as the key document for the stakeholders' survey. In section 7, the followed analysis is presented. Based on the results of the questionnaire, in section 8, are presented 4 scenarios for implementation of new SDI contents - complete curriculum, module, introducing of full SDI courses in existing curriculums and introducing specials lectures in existing courses. Considering of the expressed needs of the partners universities for introduction of geodetic and cartographic contents as preparation for education of new SDI contents, in section 9 are presented two new complete courses with minimum of the expressed contents in field of geodesy, cartography, cadaster and GIS. The report ends with a set of conclusions (Section 10).

2. Indicators and deliverables

The task will produce the following deliverables:

Number	Title	Date
R1.5-1	Produced questionnaire for adaptation of Project curriculum	15.10.2017
R1.5-2	Analysis of the result of the questionnaire	01.11.2017
R1.5-3	Questionnaire results presented and discussed at the project meeting in Mostar	07.11.2017
R1.5-4	Draft report on Specification of adapted Project curriculum	14.03.2018
R1.5-5	Final report on Specification of adapted Project curriculum	25.03.2018

TABLE 2: PLANNED DELIVERABLES FOR T1.5

The task is monitored and evaluated by the following indicators and targets.

Number	Indicator	Assessment method	Target value
1	D1.5	Survey (Questionnaire)	100% of all questions are answered
2	I1.5	Response to questionnaire	94% partners responded to questionnaire
3	M1.5	Reporting – analysis of survey result	Sub-task report is delivered Report contain all information about adaptation (according specific needs) of Project curriculum in all partners

TABLE 3: INDICATOR(S) FOR T1.5

3. Communication within the work package

For the purpose of internal communication between the workshops, the Project Office (PO) established a Moodle platform for communication on, and implementation and monitoring of tasks including information and data on submissions, implementation of surveys and working documents exchange.

Information collection was conducted through a web survey (questionnaire) about specific needs in partners institutions according adaptation of Project curriculum. The survey was fully web-based and user friendly in order to achieve a response as high as possible.

The timeframe of T1.5 can be described as a short term task (lasting 3 months – according PMP 5.1) task leaders and TG members (contributors) will communicate in following manner:

- Regular communication – via e-mail messages and through the Moodle platform;
- Information delivery and survey – via Moodle platform;
- Regular Skype meetings are not foreseen, but they will be organized with all or some of partners if necessary;
- Initial discussions were held in the workshops in Mostar (6-8.11.2017). Final discussion is foreseen on workshop in Banja Luka (23-25.04.2018);
- It is foreseen that TG leader delivers the Report on adapted Project curriculum during March 2018.
- Project manager should approve Report and close TG activities in a week after Report submission.

4. Methodology

The methodology for realization of T1.5 - *Specification of adapted Project Curriculum on SDI*, covers a range of activities that will lead to successful realization of this task.

From previous tasks in frame of WP1 (T1.1 – T1.4) will be provided the basic input information. With particular importance are the results from T1.4 - *Project Curriculum on Spatial Data Infrastructures*, in which should be defined the basic directions for conceptualization of the contents in the individual blocks that will systematize the necessary education from the area of the SDI. Therefore, for start of the work in T 1.5, more than necessary are the informations that are obtained from T 1.5.

In order to perceive the needs and possibilities for implementation of new SDI contents in educational curriculums of the partner universities has been prepared questionnaire that is answered from all partners of the Project. In the questionnaire, beside the needs of basic and advanced knowledge of SDI, the partners should define the possibilities for implementation of new study programs, new modules, new courses and possibilities for partial change in existing courses, with implementation of new SDI contents.

The analysis of the results from the questionnaire should result with suggestion for adaptation of the new courses/lectures from SDI (according T1.4) in partner institutions.

Beside already mentioned, according to suggestions from T1.4, will be developed curriculums for basic geodetic/cartographic courses - according the needs of the partners.

The discussion in the TG is the responsibility of TG leader and TG deputy leader, while intersection among the task groups and work packages will be responsibility of work package leaders and deputy leaders together with the project manager.

The results of the discussions feed this final report forms an important base for the execution of T2.1 and T2.2 in the next work package (WP2A).

5. Lessons learned from T1.4

In actual report for T1.5 - *Specification of adapted Project Curriculum on SDI*, are used the results from the survey conducted and commented in Reports for tasks T1.1 – T1.4.

The reports for T1.1 - T1.3 are commented in detail in the Report for T 1.4 - *Project Curriculum on Spatial Data Infrastructures,* while in the actual report will be presented the **basic informations** from T1.4, which are key input for preparation of the Report for T1.5.

5.1. Project curriculum design

The design of the project curriculum is organized in different steps: from high level, and then gradually to a more detailed design. The organization of the project curriculums is in form of building blocks required to cover all aspects of SDI based on experiences at different European universities and in other European projects and how these can be organized/used.

The building blocks have been designed on the basis of 'logic' steps in the SDI learning process. Based on these assumptions the curriculum is set-up as a series of building blocks, initial as well as specialized ones. Some of those building blocks are '**required'** (blue), others are rather '**optional'** (yellow), depending on the focus and interest of the faculty (e.g. more interested on data use versus more technology oriented), while the remaining ones are '**nice-to-have'** (green).

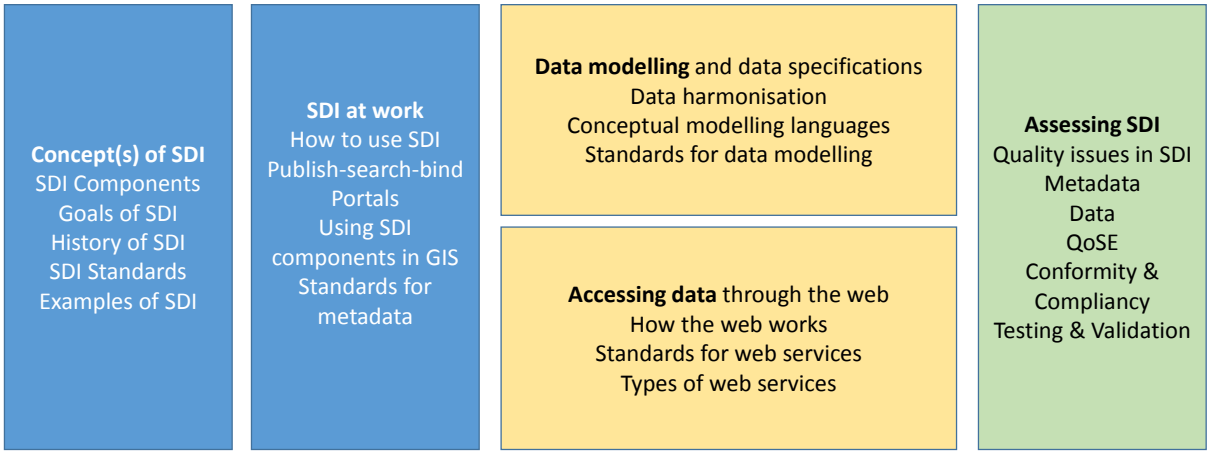

FIGURE 1: INITIAL SDI LEARNING BUILDING BLOCKS

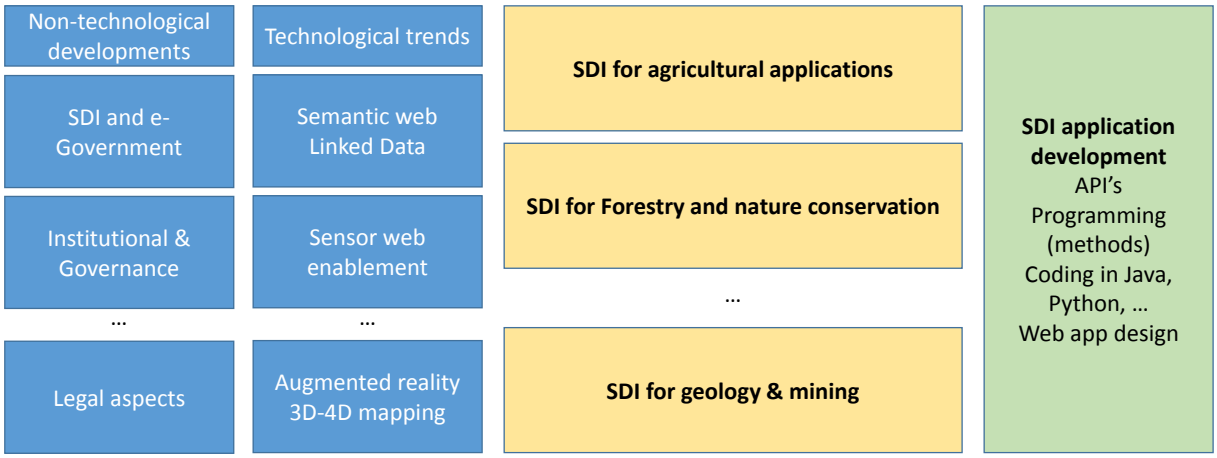

FIGURE 2: SPECIALIZED SDI LEARNING BUILDING BLOCKS

The three colours provide also a logic from the sequence point of view: it is not possible to tackle the yellow building blocks without tackling first the blue ones, while it is also not possible to teach topics from the green building blocks without having treated the blue and (some of) the yellow ones.

5.2. Detailed description of the building blocks

In this sub-section Mr. Vandenbroucke describe in more detail the building blocks: title, the topics covered, its content), the structure, the major learning outcomes, pre and post-requisites, the level(s) and formats, the required efforts in terms of learning hours and the 'value' as number of ECTS, and the available reference(s)/reference material.

In continuation will be presented the short versions of SDI concepts which are described in more detail in T1.4.At the same time will be presented the informations which are key important for preparation of the questionnaire and the Report for T1.5.

5.2.1. SDI Concepts

Title: SDI concepts and principles

Topics covered: spatial data; data and service sharing; barriers to access and use, sharing and (re-)use of data; SDI objectives; SDI components; SDI standards; SDI examples; History of SDI and SDI typologies.

Learning outcomes:

- Understand and being able to identify the objectives of SDI's, the different components of an SDI and the different types of SDI in place;
- Gaining insight in the geospatial standardisation process, the most important standardisation bodies and the different types of geospatial standards;
- Being able to identify existing Best Practice SDI implementations in the world.

Pre- and post-requisites:

Pre-requisite(s) – Geolocating data to earth, Fundamentals of Geographic Information, GI collection techniques, Relationships and GI, GI Storage and Management techniques.

Level(s) and formats:

- Basic – Lectures (and demonstrations)

Required efforts: between 1,5 and 6 hours

Value: 0,5 ECTS (if fully developed)

5.2.2. SDI at work

Title: SDI at work

Topics covered: Publish-Search/Find-Bind paradigm, Geoportals and Open Data Portals, Metadata, Catalogues and Catalogue Services, Metadata Standards and Metadata Elements, Discovery and Evaluation of metadata (fit-for-use concept).

Learning outcomes:

- Being able to identify the different functionalities and operations of geoportals and to identify the characteristics/criteria of/for good geoportals;
- Understand and being able to identify the standards for metadata and the mandatory metadata elements required for spatial data sets and services;
- Being able to search and find a specific spatial data set or service through a geo-portal, to evaluate the resource and to load it through a web service into an application (e.g. QGIS).

Pre- and post-requisites:

Pre-requisite(s) – Geolocating data to earth, Fundamentals of Geographic Information, GI collection techniques, Relationships and GI, GI Storage and Management techniques.

Pre-requisite(s) – "SDI Concepts and Principles"

Level(s) and formats:

- Basic – Lectures + exercises (and possibly group work)

Required efforts: between 1,5 and 12 hours

Value: 1 ECTS (if fully developed)

5.2.3. SDI data

Title: SDI data modelling and data harmonization

Topics covered: spatial data; data models and data specifications; data harmonization and data interoperability; data transformation; standards for data modelling (ISO 19100 series); conceptual modelling languages; data exchange formats.

Learning outcomes:

- Understanding the key concepts and principles of spatial data modelling and data modelling languages;
- Being able to identify, read and interpret the relevant International standards for defining such specifications;
- Obtaining the knowledge and basic skills in order to be able to harmonize existing data sets towards such specifications based on mapping, matching and ETL techniques.

Pre- and post-requisites:

Pre-requisite(s) – Geolocating data to earth, Fundamentals of Geographic Information, GI collection techniques, Relationships and GI, GI Storage and Management techniques.

Pre-requisite(s) – "SDI Concepts and Principles" and "SDI at work"

Level(s) and formats:

- Basic – Lectures (and demonstrations)
- Advanced – Lectures and exercises
- Expert (LLL) – Lectures, exercises and group/home/project work

Required efforts: between 6 and 36 hours

Value: 3 ECTS (if fully developed)

5.2.4. SDI access mechanisms

Title: SDI access mechanisms

Topics covered: WWW; Service Oriented Architecture (SOA); URI's, URL's and URN's; Servers and services; Data delivery through services; Standard interfaces; OGC Web Services; Service Capabilities and Operations; Service chaining and orchestration; SOAP and REST (full) Services.

Learning outcomes:

- Being able to identify the main characteristics of the web and the importance of URI's, URL's and URN's and how they are composed, as well as the major components of a Service Oriented Architecture;
- Gaining knowledge and insight in the different types of OGC web services and how they work and the capabilities they have;
- Being able to set-up 'simple' web services to visualise, download and discover spatial data sets and services.

Pre- and post-requisites:

Pre-requisite(s) – Geolocating data to earth, Fundamentals of Geographic Information, GI collection techniques, Relationships and GI, GI Storage and Management techniques.

Pre-requisite(s) – "SDI Concepts and Principles" and "SDI at work"

Level(s) and formats:

- Basic – Lectures (and demonstrations)
- Advanced – Lectures and exercises
- Expert (LLL) – Lectures, exercises and group/home/project work

Required efforts: between 6 and 36 hours

Value: 3 ECTS (if fully developed)

5.2.5. SDI assessment

Title: SDI assessment and quality issues

Topics covered: Quality Assurance; Quality Control Process; QA of metadata, data and services; Quality and Experience of a Service; Conformity and compliancy; testing and

validation; SDI assessments and benchmarking; impact assessment (value, C/B) and performance measurement.

Learning outcomes:

- Being able to identify Quality Assurance issues and the Quality Control Process in the context of SDI for the major SDI technological components: metadata, data and web services;
- Obtain in depth knowledge and basic skills to assess metadata quality on data and services including the use of tools to check their contents and conformity;
- Being capable of assessing different SDI's based on the pre-defined set of criteria for evaluating and benchmarking SDI's.

Pre- and post-requisites:

Pre-requisite(s) – Geo-locating data to earth, Fundamentals of Geographic Information, GI collection techniques, Relationships and GI, GI Storage and Management techniques.

Pre-requisite(s) – "SDI Concepts and Principles", "SDI at work", "SDI data modelling and data harmonization" and "SDI access mechanisms"

Level(s) and formats:

- Basic – Lectures (and demonstrations)
- Advanced – Lectures and exercises
- Expert (LLL) – Lectures, exercises and group/home/project work

Required efforts: between 3 and 24 hours

Value: 1,5 ECTS (if fully developed)

5.2.6. Non-technical developments

Title: Non-technological developments

Topics covered: Governance and e-Government; Institutional aspects; IPR and open licensing; PSI and re-use of data; open data; privacy, data protection and GDPR; citizens' science and crowdsourcing

Learning outcomes:

- Being able to identify the major non-technological trends;

- In-depth understanding on e-Government processes and their G2C, G2B and G2G interactions and gaining basic skills to model a business process;
- Being able to distinguish the differences and commonalities between the geospatial sector relevant European Directives, and between authoritative and open data.

Pre- and post-requisites:

Pre-requisite(s) – "SDI Concepts and Principles"

Level(s) and formats

- Basic – Lectures (and demonstrations)
- Advanced – Lectures, exercises and group work

Required efforts: 1,5 – 12h

Value: 1 ECTS (when fully developed)

5.2.7. Technological trends

Title: Technological trends

Topics covered: Semantic Web and Linked & Open Data; Geospatial Data on the Web; 3D/4D and Augmented Reality; Indoor mapping and BIM; UAV's; Big data and cloud computing; Secure access mechanisms.

Learning outcomes:

- Being able to identify the major technological trends;
- Being able to analyse a 3D geospatial data model and recognise ways of exploiting 3D in the context of a GIS;
- Understand and gain basic knowledge and skills on the semantic web and how Linked Data technology is used to publish, link and use spatial data on the web.

Pre- and post-requisites:

Pre-requisite(s) – "SDI Concepts and Principles" and "SDI at work"

Level(s) and formats:

- Basic – Lectures (and demonstrations)
- Advanced – Lectures, exercises and group work

Required efforts: 1,5h – 24h

Value: 2 ECTS (when fully developed)

5.2.8. SDI for thematic applications

Title: SDI for thematic applications (consists of different blocks, one for each thematic field)

Topics covered: Relevant European legislation for the thematic field; specific thematic SDI initiatives; thematic data models and standards; specific metadata implementations; particular data harmonization efforts; existing platforms and tools for the thematic community

Learning outcomes:

- Being able to identify the relevant European and national legislation for the particular thematic field;
- Being able to identify and explain the differences and commonalities of specific data sets and data models against international standards such as the INSPIRE specifications;
- Being able to understand and interpret specific metadata information collected and maintained by the thematic community and the differences with the basic SDI discovery metadata.

Pre- and post-requisites

Pre-requisite: "SDI Concepts and Principles"; "SDI at work"; "SDI data models and data harmonization"; "SDI Access Mechanisms"

Level(s) and formats:

- Basic – Lectures (and demonstrations)
- Advanced – Lectures and exercises
- Expert (LLL) – Lectures, exercises and group/home/project work

Required efforts: 3 – 24h

Value: 2 ECTS (when fully developed)

5.2.9. SDI application development

Title: SDI application development

Topics covered: Requirements analysis in GI; methods for process description and GI; design of (web) applications and programming methods; user interfaces and usability; API's and geospatial API's.

Learning outcomes:

- Being able to identify and describe the importance of a good design for information systems (tools, web applications …) including the way a user requirement analysis is set-up;
- Being able to derive use cases based on de description of a work process (both narrative and in BPMN) by making use of UML diagrams;
- Being able to identify the role of (geospatial) API's and to use one of the common existing geospatial API's.

Pre- and post-requisites

Pre-requisite: "SDI Data Models and Data Harmonization" and "SDI Access Mechanisms"

Level(s) and formats

- Basic – Lectures (and demonstrations)
- Advanced – Lectures and exercises
- Expert (LLL) – Lectures, exercises and group/home/project work

Required efforts: 6 – 24h

Value: 2 ECTS (when fully developed)

5.3. Project curriculum basis for adapted curricula

The project or basic curriculum defined in section 6 does not contain all building blocks that were deemed necessary by the BESTSDI stakeholders such as: "Conceptual foundations" and "Analytical methods". They are considered important, but assumption is made that these are already covered in some of the existing courses at the different faculties (e.g. in Geographic Information Systems). So they are treated as 'pre-requisites' for the SDI curricula / building blocks. It was also found during the discussions in the Mostar Workshop (11/2017) that **some of the partners' curricula lack basic teaching in Geodetic aspects**. This will be further developed under Task 1.5 and later it might be added and integrated as part of the

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SDI project curriculum. However, these additional geodetic building blocks should also be considered as mandatory pre-requisites to teach correctly on SDI's.

Task 1.5 is developing localized curricula which aim is to 'translate' the project curriculum into the local curricula. In Section 5 it was explained that many existing courses can 'host' SDI topics. How that will be done depends on the courses themselves, and on the organisational and institutional settings. The way BESTSDI wants to approach this is to perform this integration in a flexible way (total new curricula/courses will be the exception). The BESTSDI project curriculum can be seen as an 'SDI Cookbook' (all the possible building blocks) from which faculties will derive 'SDI menu's' (see figure 3).

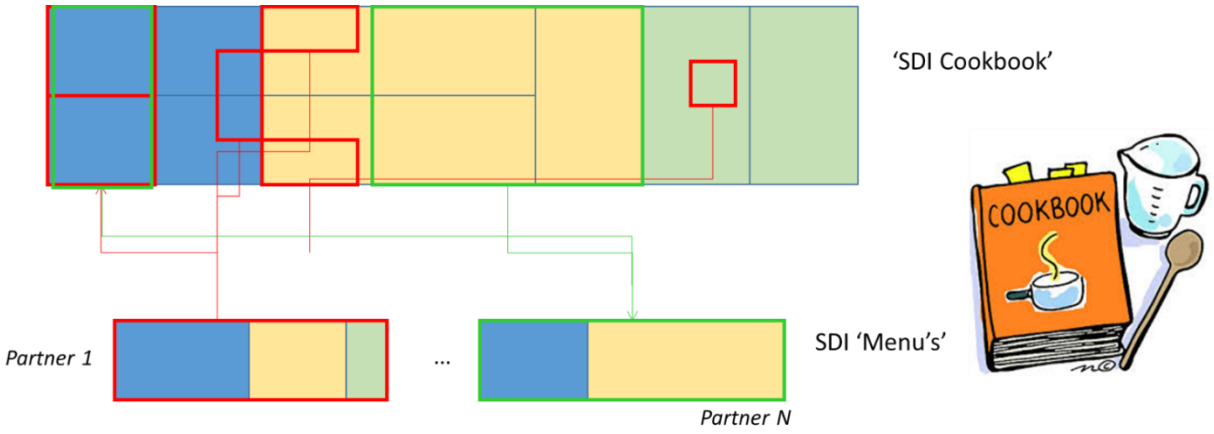

FIGURE 3: FROM PROJECT CURRICULUM TO LOCAL CURRICULA

Those menus can/will be different for each partner. Some partners will have a limited amount of hours available, others more. Some partners have a big interest in the technological aspects, while others are more focused on the thematic applications, or the data, etc. However, the project curriculum allows selecting the most relevant parts that are then assembled into a consistent offer. This can be clarified with an example: a partner might have room for 18h and foresee teaching on the concepts and usage of SDI's, exploring some of the spatial data (harmonisation) and SDI access mechanisms, while adding some elements on data & service quality and touching upon technological and non-technological trends as well. Another faculty might introduce SDI concepts and usage, while focusing on how SDI is/can be implemented in a particular field of application (data and services). Many scenario's exist.

The adaptation for localizing the curricula will be the topic of D1.5 - Curriculum adaptation specification.

6. Questionnaire

For the needs of the research in frame of T1.5 is prepared questionnaire for basic needs and possibilities for implementation of new SDI contents in existing (or in new) curriculums of partner universities.

The questionnaire contains 11 questions, which are connected with:

- Type of high educational organization;
- Number of courses from current curricula related to geodetic contents;
- Basic geodetic or cartographic contents interested for existing curricula;
- Number of courses from current curricula related to the SDI basic or advanced contents;
- Basic SDI contents interested for existing curricula;
- Advanced SDI contents interested for existing curricula;
- Possibility of change in the existing curricula;
- Courses of the existing curricula could add new SDI contents;
- Number of hours can add or make available for SDI topics;
- Opportunity to introduce new courses in existing curricula;
- Proposed SDI courses for new curricula.

The final questionnaire is available in *Annex I.*

The questionnaire is prepared and sent to partner universities in October 2017.

17 institutions in total answered the questionnaire. In the same time, two institutions were represented with two faculties:

- Polytechnic University of Tirana (PUT) and
- University of Montenegro (UCG)

They gave answers for both faculties together.

Contributors in the research were:

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University/Faculty	Role	Name
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UBL (P08)	Contributor	Mladen Amović
UNIMO (P09)	Contributor	Snježana Musa
UNSA FAFS (P10.2)	Contributor	Melisa Ljuša
UNTZ (P11)	Contributor	Mirza Ponjavić
UBT (P12)	Contributor	Naim Preniqi
UCG FPH (P13.1) UCG BTF (P13.2)	Contributor	Mirko Knežević
UNIBG (P14)	Contributor	Milorad Janić
UNINS FTS (P15.1)	Contributor	Dušan Jovanović
UNINS FCE (P15.2)	Contributor	Danijel Kukaras
UniPz (P16)	Contributor	Bashkim Idrizi

TABLE 4: THE CONTRIBUTORS

On the other side, only one partner institution did not provide answer of the questionnaire:

University/Faculty	Role	Name
UNISA FCE (P10.1)	Contributor	Slobodanka Ključanin

TABLE 5: PARTNERS THAT DID NOT ANSWER THE QUESTIONNAIRE

Despite the fact that response is not 100%, analysis of the results from the questionnaire gave important informations for the needs of the partner institutions, on which are based the results and suggestions presented in this report. The first results of the questionnaire were presented at the workshop in Mostar (November 2017).

7. Analysis

On the questionnaire, that is integral part of the Report for T1.5 - Specification of adapted Project Curriculum on SDI, answered total 17 of 18 faculties from the program and partner counties.

The first question from the questionnaire is related with the type of the high educational institution. From the answers, it can be concluded:

Type of high educational organization	Responses	Percent (%)
Geodesy	7	41
Other (geography, agriculture, forestry etc.)	10	59

TABLE 6: TYPE OF HIGH EDUCATIONAL ORGANIZATION

The second question is related to the number of courses from current curricula related to geodetic (cartographic) contents.

Number of the geodetic/cartographic courses in existing curricula	Responses (average)
Faculties of Geodesy	18.3
Other faculties	3.3

TABLE 7: NUMBER OF THE GEODETIC/CARTOGRAPHIC COURSES IN EXISTING CURRICULA

From the answers, it can be concluded that the average number of geodetic/cartographic courses that are present at the non-geodetic faculties - members of the BESTSDI Project is 3.3. That is good base for upgrade of the educational material from the area of SDI. However, it is noticeable that certain faculties do not have geodetic courses, as well as the basic knowledge of the definition and acquisition of spatial data - topics that are necessary as a base that would be upgraded in the current project with courses from SDI area.

The third question is intended to non-geodetic faculties and the aim of the question was to define the need for geodetic/cartographic courses. The results of that question are presented in next table:

Basic geodetic/cartographic contents interesting for existing curricula	Responses	Percent (%)
Surveying	7	70
Coordinate systems	4	40
Cartographic projections	4	40
Photogrammetry	4	40
Cadaster and GIS	9	90
Other	4	40

TABLE 8: NUMBER OF THE GEODETIC/CARTOGRAPHIC COURSES IN EXISTING CURRICULA

The results of the questionnaire presenting the fact that the faculties (which are non-geodetic) from the partners countries mostly want to include contents of Cadastre and GIS (90 %) and Surveying (70%) in their existing curriculums.

The fourth question is related with the number of courses from current partners curricula related to SDI basic or advanced contents.

Number of the SDI courses in existing curricula	Responses (average)
Faculties of Geodesy	10.1
Other faculties	2.6

TABLE 9: NUMBER OF THE SDI COURSES IN EXISTING CURRICULA

From the answers, it can be concluded that the average number of courses represented at the non-geodetic faculties partners in BESTSDI project is 2.6. This can be good foundation for upgrading with educational material from SDI area, which will be developed in frame of the actual project.

The fifth question is connected with basic SDI courses for which are interested the partner institutions in this Project. The basic SDI courses are defined in Report of T 1.4.

Basic SDI contents interesting for existing curricula	Geodetic faculties		Other faculties		Total
	Responses	Percent (%)	Responses	Percent (%)	Percent (%)
Concepts of SDI	7	100	5	50	**70**
SDI at work	6	86	3	30	**53**
Data modeling	7	100	7	70	**82**
Accessing data	6	86	6	60	**70**
Assessing SDI	5	71	4	40	**53**

TABLE 10: BASIC SDI CONTENTS INTERESTING FOR EXISTING CURRICULA

The results of the questionnaire show the fact that the biggest interest is for contents of Concepts of SDI, Data modeling and Accessing data.

The sixth question is connected with advanced SDI courses for which are interested partner institutions of the project. The advanced SDI courses are defined in Report of T1.4, as a form of blue, yellow and green columns with different contents.

Advanced SDI contents interesting for existing curricula	Geodetic faculties		Other faculties		Total
	Responses	Percent (%)	Responses	Percent (%)	Percent (%)
Blue columns	5	71	1	10	**35**
Yellow columns	5	71	10	100	**88**
Green columns	6	86	2	20	**47**

TABLE 11: ADVANCED SDI CONTENTS INTERESTING FOR EXISTING CURRICULA

The results of the questionnaire show that the biggest interest is for contents of Yellow columns, which cover the application of SDI in specific areas.

The seventh question is connected with possibilities for change of the existing courses (according to University regulations and legislations) wit aim introducing of new SDI contents.

The possibility of change in the existing curricula	Geodetic faculties		Other faculties		Total
	Responses	Percent (%)	Responses	Percent (%)	Percent (%)
0 %	0	0	0	0	**0**
up to 10 %	5	71	2	20	**41**
up to 20 %	2	29	3	20	**29**
up to 30 %	0	0	4	40	**24**
more than 30 %	0	0	1	10	**6**

TABLE 12: THE POSSIBILITY OF CHANGE IN THE EXISTING CURRICULA

The results of the survey show that the biggest part of the faculties can make changes in the existing courses from **10% to 20%.**

The eight question of the questionnaire refers to the courses in which partner institutions are planning to make changes and upgrades with new SDI contents. Therefore, in continuing are presented those courses (certain courses have identical names at different faculties and for that, names of that curses are presented only once, e.g. GIS).

Courses of the existing curricula (according to T 1.1) with possibility for adding new SDI contents:

- Application of GIS in Agro ecological zoning
- Basics of building design
- Basic cartography in spatial planning
- Building heritage protection and revitalization

- Complex synthesis
- Climatology
- Database in Mining
- Design of multi-family housing
- Distributed GIS
- Engineering geology
- Exploitation of mineral resources
- Fundamentals of GIS
- Geodesy
- Geodesy and GIS
- Geoinformation quality
- Geophysics
- Geoportals
- Geographical bases of spatial planning
- Geo ecological problems in BIH
- GIS
- GIS in agriculture
- Hydrogeology
- Heritage in tourism
- Integrated systems of survey
- Irrigation and drainage engineering
- Land capability
- Land consolidation
- Melioration and Landscaping
- Regional Geography of BIH
- Regional Geography in SE Europe
- Regional Geography of the World
- Remote sensing
- Spatial Databases
- Spatial Data Infrastructure
- Spatial planning
- The basics of urban planning
- Topographic cartography
- Tourist destinations
- Visualisation of geospatial data
- WEB cartography
- WEB GIS

With analyses on the results of the questionnaire, it can be concluded that all of the 48 courses can be systematized according to thematic areas:

Thematic area	Responses	Percent (%)
GIS	11	23
Spatial/urban planning	10	21
Geodesy/Survey	6	12
Cartography	3	6
Other	13	27

TABLE 13: THEMATIC AREA

From the results of the previous table it can be concluded that most of the partner faculties are planning to include new SDI contents in their specific courses (27%), while in the geodetic faculties this contents will be included in courses connected with GIS and spatial/urban planning (44%).

The ninth question is related on the number of hours with new SDI contents that are planned to be included in existing curriculums.

Number of hours available for SDI topics	Geodetic faculties		Other faculties		Total
	Responses	Percent (%)	Responses	Percent (%)	Percent (%)
Less than 6 h	4	57	2	20	**35**
6 - 12 h	2	29	8	80	**59**
12 - 18 h	0	0	0	0	**0**
More than - 18 h	1	14	9	0	**6**

TABLE 14: NUMBER OF HOURS AVAILABLE FOR SDI TOPICS

The results of the survey indicate that most of the faculties (59%) are interested to include new SDI contents in range of 6-12 hours.

The penultimate question of the questionnaire is related to possibilities for start of new courses with SDI contents in academic year 2018-2019.

The results of the survey are presented in next table:

Opportunity to introduce new courses in existing curricula in academic year 2018/19	Geodetic faculties		Other faculties		Total
	Responses	Percent (%)	Responses	Percent (%)	Percent (%)
Yes	0	0	3	30	**18**
No	7	100	7	70	**82**

TABLE 15: POSSIBILITY TO INTRODUCE NEW COURSES IN EXISTING CURRICULA IN ACADEMIC YEAR 2018/19

From the results in table 15 can be concluded that the bigger part (82%) of the surveyed faculties aren't in possibilities to start with new SDI courses in next academic year. That is understandable because introduction of new courses is connected with reaccreditation process of curriculums in averaged period of every 5 years.

This means that the inclusion of the SDI contents **should be done by changing the existing courses** (10-20% according to the previous analyzes).

For faculties that can introduce new courses in academic year 2018/19, the last question in the questionnaire is related with the proposed SDI courses. There were six proposals for new courses with SDI contents.

- Earth science;
- Geo science;
- SDI for geology and mining;
- SDI in geography;
- Application of SDI in geography surveys.

8. Proposal for adapting SDI contents

According to the conception presented in T1.4, in continuation are presented four scenarios/levels for adoption of new SDI contents:

- New **Programme** (proposed 4-semester Master study of SDI);
- New **module** (proposed 2-semester module in Bachelor study program);
- New **courses**;
- New **lectures**.

From the answers of the questionnaire, it can be clearly concluded that none of the partner universities cannot implement new curriculum or new module in academic year 2018/19, while only 3 of them can implement new courses with SDI contents starting with the same academic year. That is understandable because those changes are connected with process of accreditation and their adoption needs a long period. Therefore, in the proposal that follows, the fourth level on implementation of new SDI contents - new lectures it is elaborated in detail.

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1. **Programme**

The introduction of new curriculum is conceived as new curriculum of master studies. This curriculum should contain 10 - 12 courses with SDI contents and, could include (according to the needs of the partner institution) all proposed SDI contents (and of course, the list can be expanded).

We believe that four of the proposed contents should be mandatory, while the others may be elective.

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Mandatory

Elective

2. **Module**

We believe that three of the proposed contents should be mandatory, while the others may be elective.

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Mandatory

Elective

3. Courses

Because of different existing curriculums in which part of the stated contents are covered, each partner institution can make a choice from the proposed list of courses.

If there are no courses related with SDI, then we propose adoption of courses from "blue" list + course on application of SDI in specific scientific discipline.

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

4. Lectures

Taking into account the specifics of different needs and possibilities, the list of the lectures is prepared for each partner institution in the project.

The list is prepared according to questionnaire (especially point 5 and 6).

- *THE GEODETIC FACULTIES*

1. University of Zagreb UNIZG FOG

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

2. University of Split UNIST

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

3. Ss. Cyril and Methodius University in Skopje UKIM

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

4. Polytechnic University of Tirana UPT (one answer)

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

5. University of Novi Sad UNS FTS

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

6. University of Banja Luka UBL

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

7. University of "Ukshin Hoti" in Prizren UPZ

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

- *NONGEODETIC FACULTIES*

8. University of Zagreb UNIZG FGS

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

9. Agricultural University of Tirana AUT

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

10. University of Mostar UNMO

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

11. University of Sarajevo UNISA FAFS

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

	Courses for which the partner university has expressed interest

12. University of Tuzla UNTZ

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

	Courses for which the partner university has expressed interest

13. University for Business and Technology UBT

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

	Courses for which the partner university has expressed interest

14. University of Montenegro UCG FP and BF

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

15. University of Belgrade UNBG

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

16. University of Novi Sad UNS FCE

Concept(s) of SDI	SDI at work	Data modelling	Accessing data	Assessing SDI

Non-technological developments	Technological trends	SDI for agricultural applications	SDI application
SDI and e-Government	Semantic web Linked data	SDI for Forestry and nature conservation	
Institutional and Governance	Sensor web enablement	SDI for geology & mining	
Legal aspects	Augmented reality 3D-4D mapping	SDI for other scientific disciplines	

Courses for which the partner university has expressed interest

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9. Geodetic courses as a base for upgrading of existing curriculums with new SDI contents

As was highlighted in Report for T1.4 - Project Curriculum on Spatial Data Infrastructures, in frame of the project was discussed also for some geodetic/cartographic contents, which are necessary as a base for successful implementation of new SDI contents. In addition to this are the results from the analyses of the questionnaire, which are indicating that at certain partner universities there is a need of basic knowledge of geodesy and cartography, primarily in field of acquisition of spatial data.

From the other side, some of the faculties are highlighting that in their curriculums already have geodetic/cartographic contents. Therefore, the proposal for introducing new geodetic/cartographic courses will be limited to minimum 2.

Such a proposal corresponds with the expressed interest in the survey where most of the partner institutions express needs for introducing contents from Cadaster and GIS and Surveying.

The proposals will refer to complete courses from listed disciplines, but of course, if the partners already have some contents, they will be able to choose some parts of the listed courses.

Title: SURVEYING SYSTEMS IN SDI

Topics covered: Basics of geodesy and cartography; Surveying systems for acquisition of spatial data.

Abstract:

The aim of this course is to provide students' knowledge with basic concepts of the geodesy and cartography, which are necessary for later successful overcome the topics related with SDI.

The content of the course begins with the theories of the Earths shape and Earths dimensions, and with the coordinate systems used in geodesy and cartography.

Then there is a section dedicated to cartographic projections as mathematical models for transformation of the ellipsoid surface into a plane, as well as studying the basics of the state cartographic projection.

The central part of the course is dedicated to geodetic systems and methods for acquisition of spatial data. The methods for acquisition of the spatial data are divided to informatics, geodetics and photogrammetry. The measuring systems are containing the basics of the geodetic systems for acquisition of the spatial data, as well as measuring systems that are used in photogrammetry and remote sensing.

An integral part of the studying material should be the comparative analysis of the measuring systems in term of accuracy, effectiveness and price.

Structure:

- *Introduction in geodesy and cartography*. The shape and size of the Earth. Rotating ellipsoid. Coordinate systems (rectangular and geographic). The basic geodetic networks. Scales and deformations. Cartographic projections. The Gauss-Kruger projection. The UTM projection.
- *The basic cartographic products*. Definition and classification of the maps. Cadastral maps Topographic maps. Thematic maps. Cartometry.
- *The basic methods for acquisition of the spatial data.* Informatics methods. Geodetic methods (classic and modern). Photogrammetric methods (photogrammetry and remote sensing).
- *Geodetic systems for acquisition of the spatial data.* Classical measuring instruments - principle of functionality and measuring. Global Positioning System. Structure and description of the system. GPS Methods and measuring accuracy. Absolute and relative positioning. Use of the GPS. Laser scanning.
- *Measuring systems in photogrammetry and remote sensing.* Basic principles Basic cartographic products obtained by photogrammetry.
- *Usage of the measuring systems in SDI.* Usage of the measuring systems in designing, cadaster, spatial planning.
- *Comparative analyses of the measuring systems.* Advantages and disadvantages of the measuring systems. Economic aspects on usage of the measuring systems for acquisition of the spatial data.

Learning outcomes:

- Getting acquainted with the basics of geodesy and cartography;
- Being able for to identify and manipulate with basic cartographic products.
- Getting acquainted with the basics methods for acquisition of the spatial data;
- Getting acquainted with the geodetic systems for acquisition of the spatial data, their characteristics and comparative analysis of the advantages and disadvantages.

Pre- and post-requisites:

-

Level(s) and formats:

- Advanced – Lectures and exercises

Required efforts: 30 h + 30 h (lectures + exercises)

Value: 4 ECTS

Reference material

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Title: CADASTER AND GIS

Topics covered: Cadastral systems. Geoinformation systems.

Abstract:

The aim of the course is introduction to the concept of real estate, dimensioning and organization of the real estate data, as well as introduction to the national cadastral system. In the same time, the students should be introduced to the practical procedures for registering rights in national cadastral system.

In the second part of the course, students will have introduction to the Geoinformation systems, approaches to their formation and implementation. A particularly important part is the application of GIS in different areas of human activities.

Structure:

- Systems for spatial data management. Cadaster as a system. Contents and objectives of the cadaster. The basic principles of the cadastral system. Types of the cadastral systems. Legal, technical and managing aspects of the cadaster.
- Definition of the real estates. Registering of the real estate.
- Basic functions of the cadaster. Types and distribution of services. Management with cadastral systems.
- 3D cadaster.
- SDI and location of the cadastral systems in SDI.
- Introduction to GIS. Historical development. Definition and notions. Types of data in GIS. GIS components.
- Structured data types. Spatial entity and spatial dimensioning. Data models, concepts and terms. Data sources, acquisition, measuring technology, analog and digital conversion. Data quality, accuracy definition of the spatial and attribute data, logical consistency. Standards and standardization of geodata.
- Geometry. Spatial attributes. Raster and vector models.
- Topology**.** Introduction. Creating, properties and models.
- Spatial analyses. Modeling. Interpolation. Buffering. Spatial queries.
- Formation of GIS. Factors that determine the formation. Defining the design requests. Analyze of the system. Design of the system. Implementation. Servicing.
- An overview of the different application of the GIS. Areas of application: Development of SDI, infrastructure, spatial planning, telecommunication, transport systems, environmental protection, local, national and global application in agriculture. Geo-visualization. Methods for visualization in 2D and 3D.

Learning outcomes:

- Real estate acquaintance, dimensioning and organization of the data with real estate;
- Getting acquainted with the national cadastral system;
- Getting acquainted with the constructive components of GIS, approaches to their formation and implementation;
- Application of GIS.

Pre- and post-requisites:

Surveying systems in SDI

Level(s) and formats:

- Advanced – Lectures and exercises

Required efforts: 45 h + 45 h (lectures + exercises)

Value: 6 ECTS

Reference material

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10. Conclusions

Basic goal of the task T1.5 – Curriculum adaptation specification was identification of the specific needs of the partner university and their possibilities for implementation of the new SDI contents. The analyses in this task group was directly connected with surveys carried out from T 1.1 till T 1.4, where the main input of the data for the actual analyses is block concept of SDI contents which is defined in T 1.4 - Specification of project curriculum.

A Special questionnaire was prepared for needs of the analyses in this task group, which main goal was determination of the needs of the individual project partners that are connected with introduction of new SDI contents in their existing or new curriculums. In the same time, the separated part of the questionnaire was foreseen for the possibilities of the partner institutions for introducing of new programs, modules, courses or lectures with SDI contents.

The analysis of the questionnaire results from one side points to the great interest and need of the partner universities for introducing of new SDI contents, but in same time points to the limited opportunities for introducing new programs, modules and courses (problems which are connected with accreditation of new curriculums).

The proposal for adapting of new SDI contents arising from the analysis of the questionnaire results, resulted with presentation of 4 scenarios for introducing of:

- New **Programme** (proposed 4-semester Master study of SDI);

- New **module** (proposed 2-semester module in Bachelor study program);
- New **courses**;
- New **lectures**.

Because of very limited possibilities for introducing new programs, modules and courses, the fourth level of implementation of the SDI contents -introducing new lectures is processed in detail. This level is conceptualized in accordance with expressed interest of the partner institutions.

As was highlighted in Report for T1.4 - Project Curriculum on Spatial Data Infrastructures, in frame of the project was discussed also for some geodetic/cartographic contents, which are necessary as a base for successful implementation of new SDI contents. In addition to this are the results from the analyses of the questionnaire, which are indicating that at certain partner universities there is a need of basic knowledge of geodesy and cartography, primarily in field of acquisition of spatial data. Because of the above, in frame of the T 1.5 are presented contents of two geodetic/cartographic courses: *Surveying systems in SDI* and *Cadaster and GIS*.

The results of the survey in this task group are fundamental as input data in analyses that will be implemented in next work package WP2A DEVELOPMENT – Development of curriculum, especially in T 2.1 - Development of project curriculum and T 2.2 - Development of Life-long learning (LLL) courses for professionals.

11. References

Crompvoets, J. (2017): *Task 1.3 - Requirements Analysis*. BEST SDI project.

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Tutić, D. and Vandenbroucke, D. (2017): *Task T1.1 - Current Curriculum Status*. BEST SDI project.

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12. Annex I - Questionnaire for adaptation of Project curriculum

Partner institution_____

1. What is the type of high educational organization (character of the educational program - curricula) of program/partner institution?

   □ Geodesy
   □ Other (geography, agriculture, forestry, geology etc.)

2. Which is the number of courses from current curricula related to geodetic (cartographic) contents?

   □ _____

3. For which basic geodetic or cartographic contents is interested your existing curricula?

   □ Surveying
   □ Coordinate systems
   □ Cartographic projections
   □ Photogrammetry
   □ Cadaster and GIS
   □ Other_____

4. Which is the number of courses from current curricula related to the SDI basic or advanced contents with accordance to presentation from TG 1.4 (in attachment)?

   □ _____

5. For which basic SDI contents is interested your existing curricula? (With accordance to presentation of TG 1.4. Slide number 16).

   □ Concepts of SDI
   □ SDI at work
   □ Data modeling
   □ Accessing data
   □ Assessing SDI

6. For which advanced SDI contents is interested your existing curricula? (With accordance to presentation of TG 1.4. Slide number 17).

   □ Blue columns (SDI and e-government, legal aspects etc.)
   □ Yellow columns (Specific thematic SDI - Forestry, agriculture etc.)
   □ Green columns (SDI application development etc.)

7. What is the possibility of change in the existing curricula in accordance with the statute or rulebook of your Faculty/ University?

   □ 0 %
   □ up to 10 %
   □ up to 20 %
   □ up to 30 %
   □ more than 30 %

8. In which courses of the existing curricula (according to T 1.1) you could add new SDI contents (min 3)? (If question 7 is not 0 %)

   □ _____

9. What is the number of hours you can add or make available for SDI topics?

   □ Less than 6 h
   □ 6 - 12 h
   □ 12 - 18 h
   □ More than - 18 h

10. Is there an opportunity to introduce new courses in existing curricula in academic year 2018/19?

    □ Yes
    □ No

11. If answer of question 10 is "yes", which are the proposed SDI courses for new curricula?

    □ _____