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WP 4 – Pilots results of the Training program in the created learning environment

DIHUB

DIGITAL INNOVATION HUB FOR CLOUD BASED SERVICES

Contents


DIHUB

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1. Implementation plans of the 2 pilots in 5 National Nodes – introduction

The cloud landscape started to shift rapidly since 2019. The hybrid market, and the SaaS (software as a service) players offering technological platforms to the companies are in continuous change - the strategies, and approaches to the market are all in flux also thanks to the COVID-19 influences. The infrastructure-as-a-service providers such as Microsoft Azure, Amazon Web Services and Google Cloud Platform are the main players on the market, but new technologies such as artificial intelligence and machine learning have opened the field up to other players.

There is a huge need for new talents and professionals to be developing cloud based services for companies and other organizations using the latest technology in this rapidly changing environment. That's why we need new agile learning VET -platforms which are tightly related to real needs of the companies. The DIHUB project was brought to life to develop an adaptable model and environment for VET players to be proactive in creating vocational excellence on this area of expertise.

In this report the DIHUB project team will introduce an approach chosen to develop and carry out the Piloting of the DIHUB training program in five project countries - Finland, Croatia, Bulgaria, Portugal and Estonia.
The Piloting was done in two rounds - first to test the training program and secondly to implement updates and improvements suggested by the educational institutions and SME representatives after to better comply with the job market expectations. Both the Pilots and recommendations for the following trainings are included in this document.
The report is compiled by WP4 leaders Signe Vedler (VOCO, Municipality of Tartu) and Triin Kangur, BCS Koolitus AS.

1.1. Initial plan and Timetable

The initial objective of the pilots within the DIHUB project was to pilot the training program with students and to consider the obtained learning results. The desired outcome was to gather information and participants feedback to compare piloting experiences and learning results between institutions of different participating countries providing further ideas for development and cooperation inside the Cloud Ecosystem in terms of cloud service design and training provision.

Initial plan, as described in the Project Proposal - Structure of the Training program in Hub concept:
Duration

- 21 days training + 130 days development project

Testing period

- first round 3/2020-9/2020
- second round 10/2020-4/2020

Number of testers

- 15 testers/hub/round, total number of testers in five hubs including both rounds 140

Planned validation arrangements

- Each educational partner institution validates the training content into their existing curriculum respectively

Foreseen certification

- Each educational partner institution includes the training program into their existing curriculum or creates a new VET training program thus certifying the training nationally. There will be issued also a special certificate for participating and passing the training program.

Testing and Implementation period:
- 1st round 3/2020 – 9/2021
- 2nd round 10/2020 – 4/2022

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Number of students/testers involved:
- 14 testers per HUB, per each round
Total number of testers including both rounds: **140**

Table 1: General Pilotes data

Partner	1st Pilote datas	2nd Pilote datas
Initial Plan	02.09.2020-13.11.2020 (training) 16.11.2020-31.05.2021	04.01.2021-08.02.2021 (training), 15.02.2021-15.06.2021
REAL PILOTING		
Estonia	03.09.2020-06.11.2020 (training) 09.11.2020-21.03.2021	02.09.2021-05.11.2021 (training) 15.11.2021-10.04.2022
HH Finland	1.06.2020-20.11.2020 (training), 11.2020 - 05.2021	25.10.2021-17.12.2021(training) 06.2021-11.2021
BC Finland	04.2020-05.2020+03.2021(training) 06-08.2020+03-08.2021	01.09.2021-30.09.2021(training) 10.2021-12.2021
Croatia	04.2020- 06.2020 (training) 06.2020- 11.2020	03.2021-05.2021 (training) 06.2021-10.2021
Bulgaria	12.2020-02.2021 (training) 02.-05.2021	12.2021-02.2022 (training) 01.2022-02.2022
Portugal	10.-12.2020 (training) via HH 01.-06.2021 via HH	08.2021-12.2021 (training) via HH 01.2022-04.2022, to be continued until 06.2022 due to the COVID

Involvement in the 1st and 2nd Piloting round – in total:

- **311 students enrolled to the Pilot 1 and 2**
- **229** participated on the SMEs´ development projects (Business Cases)
- **84** teachers/professors mentored the students throughout the two pilots
- **41** business cases were delivered,
- **89** SMEs were engaged, as part of the companies participated as content providers for the DIHUB program, especially in Portugal.

1.2. Students profile

The participating students of the DIHUB project varied at large - providing age and qualification appropriate training measures depending on pupils' pre-knowledge, abilities and vocational background. The students varied from lower VET pupils, aged 15-17 to EQF level 4 students (aged 18 - 24) and grownups, taking advantage of the available governmental up-skilling and re-skilling programs. Lower VET DIHUB programs were provided to Bulgarian, Estonian and to Business College Helsinki (Finland) students.

Haaga Helia University (Finland), together with Croatian Algebra University College offered DIHUB courses and piloting for higher education students – both on bachelor and master level (EQF level 5-7); The range of participants profile included students from a number of study programs, such as software developers, AI and

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cloud computing. Pre-conditions for following the DIHUB course were described and updated before each Piloting round.

As Portugal national partners did not have a direct access to their local VET provider, the students were given a possibility to take part of Haaga Helia Uni. online training courses, but still develop and deliver the business case in their local company. Portuguese students were participating in their bachelor's degree programs in the area of IT.

1.3. Training program

The DIHUB Training program proposed by DIHUB consists of 21 days live/online learning modules (Annex 2) with development and implementation of a real business case with the SME, carried out in 100-130 days.

This concept was tested twice through the implementation of two pilots in 5 participating countries of DIHUB. In the following report the results of the journey of piloting will be introduced, illustrated by descriptive business cases and gathered feedback from all counterparts.

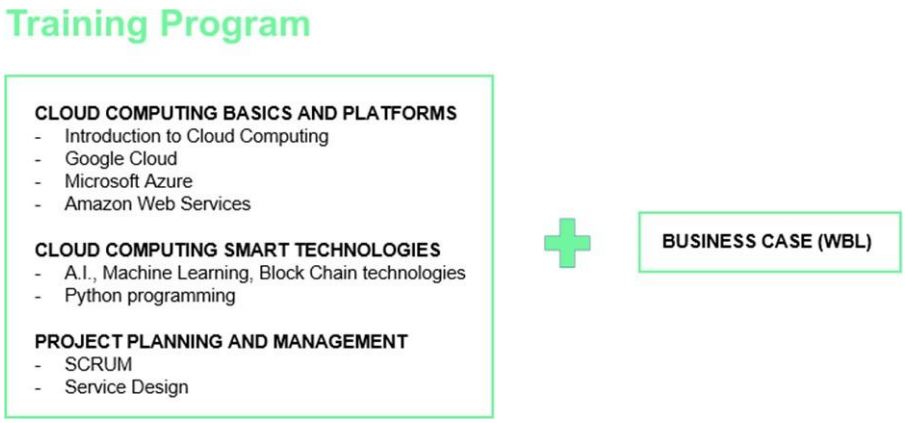

Figure 1Training program model in DIHUB project

The Training program was to create a common reference for all VET providers to be a starting point for further development and elaboration of formal and informal training in the context of cloud technologies. During the development and Pilot1 process, the curriculum was changed and to meet the EQF level 4 and 6 particular needs. The changes were made based on the gathered students and teachers/cotches feedback analysis.
The Training content was to match learning methodology with already existing formal and informal curriculums to reach the latest skills and competencies needed in the job market. At the same time new innovations (weather small or large) were created for the SME's in cloud-based services.

General Content of the DIHUB Project training:

- Introduction to development hub concept for cloud-based services, 1 day
- Service design, 1 day
- SCRUM as a project management tool, 2 days
- Planning the project design and problem set up, 5 days
- Foundations of cloud technology, 2 days
- Planning the cloud architecture for a company-based project, 5 days
- Coding in cloud-based services, 5 days
  - machine learning
  - block chain thinking
  - artificial intelligence
- Finding an industry-based service idea/platform for the development project (1-30 days)
- Creating a solution/cloud-based platform for a company through a development project (100 days)

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The industry driven development projects were carried out through SCRUM method by the students with the help of SCRUM masters, hub staff and company representatives. Each educational partner institution included the created training program into their existing curriculum. In curriculum development each educational partner institution utilised DACUM methodology where the curriculum was changed according to the real and latest skills and expertise needed when working on this area. Between Pilot 1 and Pilot 2, the intensive research of DACUM curriculum development process was carried out by the Algebra University College. The core skills and sub skills from the real work duties the experts are performing were identified and carefully examined.
As a result, DIHUB curriculum and included thematic courses were mapped with skills identifier and content of the curricula updated accordingly.

1.4. Academic recognition and appliance of EQF qualification framework

Student's project activities were assessed based on the European Qualification Framework (EQF). Most of the activities focused on the EQF levels 4-7. Project's VET-partners programs run within that framework. Student activities were measured in ECVET points and ECTS points respectively depending on the VET qualification (program)

ECVET Quality assurance process was utilised in project planning and management in every project assignment, introduced by companies. Each project assignment followed the project work procedures, so the ECVET-procedure was also treated as a natural part of the core actions.

An exception applied to **Bulgarian** Node as the students attending the DIHUB course were not measured via EQF levels. The students received a certificate of attendance, acknowledgement of learning outcomes achieved, and skills developed. The Know and Can organisation does not stand in the position of proposing the training course with ECVET principals as it is not an education provider.

In **Finland** ECVET principles were applied and the connection to VET qualifications made according to the European and National standards. Project has applied EQAVET principles to creating and implementing the quality assurance for the project. The recognition of the acquired knowledge, skills and competencies will be carried out through national VET qualification standards and through the specific training program in this project. The Specific training program will be integrated as a part of the VET qualifications (secondary level). The designed study path on cloud technologies and cloud-based AI technologies is integrated in 45 ECTS when implemented in Haaga-Helia University of Applied Sciences.

In **Portugal**, partners were collaborating with Higher Education Institutions (ISEP/Instituto Politécnico do Porto and ESTGA/University of Aveiro) for the implementation of the training and the pilots. ISEP performed the required steps to acknowledge two training courses provided by DIHUB (Advanced Artificial Intelligence and AWS) so that each student was awarded 5 ECTS per course upon successful evaluation. ESTGA was also planning to recognize ECTS credits for training courses and considering on-job training as the required apprenticeship/capstone project within their EQF 5 programs and, therefore, awarding credits according to the approved curricula.

In **Estonia** the IT students of Tartu Vocational Centre (VOCO) applied for the EQF level 4 qualification when successfully graduating the DIHUB course and apprentice period.
The pilot training in Bulgaria was scheduled to start in early November, but actually started in December. The training was attended by students from all courses of the Technical University in Sofia, from various specialties (30) and students from 11th and 12th grade of the Vocational School of Audio, Video and Telecommunications in Sofia (12). Theoretical and practical classes were held in December, January and February, and several opportunities were provided for the evaluation session.

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1.5. Examples of the training courses under the DIHUB program

After the Pilot 1 analysis the preconditions for students entering the course on EQF level 4 and level 6 were described. All 4 examples are described via process steps, that are compared to each other, based on the Algebra University training delivery approach.

The joint DIHUB curriculum covers following cloud jobs relevant across cloud landscape:

- Cloud manger/administrator
- Cloud migration expert
- Cloud strategist and monetization expert
- Cloud service/content creator
- IT-support cloud specialist (EQF 4)

1.5.1. Example 1; Tartu Linn, Tartu Kutsehariduskeskus (VOCO), Estonia

Course name: DIHUB training program IT System Specialist for cloud services deployment
ECTS credits: 5
EQF level: 4
Name of degree programme(s): IT System specialist
Teaching language: Estonian

Learning objectives:

- Ability to configure a predefined cloud service to tailor an IT services, according to a certain business needs;
- Ability to create an environment necessary to host the application or service using the capabilities of the cloud service provider;
- Capability to protect IT systems using the services of cloud service providers and capabilities;
- Prepare the usage reports of services, users, and devices, based on data collection results of cloud services and reporting tools usage.

Table 1 Training program of Estonia

Day no	Topics	Definition by DACUM skills identifier
1	Introduction. Methodology	Communication
1	Different Cloud service providres. Cloud contception	Service Architecture, Presentation
2	Different Cloud service providers. Cloud contception	Service Architecture, Teamwork, Presentation
3	Public Clouds- OneDrive, Google Drive, Dropbox, OwnCloud, NextCloud	Service Architecture, Presentation
3	Design thinking. Persona. Lean business model	Communication, Teamwork
4	Synology private cloud	Service Architecture
4	Agile project management. Manifesto.	Teamwork, Presentation
5	Practice: Domain registration (pilw.io)	Service Architecture

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Day no	Topics	Definition by DACUM skills identifier
5	Different business sectors. Their business needs and processes	Presentation, Ethics
5	Process management	Presentation, Communication
6	Practice: DNS subscription, containers	Serverless Architecture
6	Business processes and support processes	Teamwork, Presentation
6	Cloud Panel management	Cloud Deployment
7	Cloud Panel management	Cloud Deployment
7	IT-support	Cloud Deployment, Automation
7	Teams, roles, rules of the team, Team building activity. Team contract	Teamwork, Communication, presentation
8	Cloud environment- pro and cons	Serverless Architecture, Ethics, Communication
8	Risk management	Teamwork, Presentation
8	Cloud service design	Serverless Architecture, DB Management
9	Cloud service design. AI possibilities	Presentation, Ethics
9	Demo solutions	Presentation
10	Cloud service design, security.	Security
11	Demonstration session. Trends	Teamwork, Presentation
11	Visit SturtUp or SME and map their needs	Presentation, Ethics
12	Practice: Customer profile. Needs and business processes. Cloud service as one solution- pro and cons	Server Architecture, Serverless Architecture, Presentation, Teamwork, Communication
13	Practical teamwork: team meeting for 1st solution design sprint, choose the environment, solution design	Teamwork, Serverless Architecture, communication
13	Contracts between customer and service provider	Teamwork, Presentation, Communication
13	Practice: Solution design, Mock up	Serverless Architecture, DB Management, Presentation
14	Practice: Solution prototype at virtual machine vCenter	Cloud Deployment, Security
15.-16.	e-learning: virtual team work (prototyping). Team meetings for sprint	Cloud Deployment, Ethics
17	teamwork: further development of prototype	Automation
18	Team meeting for next sprint	Cloud Deployment
18	Further development. Conversation with customers	Teamwork, Presentation, Communication
19	teamwork: Testing	Cloud Deployment, DB Management, Security
20	Documentation. Prototype technical solution accordance to the contract	Teamwork, Communication
20	Documentation: Project management	Teamwork, Communication

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20	Documentation: Prototype accordance to the business processes	Teamwork, Communication
21	Team presentations: Solution structure technical model, Lean canvas model, Prototype technical solution presentation, Feedback	Teamwork, Communication, Presentation

Execution methods:

- classroom learning
- virtual classes
- independent learning
- hands-on laboratories
- project based learning
- hackathons with company representatives
- internship (42 ECTS credits) in companies

Learning materials:

1. VOCO Moodle course: https://moodle.edu.ee/course/view.php?id=32406
2. Azure Fundamentals - https://docs.microsoft.com/en-us/learn/certifications/azure-fundamentals/
3. Microsoft Learn - https://docs.microsoft.com/en-us/learn/
4. Google Workspace - https://workspace.google.com/training/
5. Microsoft 365 - https://support.microsoft.com/en-us/training
6. AWS training - https://www.aws.training/
7. Google Cloud - https://cloud.google.com/training

Pre-requisites/Starting level and linkage with other courses:

- IT System specialist, EQF level 4;
- Basics of IT management (at minimum 10 ECTS credits); basics of Linux and/or Windows operation system (at minimum 8 ECTS credits);
- Application servers (at minimum 8 ECTS credits);
- IT management automation and services (at minimum 10 ECTS credits);
- Computer networks (at minimum 16 ECTS credits).

1.5.2. Example 2: Bulgaria

Course name: DIHUB training program Business Impacts of Cloud-Based AI Services

Institution: Technical University of Sofia and 2nd pilot: The University of Forestry in Sofia
ECTS credits: 5
EQF level:4 (2nd pilot involved also students from the secondary school level (EQF level 3) and university students (EQF level 5)
Name of degree programme(s): System Specialist for cloud services deployment
Teaching language: Bulgarian

The research showed that there were no educational institution in Bulgaria at all educational levels who would have had a comprehensive course on the use of cloud technologies available at that time. This led to the decision to adopt an experimental online course, close enough in content to the content discussed in the partnership, as additional topics in it would be holographic solutions and the use of virtual reality in the educational process, topics in which the Technical University has traditions and facilities for practical implementation. It was considered that the course is suitable both for students from all levels of higher education and for the last two courses of vocational high schools with relevant specifics.

Know and Can Association be responsible for the logistics of training and technical support of online events. Technical infrastructure used for delivering the first Pilot's results were e-mails and the closed VPN group allowing the use of educational theoretical resources, as well as paid ZOOM version for the meetings, Amazon and Microsoft cloud resources. VPN connection and paid (chosen by the trainers as they had no financial resources for them). FB group for communication on any issues.

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After the education process, students were connected to the SMEs who expressed their interest in participating in the DIHUB project. SMEs presented the issues they would like to resolve with the cloud-based technologies. Some examples of projects students were working on are as follows:

- The first project was aimed at transferring a database located on a local server on a cloud with access levels, to facilitate online work.
- The second project was related to a mobile application for insurance agents in damage assessment, which helps them to quickly advance the quantitative assessment.
- The third project is a thesis of a student from the Agricultural Academy, who joined the course with a slight delay, on the collection and analysis of data obtained by drone on the state of crops and anticipation of optimal agricultural activities - watering, spraying, etc.

During the 2nd piloting round the University of Forestry included to involve 8 secondary school students and 7 university students who formed three student teams. The secondary school where the students participated in the project is a private UniSoft educational institution specializing in the education of ITC students. In Bulgaria, this level of education corresponds to EQF3. The students who participated in Pilot 2 attend the University of Forestry and are at the EQF4 and EQF5 level, and the topics covered during the pilot are completely new to them.

1.5.3. Example 3: Algebra University College, Croatia

Course name: DIHUB training program Business Impacts of Cloud-Based AI Services

System Specialist for cloud services deployment
ECTS credits / 5
EQF level: 6
Teaching language: English

Course Information
Pre-requisites: Program is open to undergraduate students who have completed at least 1 year of study at the time of participation. Entry to the program is on a competitive basis.

Course Description
The course cover´s simple representation schemes, problem solving paradigms, constraint propagation and search strategies. Areas of application such as knowledge representation, natural language processing, expert systems, vision and robotics are explored followed by an in-depth understanding of AI cloud-based products, services, applications.
Course dominantly focuses on demonstrations of AI in the business domain through real cases, many of them hands-on, which unlock opportunity to play with tools that are considered to be building blocks of the modern approaches to AI.
All throughout the course **knowledge exchange, education and prototyping** are highly supported.

The course roughly consists of:

- 40% theoretical classes: AI explained in plan terminology for non-IT students.
- 30% business applications of AI: Up to date, most relevant, real world business cases of AI applications with a detailed breakdown analysis and explanations of functionalities. Why are data-driven and AI-based companies really succeeding? Where is the real return of investment and how-to assess it?
- 30% practical demonstrations of AI services, programs and platforms: From the world leading providers of AI cloud-based services for corporations (like Google, Amazon and Microsoft) we are bringing a selection of top applications with demonstrations of their usage.

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1.5.4. Example 4: Haaga-Helia University Applied Sciences, Finland and Portugal

Haaga-Helia UAS provided online learning courses to degree students in 4 cloud technology related areas which are described in detail under the Project´s WP3 report. Following examples are only fragments of the training courses provided to students during the 1st and 2nd piloting cycle. Enrolment to a specific course depended on students´ pre-knowledge or skills acquired beforehand.

Course name: System Specialist for cloud services deployment
ECTS credits: 56
EQF level: 6
Name of degree programme(s): Cloud computing specialist
Teaching language: English

Topics covered under the course:

- Hybrid cloud
- DevOps
- Application migration strategies
- Automation
- Performance testing
- Change management
- Teamwork
- Ethics
- Communication
- Presentation

Topics taught under the DIHUB Program by Haaga-Helia University of Applied Sciences

- AWS Foundations as found in the AWS Academy and MS Azure materials
- Basics of machine learning
- Business case examples
- Machine-learning environments in the cloud environment
- Basics of techniques for implementing chatbots
- Implementation of a chatbot with the ability for informative dialogues with the IBM Watson Assistant cloud service

Courses provided to students during the 2nd Piloting round:

- **AWS Cloud operations** (**Target:** students already enrolled in previous AWS Academy Cloud Foundations course)
- **Microsoft Azure Cloud Fundamentals** (**Target:** students initiating the DIHUB path)
- **Advanced AI** (**Target:** students who have completed the course Basics of AI or elsewhere acquired the same knowledge and skills)
- **Microsoft Azure Cloud Fundamentals** (**Target:** students initiating the DIHUB path).

Portugal

In Portugal the students of higher education participated in the Haaga-Helia University online training courses, but developed and delivered their business cases locally, in cooperation with the Portuguese SMEs.

In Portugal, the first step was to dialogue with Haaga-Helia partners to identify the courses where Portuguese students could participate. In parallel, Portuguese partners of DIHUB identified Higher Education Institutions

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interested in collaborating with the DIHUB project to offer additional training to their students and potentially integrate this training offer in the future in their curricula.

1.5.5. Example 5: Business College Helsinki, Finland

Course name: DIHUB training program for ICT-support Specialist
ECTS credits: 8
EQF level: 4
Name of degree programme(s): ICT-support Specialist
Teaching language: Finnish / English
Contents of the Training Program: CLOUD COMPUTING BASICS AND PLATFORMS

Introduction to the Cloud Based Services-Training Program and DIHUB environment (1 day)
Foundations of cloud technology (4 days)

1. Linux Virtual machines
2. Microsoft Azure
3. Google Cloud
4. Amazon Web Services

MS / Google Cloud Platform fundamentals (4 days)

CLOUD COMPUTING SMART TECHNOLOGIES
Coding in cloud based services, (5 days)

5. machine learning, 1 day
6. block chain thinking, 1 day
7. artificial intelligence, 1 day
8. introduction to programming with Python, 2 days

PROJECT PLANNING AND MANAGEMENT
Finding an industry based service idea/platform for the development project in SME
Planning and managing the company based project (3 days)
SCRUM as a project management tool (1 day)
Service design and improving the Customer Experience (3 days)

Execution methods:

9. Classroom learning / Distance learning / Online learning
10. Self Study
11. Video Tutorials
12. Quizzes
13. Assignments

Learning materials:

14. Business College Helsinki - itsLearning course materials
15. Google Cloud Training - https://cloud.google.com/training

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16. Microsoft Learn – https://docs.microsoft.com/en-us/learn/paths/az-900-describe-cloud-concepts/
17. AWS Fundamentals - https://aws.amazon.com/getting-started/fundamentals-core-concepts/
18. Teachable machine tutorials - https://teachablemachine.withgoogle.com/train
19. DIHUB Online learning materials – https://courses.dihub.cloud/course/introduction-to-artificial-intelligence/
20. DIHUB Online learning materials – https://courses.dihub.cloud/course/service-design/
21. Teachable machine tutorials - https://teachablemachine.withgoogle.com/train
22. Helsinki University MOOC materials - https://programming-22.mooc.fi/
23. LinkedIn Learning courses

2. Piloting plan - Implementation guidance and scheduling in 5 National Nodes

In WP 4 the created services are piloted through real industry driven needs/assignments which are formulated as a development projects. In each partner country there will be addressed five development projects in which there are three students per one project (this can be modified a bit depending on the development projects available). Thus total amount of students in each partner country is 15 in one Training round. The Training program is piloted two times. After the first round the training program is modified according to the feedback received. All pilots in five partner countries will be documented

The cloud landscape started to shift rapidly since 2019. The hybrid market, and the SaaS (software as a service) players offering technological platforms to the companies are in continuous change - the strategies, and approaches to the market are all in flux also thanks to the COVID-19 influences. The infrastructure-as-a-service providers such as Microsoft Azure, Amazon Web Services and Google Cloud Platform are the main players on the market, but new technologies such as artificial intelligence and machine learning have opened the field up to other players.

There is a huge need for new talents and professionals to be developing cloud-based services for companies and other organizations using the latest technology in this rapidly changing environment. That's why we need new agile learning VET -platforms which are tightly related to real needs of the companies. The DIHUB project was brought to life to develop an adaptable model and environment for VET players to be proactive in creating vocational excellence on this area of expertise.

Although the general idea of the learning objectives was similar, the training delivery modes and approaches differed at large, depending on the study levels (EQF levels), education institution forms (VET, university, university of applied sciences).

2.1. Sample models of Piloting

In this chapter we introduce a training approach the National Nodes chose to use for delivering the training and apprenticeship. An approach is demonstrated via the process steps described below.

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2.1.1.

Sample model of piloting and pitching of business cases (by Algebra University College)

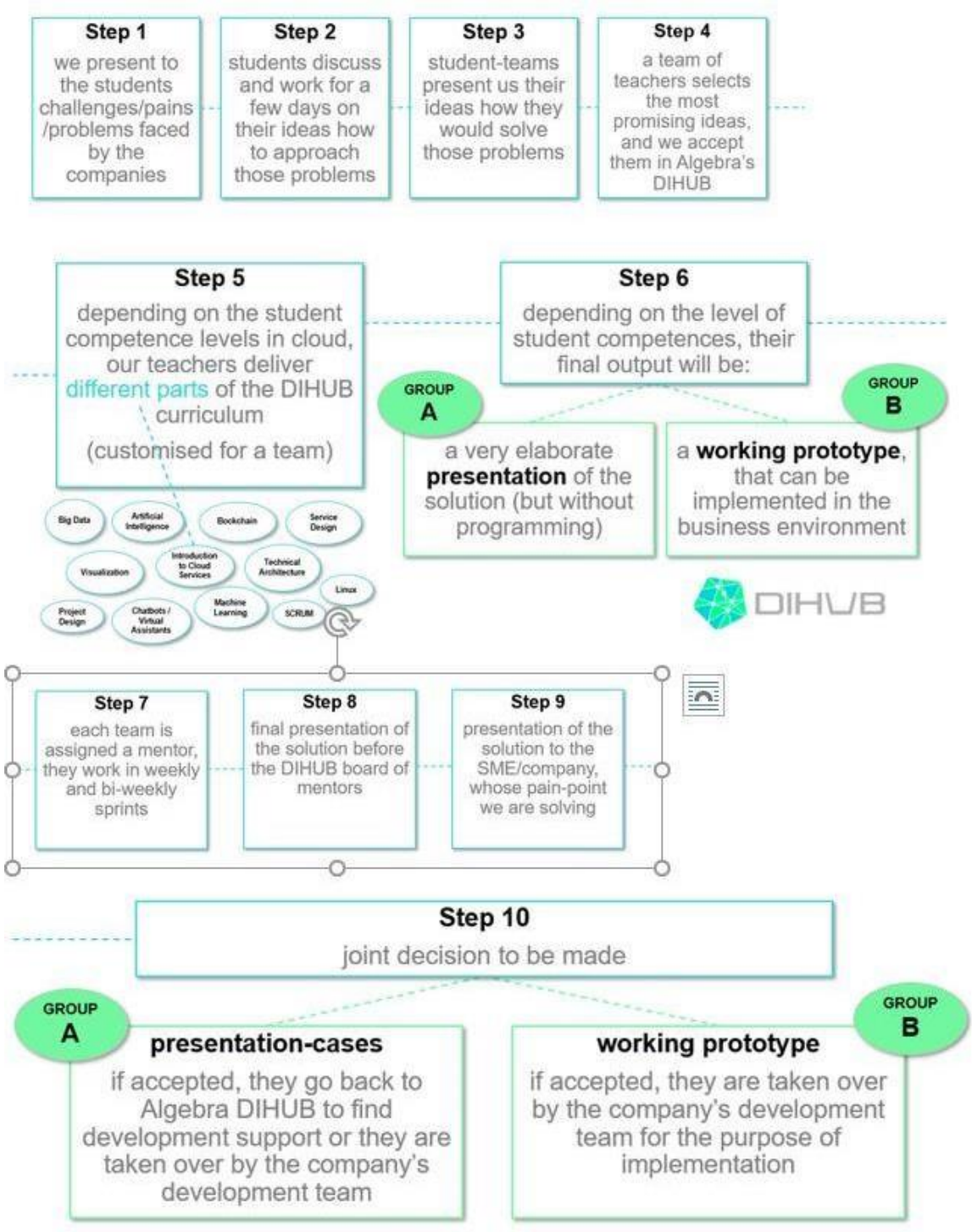

Figure 2 Algebra University college piloting model for DIHUB

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2.1.2. Training approach for Pilots in Estonia compared to Croatian model

When comparing the Croatian model with Estonian training approach the process steps are similar,but vary in sequence. For Estonian DIHUB model the writing of the Diploma paper is a mandatory step, as it qualifies as a part of the national qualification exam.
It includes the following parts: Defining the customer needs; Research; Solution finding and justification; Prototyping; Practical solution development; Deployment to the customer; Testing; Project documentation; Feedback and Forwarding.
Similar training and piloting model is in use in Bulgaria, except for the diploma paper writing and qualification

Figure 3 Piloting model of Estonia

2.1.3. Training approach for Pilots in Bulgaria

In Bulgara the same type of pilot steps were used as in Estonia. Likewise to Finnish students, the Bulgarian students did not write a diploma paper but carried out the business cases as extra curricular actvity. The 5 business cases developed were publicly announced. Supporting audio-visual materials were created and dissemiantated via Yutube channels.

2.1.4. Training approach for Pilots in Finland

Business College had a very similar process compared to Estonian model with the exception that the business projects were not part of students' internship. Students took part on business projects as an extra curricular activity. Business College students did not write a diploma paper, but they did write a report about their projects.

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Business College Helsinki process steps:

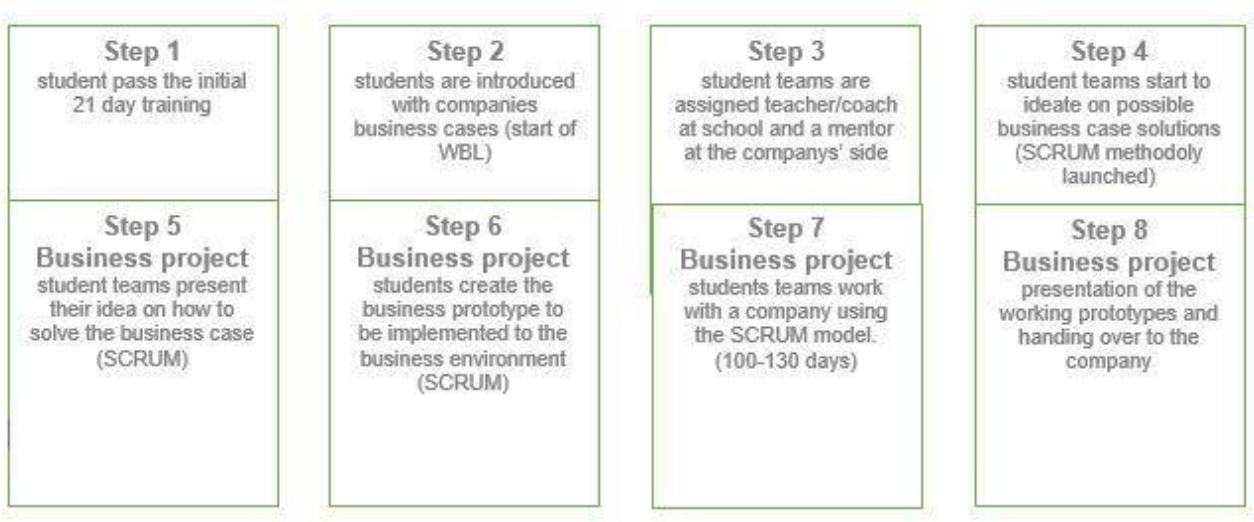

Figure 4 Helsingi Business College piloting model

Haaga-Helia and Portuguese training program process steps

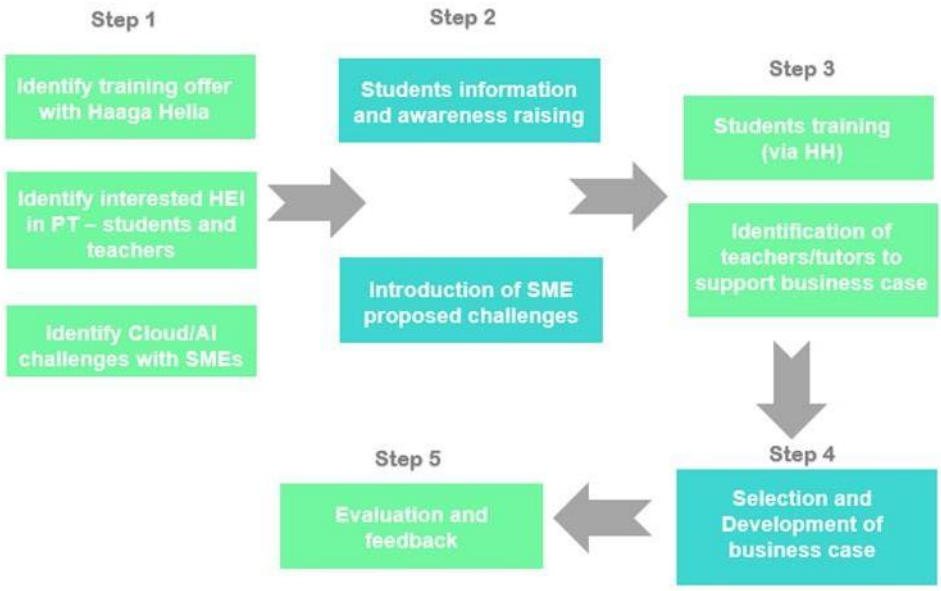

Figure 5 Haaga-Helia University and Portuguese piloting model

In Portugal, the first step was to dialogue with Haaga-Helia partners to identify the courses where Portuguese students could participate. In parallel, Portuguese partners of DIHUB identified Higher Education Institutions interested in collaborating with the DIHUB project to offer additional training to their students and potentially integrate this training offer in the future in their curricula.

Meanwhile, Portuguese companies who had participated in the survey held under WP2 were invited to propose challenges related to cloud-based technologies and AI that could be addressed by students. So, this first stage entailed the following key components:

1.1. Cloud/AI training provided by Haaga Helia

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1.2.

1.3. Portuguese Higher Education Institutions willing to collaborate with the project (providing students to participate in the project and teachers/tutors to support students)
1.4. Challenges proposed by SMEs that could be turned into business cases
1.5. Support of Portuguese partners (INOVA+ and TICE) to bridge all the components and support each party.

A second step of the process entailed the engagement of students (presentation of the project, training offer and next steps) and presentation of challenges proposed by companies. This was usually done through the organization of awareness raising sessions by INOVA+ and TICE with students, teachers, and SMEs. Before and after these sessions there was also information provided per e-mail and in the online platforms of the Portuguese Higher Education Institutions.

Thirdly, students with interest in engaging in the project were supported by the Portuguese partners to register and participate in the training provided by Haaga-Helia. At the same time students were invited to think about the challenge/project to develop with companies and DIHUB partners worked with the Higher Education Institutions to identify the teachers that would be able to support students in liaison with SMEs in the development of the business case. Initial proposals were developed by companies to establish challenges, objectives, and goals, but, also, to define the context and the problem and potential approaches. This early-stage document was assessed jointly by professors and students to align it with their on-going higher education programs. For example, based on companies' proposals, ISEP professors submitted for evaluation and for students' selection some of the proposed cases in order to be developed during MSc thesis preparation courses. This required them to further elaborate on the methodology and on scientific objectives. Proposals were approved by courses' directors.

After completing the training component, the students would continue their dialogue with the hosting SME with the mediation of the professor from the Portuguese Higher Education Institution. However, this step was difficult to implement due to various reasons (explained in detail in the reports of Portuguese Pilots provided under WP5), so Portuguese students who completed the DIHUB path worked on practical projects of their family businesses.

In short, the DIHUB proposal of internship/collaboration with companies overlaps with the current offer of paid internships and already selected projects provided by several Higher Education Institutions. Thus, participation in DIHUB internships would represent an additional burden that would be very difficult to accommodate by students (students in IT – or related - fields are already very much demanded by companies who provide them attractive grants or job offers).

Once the practical component of the work was completed, there was an evaluation with students and professors involved in order to collect information for reporting purposes.

3. Training and apprenticeship mode

The goal of the participating schools was to offer their students the opportunity to solve life-like tasks and use the same environments that companies use to implement cloud solutions.

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An important detail in the preparation of business solutions is that the needs mapping or the request for a real working solution is submitted by the SME itself. Strong emphasis in developing the business cases was on

mutual collaboration and communication building between students and an SME; The role of the coach was purely to support the students team in their working process towards atchieving the goal - delivering of the working prototype version of a cloud-based solution.

Except for Haaga Helia University, all other education providers proposed the DIHUB training as a hybrid learning course for students. Even if the initial plan was to run the training only in classroom mode, the CORONA-19 pandemic was a true game-changer and forced education providers to switch to online or hybrid study mode, instructing students, teachers, and coaches to work from school, from home and offices and taking advantage from various online platforms.

As Portuguese students took part in the courses offered by Haaga-Helia, their training took place only online, which required a very high level of intrinsic motivation. Participating students earn extra credit for being so devoted to their task and goal, especially because also courses were taught in English.

3.1. Student mentoring – coaching

For mentoring, the DIHUB project partners have chosen the internationally acknowledged TOY methodology, that enables more relevant stakeholders in the student mentoring process and give the mentee an opportunity to use an agile project and also problem solving methodology. It also encourages “learning by doing” approach, with continuous feedback and supported collaboration between team members.
According to Minna Erkko and Jaana Hiltunen (2017), the TOY methodology implementers and trainers at Tiimiakademia, Finland, the key elements of the model are team-learning, learning by doing, regular team learning sessions with a team coach, continuous self-reflection. TOY model is considered to be flexible and easily adoptable by the education providers (institutions and independent teachers), providing vocational learners the opportunity to gain practical knowledge of the entrepreneurship and implement the team teaching methods in vocational training in general.
According to the TOY methodology the mentoring is run by a team-cotch – an adequately trained content expert or a teacher, being able to coach the work of the team and notice each team member's personal development, with the task of supporting students learning, not by teaching but by listening and coaching. (retrieved from http://inku.ee/toy-model)

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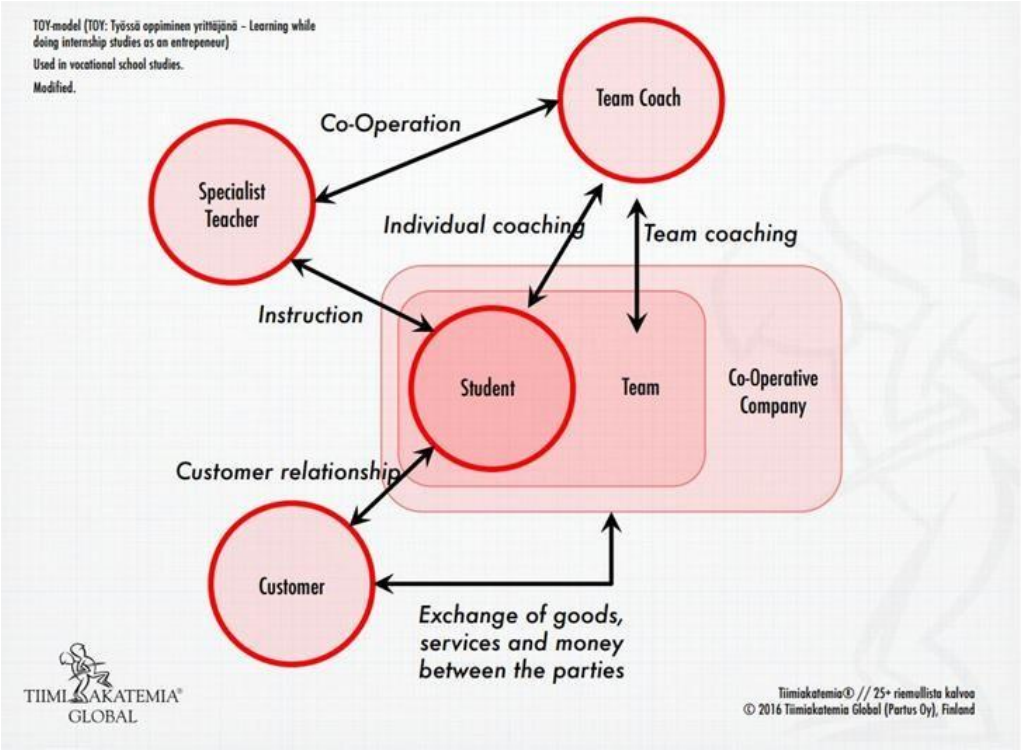

Figure 6 TOY-methodics model by Tiimiakademia

3.2. Mentoring by SMEs

Mentoring was considered as a vital part of the Piloting. The methodology chosen for the process was the Finnish team-learning approach of TOY – as an example the Estonian approach is described in more detailed way. For both Piloting rounds the 3-member student teams were appointed a field specialist. During the 1st Piloting Round the mentors were VOCO´s or BCS Koolitus´ employees; for the 2nd Round of Piloting the IT internship supervisors also carried out the role of a mentor (cotch).
As an agile project management methodology was implemented, the teams divided and prioritized their development tasks between sprints and among team members. Mentors encouraged students to study their development tasks independently; carry out research on similar known solutions developed and implemented in the sector. As an important part of the mentoring process weekly meetups between the team and a mentor

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and a customer representatives were organized to review the activities carried out inside the sprint. Also new plans and timeframe was set up for the next sprint.
As a rule, each team was able to reach a solution independently, in the meantime it was possible to test what was done and ready from the customer´s view-point. Based on the feedback received, the following tasks were started. In order to ensure that the project would be completed by the agreed time, there was also close contact between the school and the SME representative and, if necessary, a trainer from the BCS training was involved to obtain the expertise.

3.3. Pitching of business ideas

At the end of the training, before the internship, the teams pitched their ideas. The students gave an overview of which company the solution is made, what the company is dealing with, what IT problems need to be solved, who is the persona, they made a structural plan where they explained which cloud technology would help to solve them. They assessed the risks of moving to cloud technology and devised risk mitigation measures. Based on the feedback received from the internship company, the students introduced changes in their conceptual design as well as in the development work at a later stage. In summary, when planning DIHUB project-type activities, the students found the project management methodology to be very useful and usable in the future.

3.4. Examples of best practices – Business Cases

3.4.1. Business cases of Finland

Helsinki Business College

Business Case 1; Serching engine solution for enviromental newsfeed platform (two students)

- Interest to cloud services
- Interest to the issue of the business case as there was sustainable development aspect and the other student had know how on that area (engineer from the field of enviromental issues)
- Interest to search robot practices
- High motivation to solve a business challenge

Business Case 2; MS 365 service platform for the multirestaurant concept (5 students)

- Learn new things and expand your skills.
- Have a really big digital interest and I live in the spirit of new SaaS, PaaS and IaaS services and automation. DIHUB fits well with my area of interest which is

1: Surveys the digital needs of companies
2: build a workable solution
3: assists in deployment, guidance, and training

- Gaining practical experience
- To have a concrete example of job skills needed
- To learn / experience new things, get to use learned knowledge skills, rewarding to see your own handprint
- Renewing digital needs and solving problems
- Own interest in cloud services and service design

- High motivation to solve a business challenge

Business Case 3; Chatbot solusion in e-commerce in the area of celebration industry (2 students)

- To learn new things at new area
- Interesting topic to have a business related challence
- Willigness to help the entrepreneur
- To test the limits of own abilities
- High motivation to solve a business challenge

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The Haaga-Helia UAS students were vey motivated to participate in the pilot 1 because the course contents were very much related to what is asked by the job market. The contents included topics such as: AWS Foundations and the implementation of a chatbot using the IBM Cloud, more specifically the IBM Watson Assistant.

In addtion the pilot 1 offered access to an expert network which lasts also after the completion of the first pilot.

Business Case 4

- Chatbot implemeted in the area of travel industry. The cloud platform provider was IBM and the business partner was Hotelwayai. Number of students participating was 14.

Business Case 5

- A robotic process automation (RPA) tool was implemeted to a company. The SaaS from Blue Prism Cloud was used. Number of students participating was 2 (thesis author and the peer reviewer).

3.4.2. Business cases of Croatia

There were six business cases in total implemented by student teams at Algebra University College.

Business Case 1

- Cloud platform for gamification of early-school education.
  The platform is intended for primary school students aged from 6 to 11 who are involved in distance learning. The main use of a game-like learning environment is to provide a fun, friendly, and simple way for children to learn online by combining a game and education. This virtual game allows students to interact with one another by moving around the virtual classroom environment and use predefined actions. It also allows sharing files between the teacher and students. The class environment would be controlled by the teachers who would have certain privileges to keep the desired learning atmosphere. Students would learn, solve quests and quizzes, collect points and virtually socialize with friends.

Business Case 2

- Cloud platform for digital nomads
  After settling in the new country, digital nomads need to arrange many services. This is why students also try to enable the possibility of finding the transportation and telecommunications services with the help of Nomad Rescue application. In addition, the application would make it easier for users to find documents which they might need for contracting banking, legal and insurance services. Also, plan is to make it easier for users to find an available coworking spaces and engage in a virtual tour-guide according to their preferences.

Business Case 3

- Cloud-based platform for insurance companies for personalised data collection
  According to the team's plan, the application would collect the data on users' daily activities and behaviours. Data collecting would be enabled by smart bracelets and smartwatch technology.

- Thus, the application would calculate and propose personalized health insurance based on user's behaviour. The prices of the insurance itself would be based on the policyholders' lifestyles. Those who exercise regularly, eat healthy and do not consume harmful substances would pay less for the health insurance than those who do not engage in physical activities and have poor eating and living habits.

Business Case 4

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- Cloud-based platform for tourist agencies for creating personalized tourist tours.
  The Travelty app would create recommendations for user based on user's personal preferences. Except offering the suggestions on various locations, users will have the option to search for places. After creating a personalized journey, the user would be presented with an interactive map showing the route with information for every sight the traveller is visiting. When traveller passes by some city landmark, the app can tell him more about this place – not just history facts, but also many fun facts and anecdotes. The voice navigation could be turned off and then the information would be presented by text. The Travelty app would represent an encyclopaedia, tour guide and trip planner all in one – in your pocket.

Business Case 5

- Cloud-based information solution for the care of elderly people.
  The team is working on a Silver Care solution that will help elders manage their daily routine while informing their families and caregivers of any issues. The Silver Care application would remind the elders to take medication, emphasizing which medication and in what quantity they should take at a certain time. Also, the elders, but also caregivers would receive notifications about the date when it is necessary to visit a doctor to issue a new prescription for a particular medication. Since elders often have impaired vision or hearing, students are developing a solution in a way that will provide additional light notifications or device vibrations when receiving notifications. Of course, students are also working on the ability to adjust the size of the text on the screen. As the elders, despite their health condition, often prefer to live alone, their caregivers often worry about whether everything is fine with their loved ones. Therefore, the idea is that Silver Care allows periodic measurement of the elderly person's heart rate and detects a potential drop with the help of a smartwatch.

Business Case 6

- Cloud solution for medical tourism.
  Team members pointed out that their solution would provide numerous reliable information to potential patients interested in undergoing medical procedures in Croatia. Users of the platform could search for available medical procedures and filter search results based on treatment type, price, location and desired date. Furthermore, the platform would allow individual consultations with medical professionals prior to treatment in order to give patients the opportunity to discuss their medical situation with a specialist.

3.4.3. Business cases of Bulgaria

Business Case 1

- Used cars online repair-shop website and e-commerce solution development
  The fleet in Bulgaria is the oldest in the European Union. After accidents and other repairs, second-hand parts are often used. But finding them takes a long time, because the parts are not well packed, there are often discrepancies in the years of production and they do not fit. A medium sized garage approached the team from the second DIHUB pilot training to inventory, z

- by vehicle brand and model second hand spare parts, describe their location (the garage is 8 acres) and set up an online ordering shop. A virtual machine in the cloud processes Big Data - creating a model for each day of the year based on the results, taking into account the weather data for the day recorded in the logs of each generator. Another virtual machine compares forecasts from three different sources and produces a program with a forecast of wind directions. The two results are compared and the optimal solution is sought, with the advantage of the second machine running on the fresh forecast. The car wash area is divided into quadrants, rows, tiers and floors for ease of locating, and this information is also entered into the bar code.

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https://monzacar1.mobile.bg/ For the realization of the online store the platform of mobile.bg the largest retailer of cars and spare parts in Bulgaria was used.

Business Case 2

- Audio-video materials creation, rendering and files transfer to cloud servers.
  Using a local resource (server) various advertising media materials were developed and processed, including video ones. Rendering requires significant computational resources and additional storage space. The company was offered, as part of their terms of reference, a cloud server transfer, with different levels of employee access. The timing was particular because of the restrictions imposed related to Covid and remote working, which made it very difficult for external contractors to complete the tasks set for the company. https://neterra.cloud/bg was selected for test trials, with only a portion of operations initially transferred to the cloud server.
  A solution was found to work together on the physical and virtual, with the increased computing power, the waiting time was significantly reduced, hence the productivity of the company. All employees were able to work from home. Subsequently, the package used was upgraded one more time, which not only fully satisfied the immediate needs, but also had a significant margin for expanding the work. The BRCC partners submitted this case for resolution after quite lengthy discussions, mostly related to information protection. The company works in the field of advertising, where competition is very high and theft of ideas (not yet copyrighted) is a very serious problem.

Figure 5 Business case 2 result

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Business Case 3

- Optimization of windmills´ turbines' performance by 8-10% based on a meteorological forecasts and accumulated data collection
  A virtual machine in the cloud processes Big Data - creating a model for each day of the year based on the results, taking into account the weather data for the day recorded in the logs of each generator. Another virtual machine compares forecasts from three different sources and produces a program with a forecast of wind directions. The two results are compared and the optimal solution is sought, with the advantage of the second machine running on the fresh forecast. The case is interesting for the subject matter and the manner of execution. It certainly cannot be classified as an SME, but it was part of the first pilot International company owner of the largest wind farm "St. Nicholas" with 52 turbines located on the seashore near Kavarna. The company also owns wind farms in other countries with different geographical locations and different wind sources.

Business Case 4

- Development of a drone-based monitoring system for farming.
  Farmers today need to keep in touch with all parcels of their farmland to rely on GPS-based precision agriculture and analytics databases to increase yields and revenue, for example by reducing pesticides and using the right amounts of water. The first stage of the assignment is a precise elevation survey with all features, high and low voltage poles, roads and overpasses for machinery, water channels for irrigation and other important elements. The areas captured by drone and dimensioned are compared with the cadastral assets. Using artificial intelligence, the drone has been trained to recognise different plants from the air, as well as their stages of development. A Lancaster – 5 drone
  https://www.precisionhawk.com/blog/media/topic/lancaster-5 was used with integrated AI software. There is one numerical result that is significant, namely the production of herbal honey. The production of the three types of honey has increased by 75% for the seed of the timely relocation of mobile hives in close proximity to flowering plants - acacia, rape, lavender. The investment in drone and software has paid for itself with this difference in just one season, and we are yet to assess the harvest outcome of the other plants. A not insignificant effect is the greatly reduced poaching and theft through extraordinary drone flights.
  https://www.youtube.com/watch?v=2SI1oLN05Io

Figure 6 Business case 4 illustration

Business Case 5

- Continuation of the Business Case 4 - Using a drone with artificial intelligence inventory, monitoring, detection of potentially dangerous trees through the use of an application for sustainable green urban environment.
  This business case is realized by the same group of students which worked in the 1st pilot and is again connected with the use of a drone but this time supporting the NGO “Save Sofia”

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https://spasisofia.org/en/projects/macedonia-park working mainly with volunteers in all aspects connected with the historical heritage of the capital and its green face. The case is about Sofia Urban Forestry, using a drone with artificial intelligence inventory, monitoring, detection of potentially dangerous trees through the use of an application, as well as the search for suitable locations for horizontal and vertical landscaping, especially in the central urban area. This project is logical prolongation of http://innovationstarterbox.bg/events/homemade-green-sofia/ aiming at a sustainable green urban environment.
The role of trees in the urban environment is clear to us all. However, in addition to being a source of oxygen in urban environments, they also perform other functions - through their shade they limit excessive heating in summer, through their root system they help to absorb more water and reduce the chances of flooding, they stop the chaotic movement of microscopic particles. On the other hand, there are many old and potentially dangerous trees in Sofia, others emit pollen and contribute to allergic reactions in an increasing number of people. “Save Sofia” contacted participants in the DIHUB pilot in an effort to address this issue. The idea is to use a drone, pre-trained, which through artificial intelligence recognizes the trees and makes a map of them as shown in the pictures. **https://www.youtube.com/watch?v=2SI1oLN05Io**

3.4.4. Business cases of Portugal

Despite it was not easy to engage students in the on-job training component of the DIHUB path, especially due to some mismatches related with school calendars and also due to competing offers from the labour market for paid internships/apprenticeships or even jobs for students, it was possible – due to an intense cooperation work between Portuguese partners and the ecosystem – identify 7 entities who have proposed a total of 15 cases to be developed by students in their on-job training component using cloud and/or AI technologies.

These proposals were targeting students from ICT, Mechanical or Industrial Engineering domains and therefore were highly focused on real business challenges including in industrial domains. Below there is a summary of the challenges proposed by the 7 organisations to DIHUB students from Portugal.

ABIMOTA, an association which gathers actors from Two-Wheel, Hardware, Furniture and Related Industries, develops activities in vocational training, normalization/standardisation as well as providing certification and qualification tests of products, materials, surfaces (including chemical tests) and metrology. It has presented three different challenges mainly targeting the usage of AI to automate and improve their tests quality, but also for enhancing their customer support and commercial processes. They were aiming to develop an automated system (machine vision) to assess materials corrosion, a calibration system for their measuring tools (metrology) and an automated chatbot to guide their customers in budgeting, conformance analysis process and ordering.

EBI is an SME that operates an electric vehicles’ charging network. They were aiming to develop an AI solution to classify and cluster customers’, automating the creation of personas, and identifying potential services to serve them. The system should collect and analyse data from the whole system, create customer profiles and recommend personalized services according to personas, user’s context, and location.

Enimbos, a SME which was merged in Accenture recently, provides cloud optimization services to their customers. They have developed several tools which analyse cloud-usage profiles, on-premise infrastructure,

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licensing policies and dynamically adapts cloud-services to the best scenario (reducing price and maintaining resilience). They were looking for several students to further develop their platforms (which required AI and cloud-services expertise) and, also, to operate their customers' multiple cloud-provider solutions.

Getboarded is a start-up which is implementing career management systems based on AI. They have presented two challenges to students:

- Develop a Cloud-based web application to support user's career planning, namely by automating and compiling job offers, skills, preparing data and Machine Learning Models.
- Develop a CV analysis system (in Portuguese) to identify the structure, classify the text according to categories and extract relevant information. A CV is often an unstructured document.

HFA is a SME specialized in assembling and testing electronic and telecommunication equipment, under a subcontracting basis. They are an industrial company working with large companies in demanding sectors including Telecommunications and Automotive. They have presented two challenges:

- To develop a solution to implement an automate and real-time response system in their SMD lines which based on key parameters (collected from the operation on real-time) could forecast the final product quality and decide if products would be likely rejected (quality issues) at any time during the production, avoiding potentially defective products to go through unnecessary processes (which would add costs) and signaling predictive maintenance moments.
- To develop a system which integrates information (real-time) from the various machines in a SME production line in a data lake, extracting relevant parameters and feeding analysis models to be used by the prediction system. One of the key issues is the lack of standards for machine interoperability and, sometimes, there are disconnected systems which requires reverse engineering of custom interface design.

Salvador Caetano is a large Portuguese group which includes companies operating mainly in automotive related domains. Two companies from the group have presented challenges to students:

- One is related with their omni-channel customer experience: they were aiming to develop a solution which collects, compiles and structures information from different channels and cloud allow the creation of their customers' digital footprint. This would allow them to segment their customers, optimize their journeys and recommend additional services (not only for cross-selling but also for predictive analysis). This is a complex project to be developed by a team which complementary skills over an AWS infrastructure and services. This scenario is related with their mobility and car rental services.
- CaetanoBus is developing electric buses based on Toyota fuel-cells. To optimize energy management, they were aiming to develop an optimization solution for the Slope algorithm which could forecast energy consumption and identify potential challenges in some route and adapt power demand according to vehicle charge capacity and routes. They were also aiming to develop a self-learning algorithm able to dynamically and in real-time adapt several vehicle and engine (fuel-cell) parameters based on real-time operation data.

SCUBIC is start-up developing solutions for managing water networks. They have proposed three potential challenges/work streams:

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- Develop algorithms able to calculate failure likelihood in water and energy networks and develop predictive systems based on Machine Learning to forecast operation and maintenance activities.
- Develop a front-end web and mobile application for the SCUBIC platform.
- Analise and assess market data in order to adapt SCUBIC solutions for a better market fit.

Beside these proposals, students from the first pilot proposed a family-owned company challenge which was developed by them as the on-job training component with direct support from Haaga-Helia University professors. They have developed a WordPress-based website using a Wordpress instance using a AWS instance and installed a Workmail solution. This has allowed a substantial cost reduction, an increased e-mail storage capacity, a custom domain, free SSL access and e-mail API.

3.4.5. Business cases of Estonia

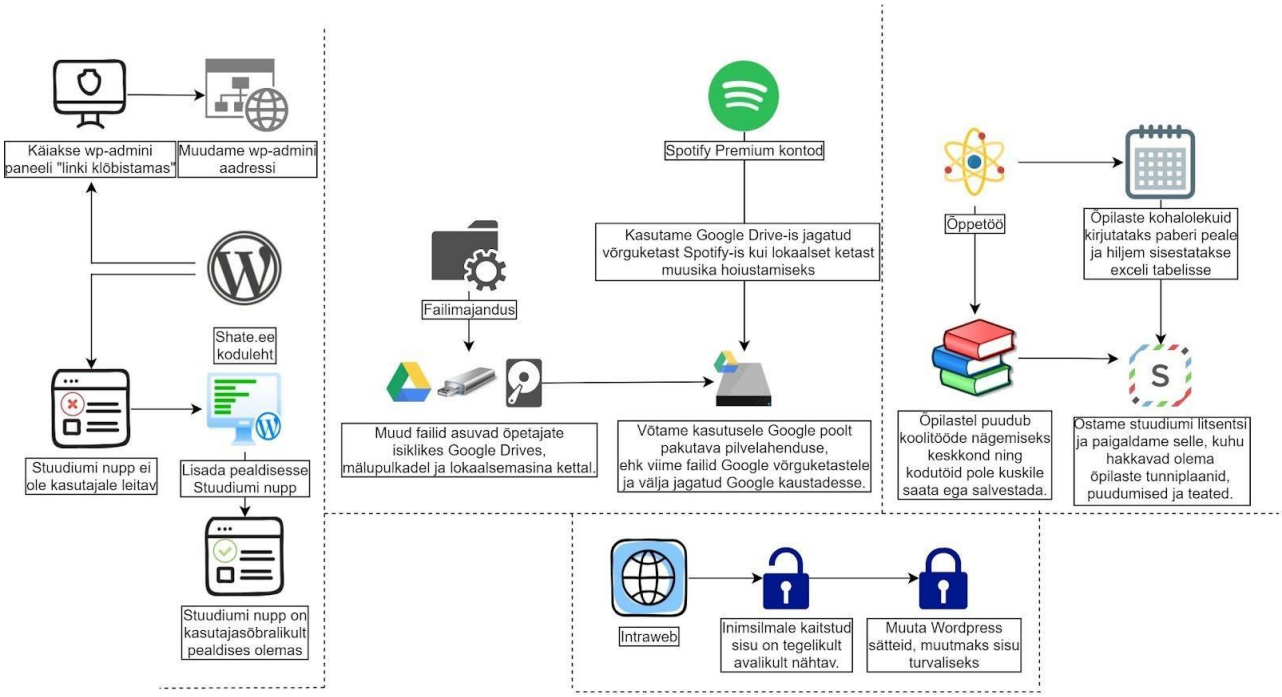

Figure 7 Business case 1 structure model

Tartu Vocational College, in collaboration with BSC Koolitus AS Business Cases

Business Case 1;
Digitization of a private hobby school´s learning processes, that would include an introduction and implementation of an e-diary, hybrid learning solution, video streaming platform. This new solution will help and allow the hobby school to continue their everyday business also during the COVID restrictions.
Business Case 2;

Development of a construction company´s infrastructure services, mainly focusing on an introduction to Microsoft 365 platform and its gadgets. Under the DIHUB project, students have the task to ensure the company`s data is protected, integrated, but available only to dedicated user groups. The Project will result with full deployment, configuration, and integration of a private cloud solution.

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Business Case 3;

Small architecture and design office IT infrastructure upgrade and deployment of a Microsoft cloud solution - Azure, Azure AD, Sharepoint, Teams, OneDrive. In addition, the private cloud NextCloud solution will be updated and developed. The project will also include a security audit.

Business Case 4;

Creation of a free virtual backup server solution for training company. Young people are expected to come up with at least two solutions, with a thorough analysis of each solution; their functionalities, relocation capabilities, and original data-recovery plan.

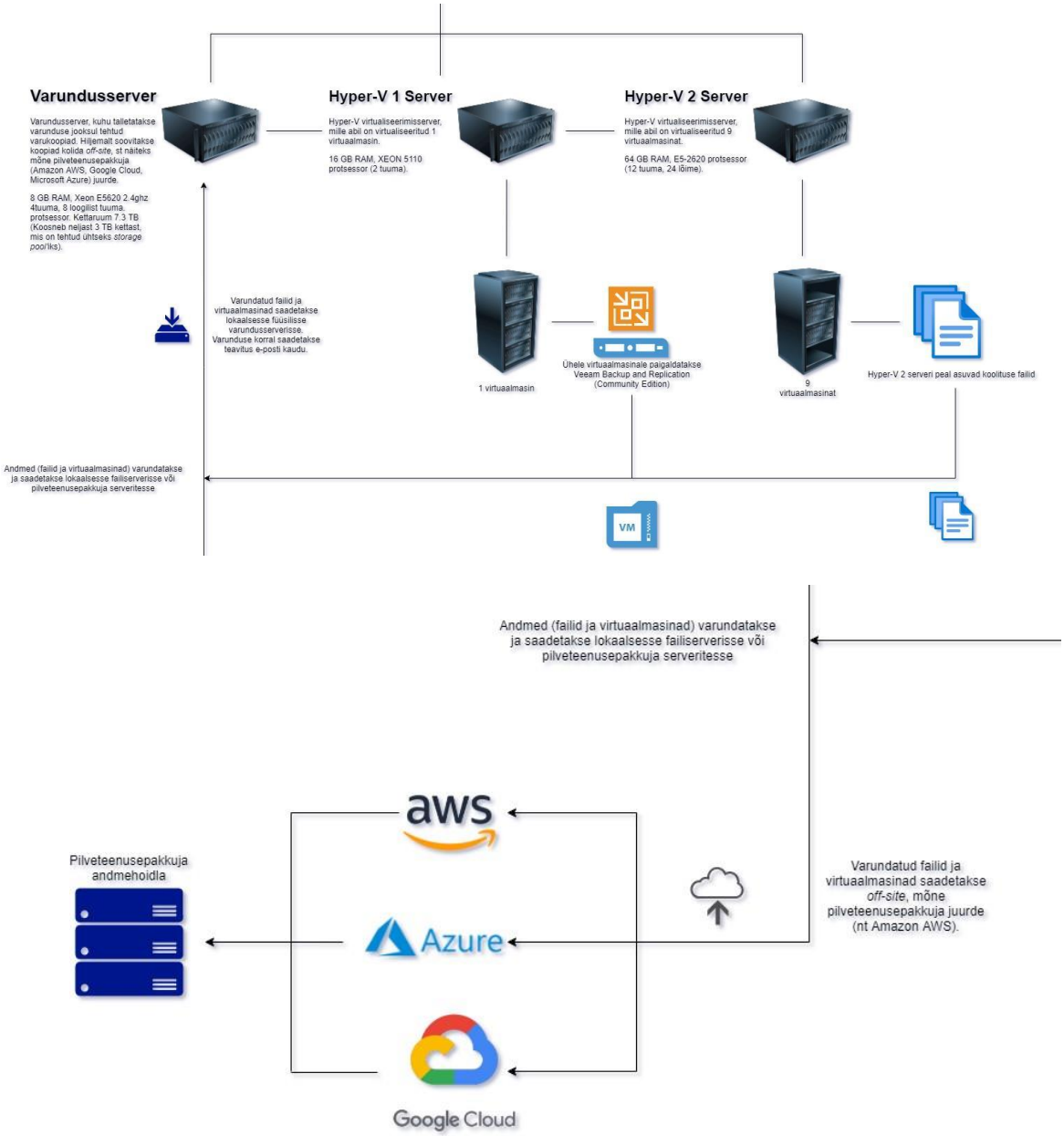

Figure 8 Business case 4 structure model

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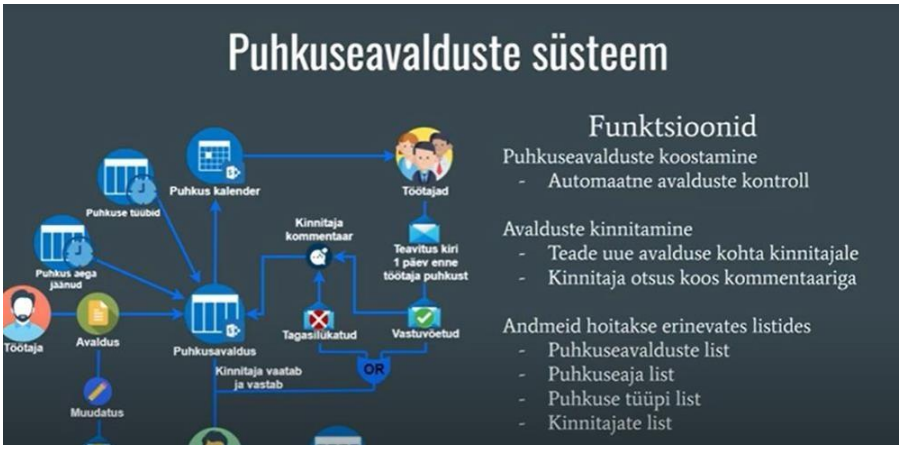

Figure 9 Business case 5 stucture model

Business Case 5;

Creation of a small-scale document management system for the company, using MS Sharepoint, Power Automate or Power Apps platform to manage the registration and processing of vocation.

Business Case 6;

Automated application and document management system using Microsoft 365 SharePoint including tools such as PowerAutomate, PowerApps for Tartu Health Care College. Projects main focus was to simplify and centralise dormitories rental, billing and management documentation system.

Business Case 7;

Migration of Tartu Health Care College´s intraweb to Microsoft 365 SharePoint site with all add-ons. Project focus was to make internal information better accessible for employees and students. Another aspect was to minimise the risk of cyberthreats and data loss since the old intraweb was running on outdated hard- and software.

Business Case 8;

Microsoft 365 as a document library and central cooperation platform for Varajase Kaasamise Keskus (rehabilitation services for children). Project teams migrated e-mails, calendars, documents, contacts to Microsoft 365 from different not integrated platforms. Project included end user training.

Business Case 9;

Development of Cloud Computing solutions at Register OÜ (nation-wide popular web platform). Project aimed to update existing Cloud Computing solutions to newer hardware and software. Project team also aimed for better stability, usability and high availability.

Business Case 10;

Getting started with Google Workspace at Tartu Nature House. Project team did a setup of Google Workspace Apps such as Drive and Docs, Gmail, Maps, Youtube etc. They also migrated data from on-premises services to the Google platform. Project included end user training.

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4. Feeding and development work after the first pilot towards the 2nd pilot

Cooperation with local and international partners is important. As a result of the pilot, a special model was developed, but it turned out that in addition to professional training, it occurred to be necessary to teach additional soft skills

In addition to the business cases offered by companies, the school must be prepared with a number of business cases, which are prepared for them beforehand, in case there could occur problems in finding suitable SMEs or specific tasks for the students to develop suiting the DIHUB program initial deliverables.

We also studied that students are often able to develop and implement practical cloud solution as requested by the company, but documentation skills would require more attention by the teachers and mentors to be supported throughout the project life cycle.

Teachers and mentors would need to turn students´ attention more on the need to explain the customer of what and how been developed and tasks solved. Customer should be able to easily understand the process and the "status quo" of the project - the solution itself, processes involved, and outcomes still expected to deliver. And not only the solution itself, but also answer the question of "Why?" such approach/services/design was selected and how will it influence customer overall business and even everyday workflow.

The teamwork skills need to be developed separately in order to learn to support team-learning.
In order to develop teamwork skills, it is important that teams hold meetings, adopt an environment suitable for project management, be able to divide larger tasks into smaller pieces, plan sprints and provide feedback on intermediate results.

As DIHUB is targeting students from various levels, it is important to find different levels of business cases, suiting each team and taking into account their previous expertise.

Specially the EQF level 4 students and teachers, guiding the participants admit, it is difficult to design business solutions without a real understanding of business processes - and this topic must be addressed before entering the apprenticeship stage of the Pilot.

In addition to the team's result, it is important that everyone reaches their individual results.

But most importantly – both from the project delivery point and from the learning perspective – it is crucial to work closely in a triangle: student-school-company.

3.5. Recommendations for 2nd Pilot in Finland

Helsinki Business College continues leading the project and strengthen the collaboration between local and international partners. Feedback has shown that more collaboration is needed between VET provider, higher education and other stakeholders in completing of the One Stop Service Hub. More space is given to WP leaders to promote the achievement of the goals. The construction of the virtual platform will be finished and gradually taken into use. The training path will be evaluated based on the pilots and developed further. The materials or pointers to the materials of the study path will be added or linked to the One Stop Service Hub. The first pilot will be finished and the second one started on spring 2020. Publishing a conference paper on the innovation hub platform and the initial experiences about its use in the pilots.

Helsinki Business College and Haaga-Helia UAS gather the data from the first pilots and from the experiences in implementing the innovation hub platform, analysing the data and forming recommendations for the further development of the study path and the innovation hub platform. All this is shared with all partners respectively.

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Results will be published on the training path and implemented pilots in the e-Signals publication series at Haaga-Helia University of Applied Sciences. Student feedback was very positive!

Most challenging in the first pilot:

- to sell the development idea to the company
- to get created a new process for handling the business cases in the college
- to get students, teachers and company staff to collaborate genuinely (soft skills needed)
- to search new information and knowhow to solve each business case as each business case is unique
- time management in business cases
- organize the teaching of a technical topic in a completely virtual manner
- motivate and engage the students even though everything is online

Most rewarding in the first pilot:

- students high motivation to solve a business challenge
- the raise of teachers motivation while there was a real business challenge to be solved
- the joy of learning while succeeding to create and solve the business case
- learning of new things from students, teachers and company´s point of view
- SME's gratitude to the development steps taken by the business cases
- collaboration between students from two countries (Finland and Portugal) and two levels of education (secondary and tertiary)
- project results were very good from the point of view of the business partner

- The company cases have to be chosen very carefully.
- Student assignments should be turned in a couple of days before live sessions to ensure that feedback can be given on them by companies and by teachers.
- Provide clear course curriculum and online study materials for the students.
- Teachers role as coach and mentor is very important.
- Meetings and communication mostly via Teams and email. Students also met f2f. Teacher / coach acted as a link between the student groups and the SMEs. (In some cases one of the students was the link).

3.6. Recommendations for 2nd Pilot in Croatia

Students are rather well versed in cloud-technologies and solutions, but we have discovered that their communication and presentation skills leave a lot to be desired. When faced with managers and business people from SMEs and other companies, they often lack the ability to interact in a business-sense productive way. They can explain technical details of services and infrastructure, but it is considerably more difficult for them to verbalise the business value of their work. Also, they sometimes lack the ability to think in end-to-end terms: in other words, they cannot correctly identify the problem and then devise all steps necessary to be undertaken to devise the solution. As a result, they require significant mentoring and guidance. If we are to make them more independent in their work, we have to provide more training hours in communication and presentation skills, as well as in what is termed « computational thinking » (algorithmic thinking).

Another learning point for us was that the level of their motivation to engage with cloud technologies significantly increased, if they were able to pursue their own startup projects. Quite often, companies require them to devise some rather basic cloud infrastructure or setup cloud-based mail&calender solutions. For more ambitious students, this is insufficient to motivate them. The best among them want to devise a new add-on for cloud-based service, or they want to develop a new service from scratch. We believe it is important to keep the best students in this programme, which is why we will enable them in the second round of piloting to work on their original ideas, provided that they rely on cloud technologies. We will then help them communicate these new products and services to the companies that can use them in their work.

The following changes were planned fof the 2nd Pilot round:

- more emphasis in the training programme on developing soft skills

- enable students included in the pilot to work on their own, original cloud-based solutions

3.7. Recommendations for 2nd Pilot in Bulgaria

The training was conducted, albeit belatedly, by well-trained lecturers, according to the approved DIHUB curriculum, and there was also a complementary special part. Students were deliberately selected from two educational levels - vocational school with appropriate profile, where students are trained in a dual form - i.e. they are in direct contact with enterprises of different size. And students from technical universities from all over the country. The training was entirely distance learning with all the consequences that this entails. From the feedback received, adjustments will be made to the duration of the second pilot project.
It should be considered that this is the first of its kind training in cloud technologies with subsequent practical application of knowledge. It was conducted under pandemic constraints, which had a negative impact especially on the practical part of the training. Despite the negative effect on 2nd DIHUB training, starting from the second semester of 2020/2021 Academic year in Technical University in Sofia Cloud technologies course for the first time is IN the regular curriculum, with all the benefits for the students – credits, LABs, financing. This largely covers most of the negative comments about the first pilot training. The training was entirely in Bulgarian, but the teachers are prepared to teach in English, and the theoretical materials were prepared in both languages. This is an additional advantage for the project, as it expands the opportunities for inclusion of students from other countries.
Like the first pilot, the lecturers believe that the course should be enriched and expanded, especially the practice part and the use of different cloud resources, but this is related to a change of the curriculum, which does not happen quickly or easily in Bulgaria, and requires additional financial resources. Adding the distance learning format, which is very likely to remain after the pandemic, the difficulties of expanding teaching venues and diversifying the curriculum, especially in its special part, are almost insurmountable.

3.8. Recommendations for 2nd Pilot in Portugal

In Portugal, there was a high interest in the training part, since the themes addressed are very appealing and needed in the labour market. The implementation of the practical part was more challenging, as it is very long and students have other paid offers to collaborate with companies.
Thus, one of the main recommendations resulting from the experience of the 1st Pilot in Portugal was the need to plan in anticipation the training content, calendar and recognition of credits. Considering that the training offer of DIHUB in Portugal was targeted at higher education students and institutions, all procedures that somehow interfere with students, training offer or calendar, need to be dully planned, go through internal validations and be conciliated with other activities and requirements of the institution. Besides, another important recommendation was that there should be a commitment from students that attend the training to follow up with the apprenticeship, otherwise most of them drop out after the training and will not reach to participate in the business case development.
The first pilot ran with the collaboration of a Higher Education Institution (ISEP) whose professors were mobilised to support the practical projects of students in companies. Companies were identified by DIHUB Portuguese partners within a questionnaire where companies were requested to identify technological challenges to be addressed through AI and Cloud based technologies. The practical part of the pilot should be aligned with activities from students' bachelor or master's degrees programs as to enhance attractiveness and potential for acknowledgement through ECTS.
Communication and dissemination activities included publishing of news and social media posts and presentation of the project in relevant events, as well as organisation of awareness-raising sessions with students.
Recommendations:

- Conciliate training offer and practical part with school calendar. There were mismatches between Portugal and Finish school calendars which have hindered our ability to attract students. In this case (PT), there needs to be an investment for training/education organisations to provide this type of

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- training outside the formal Bachelor/master's degrees. It would have been much preferably if the DIHUB consortium had an overall approach to the training part that would allow to share contents and curricula among. Another possibility, limited by calendar mismatches, would be planning company cases with at least one year in advance in order to promote them as regular offers for capstone projects in BSc and MSc programs.
- Students should identify/choose the challenge or project to develop in the follow up of the training already during the training (preferably at an early stage).
- Plan in anticipation the training content, calendar and recognition of credits.
- There should be a commitment from students that attend the training to follow up with the apprenticeship, otherwise most of them drop out after the training and will not reach to participate in the business case development.
- Eventually there could be a financial compensation for students to participate in the DIHUB, since they already have competitive offers from companies/paid internships which may make the DIHUB path less appealing.
- Reduce the duration of the practical part or integrate it with a paid internship, otherwise it is difficult to mobilize students.

3.9. Recommendations for 2nd Pilot in Estonia

Being side-by-side with DIHUB participating students and having continuous conversations with employers and service providers, Estonian project team has come to an understanding, that internship period of the Pilot period is too long for students to spend time on employers given tasks. Therefore we would like to recommend the modification of the study program by giving up the 130-day internship period.

Instead, it would be wise to pay more attention to students' independent work during the 21-day training. Estonian project teams propose to offer an abbreviated program to a wider target group, by providing the training course also to other IT field students, in addition to IT technologists, like web developers, designers, IT project management students, etc.

By changing the training program, we recommend:

- Put more emphasis on students individual tasks fulfilment, instead of working in 3-member teams. During the 1st Pilot round we have seen that tasks the companies are able to assign to students related to the deployment of cloud services are rather small/simple in scope and more suitable for individual performance.

- Form 3-member teams and hold regular meetings (eg once a week) o develop students´ cooperation and team-work skills. During the meetings all members present their weekly activities while working on the company project. Other team members can provide feedback and advice if a student is stuck in a part of a task. In this way, young people learn to give constructive feedback to their peers, while paying more attention on self-reflection.

- In addition to the internship supervisor, the students are supported by professional experts (project management lecturer and entrepreneurship teacher) who provide advice on how to solve the tasks received from the company.

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4. Recommendations about Best Practices after the 2nd Pilot

4.1. Recommendations for a follow-up project Finland

The supervising teacher / mentor / coach plays a very important role. He should communicate with students often enough. Regular project meetings are also extremely important.

A company representative should also be present at these meetings on a regular basis. The teacher also acts as a link between the company representative and the student group.
One important role for the supervising teacher is to support and advise students, but also to keep up the high motivation of the group. Challenges are always encountered in projects and it is the teacher's job to guide students in the right direction to search and find solutions to these challenges.

Efforts should also be made to define the objectives of the project. The project should be challenging, but also given the skills of the students, considered to be feasible (possible to reach the targets).
The use of time and resources must be determined realistically. The goal does not always have to be a functional product or a ready-made service, but it is also possible to develop different presentations or solutions to the challenges faced by companies.

Based on the project presentation or report, the company can continue as it sees applicable.
It is also a good idea to choose project management tools carefully so that the team's work is clear and scheduled. All groups utilized Trello (one of the tools to operationalise SCRUM) in their project management, which was well suited to this need.

Efforts must be made to communicate between the student group, the company and the supervising teacher. It is especially important that the group can communicate with a company representative often and comprehensively enough. In this way, the company's wishes and goals can be realized as well as possible. Especially in the Pilot-2 phase, we encountered a problem where it was difficult for students and the supervising teacher to reach a company representative. Because of this, the work could sometimes pause for a while because the group did not know how to proceed with the project. The company must also be committed and motivated to the project. Teachers' responsibility is very high while managing the service process and ensuring that the needs are satisfied from students and SME's side. When successfully completed this can lead to very inspirational development outcomes in SME's as well as very nice learning outcomes from students' point of view.

In later stage it would be important to utilise the DIHUB-alumni connections to gather impact information from their career to further develop the DIHUB service processes.

It would be ideal to run business cases more in international environment. For example, Finnish students working for other partner countries companies and vice versa. This needs more resources in guidance and also the requirements for the guiding teacher as well.

4.2. Recommendations for a follow-up project Portugal

In the second pilot in Portugal, there was no opportunity companies to host students, as there were only two students in the DIHUB path, and these students already had identified other projects for the practical part. Thus, as in the first DIHUB pilot and by the reasons mentioned regarding Pilot 1, it was quite hard to engage students in this part of the program.
There was a lack of overall coordination of the Pilots and especially of the training offer available: The approach to pilots' organization was "by country" and not at the consortium level. This means that, in each country, partners should deploy training paths in line with the DIHUB themes. None of the Portuguese partners has training offer in these topics and, therefore, relied on Haaga-Helia support for the off-the job training component.
The length of the DIHUB path and competition with other more financially attractive offers was an obstacle to a wider participation of students in the DIHUB Path. One of the lessons learned from DIHUB pilot 1 was that the length proposed for the DIHUB Path was too extensive (100 days of students' engagement with companies) for students who are already attending other courses and, in many cases, already actively searching for a job. In Portugal, there is huge demand for qualified human resources and even more for qualified human resources in ICT related fields. Thus, students in these fields are highly demanded by the labour market very attractive conditions are offered to them, even in early career stages. Besides, education

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institutions themselves already provide internships, apprenticeships and other initiatives for students' integration in working life and these activities are integrated into the courses' curricula. DIHUB use cases were prepared to be aligned and recognized in their education paths in close cooperation with Professors, but they had to be approved way before to be published and selected by students (sometimes one year before).

4.3. Recommendations for a follow-up project Estonia

Estonian team reccomendations for next projects are:

- Preconditions for students to enroll for the course should be described beforehand and dissemination more widely to ensure the sufficient level of understaning and expertice to follow the course
- More supportive measures could be implemented by the training facility – such as project managers, cloud technology specialists, supervisors/mentors to find extra curricular learning materials to fill in more advaned SME projects.
- More emphasis should be put on describing and undestanding the end-user of the service or product the students are about to develop during their business cases. Understaning the business processes and so calles "persona"- creation is a crucial moment in designing the cloud solution.
- Students would deeper understadning of business skills, needed to follow the customer relations and related cloud technologies possibilities on a market.
- The project is more sucessful if the student teams would include members with various skills and competencies, such as cloud architecture, frond- and backend development, service design and project management.

4.4. Recommendations for a follow-up project Bulgaria

- Stronger collaboration between the academic circle and companies would assure long-term collaboration, the chanmer of commerce could work as a link between these stakeholders**.**
- Overall, the SMEs that participated in Pilots in Bulgaria were satisfied with the project results. They have all benefited from the students' help in solving everyday problems.
- Understanding of a need for artificial intelligence and cloud solutions uptake has now been recognized on wider scale and thanks to students development projects many of them could be acknowledged as best practices to follow in the coming future, while planning both new technologies deployment and/or cooperation between VET providers and SMEs.
- The opinions of the companies about the students and the program itself are very positive, and the solutions developed will serve as an example of good practice for other companies, universities, and anyone interested in modern technologies.

4.5. Recommendations for a follow-up project Croatia

- In addition to providing SME support in developing and deploying cloud technologies, the follow-up project could also consider including startups as testbeds and cooperation partners in student projects. We would recommend adding them as a target group for the next DIHUB project.
- Likewise, we would recommend dedicating funds to other expense categories, not only to staff costs. It would have been beneficial, if we could have used some of the funds for technical infrastructure and licensing.

PARTNERS

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INOVA+ (Portugal)

Know and Can Association (Bulgaria)

Bulgarian-Romanian Chamber of Commerce and Industry (Bulgaria)

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