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# THE DIHUB MODEL FOR LEARNING AND INNOVATING

L. Aunimo<sup>1</sup>, J. Hytönen<sup>2</sup>, H. Ahola<sup>1</sup>, H. Hokkanen<sup>2</sup>, K. Häkkinen<sup>2</sup>

<sup>1</sup>*Haaga-Helia University of Applied Sciences (FINLAND)*

<sup>2</sup>*Helsinki Business College (FINLAND)*

## Abstract

This paper describes the Dihub model and its piloting in Helsinki. Dihub (Digital Innovation Hub for Cloud-based Services) is an EU-funded project that aims at the promotion and creation of cloud-based knowledge and innovations in Europe through the construction of an innovation hub platform, a study path and the related processes. These are tested in several pilot rounds during two academic years in five European countries: Bulgaria, Croatia, Estonia, Finland and Portugal. The educational partners involved are institutions from both vocational and higher education. The stakeholders involved in the Dihub model are business owners and experts in companies using cloud services, experts from cloud technology providers, educators and students.

Keywords: Curriculum design, pilot courses, cloud services, vocational education, higher education, company cooperation, study path design.

## 1 INTRODUCTION

Dihub (Digital Innovation Hub for Cloud-based Services) is an EU-funded Erasmus+ project that aims at the promotion and creation of cloud-based knowledge and innovations in Europe through the construction of an innovation hub platform, study paths and a cloud native curriculum for higher education as well as the related processes, learning management systems and laboratory environments needed for piloting the Dihub learning ecosystem. The Dihub Model is an answer for the knowledge, expertise and innovation shortage that the struggling European SME business yearns to be competitive on global markets where cloud technologies and AI based cloud services are widely used and form a competitive advantage.

The innovation hub platform may also be called a one stop service, meaning that it is one single virtual shared space that offers to all participants co-creation possibilities and access to multi-field expertise, partnering, networking, peer-learning and tutoring. It is essentially “a primus motor” for new innovations in the exponentially growing fields of cloud computing and cloud-based AI technologies.

The stakeholders of the innovation hub platform are: 1) business owners and technology experts in companies using cloud services, 2) experts from cloud technology providers, 3) students and 4) teachers. The innovation hub platform is used to match the needs and offerings between the stakeholders. For example, the business stakeholders seek innovations, skilled workforce and training for their personnel, and they can offer study cases for educators, business cases and sales for cloud service providers and employment opportunities for students. The innovation hub is also used as a platform for the development of the Dihub study path(s) using a modified version of the DACUM-method [1]. Businesses and cloud service providers are invited to participate in the co-creation of the study path – especially in defining the essential job roles, tasks, skills, cloud-based technologies and tools used at workplaces and other competences needed in 2020s for cloud native generation.

The Dihub study path is the result of the curriculum development work. It offers a set of cloud technologies and AI based cloud services related courses as well as study projects that are implemented in close cooperation with companies. The implementation of the study path varies depending on the level of studies and on the implementing educational institution. The two levels of implementation are vocational and higher education. The details of the implementation are tailored according to the institution that issues the certificate of studies in vocational and higher education. The study path implementations are combined in a flexible and adaptable way to create job role based and compact study paths leading to real life expertise in cloud services. Completion of the study path opens doors to cloud and AI native job roles and positions of the 2020s for the Dihub students

The research questions addressed by this study are: What kind of hub platform would enable the European innovation ecosystem to benefit from the recent developments of cloud technologies and

cloud-based services for artificial intelligence? How can institutions of higher and vocational education answer to the growing demand of IT professionals equipped with expert knowledge on cloud technologies and with the ability to innovate intelligent digital services enabled by cloud-based services? What knowledge and skills should be included into the study path of a future cloud services expert?

The research questions are not totally new, but most research on these topics has been done from the point of view of curriculum development or the development of educational processes in a single university. Literature on models and processes that incorporate businesses and technology providers as well as international educational partners from both higher and vocational education providers are scarce. Incorporating institutions of vocational education is especially rare when it comes to research on models for teaching cloud technologies and innovations in cooperation with companies and international partners.

The rest of this paper is structured as follows: Chapter 2 describes prior research in this field. Chapter 3 describes the Dihub model that was created using action research methodology while seeking an answer to the research questions. The piloting of the Dihub model in one of the participating countries – namely Finland – is described in chapter 4. Chapter 5 concludes this study.

## **2 RELATED WORK**

The Dihub-project is not the first project addressing the challenges that educational institutions face when attempting to offer up-to-date skills and knowledge for future IT-professionals together with businesses, technology providers and international actors. In the following, we will first describe previous attempts in incorporating input from businesses and technology providers both into the development of a curriculum and into the actual study contents of courses. We will also discuss existing models for developing internationally recognized diplomas and contents, building professional networks for students and for teaching innovativeness. Secondly, we will describe models especially tailored for adopting and teaching cloud technologies.

Haaga-Helia University of Applied Sciences (UAS) has a long tradition of incorporating businesses in both study contents of courses and into the development of contents for curricula, see e.g. Aunimo and Huttunen [2] and Soitinaho and Palviainen [3]. Businesses typically participate in courses by giving guest lectures, project work topics and materials such as data or use case descriptions [2, 4]. They may also participate as product owners in software projects where the SCRUM-methodology is used [5]. In some cases also the technology provider contributes actively during the course. This is the case in the model developed in Haaga-Helia UAS [2] where new technology may be incorporated into the curriculum rapidly.

Curriculum development is the other place where business partners typically interact with the academic partners [2, 3, 6]. In addition to interaction via physical and virtual platforms, also job adds published by businesses have been used as a source for forming an insight on the skills and knowledge needed by the job market. Ketamo et al. [7] use artificial intelligence methods to mine job adds from the Finnish job market to form an overview of the current needs. Vinel et al. [8] do the same using job adds from the Russian labor market.

The job market of IT professionals is global [9, 10]. This is why institutions of higher education attempt to offer contents, certificates and diplomas that are internationally recognized. In addition to internalization, also professional networks and innovativeness are important for future IT professionals and that is why also these have been paid attention to in higher education [10, 11].

The Dihub project aims at promoting the knowledge and skills related to cloud technologies and innovations enabled by them. There is some existing literature on the adoption of cloud technologies in education. Most of this literature deals with the topic from the point of view of the IT administration and discusses the adoption of common SaaS (Software as a Service) products such as email, Office 365, CRM (customer relations management) systems etc. (see e.g. [12]). In this project, the aim is to train future IT professionals who can work in IT administration with cloud services, software engineering and product development using cloud services. Thus all common cloud service models, including IaaS (Infrastructure as a Service), PaaS (Platform as a Service) and SaaS (Software as a Service) have to be taken into account. Markova et al. [13] describe how these different service models of cloud services may be used in the education of future IT professionals.

### 3 THE INNOVATION HUB PLATFORM AND THE STUDY PATH

As a response to the questions on how the European software industry may retain its competitiveness and its innovativeness by exploiting the possibilities offered by cloud services, the Dihub project has developed an innovation hub platform and a European study path for cloud-based services. These have been developed using action research methodology [14] where the researchers themselves are active actors. The researchers develop and pilot the new models in practice, gather data from the pilots, evaluate the data and enhance the model based on it. In the following, we will first describe the innovation hub platform and after that the study path for cloud-based services.

#### 3.1 The Innovation Hub Platform

The Dihub innovation hub may also be called a one stop service, meaning that it is one single virtual space that offers to all participants co-creation possibilities and access to multi-field expertise, partnering, networking, peer-learning and tutoring. It is essentially “a primus motor” for new innovations in the exponentially growing fields of cloud computing and cloud-based AI technologies.

The Dihub innovation hub platform for cloud-based services is depicted in Figure 1. The stakeholders of the hub platform are depicted in the orange rectangles. The most important contributions of each stakeholder are listed below it, respectively.

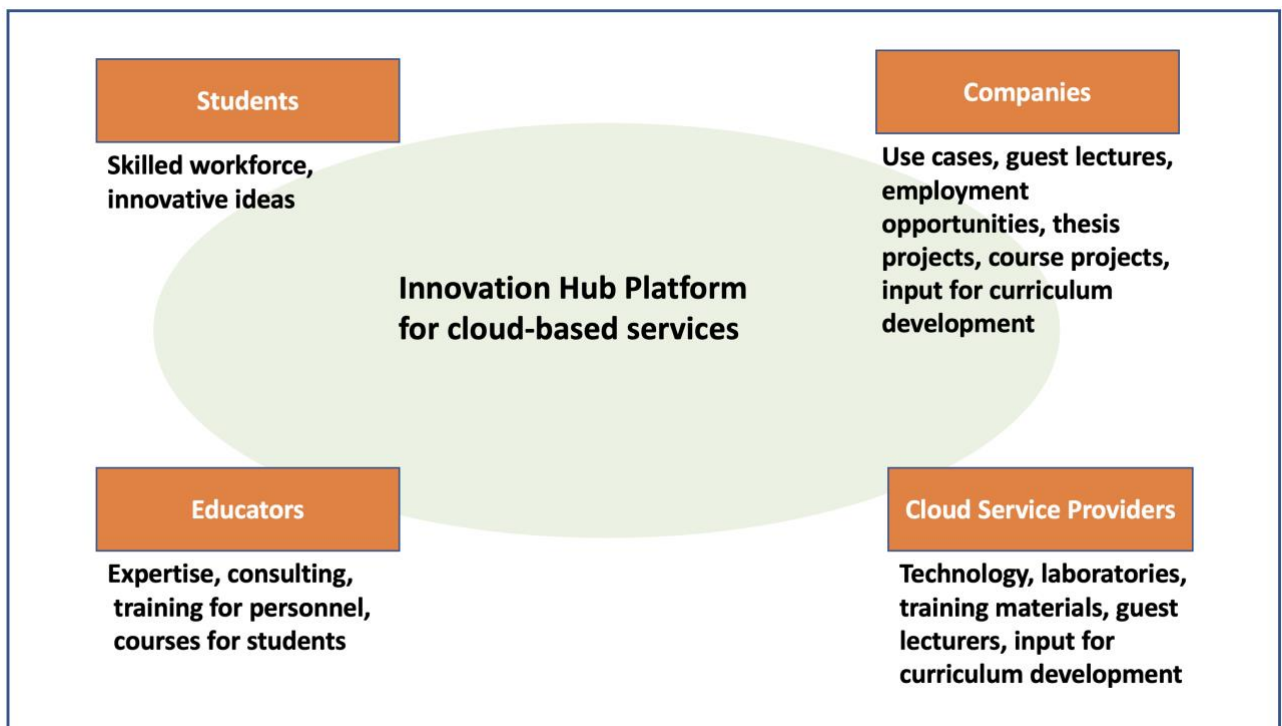


Figure 1: Innovation hub platform for cloud-based services. The hub gathers together four types of stakeholders: Students, Companies, Cloud Service Providers and Educators. The hub acts as an incubator for innovations, co-creation, sharing of expertise and training.

### 3.2 The Dihub Study Path

The Dihub study path is iteratively and incrementally developed in close cooperation with educational institutions at both vocational and higher education levels, companies and cloud service providers. Selected elements of the Dacum process are used. Figure 2 depicts the current status of the study path at Haaga-Helia UAS.

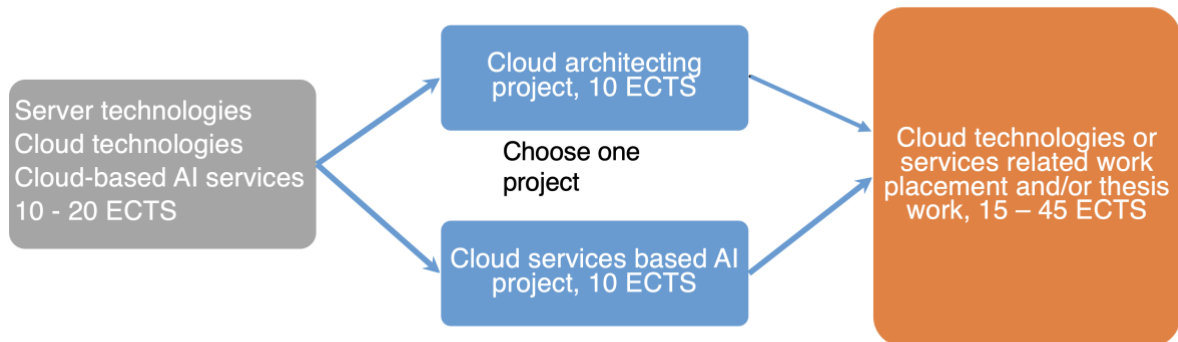


Figure 2: The Dihub study path at Haaga-Helia UAS. The student must complete at least 30 ECTS from this path to earn the Dihub certificate.

Haaga-Helia UAS's Dihub study path phase 1 is illustrated by the grey box in Figure 2. It consists of a series of introductory courses, each 5 ECTS, on cloud technologies and services. After the completion of phase 1, students continue to phase 2. It is illustrated by blue in Figure 2 and it consists of a project course with companies on either cloud computing architectures or cloud-based AI technologies, each worth 10 ECTS. After this, the students proceed to 15 – 30 ECTS worth of thesis project work in a company or work placement in tasks involving cloud computing services. This is depicted by orange in Figure 2.

## 4 PILOTING THE INNOVATION HUB PLATFORM AND THE DIHUB STUDY PATH

According to the action research methodology, the first versions of the innovation hub platform and the Dihub study path have been piloted and data has been gathered from them. The piloting begun in Helsinki in May 2020. Helsinki Business College has implemented one part of the pilot and Haaga-Helia UAS another part. These are described in the following.

### 4.1 Piloting of the Innovation Hub Platform

The piloting of the innovation hub platform has just begun as of October 2020. Technically, the platform consists of a virtual expert collaboration and meta knowledge sharing platform implemented in Microsoft Teams and SharePoint as well as of various cloud technology laboratory environments. The environments that have been piloted in Helsinki are the AWS laboratory environment and the IBM cloud service environment. The meta knowledge sharing part of the platform mainly contains links to contents shared elsewhere, such as video sharing platforms of the educational institutions and public curricula and course content descriptions of the universities. The expert collaboration site so far has members from Haaga-Helia UAS and from Helsinki Business College. It will be opened to members of other participating organizations, businesses, technology providers and students as soon as feedback from the users of the first pilot has been collected and taken in account in the implementation.

## 4.2 Piloting of the Dihub Study path at the Helsinki Business College

The first pilot of the Dihub study path at Helsinki Business College consisted of three parts: one preparatory course that would allow the participation of students at the Dihub course offered by Haaga-Helia UAS, participation at the Dihub-course by Haaga-Helia UAS and a company project. The company projects were still ongoing as of October 2020. The companies for the pilot projects were chosen by a survey done by Chamber of Commerce of Helsinki, which is also a partner in the Dihub project. In that survey the last question was about co-operation interests. All companies which were interested in any kind of co-operation were contacted. A challenge was that some of the companies couldn't specify their needs and wishes. Some students are currently - as of October 2020 - working on an information package on how to utilize cloud services and artificial intelligence in business. This shows that companies are interested in using cloud technologies, but that they lack the expertise and cloud competent workforce. The Dihub project will contribute to rising the level of knowledge on cloud services in the companies that participate in the pilots.

## 4.3 Piloting of the Dihub Study path at Haaga-Helia UAS

The piloting of the entire Dihub path as described in Figure 2 is going on as of October 2020. The first students who have completed the entire path are expected to receive their certificates in spring 2021. As of October 2020, one of the courses of the Dihub path had been fully completed. Contents and experiences of this implementation are described in the following.

The Dihub pilot in Helsinki started officially on 25th of May 2020 in co-operation with Helsinki Business College. Haaga-Helia UAS provided Helsinki Business College's teachers and Dihub students an access to the private cloud environment and learning management systems. A considerable part of the course contents were based on the "AWS Academy Cloud Foundations" course provided by AWS Academy [15]. The implementation at Haaga-Helia UAS was planned to be implemented as blended learning [16] where online materials and interaction is combined with traditional place-based classroom methods, but because of the pandemic situation in 2020, the implementation was completely virtual. However, the AWS course was tailored especially for the Dihub pilot.

The course start was a real success with 81 applicants subscribing to the course within one hour of its announcement. Due to AWS Academy cloud-based eLaboratory restrictions the number of students had to be carved out down to 38 students. To get a seat on the course the student had to complete the AWS Cloud Practitioner Digital Essentials eLearning mini course before participating the first lecture which took place on the 8th of June in a Microsoft Teams video session. This AWS Academy Cloud Foundations online blended learning course ended in August 2020 with 38 eagerly participating students. More than a dozen of the students were from Helsinki Business College and the rest were bachelor level IT students from Haaga-Helia UAS. Three teachers from Helsinki Business College were attending as regular students on the course. After completing the course the students and teachers were eligible to take the "AWS Cloud Practitioner certification" on any certification center around the globe.

The collected student feedback from the pilot course was very positive and demonstrated the dire need of cloud computing skills for all IT students both at VET and university level of education. In the following is a genuine excerpt from one of the students: "To me the most interesting and important have been, for example, ways to connecting to the internet and managing traffic (gateways, route tables, load balancers etc.), running code (Lambda, EB etc.), working with databases (RDS, Aurora etc.), forwarding messages and tasks (SNS, SQS etc.), and many more. So, in total, I would say that I have learned a huge amount in this course. This has also been very interesting. I would almost say, that this has changed the way I look at the programming of tomorrow. As more and more services are moving to the cloud, this will be the future of programming."

## 5 CONCLUSIONS

The first year of the project has been a period of intensive development of the Dihub Model: the innovation hub platform and the Dihub study path and the related processes. First versions of the innovation hub platform and the Dihub study path have been piloted in the Helsinki Hub consisting of both the Helsinki Business College and Haaga-Helia UAS. Data for the evaluation and further development of the model has been gathered and will be collected from the currently ongoing pilots. During the next phase of the project, data from the Dihub pilots in other participating EU countries will

be combined with the data collected in Finland by Haaga-Helia UAS and Helsinki Business College. This joint data will be analyzed and used to develop the second version of the Dihub Model. This model will cover not only partners in Helsinki, but all participating partners in Europe.

The Dihub project has already contributed to the amount of industry-academia collaboration and to the amount and quality of education offered by the participating institutions on cloud services and on AI technologies. After the first year of Dihub project from October 2019 to October 2020, it has already had a big impact on the curriculum, cloud services related courses offered to students, staff training, computing resources and general cloud service awareness at the Haaga-Helia UAS. In the second year of the project, we expect to generalize the model for all European Dihub partners and to ensure that the best parts of the model will become a permanent part of the cloud and AI related education and innovation ecosystem in the Helsinki Hub.

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