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Deliverable D8.4

Final Report on Sustainability and Exploitation

Deliverable D8.4

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Executive Summary

The Up to University (Up2U) project aims to bridge the gaps between secondary schools and universities by providing European schools with a next-generation digital learning environment that helps students to develop the knowledge, skills, and attitudes they need to be successful in universities. This concept motivated the Up2U project consortium in developing its architectural vision, heavily relying on modularity.

One of the objectives of the Up to University (Up2U) project is to ensure that its outcomes can be sustained after the project finishes. To this end, Work Package 8 *Sustainability and Exploitation of Results* (WP8) has investigated and evaluated appropriate business models using the expertise of the Small Medium Enterprise (SME) and National Research and Education Network (NREN) partners, as well as their contacts with third-party business actors. The objective was to show that profitable business opportunities can result from the Up2U project.

The previous deliverables analysed Up2U ecosystem and existing business models, provided a better understanding of the necessities, opportunities and mutual benefits that are associated with potential Up2U business models, and finally identified business models that offer new opportunities to business actors and for supporting the exploitation of the project's outcomes.

This final deliverable:

- Introduces business models to ensure that Up2U will be sustainable after project concludes.
- Details the market analysis of popular e-learning platforms and associated tools.
- Describes the implementation process of each business model on centralised and national levels, including funding resources, sustainability period and timeline.

The main aim of this document is to ensure that Up2U will be continued after the project concludes and that each partner exploits the project results appropriately, according to the objectives of the project.

1 Introduction

One of the objectives of Up2U was to ensure that all the tools and services it designs, develops, tests, and incorporates, are sustainable after the project concludes. To achieve this, WP8 *Sustainability and Exploitation of Results* has developed business plans and investigated appropriate business models. The sustainability impact expected to be created from WP8's perspective is based on the combination of the project's exploitable results, together with partners' exploitation plans, and the implementation of the identified business models by business actors that will be engaged by the project.

This deliverable is structured as follows:

- Section 2 introduces the Up2U business models, including their structure and how they relate to the business models introduced in deliverable D8.3 *Up2U Business Models* [\[D8.3\]](#).
- Section 3 provides a market analysis of popular e-learning platforms and associated tools.
- Section 4 describes the implementation of each business model and provides an overview of the sustainability and exploitation plans and activities the project partners have in place for these different models. The section also provides a detailed analysis of costs for the hosting of the Up2U infrastructure, considering both a centralised model and different national models, which is based on the services that will be offered after the project has ended. Special exploitation plans of other partners are also described.
- Section 5 details industry engagement.
- Section 6 summarises the deliverable's main points and offers conclusions.

2 Business Models – Exploitation Activities

This section focuses on the most realistic of the business models that were proposed, by concentrating on NRENs and schools.

Deliverable D8.3 *Up2U Business Models* [D8.3] introduced seven potential business models together with a cost-benefit analysis. In this deliverable, the final sustainability and exploitation plans are provided based on four business models:

- Up2U tools for NRENs and Schools
- Up2U tools for e-Learning Platform
- University as a Hub
- Autonomous Use

Figure 2.1 shows the evolution process of the business models, and how the business models introduced in D8.3 helped design and develop the final sustainability and exploitation plans.

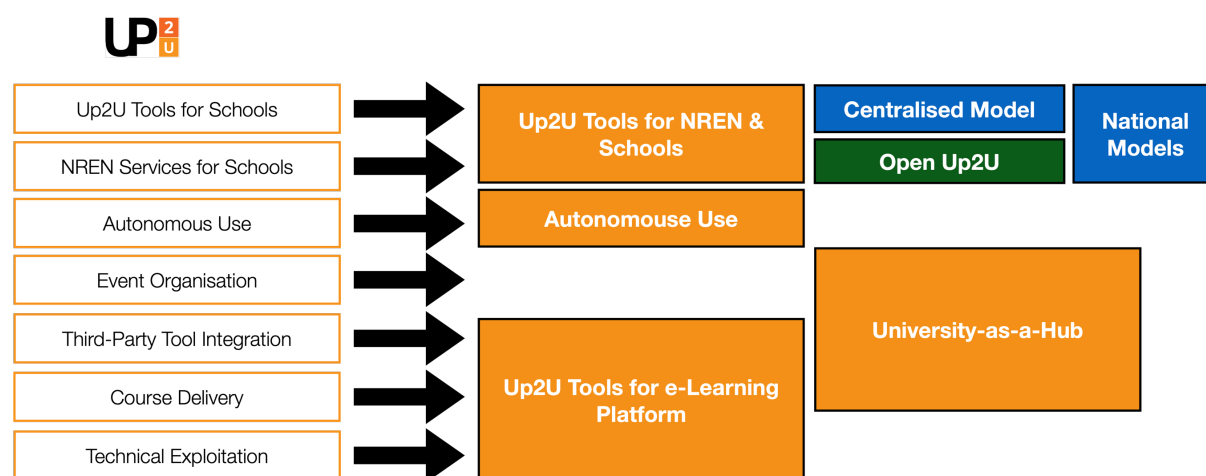


Figure 2.1: Relation between introduced BMs in D8.3 and final BMs in D8.4

Figure 2.2 shows the involvement of each partner in the design of the business models and sustainability/exploitation plans.

Up2U Tools for NREN & Schools		Up2U Tools for e-Learning Platform	Other
Centralised Model	National Models	GWDG	UK
		University-as-a-Hub	Israel
GEANT	KTU		Switzerland
PSNC	KIFÜ	UROMA	Spain
GRNET	GRNET	Autonomous Use	
GWDG	NTUA		
	PSNC	ISEP	
	GARR	UROMA	

Figure 2.2: Involvement of each partner in the design of the business models

2.1 Up2U Tools for NRENs and Schools

Further investigation of the hosting-related business models defined in Deliverable D8.3 made it possible to define a pan-European-strategy-based on central and national models that will become the core of the continuation of current infrastructure and services.

Starting with the earlier defined 'Up2U tools for schools' and 'NREN services for schools' business models, and focusing more on NRENs, two main types of NRENs and other institutions were identified that exist both in the Up2U consortium and beyond:

- The first group comprises those who are willing to host the Up2U platform without assistance, most often as a part of their existing education services. Examples of such NRENs within the Up2U consortium are GARR, GRNET, KTU/LITNET and PSNC. For this group, the national model is defined.
- The other group are NRENs and other institutions who cannot host the platform on their own, however, they are still interested in offering it to their schools. Examples within the consortium are FCCN, ISEP, and UVigo. For this group, the central model is proposed, in which the Up2U service is offered by GÉANT supported by other NRENs.

The new central and national models are presented in Section 2.1.1 and 2.1.2. The related cost model is discussed in Section 4.1.3.

2.1.1 The Centralised Model

Based on the interest shown both within the project partners and organisations, and NRENs outside of the project consortium, a centralised model has been developed for provisioning the Up2U service on a hosted platform in order to serve the education community across Europe. The use of this service is tailored to each particular organisation.

Organisations contracting GÉANT about using the Up2U platform will be given access to the Up2U toolbox.

This includes:

- learning management systems
- file sync & share
- eduOER
- SWAN/Jupyterhub
- video conferencing, video recording and sharing
- learning analytics
- designated storage of up to 5GB
- staff training
- technical support
- SSO login

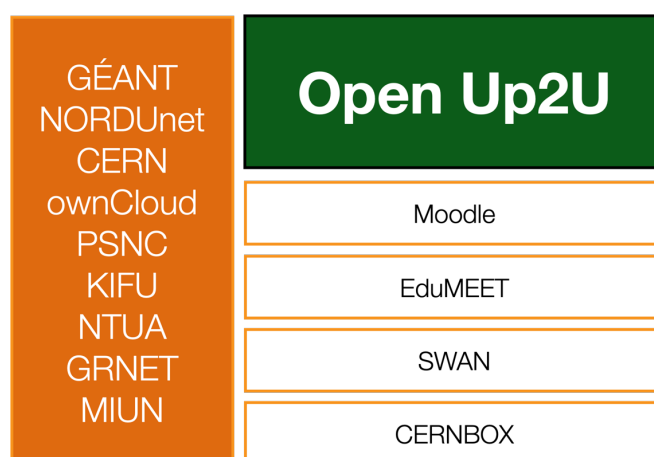
The service would be provided jointly by PSNC, GRNET and GWDG. Each organisation would be responsible for a particular element of the service that they currently are responsible for within the project.

2.1.2 openUp2U

In the light of the COVID-19 outbreak and the lockdown situation in multiple European countries, the Up2U Project Coordination team decided to start the openUp2U initiative to support schools and other educational institutes, so that education would not come to a standstill.

The openUp2U initiative was funded by the GN4-3 project. The aim is to offer openUp2U until the end of the COVID-19 pandemic, or at a minimum until the end of the academic year (2020).

openUp2U has been developed and offered with the support of Up2U project partners including GÉANT, NORDUnet, CERN, ownCloud, PSNC, KIFU, NTUA, GRNET, GARR, The Open University and MIUN.



2.1.3 The National Model

The goal of this business model is to provide the Up2U Application Toolbox (also called the Up2U platform) to high schools or even K12 schools, using the Software as a Service (SaaS) model on a national level. The target schools could be also a part of NRENs and their communities.

This is the 'NREN Services for Schools' model defined and analysed in D8.3 (see Figure 2.3). The core of this model is an NREN that could extend its current offer of connectivity services to schools with Up2U software and also offer related training. Such a combined service would provide the NREN with added-value in comparison to other connectivity or SaaS providers.

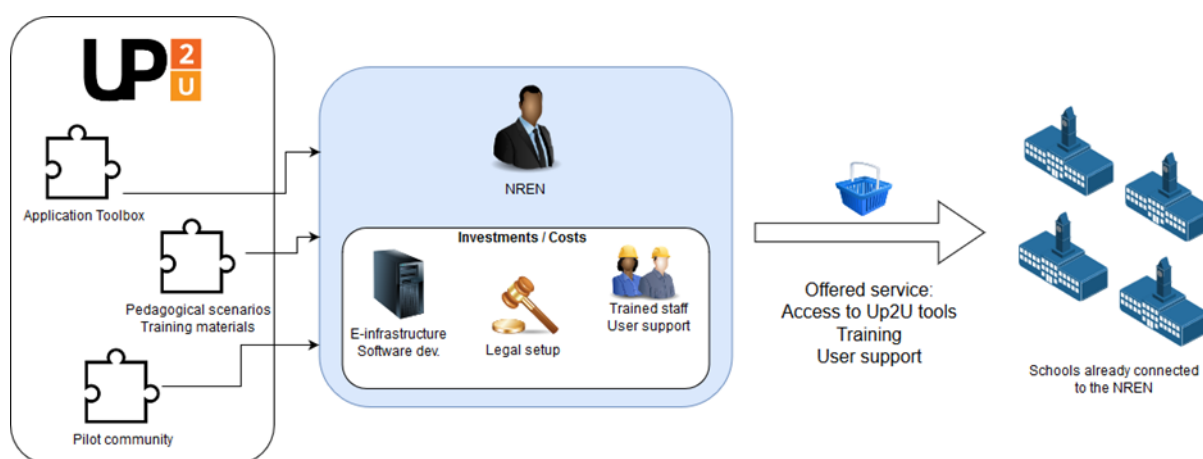


Figure 2.3: Overview of the NREN Services for Schools business model

Currently, there are five successful sustainability and exploitation models:

- **Lithuania:** KTU will manage the services regardless of the availability of funding from the government for at least two years after the end of the project. This period of free services will be extended if national funding is provided. Otherwise, further sustainability of the platform will be ensured by collecting membership fees via a formed consortium.

- **Hungary:** KIFÜ is willing to provide this service via the Up2U project for five years after the end of the project.
- **Greece:** The platform will be sustained by GRNET and NTUA for at least one year after the end of the project by the Greek partners regardless of the availability of funding from the Ministry of education. If national funding is provided, the support of the platform will be further extended.
- **Poland:** PSNC plans to keep maintain and continuously improve the national instance for as long as schools express an interest. At the moment, the platform is to be maintained for at least one year. Ffurther steps depend on funding sources that are under investigation.
- **Italy:** GARR conducted an analysis to evaluate costs to be claimed by an NREN or another national or federated entity hosting the Moodle Up2U platform on the cloud and providing it as a service to all interested schools. The analysis has been used for the development of Italian national model.

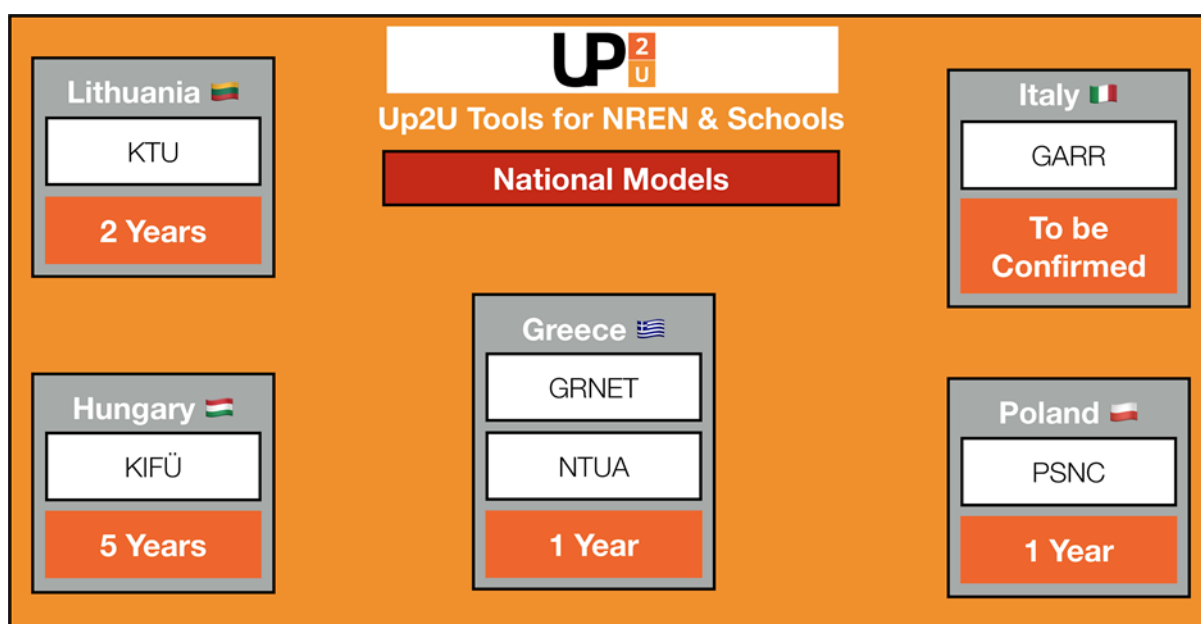


Figure 2.4: Up2U National Models

More details about the implementation and structure of each national model can be found in Section 4.2.

2.2 Up2U Tools for e-Learning Platforms

D8.3 introduced a 'Technical Exploitation' business model. The main aim of this model was to provide the option to reuse the developed technology in other use cases. In fact, the software outcome of the project was supposed to be used for other software engineering challenges of business actors (more details in D8.3). 'Up2u tools for e-learning platforms' BM is a result of the technical exploitation business model to use the Up2U platform, tools, solutions, methods and modules to provide an e-learning platform not only for secondary and high school students, but for wider range of users and

stakeholders such as universities, private e-learning providers, etc. Business actors can exploit the Up2U platform and associated tools for wider purposes based on their needs.

2.2.1 GWDG Academy

GWDG Academy is the main use case for this business model. As the university computing centre of the Georg-August-Universität Göttingen, and as a computing and IT competence centre of the Max Planck Society in Germany, GWDG has the ability to reach a wide range of learners including university students, training and internship students, etc. Accordingly, GWDG wants to use this opportunity to provide free learning materials to target groups of learners (specifically IT-related topics such as programming languages, IT-security, networking, designing, software engineering, data engineering, parallel computing, etc.).

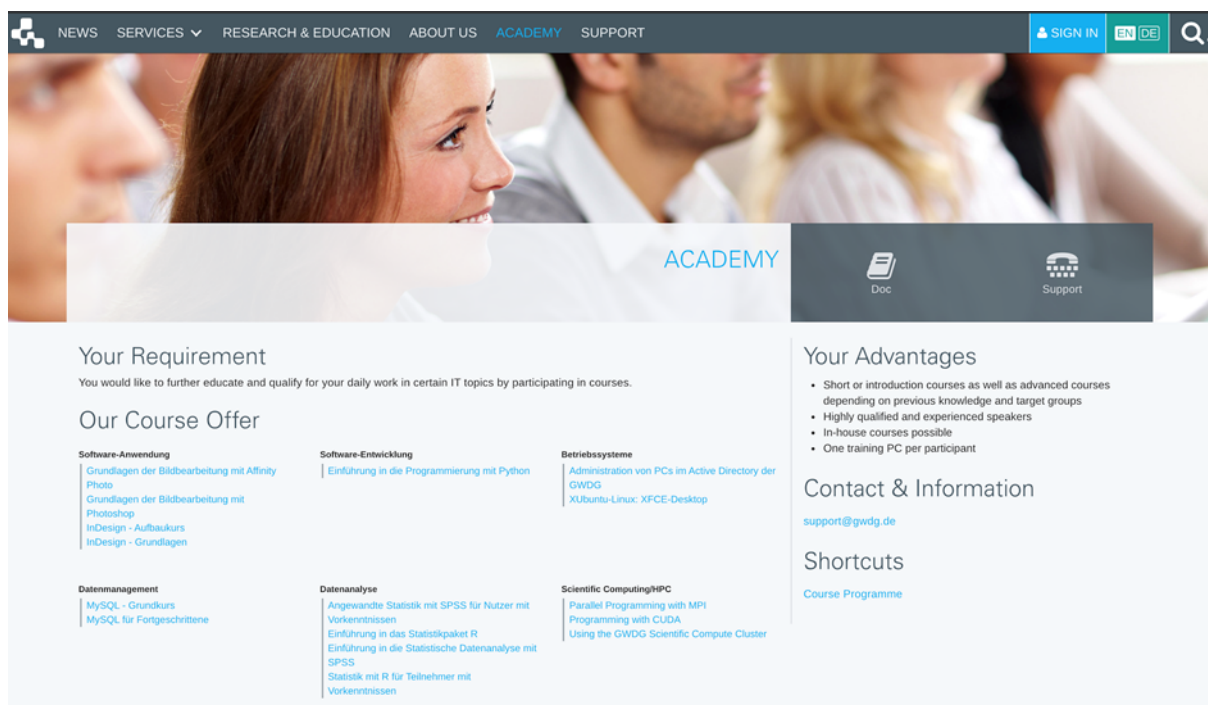


Figure 2.5: GWDG Academy Home Page

GWDG Academy has officially been announced on 29.01.2020 [Academy]. The first phase of the academy offers short and advanced courses to employees of all institutions of the University of Göttingen, the Max Planck Society and scientific institutions that belong to the extended circle of users of the GWDG. The idea of exploiting the results of the Up2U project for the second phase of GWDG academy was discussed with managers of GWDG. This would bring advantages such as:

- There is no need to spend time and resources on providing a new platform. GWDG only needs to localise the platform according to their needs, requirements and capabilities.
- Providing the GWDG virtual academy based on UP2U results would allow the Up2U project to use the platform, modules, tools, etc. for a wider range of users based on the objectives of GWDG Academy.

- GWDG can use the UP2U platform for both lecturers and students to create, access, search, share and collaborate on e-learning content.
- GWDG can offer the service to a limited number of lecturers to provide e-learning content or even make the service public, so that all certified lecturers can create their own virtual classroom.
- GWDG can integrate the tool with other tools and solutions according to their needs.
- It is possible to offer IT certification courses such as CISCO, AWS, etc. via this platform.

Accordingly, GWDG plans to use the Up2U platform with associated tools and modules for providing e-learning material to users. More details about the plans, timeline, resources, etc. can be found in Section 4.4.

2.2.2 Poddium

Within the framework of this project, Teltek proposed, designed and provided the Galicaster Personal Recorder tool, a multi stream recording tool that could be launched from any personal computer through a web browser.

To complete the experience of the Galicaster Personal Recorder in the UP2U project, Teltek also developed the Poddium platform for the project. Poddium provides improved access to the tool, through the project's own single sign on, and improves access to user-recorded videos.

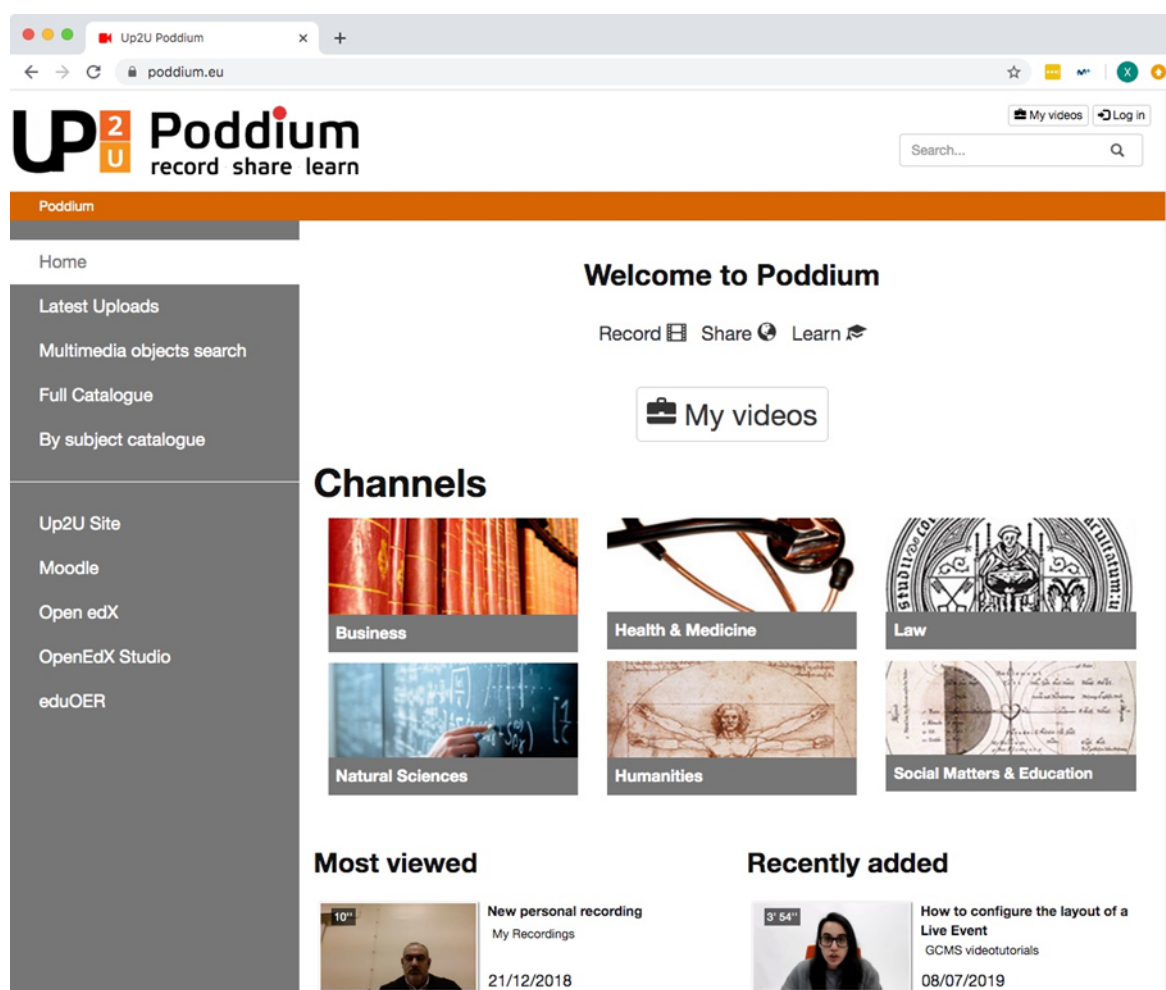


Figure 2.6: Poddium Tool Overview

In Poddium, students and teachers can record their own multistream videos directly from their personal computer. They have only to open a web browser and allows the use of a webcam.

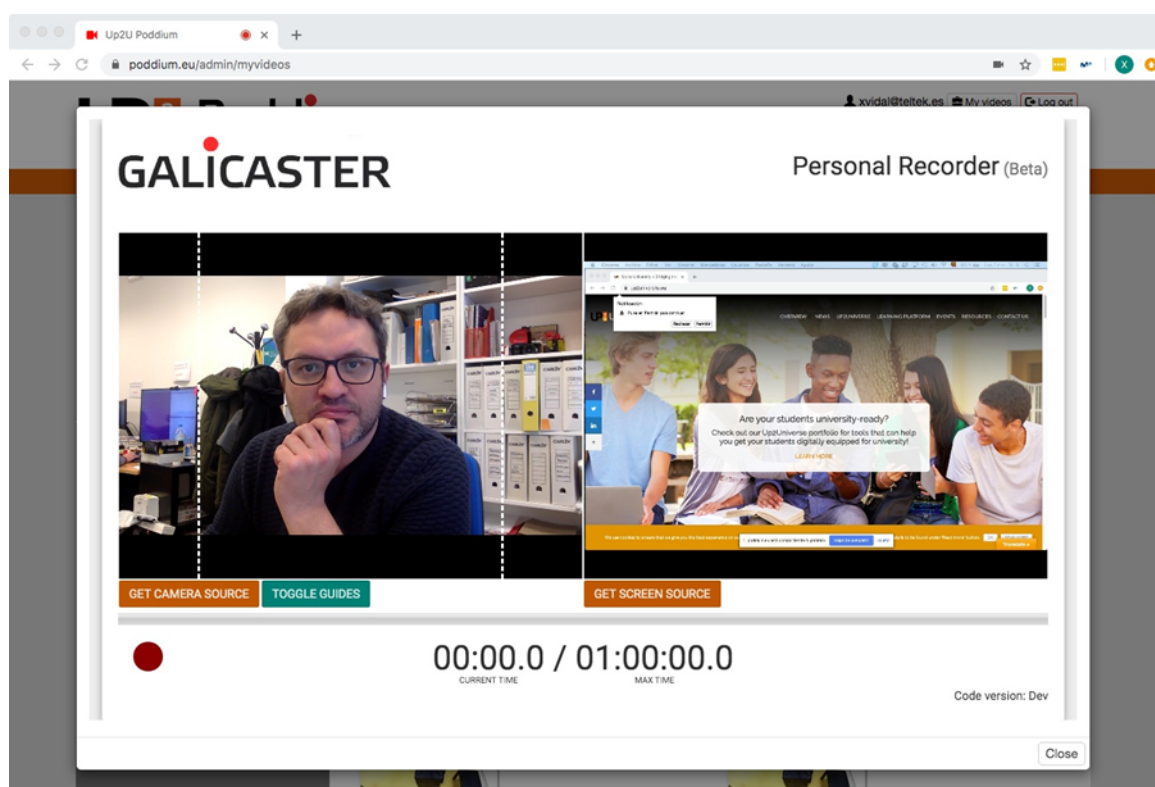


Figure 2.7: Poddium Video Recorder

Poddium has a personal storage space for the dual stream videos recorded with the Galicaster Personal Recorder. Users can also upload other videos directly to this personal multimedia library, assign tags to videos, and add them to different categories. In addition, users can control whether other users can view these videos.

The Poddium portal can be deployed for a single institution or for a group of institutions in a country. The personal recording tool could even be made available to other platforms, with some integration development, through the available API. It is up to the project members to decide whether or not to use this tool.

During the UP2U project, several institutions have expressed interest in Poddium and the possibility of maintaining the service once the project is finished. Poddium is currently available to all institutions and demos within the scope of the project, as well as specifically in the NREN of Lithuania, but there have been other NRENs, such as the Portuguese, also interested in the tool and its continuity.

Teltek Video Research SL can provide this service on client's premises or in the Software as a Service (SaaS) model, so its distribution fits both the centralised model and the decentralised model defined as business models within the scope of this project.

2.3 University as a Hub (U-Hub)

As stated throughout the project, Up2U's intention has been to leverage the role of Universities and their orientation efforts towards an innovative learning model that can be considered and (hopefully) adopted by secondary school teachers, deans and policy makers.

The following eight universities joint forces to form a European Academic Alliance called CIVIS, the first European Federated University:

- Aix Marseille Université (France)
- National and Kapodistrian University of Athens (Greece)
- University of Bucharest (Romania)
- Université Libre de Bruxelles (Belgium)
- Universidad Autonoma de Madrid (Spain)
- Sapienza Università di Roma (Italia)
- Stockholms Universitet (Sweden)
- Eberhard Karls Universität Tübingen (Germany)

Of these, Eberhard Karls Universität Tübingen plays a major role into the learning and teaching structure, and Sapienza plays a role in the Multilingualism and Multicultural studies, with an obvious impact on the electronic content management and curation.

The CIVIS alliance, created under the statute that a European University must meet the criteria of the Erasmus + call of the European Commission, will bring together some 384,000 students and 55,000 staff members.

Sapienza is now enrolled in a federated atheneum of circa 400.000 students, where the “scale factor” is potentially 6-8 times bigger than the actual regime of content creation, content curation translation and management.

Therefore, it is feasible that the experiences, methodologies and software integration created in Up2U will be valuable in the future, and the pedagogical team at UROMA Sapienza is working to make this a reality. U-Hub activities should engage with this too. Particularly, the effort to collect educational and pedagogical content to disseminate to secondary schools should find new reasons to be activated and enforced.

- Up2U U-Hub and Up2U

In late 2018 a branch of the Up2U project was proposed with the name “University as a Hub”. It was conceived as the collection of activities that universities inside the Up2U project would have to coordinate, targeted at secondary schools. After 18 months the activity of this group led to the deployment of a web page that lists and outlines all the initiatives.

- Classifying Digital Contents by Grade Level

UROMA devised a tool that enables teachers to analyse digital content and classify it according to grade levels commonly in use in European secondary schools. Like in the CEFR classification,

which is popular for L2 teaching and learning, Up2U is providing via the CommonSpaces platform a service to rate text materials according to a unified difficulty scale .

- A frontpage referring to host repositories tagged as U-Hub to leverage open content produced and administered by Universities for outreach and foundation courses
Access to these digital materials is facilitated by an aggregation page that is automatically generated inside CommonSpaces and can be reused in any other web page (including the Up2U frontpage). The maintenance and moderation of this directory will be carried out by UROMA personnel until the end of funding period of the project.
- A selection of real-world experiences managed by universities to orient educational activities coordinated by educational innovators who work in higher education research centres

Besides the references collection of U-Hub, UROMA will moderate discussions containing reports about sample usage of these materials.

Discussions will be in the form of single page forums where every group of teachers can publish their own experiences (in English) and receive and answer questions to share country-based experiences with other universities that joined the initiative.

Comments, questions and answers will be available later for analysis. A sample of this will be available inside the specified CommonSpace project University as a Hub.

2.4 Autonomous Use

2.4.1 Italian Example

In Italy, Up2U are experimenting with self-paced pilots with groups of self-organised learners.

- MusAppInt - Music education between secondary schools and conservatoriums
As a first sample of autonomous, self-organised groups of learners, Up2U promoted the adoption of the Up2U ecosystem by groups of individuals organised around an adult teacher (often acting as a mentor) where music education is needed. Up2U found that in Italy music education is not a top priority in secondary schools. Despite Italy's musical reputation, secondary musical education is left to private bodies and conservatoriums¹. Topics are"

An ear-training personal app records and evaluates the performances of each student, i.e. the progression in skills acquisition. Data is transferred off-line to CommonSpaces, which transforms it into a list of xAPI statements and sends it to the LRS.
- Ammappalitalia ("Let's map Italy") - Collaborative production of walkable paths in Italy, georeferenced and published in an open data map
Main topics are cultural heritage, territory care, gGeoreferencing and text quality.

¹ In Italy, there are 57 conservatories, many of which are over 300 years old. This network is mainly responsible for the higher education system, but is also responsible for secondary schools that specialise in music.

The objective is to offer secondary students of Tourism Studies an opportunity to collaborate on producing “slow pathways” of relevant touristic areas in the area of Rome and Lazio. This will produce a community of new profiles of tourism operators in the Tourism 4.0 job arena.

An existing web-app will be used: Ammappalitalia. Collaboration on the production of the paths tracks in an interoperable format will be monitored through CommonSpaces and recorded with Learning Locker

- Loquis Loquenda (“Hear, the world is speaking”) - Collaborative production of geo-referenced speakable texts in an open data map.

Main topics are: augmented reality, georeferencing, cultural heritage and text quality.

The objective is to offer secondary students of Tourism Studies an opportunity to collaborate on producing podcasts on relevant touristic sites in the area of Rome and Lazio. This will produce a community of new profiles of tourism operators in the so called Tourism 4.0 job arena.

An existing mobile app will be used: Loquis. This will send data to the LRS. Collaboration on production or adaptation of the podcast texts will be hosted by CommonSpaces, supported with text-analysis functions and monitored through interaction with Learning Locker

2.4.2 Portuguese Example

In Portugal Up2U contacted several private teachers about autonomous use. Although none of them had participate in CPD M1 and 2, they had a look at the information provided about the project and gave informal feedback. Based on this, it is possible to provide a projection for the autonomous use cases for any teachers or teacher groups (tutoring centres) that want to use the Up2U platform.

For tutoring centres, the business model can be thought as a monthly fee.

In these centres, a minimum of 20 students could be charged approximately 1 additional euro per month to be able to access the platform from home.

There are two ways the tutorial centre can generate an income.

Based on an example of 20 students and considering that Up2U can charge 20 euros monthly for each tutoring centre, and based on a simulation table where the monthly fee charged by the tutoring centre to parents goes from 1 euro to 5 euros/month, a maximum monthly income of 100 euros can be projected.

That is not bad considering that the tutorial centres will improve the pedagogical process and extend it to their homes even during holidays.

CHARGED MONTHLY TO STUDENT / PARENTS	MONTHLY INCOME FOR THE TUTORIAL CENTRE
1	20
1,5	30

2	40
2,5	50
3	60
3,5	70
4	80
4,5	90
5	100

Table 2.1: Cost Calculation for Autonomous Use BM

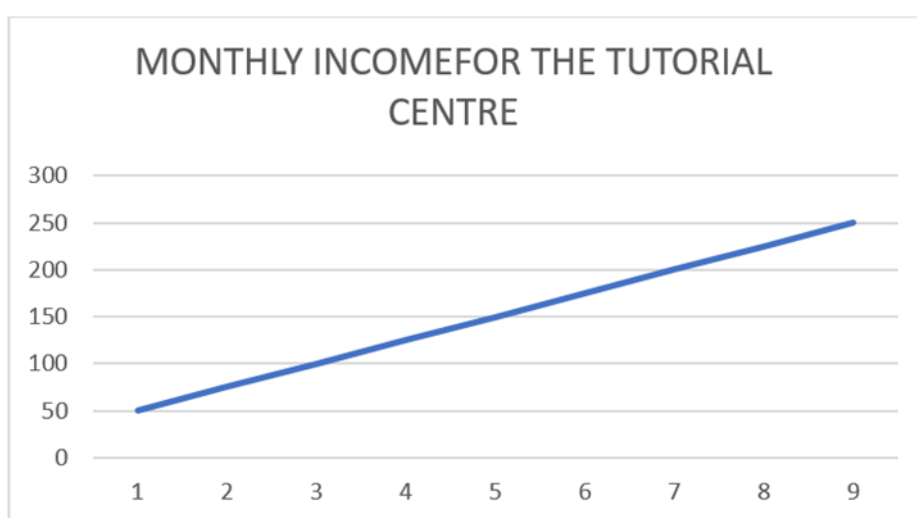


Figure 2.8: Monthly Income for the Tutorial Center

The second way tutorial centres can generate profit is by increasing the number of students. That is, if instead of 20 the tutoring centre has 50 students, the profits obtained by the centre with the Up2U platform increases as shown in the previous graph.

This means that the tutoring centre can use the Up2U platform and even generate a profit with it. Based on this projection, the contact persons responsible by these centres indicated that they could be interested.

From the perspective of a company that owns the Up2U platform the profits can be projected as follows:

NUMBER OF TUTORING CENTERS	NUMBER OF TUTORING CENTERS
1	20

200	4000
1000	20000
10000	200000

Table 2.2: Industry Engagement for Autonomous Use

A graph that shows the perspective from a European level with 10000 tutoring centres shows that the profit may be 200.000 per month.



Figure 2.9: European level with 10000 tutoring centres

This will need a good commercial team that can present that tutoring centres can generate their own profit, while also improving the pedagogical and technical skills of their students.

3 Market Analysis

As indicated in D8.3 regarding the sustainability of the project, no known solution exists in the market that is as complete as the one presented by the Up2U project. There is no educational platform that provides such a level of tool integration and interconnection. Therefore, each part of the system has to be analysed separately. To do this, the tools are separated into two large groups: the e-learning platforms or LMS (Learning Management Systems), and other tools that enrich the UP2U experience. Our cost calculation based on this analysis can be found in appendix 1² (dissemination level: private).

3.1 Market Analysis of e-Learning Platforms

In this section, the most popular e-learning platforms, as well as, their overview, features and costs have been described.

3.1.1 NRW 1.0

Website	https://products.office.com/de-de/home?rtc=1
Provider	Microsoft
Data Storage	EU data centers (MS Sway US data centers)
Data Security	ISO 27001 certified
Initial Setup	Official prices depend on the subscription plan, e.g. B. A3, discounts possible via graduation
One-Off Costs	
Annual Operation Costs	
Annual Additional Costs	
Teacher Accounts	depending on the plan * € 3.20 (A3) to € 7.85 (A5). A1 free (limited so) prices here per month
Student Accounts	depending on the plan * € 2.45 (A3) to € 5.90 (A5). A1 free (limited so) prices here per month
Software	Office 365
Module Overview	Dashboard with applications (Outlook, OneDrive, Word, Excel, PowerPoint, OneNote, etc.)

² Note that the appendices are only available in the confidential version of the document.

	Documents
	Recently used
	OneDrive
	SharePoint
	Teams
	Streams
	Sway
	Forms
	Skype

Table 3.1: NRW 1.0

3.1.2 Office 365

Website	https://products.office.com/de-de/home?rtc=1
Provider	Microsoft
Data Storage	EU data centers (MS Sway US data centers)
Data Security	ISO 27001 certified
Initial Setup	Official prices depend on the subscription plan, e.g. B. A3, discounts possible via graduation
One-Off Costs	not available (may be implemented via API interfaces)
Annual Operation Costs	
Annual Additional Costs	
Teacher Accounts	depending on the plan * € 3.20 (A3) to € 7.85 (A5). A1 free (limited so) prices here per month
Student Accounts	depending on the plan * € 2.45 (A3) to € 5.90 (A5). A1 free (limited so) prices here per month
Software	Office 365
Module Overview	Dashboard with applications (Outlook, OneDrive, Word, Excel, PowerPoint, OneNote, etc.) Documents Recently used OneDrive SharePoint Teams Streams

	Sway
	Forms
	Skype

Table 3.2: Office 365

3.1.3 uCloud4Schools

Website	https://www.ucloud4schools.com
Provider	regio iT
Data Storage	German data center
Data Security	ISO 27001 certified Data transmission via SSL can also be completely encrypted; End to end (E2E) possible. 2-factor authentication (2FA) adjustable for users
Initial Setup	200 €
One-Off Costs	Moodle (€ 200) Dashboard (€ 100) Single Sign-On (€ 100) Dudle, incl. 10 GB (€ 50) Etherpad, incl. 10 GB (€ 50) MRBS (resource management), incl. 10 GB (50 €) pmWiki, incl. 10 GB (50 €) DWO (on request)
Annual Operation Costs	280 €
Annual Additional Costs	MRBS (45 €) pmWiki (45 €) LibreOffice Online (9.50 €) 1 GB additional storage (0.60 €)
Teacher Accounts	€ 2.55 (with 1GB data storage)
Student Accounts	€ 2.55 (with 1GB data storage)
Software	Nextcloud (may not be the latest version) Upgrade to Major once a year
Module Overview	Dashboard data storage

	calendar
	E-mail integration
	Contacts
	EDMOND
	online office (on request)
	Moodle (optional)
	Dashboard (optional)
	Single-Sign-On (optional)
	Dudle (optional)
	Etherpad (optional)
	MRBS (resource management) (optional)
	pmWiki (optional)

Table 3.3: uCloud4Schools

3.1.4 EduDocs

Website	https://get.edudocs.org/de/
Provider	Uplinked UG
Data Storage	German data centers (Hetzner + 1 & 1)
Data Security	ISO 27001 certified Data transmission via SSL NextCloud can also be completely encrypted; End to end (E2E) possible. 2-factor authentication (2FA) adjustable for users
Initial Setup	Free
One-Off Costs	Existing additional modules can be installed at no extra cost. Individual solutions on request.
Annual Operation Costs	€ 36 (with 100 GB total storage) € 96 (with 500 GB total storage) € 168 (with 1 TB total storage)
Annual Additional Costs	1TB additional storage (€ 168)
Teacher Accounts	2.40 €
Student Accounts	1.20 €
Software	Next Cloud

Module Overview	<p>File manager</p> <p>Talk (a messenger that can also be used via apps)</p> <p>Activities</p> <p>E-mail integration (optional)</p> <p>Calendar</p> <p>Audio Player (optional)</p> <p>Deck (a kind of Kanban)</p> <p>Surveys</p> <p>Online Office (Collabora preset; on request OnlyOffice, license from school)</p> <p>Chat (like Facebook, optional)</p> <p>many more available (> 200)</p>
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Table 3.4: EduDocs

3.1.5 WwSchools

Website	https://www.wwschool.de
Provider	DigiOnline GmbH
Data Storage	German data center
Data Security	ISO 27001 certified, data transfer via SSL
Initial Setup	500 euros (incl.VAT)
One-Off Costs	Free additional components: Apps for iOS, Android and Windows, WebWeaver Proxy for local temporary storage of files with insufficient bandwidth, WebWeaver Connect for user synchronisation with the school administration ONLYOFFICE / web conference: on request
Annual Operation Costs	The basic price includes all additional components (with the exception of a web conference), technical support and updates and is 3 euros per user. At wwschool ONLYOFFICE is included in the annual costs of 3 euros per user. Minimum annual costs: 900 euros (including VAT), including 300 users
Annual Additional Costs	Storage expansion up to 250 GB: 25 percent surcharge on annual costs
Teacher Accounts	The cost for users in all roles (teacher, student, partner, parent) is 3 euros per user
Student Accounts	The cost for users in all roles (teacher, student, partner, parent) is 3 euros per user
Software	WebWeaver
Module Overview	<p>User functions standard:</p> <p>mail service,</p>

	<p>address book,</p> <p>messenger (1: 1 and classes / groups),</p> <p>member list,</p> <p>forum,</p> <p>surveys,</p> <p>chat,</p> <p>teacher board,</p> <p>student board,</p> <p>mailing lists,</p> <p>pin board,</p> <p>file storage,</p> <p>messages,</p> <p>calendar,</p> <p>tasks,</p> <p>bookmarks,</p> <p>timetable,</p> <p>resources,</p> <p>notes,</p> <p>System messages,</p> <p>forms,</p> <p>substitution plan,</p> <p>interactive learning modules including online authoring tool,</p> <p>learning plan,</p> <p>media search (e.g. Edmond NRW),</p> <p>learning diary,</p> <p>learning success control,</p> <p>blog,</p> <p>photo album,</p> <p>Website,</p> <p>profile,</p> <p>wiki,</p> <p>office hours.</p> <p>Optional:</p> <p>ONLYOFFICE,</p> <p>web conference</p>
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Table 3.5: WwSchools

3.1.6 WebWeaver School

Website	https://www.webweaver.de/school
Provider	DigiOnline GmbH
Data Storage	German data center
Data Security	ISO 27001 certified, data transfer via SSL
Initial Setup	On demand
One-Off Costs	Free additional components: Apps for iOS, Android and Windows, WebWeaver Proxy for local temporary storage of files with insufficient bandwidth, WebWeaver Connect for user synchronization with the school administration ONLYOFFICE / web conference: on request
Annual Operation Costs	The basic price includes all additional components (with the exception of ONLYOFFICE and web conference), technical support and updates and is 3 euros per user.
Annual Additional Costs	On demand
Teacher Accounts	The cost for users in all roles (teacher, student, partner, parent) is 3 euros per user
Student Accounts	The cost for users in all roles (teacher, student, partner, parent) is 3 euros per user
Software	WebWeaver
Module Overview	<p>User functions standard:</p> <ul style="list-style-type: none"> mail service, address book, messenger (1: 1 and classes / groups), member list, forum, surveys, chat, teacher board, student board, mailing lists, pin board, file storage, messages, calendar,

	<p>tasks,</p> <p>bookmarks,</p> <p>timetable,</p> <p>resources,</p> <p>notes,</p> <p>System messages,</p> <p>forms,</p> <p>substitution plan,</p> <p>interactive learning modules including online authoring tool,</p> <p>learning plan,</p> <p>media search (e.g. Edmond NRW),</p> <p>learning diary,</p> <p>learning success control,</p> <p>blog,</p> <p>Photo album,</p> <p>website,</p> <p>profile,</p> <p>wiki,</p> <p>office hours.</p> <p>Optional:</p> <p>ONLYOFFICE,</p> <p>web conference</p>
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Table 3.6: WebWeaver School

3.1.7 G Suite for Education

Website	https://gsuite.google.com/signup/edu/welcome
Provider	Google
Data Storage	European data centers + worldwide, with Enterprise Edu only EU possible
Data Security	ISO 27001, ISO 27017, ISO27018, C5 BSI, SOC2
Initial Setup	completely free, unlimited storage
One-Off Costs	completely free, unlimited storage
Annual Operation Costs	completely free, unlimited storage

Annual Additional Costs	Enterprise for Edu € 2 monthly for staff at least 50 licenses, students free of charge
Teacher Accounts	free
Student Accounts	free
Software	G Suite, Classroom
Module Overview	docs, sheets, slides, drive, forms, meet, classroom, drawings

Table 3.7: G Suite for Education

3.1.8 Moodle

Website	https://eledia.de
Provider	Dialogue in eLearning
Data Storage	German data center
Data Security	Data center ISO 27001 certified, CO2 neutral. Energy from hydropower, contracts with school GDPR compliant, support in data protection compliance by providers
Initial Setup	Setup included in annual fee, optional system configuration, connection to LDAP / AD
One-Off Costs	optional
Annual Operation Costs	from € 850 net / year, 250 users
Annual Additional Costs	on demand
Teacher Accounts	like other users
Student Accounts	like other users
Software	Moodle, optional Mahara
Module Overview	

Table 3.8: Moodle

3.1.9 School Manager (Schulmanager) Online

Website	https://www.schulmanager-online.de
Provider	School manager online
Data Storage	German data center
Data Security	Data center ISO 27001 certified, contract for order processing according to GDPR
Initial Setup	free
One-Off Costs	free
Annual Operation Costs	No base price, only module prices
Annual Additional Costs	Annual prices per module between € 89 and € 239. First 6 months free. Details: https://www.schulmanager-online.de/kondbedingungen.html
Teacher Accounts	free
Student Accounts	free
Software	School manager online
Module Overview	<p>absence management</p> <p>grade management</p> <p>Messenger</p> <p>room / resource booking</p> <p>class work calendar</p> <p>letters to parents send them via e-mail</p> <p>consultation booking</p> <p>Infoscreen</p> <p>documents</p> <p>Elternsprechtag</p> <p>money collect by bank transfer</p> <p>register for electives</p> <p>bulletin board</p> <p>displaying the representation plan</p> <p>application for leave</p> <p>sick note</p> <p>calendar</p>

Table 3.9: School Manager (Schulmanager) Online

3.1.10 School (Schule) Plus

Website	https://www.schule-plus.com/
Provider	Schule Plus, Benjamin Ledel, IT services
Data Storage	Own servers
Data Security	ISO 27001 certified, contract for order processing according to GDPR
Initial Setup	3 monthly fees
One-Off Costs	on demand
Annual Operation Costs	0 €, billed according to user numbers
Annual Additional Costs	on demand
Teacher Accounts	depending on the modules in the system € 0.70 - € 1.80
Student Accounts	depending on the modules in the system € 0.70 - € 1.80
Software	School Plus, own development
Module Overview	<p>Basic system:</p> <ul style="list-style-type: none"> - User administration - Group administration - New system (contributions in groups or globally for the whole school with comment function) - Calendar - File storage per group and personal extensions - Display of timetable and substitution plan data - Digital sheets (worksheets, evaluation sheets, eLearning system) - Collaborative Whiteboard software (blackboard) - messenger - room, device and resource management - class work planner (assistant supported) - e-mail server - plans - absenteeism - digital class book - course choices (illustration of upper level choices)

	and afternoon offers) - Connection to any external, existing system possible
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Table 3.10: School (Schule) Plus

3.1.11 edu-Sharing

Website	https://edu-sharing.com/
Provider	edu-sharing.com (service) / .net (association / community)
Data Storage	On a local server, e.g. from the country or the municipality
Data Security	Logineo NRW
Initial Setup	NA
One-Off Costs	NA
Annual Operation Costs	NA
Annual Additional Costs	NA
Teacher Accounts	NA
Student Accounts	NA
Software	https://edu-sharing.com/
Module Overview	<p>Basic system:</p> <ul style="list-style-type: none"> - User administration - Administration of organizations and. Groups - Rights and inheritance administration - Playback / rendering of various content formats - Access rights management for content - Automatically correct display of license - including legally required information <p>For content managers: Inside:</p> <ul style="list-style-type: none"> - Content portal (editorial homepage, search) - Content collections (thematically , Curriculum, ...) - content sources (federated and harvesting) - editorial workflows - communication with authors: <p>for authors / teachers</p>

	<ul style="list-style-type: none"> - personal document management, school, groups - editors (see extensions) - Collections (personal, groups, editing) - Comments, rating for content <p>extensions via plugins / interfaces</p> <p>for using the content as well as upload, editing</p> <ul style="list-style-type: none"> - editors (e.g. OnlyOffice, H5P) - learning platforms (e.g. Moodle, Ilias, Opal) - WebCMS (<p>e.g. Wordpress, Typo3) - EPortfolio (Mahara)</p>
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Table 3.11: edu-Sharing

3.1.12 UCS@School

Website	https://www.univention.de
Provider	Univention GmbH
Data Storage	On the school's local server or in the municipal data center
Data Security	<p>Certificate depending on the data center (typically ISO 27001 certified)</p> <ul style="list-style-type: none"> - Data transmission via SSL - School server component (UPS, access protection, air conditioning, ...)
Initial Setup	No direct costs, if necessary service support
One-Off Costs	Many (> 80) packages are available in the App Store. Partly chargeable, partly free of charge
Annual Operation Costs	195 €, net per server
Annual Additional Costs	Possibly. to discuss directly with the manufacturer
Teacher Accounts	€ 1 per user per year
Student Accounts	€ 1 per user per year
Software	UCS with extension @school for schools
Module Overview	<p>Over 80 apps can be integrated. Among other things, connections to</p> <ul style="list-style-type: none"> - itslearning, - schul.cloud, - G Suite for Education + Google Classroom,

	<ul style="list-style-type: none"> - WebWeaver School, - Office 365. https://www.univention.de/produkte/univention-app-center/app-katalog/
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Table 3.12: UCS@School

3.1.13 iServ

Website	https://iserv.eu/
Provider	IServ GmbH
Data Storage	Servers are set up in the school or with central administration (new) at the school authority / IT service provider and at school.
Data Security	Since the iServ is operated on its own hardware, two aspects are relevant when it comes to data security: Securing the iServ server software itself - see https://iserv.eu/portal/security/ Securing the server environment (UPS, access protection, air conditioning, ...)
Initial Setup	<p>€ 595.00 per license (setting up the license, registering the desired domain, creating an official SSL certificate, setting up the DynDNS and mail relay services)</p> <p>If a server / backup server is required, this can be obtained from iServ. Prices (net): € 1,200 to € 5,500 (server) or € 700 to € 900 (backup server)</p>
One-Off Costs	Other packages can be installed independently and at no cost via OpenAuth and single sign-on.
Annual Operation Costs	The annual operating costs result from the actual number of pupils at the school. The number of actual users is unlimited, so user accounts for teachers, staff, alumni and parents can be created at will.
Annual Additional Costs	free of charge in the scope of the annual usage fee for all self-developed, new modules
Teacher Accounts	Free
Student Accounts	<p>Elementary and special schools: € 3.00</p> <p>Secondary schools: € 4.00</p> <p>Vocational schools: € 5.00 (half-time vocational students are charged half)</p>
Software	<p>Elementary and special schools: € 3.00</p> <p>Secondary schools: € 4.00</p> <p>Vocational schools: € 5.00 (half-time vocational students are charged half)</p>
Module Overview	<p>Address Book</p> <p>tasks</p> <p>Brockhaus</p> <p>bookings</p>

files
Print
E-mail
Edupool (eg Edmond NRW)
Forum
Device Control
Info Screen
Calendar
Exam Schedule
knowledge base
course choices
Messenger
Mobile Device Management (iOS)
News
online office
online media
plans
Calculator Application
Quick Polls
students career
fault message
Timetable
texts
polls
WebDav
WLAN (RADIUS)
Media Wiki
from external providers:
Schulbuchausleihe
Vocabulary Builder
Time-for-Kids

Table 3.13: iServ

3.2 Ecosystem Analysis – Comparison

During the project, we conducted two types market analysis:

- Research about popular e-Learning platforms and their characteristics.
- Analysis of the most popular e-learning tools in each country.

Based on the analysis, we learned which features need to be added to the Up2U platform to make it unique and comparable to other similar tools.

Our competitive analysis shows the results of this research. In fact, we wanted to give our users the confidence that Up2U has more features and attractive characteristics in comparison to similar tools in each country.

The competitive analysis is available in our public website: <https://up2university.eu/up2u-competitive-analysis/>

The competitors were selected based on two main factors:

1. Most Popular in each country based on the results of Section 3.3. We selected three of the most popular tools according to the results. For sure there are more tools. But we selected the most popular ones.
2. Moodle as the basis of Up2U. In fact we want to show how Up2U increases the efficiency of Moodle.

3.2.1. Why Up2U?

Up2U is an Open-Source, EC-recommended platform, specifically designed for EU countries with different types of instances (In particular: Central and Local) according to the requirements of NRENs and schools. It uses the latest technologies such as Docker, Kubernetes and Puppet to easy install in multiple platforms. Furthermore, Up2U supports LTI, Single Sign On, Multi-Tenancy, GDPR Compatibiltiy and Multi-Language to increase the efficiency and security in comparison with other tools. In pedagogical aspects, Up2U supports variety of pedagogical scenarios, comprehensiveness of assessment tools, learning analytics, as well as, interactive content creation and adaptive learning scenarios.

There are several other characteristics and features that make Up2U unique and comparable to the most popular e-learning tools. You can find the full competitive analysis of Up2U platform in the following Link: <https://up2university.eu/up2u-competitive-analysis/>

3.3 Market Analysis of e-Learning Tools in Each Country

In this section the most popular e-Learning tools in each country are described.

Country	Most Popular e-Learning Tools in Schools and their Features
Germany	Overall, Edu-sharing, Logineo NRW, Moodle and Office 365 are the most popular tools in Germany. However, each state in Germany has different plans for the future and has provided considerable amount of funds for e-learning providers according to their needs.
Greece	Google free services and some storage services provided by the Greek School Network are the most popular solutions for Greek schools. Other tools that teachers are using in Greece are Moodle and Edmodo, in order to communicate with their students and to organise their material.
Lithuania	Moodle is the most popular, but there are a lot of teachers who use Edmodo, Google Classroom or Office 365. Another category of e-Learning tools is electronic textbooks and exercise books provided by publishers. Those are not full-featured e-learning platforms, but are quite popular. Usually those are charged per user and are paid for by parents.
Poland	Microsoft Office 365 is the most popular solution in Polish schools. Google for Education takes second place. In addition, teachers and students use freely available web services such as the free Google services.
Italy	Most popular in Italy is Google Suite for education: cloud-based scalable suite of free Google apps tailored specifically for schools. G-Suite includes Mail, Drive, Classroom, Docs, Sheets, Slides, Sites, Calendar.
Spain	Moodle is the most popular e-learning platform in Spain but Blackboard, being non Open Source Software is growing fast. For Open Courses and MOOCs OpenEdX is clearly the option of choice.
Portugal	Moodle is the most popular e-learning platform in Portugal. Office 365 and Google Suite for education are also used. Some CMS such as Joomla or Wordpress are used for content delivery. For MOOCs, OpenEdX is the adopted solution

Table 3.14: Most Popular e-Learning Platforms in Each Country

3.3 Market Analysis of Other Tools

Up2U Universe is much more than an e-learning platform, because, in addition to the spirit of sharing knowledge between different countries, it integrates several tools that improve this experience of sharing and learning. Tools such as a video-conference system, a multimedia content manager, a video recorder for educational resources or a streaming server.

This section shows a set of educational tools that are similar to the ones offered by the Up2U ecosystem

3.3.1 Warpwire

Warpwire is a video solutions platform with free integration with the most common LMS (Sakai, Canvas, Moodle or Blackboard).

The most notable features of the platform are:

- Asset-level security and secure sharing options
- Link, embed and download media options
- Guest accounts
- LMS and CMS integration
- Customisable login page
- Integration with SSO
- Mobile & tablet capture a video or photograph
- Webcam and external camera capture
- Live broadcast with live chat
- HTML5 playback and adaptive streaming
- Content tagging and metadata options
- Upload and request closed captions
- Usage statistics
- Third-party integrations

The vendor does not provide a price list for market analysis reasons.

3.3.2 Kaltura

Kaltura is the market leader providing video platforms for education, services to OTT and enterprise verticals.

The most notable features of the video platform for education are:

- State of-the-art user interface and experience
- Branding and skinning of the mediaspace video portal
- Powerful content organisation
- Robust video search and discovery
- Accessibility and closed captions
- Mobile-supported
- Live webcasting
- Built-in editing tools
- Content recommendations
- Advertising and monetisation
- Fine-grain access control and content segregation

- Collaboration features
- Analytics

Kaltura's plans involve custom pricing, but they could start at \$1000 per month and increase according to bandwidth used, storage used and transcoding costs or even minutes streamed in live streaming features.

3.3.3 Screencastify

Screencastify is a simple video creation tool for teachers and students.

The most powerful features of this tool are:

- Simplicity
- Embed the webcam in the screen recording
- Easy management of the licenses from one subscription
- Google integrations (Google Drive and Youtube)
- Export features (MP4, animated GIF or MP3)
- Usage insights for the institution

Screencastify has an individual plan of \$29 per year with education discount applied, but it is necessary to ask for a custom quote for full school plans.

3.3.4 Presentations2Go

Presentations2Go is a video platform that integrates with learning management systems and offers automated recording with recording applications or certified appliances and hardware recorders.

Presentations2Go offers diverse solutions to record videos within organisations:

- Simple screencapture and recording of flipped classroom videos using any laptop, tablet or smartphone
- Manual or full automatic lecture capture from classrooms and labs
- Mobile event recording with live streaming
- In-house recording studios to produce high quality learnings and moocs
- Integration with hardware recorders from EXtron and Matrox
- Open API for integration with room control systems

The vendor does not provide a price list for market analysis reasons.

3.3.5 BigBlueButton

BigBlueButton is an open-source web conferencing system. It is based on the GNU/Linux operating system and runs on Ubuntu 16.04.

- Integrations for many of the major learning and content management systems
- Support for multiple audio and video sharing
- Presentations with extended whiteboard capabilities
- Public and private chat
- Desktop sharing
- Integrated VoIP (using FreeSWITCH)
- Support for presentation of PDF documents and Microsoft Office documents

The BigBlueButton server can also run within a cloud environment.

There are several commercial vendors for this cloud environment and it is possible to find a cloud platform of the solution for a hundred of users for 150€ monthly fee.

4 Implementation of Business Models

4.1 Up2U Demand Analysis

At the end of the project in June 2020, GÉANT investigated the demand from NRENs and universities for using and offering Up2U as a digital learning environment in their respective educational institutions. The results showed the need for NRENs to adopt the platform to support education within their countries.

Company / Organisation	Country	Would you be interested in adopting and offering Up2U for your educational institutions?	If yes, would you be interested in creating and maintaining a national instance or would you prefer a centralised (GÉANT managed) offer?
RASH	Albania	Yes	National instance
RASH	Albania	Yes	National instance
ASNET-AM	Armenia	Yes	National instance
Belnet	Belgium	Yes	National instance
Dzemal Bijedic University of Mostar	Bosnia and Herzegovina	Yes	National instance
Cybera	Canada	Yes	National instance
CARNET	Croatia	Yes	National instance
CYNET	Cyprus	Yes	National instance
CSC	Finland	We might be interested to investigate if there is need for this service.	N/A
CSC	Finland	I am not in position to decide, I figure CSC would be interested	This would require some careful analysis, as there are some overlap with our current offerings ... hosted by CSC
CSC	Finland	We have mapped interest for HE. No need for the whole infrastructure, but the architectural model	N/A

		and the addons for Moodle are of interest.	
GRENA	Georgia	Not clear yet	National instance
GRNET	Greece	Yes	GÉANT Managed offer
John von Neumann University	Hungary	No	N/A
Szechenyi Istvan University	Hungary	Yes	National instance
KIFÜ	Hungary	Yes	National instance
KIFÜ	Hungary	Yes	National instance
RHnet - University of Iceland	Iceland	No	N/A
HEAnet	Ireland	No	N/A
MEITAL	Israel	Yes	GÉANT Managed offer
Tel Aviv University	Israel	May not be suitable for university students	N/A
GARR	Italy	No	N/A
KRENA	Kyrgyzstan	Yes	N/A
IZM	Latvia	Yes	National instance
Kaunas University of Technology	Lithuania	We are already offering Up2U.	National instance
Pannon Egyetem	Magyarország	Yes	National instance
RENAM	Moldova	Yes	GÉANT Managed offer
RENAM	Moldova	Yes	National instance
Niger-REN	Niger	Yes	Better to have a federated instance within our regional REN, WACREN
Eko-Konnect Research and Education Initiative	Nigeria	Yes	National instance
Unit	Norway	Not sure, we dont know up2u enough to decide	N/A
PSNC	Poland	Yes	National instance
ISEP	Portugal	Yes	GÉANT Managed offer
Sierra Leone Research &	Sierra Leone	Yes	National instance

Education Network Network			
ARNES	Slovenia	Partly interested, when we understand services and conditions	Depends on the expected user consumption (of a specific service), scalability and price
SUNET	Sweden	Not now, but we would like to get more information and follow the development	N/A
SWITCH	Switzerland	Yes	National instance
TARENA	Tajikistan	Yes	National instance
TogoRER	Togo	Yes	National instance
URAN Association	Ukraine	Yes	National instance
Internet2	United States	Unsure	N/A
ZAMREN	Zambia	Yes	National instance
CUDI	Mexico	Yes	National instance
Total YES		29	25 (National instance)
Total Other		10	4 (GÉANT managed offer)
Total No		4	11 (N/A)

Figure 4.1: Up2U demand analysis result

Based on the results Up2U have started working with the 19 NRENs (14 GÉANT NRENs) that responded “yes” on creating their national instances, and with the interested other 10 NRENs and educational institutions, making the case in their countries.

4.2 Centralised Up2U Tools for NRENs and Schools

4.2.1 Implementation by GÉANT

GÉANT will act as a clearing house for the European R&E community both financially and technically.

GÉANT’s role regarding the centralised model is to provide a central point of contact for organisations interested in using the Up2U platform. A standard offer for organisations is developed with the service portfolio and a scale up plan to share with organisations interested in using this service.

GÉANT provides a contract template and handles the negotiation for new organisations joining the service offering.

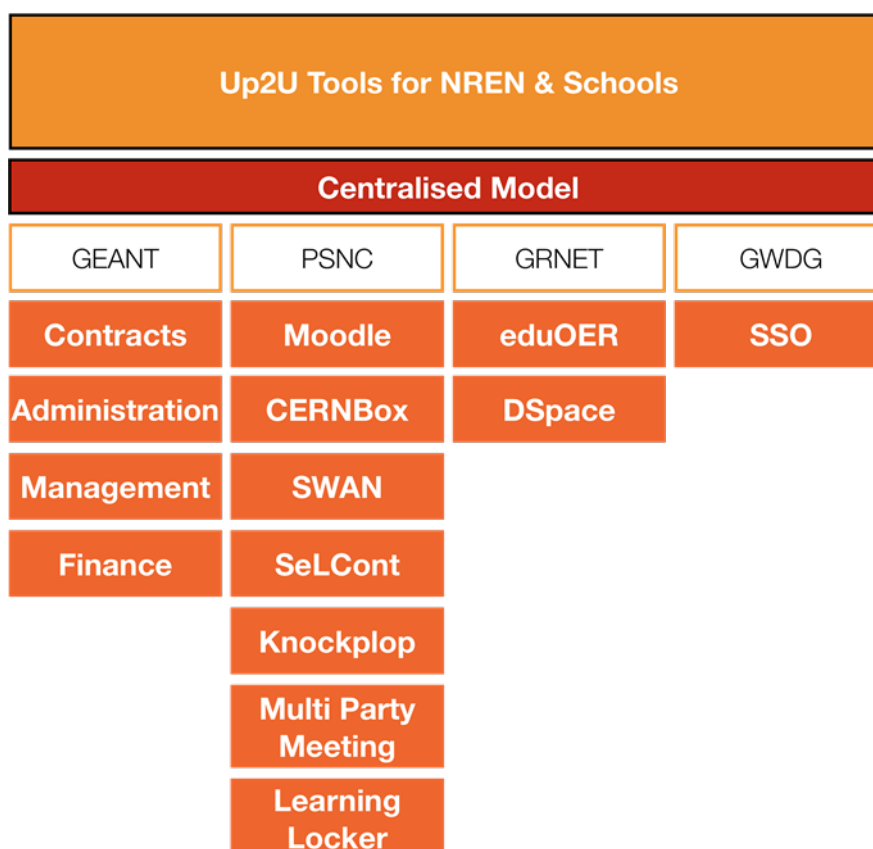


Figure 4.2: Overview of Centralised Model

4.2.2 Hosts

4.2.2.1 PSNC

Within the central model, PSNC will continue hosting the tools that it has been hosting during the project. These are Moodle, CERNBox, SWAN, SeLCont, Knockplop, Multiparty Meeting, and Learning Locker. However, the specific selection of tools and tailoring of additional services depends on the decisions of customer NRENs who provide funding. Customer NRENs will be free to use either a single common instance of the platform, sharing functionalities and costs, or dedicated instances, in which they could freely order changes and adjustments that they need.

In addition to the hosting services, PSNC could offer training targeted for staff from customer organisations who will use the hosted infrastructure, and provide services and training to their schools. All training will be performed in English.

The platform instance or instances used for the central model will be separated from the instance to be used in the national model in Poland. The reason is that PSNC expects to have a high influence on the shape of the national one, while customer NRENs who provide funding will be the main decision makers for the development of the central instances. Nevertheless, separated instances can easily benefit from each other, share source codes, new features and improvements.

4.2.2.2 GRNET

GRNET will continue hosting eduOER and DSpace. The annual cost will be calculated based on demand. GRNET will stay behind PSNC in terms of pricing and invoicing the service.

4.2.2.3 GWDG

GWDG will continue hosting SSO in the Up2U centralised model. The annual cost would be calculated based on demand. Furthermore, GWDG will support SSO if there is a gap between the end of the project and the establishment of the centralised model.

4.2.3 Funding Model

4.2.3.1 Cost Model Analysis for Up2U Tools for Schools Business Model

This section presents the cost model analysis provided by GÉANT, PSNC, GRNET and GWDG to estimate the cost of the centralised model. The cost models are provided in Appendix A and Appendix B.

General Points

This proposal is created solely for the purpose of continuing the Up2U service on a hosted platform to continue to serve the education community across Europe. The use of this service is tailored to each particular case in each country. The use case cost estimations are projected based on known scenarios for the continuation of services currently hosted as a part of the Up2U project.

All calculations are based on the projection of the recovery of the incurred costs, and do not have any provisions or margins for profits. The sole purpose of this proposal is to recover the costs incurred by hosting service which is not funded from other sources.

The cost estimation for each unit is a calculation of unit costs according to the particular parameters of each case. It is an example to illustrate the methodology.

This serves for information and estimation only and does not constitute an official commercial offer.

Cost Calculation Parameters: GÉANT

This section outlines base unit cost for the services, and the rules of summarisation as applied in this proposal.

Items	Manpower	Costs per organisations / year
Contract handling	4 hours per contract	
Technical coordination	1 week per customer	
Finance support	8 hours	
Total		4,560 EUR

Table 4.1: Cost Calculation in GEANT

Cost Calculation Parameters: PSNC

Unit costs and quantity calculations

This section outlines base unit cost for the services, and the rules of summarisation as applied in this proposal.

- Fixed unit costs are shared for:
 - An average virtual machine (VM) with 4 vCPU and 8 GB RAM per month
 - 1 TB of storage per month
 - 1 TB of backup storage per month
 - Manpower calculated either in man-months or in man-hours
 - Meeting hosted at PSNC for 20 persons, including lunch and 3 coffee breaks, per day
 - Business trip for 3 full working days (4 nights) per person
- The actual unit costs are presented in Table A.1 in Appendix A.
- All cost recovery will be subject to VAT if charged to an external party.
- The costs reduction for the higher quantities of the infrastructure is calculated for each case.
- PSNC will not attempt any recovery of non-recurring costs (NRC) for infrastructure installation based on the outlined use cases. This may be reviewed if the scalability numbers will reach limits of the currently assumed scalability levels.

Assumptions and quantities for the service calculations

- All the quantities of infrastructure units are based on the assumption that all toolbox services will be implemented. The tailoring for each organisation may change the required infrastructure and manpower quantities, but this analysis is not done in this document.
- The Up2U toolbox includes the following services: SSO, Moodle, Learning Locker, CERNBox, SWAN, SeLCont, Knockplop, Multiparty Meeting, eduOER, DSpace, CommonSpaces, and Open edX.
- Total storage per user for all the services is 5GB.
- Up2U assume that there will be oversubscription for the storage, i.e. physical storage will only be prepared for some part of the overall storage promised to users.
- The required storage space for the backup equals the size of the overall storage.
- For the SWAN/JupyterHub:
 - Max. percentage of all users working in SWAN at the same time – 1%
 - Computing power limits per user – 0.5 vCPU, 1 GB RAM ($\frac{1}{8}$ of a virtual machine as outlined in Table 1)
- Training is targeted at staff from organizations that use a hosted infrastructure, and that provide services and training to their constituencies. The training quantities are outlined in the Table 4.2. and the actual costs in Table A.2 in Appendix A. All training will be performed in English.
- Training additional to hosting service. Cases where parties are interested in being trained without applying for hosting service shall be considered individually.

Training on Site	Quantity
Preparation of initial training course and materials, MM	4
Preparation for the subsequent training sessions, MM	1
Travel costs, persons	2
Manpower costs for training, hours	80

Training at PSNC	Quantity
Preparation of initial training course and materials, MM	4
Preparation for the subsequent training sessions, MM	1
Meeting in PSNC, days	3
Manpower costs for training, hours	48

Table 4.2: Quantities for costs of trainings

Cost Calculation Parameters: GRNET

An average VM (2-4 CPUs, 2-4 GB RAM, 20-60 GB disk) costs around 400 euros per year.

The services hosted in GRNET (EduOER and DSpace) require 6 VMs.

The maintenance of those services require a 0.20 FTE, i.e. approximately 10K euros.

Case Analysis

Carrying over after the end of the project

While carrying over at the end of the project, the service will have to transform itself to implement the more production-like environment for the organisations who use it. This transformation will require some “startup” manpower thus triggering NRC. This, however, can be reduced by tailoring service components to match the requirements of the organisations.

Parameter	Value
Number of organisations	4
Number of schools per organisation	35
Number of users per school	30
Manpower for startup/transition, MM	3
Required trainings	0
Oversubscription rate (for this case)	25%

Operations manpower required (FTE)	0.5
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Table 4.3: Carrying over after the end of the project – assumptions

Table A.3 in Appendix A contains the actual cost estimation for this case.

New NREN pilots

This case includes Case 1, and at least two new pilot organisations with the same minimal parameters.

Parameter	Value
Number of organisations	6
Number of schools per organisation	35
Number of users per school	30
Manpower for startup/transition, MM	4
Required trainings	2
Oversubscription rate (for this case)	30%
Operations manpower required (FTE)	0.6

Table 4.4: New NREN pilots – assumptions

Table A.4 in Appendix A contains the actual cost estimation for this case.

Scaling up 245 schools

Parameter	Value
Number of organisations	7
Number of schools per organisation	35
Number of users per school	50
Manpower for startup/transition, MM	6
Required trainings	2
Oversubscription rate (for this case)	40%
Operations manpower required (FTE)	1.2

Table 4.5: Scaling up 245 schools – assumptions

Table A.5 in Appendix A contains the actual cost estimation for this case.

Offering depending on organisations

- The PSNC proposal is based on the delivery costs of the infrastructure. The service offering provided here is an example how the costs can be packaged and priced as services.
- This package assumes that:
 - The organization is flexible to expand its constituencies to up to 500 users. Provisionally, this is calculated as 10 schools, but the influence of the actual number of schools on the cost of the provided infrastructure is not that significant unless the scheme is skewed by e.g. having 250 schools with 2 users each.
 - The organisation is flexible to use all the 12 tools of Up2U toolbox as outlined in Section 2.2. This parameter influences the number and thus cost of VMs required per organisation. It also influences the NRC and maintenance costs.
- It is possible to customise the service packaging without any flexibility with only the current requirements of the organisations.

This example is designed as a minimal scenario and scalability is limited to the 5 organisations.

Parameter	Value
Number of organisations	1
Number of schools per organisation	10
Number of users per school	50
Manpower for startup/transition, MM	3
Required trainings	0
Oversubscription rate (for this case)	25%
Operations manpower required (FTE)	0.5

Table 4.6: Offering depending on organisations – assumptions

Table A.6 in Appendix A contains the actual cost estimation for this case, and Table A.7 illustrates the scalability influence on the potential service pricing per organisation.

Other services and concluding remarks:

- PSNC can deliver additional services like software support, customisation, and high-level help desk support. Costs of these services cannot be estimated based on the known practices and, therefore, will have to be evaluated during the process. Cost estimation will have to be implemented during the operation of the service, based on the unit costs outlined in this document.
- PSNC would not offer direct support to end-users in other countries (i.e. first-line support). PSNC could, however, provide technical support to the staff of NRENs, if they are not able to support end-users themselves.

- Training services can also be provided for organisations that opt for the standalone implementation of the toolbox, but this will require additional support in the form of consultation and remote hands-on help. The cost of such training and subsequent support is not calculated in this document.
- The case studies provide a framework for modelling the cost for a particular provision setup of the service. The business case for the service, charging models, and distribution of the costs for the users is out of scope of this document.

4.2.4 Contract and Legal Issues

Similar to the current GÉANTTCS service, the centralised Up2U service would be set up contractually.

There would be contracts between GÉANT and PSNC, GÉANT and GRNET, and GÉANT and GWDG, as they are all providers of parts of the service that would be offered to customers.

The customer would sign a single contract with GÉANT.

4.2.4.1 Framework Agreements

Framework agreements, completed in accordance with Directive 2014/24/EC, can be used for all requirements subject to scope and Value for Money (VfM) considerations being satisfied.

To place a purchase order or contract under a framework agreement, it must be done in accordance with the rules for the use of the framework agreement. Where there are multiple suppliers on a framework, option a) or b) below, is to be used. Where there is just one supplier, option a) is to be used.

(a) By applying the terms laid out in the framework agreement (where such terms are sufficiently precise to cover the particular call-off – this is likely to take the form of an online catalogue of products/services that are within the scope of the framework) without reopening competition, or;

(b) Where the terms laid out in the Framework Agreement are not precise enough (i.e. there is no ‘catalogue’ or readily available and comparable list price) proceed by holding a further competition in accordance with the following procedure:

1. Inviting all capable Suppliers party to the Framework Agreement to submit written tenders (ideally via the GÉANT eProcurement portal);
2. Fixing a time limit of sufficient length to allow suppliers to respond to invitations to submit tenders, taking into account factors such as the complexity of the subject of the contract;
3. Tenders shall be submitted in writing (preferably via GÉANT’s eProcurement Portal) and their content shall remain confidential until the stipulated time limit for reply has expired;
4. Contracts shall be awarded to the supplier who has submitted the highest scoring tender on the basis of the award criteria set out in the specifications of the Framework Agreement.

See also some general feedback about framework agreements (vs. contract) [[Frame](#)].

4.2.5 Timeline

2020				
April	May	June	July	August
Contracts prepared and signed by all service providers and GÉANT. Contract template for customers ready.	Service offering and marketing materials are ready.	Negotiation with interested NRENs.	Training workshops for national platform users.	National platform operational for schools with students.

Table 4.7: Timeline

4.3 openUp2U

The openUp2U platform offers a subset of the tools used on the production platform:

- Moodle – a course management system based on a free open source software package designed to help educators create effective online courses.
- eduMEET – an open source web-based video-conferencing platform developed in the GÉANT (GN4-3) project, that provides a self-hosted, secure and trustworthy environment for distance learning. eduMEET is currently in Beta stage.
- SWAN – a turn-key platform to produce digital notebooks to be created in a simple web interface – with text, code, pictures and video – that can be stored in CERNBox.
- CERNBox– the Sync and Share storage solution for Science, that allows students and teachers to work and collaborate anytime and anywhere from their mobile devices.

openUp2U is offered on a best effort basis: it is free to use by any level of education, with limited technical and pedagogical support from the project partners. Besides the technical platform based on a completely new architecture based on AWS, the project developed user guides, an entirely new Single-Sign On (SSO) instance, including parental consent check, and a Privacy Notice and Fair Use policy. The instance is GDPR-compliant by design.

The adoption of openUp2U could have a serious impact on the sustainability of Up2U in terms of hosting the service, cost models, and technical and pedagogical support. At the time of writing, this impact is still unclear. Therefore, any further developments and the final outcomes of the sustainability and service models will be included in the final technical report of the project.

4.4 National Up2U Infrastructure

The national Up2U infrastructure includes five real cases with different plans. Table 4.8. shows an overview of sustainability plans for each country. The plans for each case have been described in this section including the implementation, funding resources, timeline, etc.

Country/Partner	Sustainability/Exploitation Plan	Timeline	Status
Lithuania	National Model	at least 2 years	Confirmed
Hungary	National Model	at least 5 years	Confirmed
Poland	National Model	at least 1 year	Confirmed
Greece	National Model	at least 1 year	Confirmed
Italy	National Model	to be defined	to be confirmed

Table 4.8: Overview of National Up2U Infrastructure

4.4.1 Lithuanian Case

The national Lithuanian Up2U infrastructure is centrally hosted by the LITNET NREN, the data centre at KTU.

4.4.1.1 Implementation

The national Up2U infrastructure is based on a multi-tenant Moodle setup. Multi-tenancy is implemented via custom-made service management tools that allow managers to create new tenants, perform various maintenance tasks, add admin users to each tenant, collect some statistical data about each tenant, and perform overall health checks on the entire infrastructure (for a detailed description see Deliverable D7.3 *Report on the large-scale pilot services, essential features and their improvements* [D7.3]). The national infrastructure is extended with other centrally supported Up2U services such as EduOER, Personal Recorder, Multiparty Meetings, etc.

4.4.1.2 Funding Resources

Further funding of the national Up2U infrastructure is expected to be provided as part of the government funded LITNET program (Up2U are still in talks with the Ministry of Education, Science and Sports regarding this opportunity). An alternative solution is to collect payments from schools. As a University is not able to sell services for profit, schools could become members of the consortium and pay membership fees instead. Up2U already have this kind of consortium (LieDM - Lithuanian Distance Education Network) for higher education institutions and could easily extend it to schools by offering associated membership. Since Up2U already reached about 200 schools, Up2U estimate that the membership fee could be 200-300 Eur per year.

4.4.1.3 Contract and Legal Issues

If funding is received via LITNET, there are already existing templates for contracts between school and LITNET, so Up2U just need to add an additional service to it. Up2U have already started contract renewal with schools where Up2U Virtual Learning Environment is included. If Up2U have to transit to funding from consortium membership fees, there will be a new type of membership agreements with every school joining the consortium.

4.4.1.4 Timeline

Up2U agreed that at least two years after the end of the project KTU will take care of the services regardless of the availability of funding from the government.

4.4.1.5 Expected Results

National infrastructure is ensured with long term technical support and development, teacher training, and an active community of practitioners.

4.4.2 Hungarian Case

4.4.2.1 Implementation

KIFÜ's Up2U team decided to install a national instance early on in the project. When the project was launched, KIFÜ had several discussions with the Association of IT Teachers who said that the potential users of the platform, i.e. the teachers and the schools, would appreciate if KIFÜ could provide the services via a national instance, since it would grant them more stability and a more secure environment.

Within KIFÜ the management and the technical team agreed to create an online environment that can easily accommodate 50 schools.

4.4.2.2 Funding

According to KIFÜ's accounting, the KIFÜ instance operated for the pilot period costs roughly 6200 EUR. This figure derives from 200 Videotorium users, and the following details: 8 vCPU, 16 GB RAM, 160 GB storage. KIFÜ is willing to provide this service granted via the Up2U project for 5 years after the end of the project.

4.4.2.3 Expected Results

KIFÜ sees this opportunity as a pilot activity that goes beyond the lifetime of the project. KIFÜ plans to run its services for 50 schools and evaluate the activities regarding this. If the feedback coming from the schools is positive and it is clear that they require this service, KIFÜ might approach the funding ministry with the suggestion to provide such a Moodle-as-a-Service for the whole Hungarian K12 community.

4.4.3 Polish Case

4.4.3.1 Implementation

In Poland, PSNC plans to maintain and continuously improve the national instance for as long as there is interest in schools. At the moment, the platform is to be maintained for at least one year. Further steps depend on funding sources that are under investigation.

PSNC is active in many educational initiatives, funded for other sources, and thus it is planned to offer use of the platform to such initiatives. For instance, new iterations of the artificial intelligence course, which has been organised within the Polish pilot, are currently planned for upcoming months, after this project concludes.

The national instance will be kept in the state as it is used for the ongoing pilot now. It consists of Single Sign-On, H5P, Multiparty Meeting, eduOER, SeLCont, Nextcloud, and Jupyter Notebooks.

However, as the collected user feedback shows that new tools are needed, PSNC plans to integrate new tools into the platform, even after the project has finished, in order to meet users' needs and ensure they see a value. Currently the tools that are being considered for extending the platform are, as requested by teachers, Taiga for project management, and Mattermost for chatting.

PSNC is about to continue engaging users with existing channels used for the pilot but also to propose the platform to teachers that work with PSNC in relation to other multiple educational initiatives.

Although PSNC is meant to host a large part of the central instance, the national instance is to be used for Polish schools in order to have the freedom of changing and adjusting services according to needs of local users.

4.4.3.2 Funding Resources

Apart from offering the platform as an added value to the education initiatives mentioned above, PSNC is also looking for direct funding sources for hosting and development of the platform.

PSNC aims to not charge schools for accessing the platform after the end of the project. PSNC is approaching various national and local government agencies related to K12 education that could provide funding for sustaining the platform. One of the agencies is "Kuratorium Oświaty w Poznaniu", a regional government agency overseeing all public schools in a region, that has been already engaged to promote the Polish pilot. A concrete outcome will probably be known after the pilot collaboration is over.

As an alternative plan for such direct funding, PSNC is discussing opportunities provided by further development of a follow-up platform with a number of non-for-profit entities who provide connectivity services for schools in Poland,. Such a joint nation-wide collaboration might elicit interest and funding from government ministries.

The specific cost model for the national instance is similar to that defined by PSNC for the centralised model in Section 4.1. The unit costs are the same, and only the number of users needs to be adjusted for the real situation. Example calculations for cases of different size are presented in Appendix A.

4.4.3.3 Contract and Legal Issues

The national instance has already been used within the Polish pilot, and thus, the legal setup for providing the service to schools is already managed and well established. Agreements are being signed either with particular schools or with units of the country's administrative division, such as municipalities, that legally hold ownership of public schools.

4.4.3.4 Timeline

The platform will be maintained for the next schools year, i.e. 2020/2021. In the meantime, funding sources will be investigated.

In late 2020, new iterations of the artificial intelligence course might be launched to ensure the platform is being actively used.

4.4.3.5 New Instance

In May 2020, a dedicated deployment of selected Up2U tools (SSO, Moodle, Jupyter, Nextcloud, eduMEET, H5P) was created by PSNC for another European project. EOSC-synergy is an H2020 project that extends the EOSC coordination to nine participating countries (Czech Republic, France, Germany, Netherlands, Poland, Portugal, Slovakia, Spain and United Kingdom). To achieve this, the project harmonizes policies and federates relevant national research e-Infrastructures, scientific data and thematic services, bridging the gap between national initiatives and EOSC. By using the verified set of Up2U services, the project is promoting the convergence and alignment towards EOSC standards and best practices.

4.4.4 Greek Case

4.4.4.1 Implementation

The two Up2U Greek partners (NTUA and GRNET) will cooperate on installing a localised instance of the Up2U platform for the Greek Up2U community, including the majority of the Up2U tools. The central part (LMS) will be provided in two languages (English and Greek). The architecture (multi-tenant Moodle instance or central instance) of the LMS will be decided based on the schools' requirements. The infrastructure will be hosted on VMs at the Okeanos cloud infrastructure in GRNET. According to GRNET's estimation, the following specs are required to be met: 8 vCPU, 16 GB RAM, 160 GB storage.

4.4.4.2 Funding Resources

After the project concludes, the Greek partners will support the schools that participated in the pilot activities and new schools that may want to use the Up2U Learning Platform. At the same time, discussions will be initiated with the Ministry of Education for a more permanent activity (a Moodle-as-a-Service for the whole Greek K12 community). The candidate organisation for developing and maintaining this service is the Greek school network.

4.4.4.3 *Timeline*

The platform will be sustained by the Greek partners for at least one year after the end of the project regardless of the availability of funding from the Ministry of Education. If national funding is received, the period for which the platform will be maintained will be further extended.

4.4.4.4 *Expected Results*

The main aim is to keep the Greek Up2U community engaged to the Up2U platform. NTUA, as an academic partner, will also examine the possibility of collaboration with other initiatives and institutions. The Greek partners will also examine the possibility of engaging the higher education community. Additionally, feedback from schools and institutions is positive and further exploitation of the platform will be crucial for the sustainability of the localised Up2U instance after the project ends.

4.4.5 **Italian Case**

GARR conducted an analysis to evaluate costs to be claimed by an NREN or another national or federated entity that hosts the Moodle Up2U platform on the cloud and provides it as a service to interested schools.

GARR has also analysed a distributed model, where different local agencies are identified to establish a contract with the schools for the provision of the service (hosting Moodle Up2U platform on its own clouds and providing it to interested schools). Another approach to be evaluated could be the hosting of the infrastructure through the commercial providers who have signed an agreement with GÉANT (GÉANT Cloud Services) to supply cloud services to the research and education community. Costs would be estimated according to the GEANT Cloud Catalogue.

4.4.5.1 *General Remarks*

The GARR cloud platform provides an IaaS service, based on OpenStack. Its physical infrastructure spawns 5 data centers connected to the high-speed GARR network in southern Italy, totaling 9000 cores and 10PB storage. The GARR cloud platform is currently provided to the GARR associates only, and included in their annual fee. Thus, the GARR cloud currently does not have an official price list and cannot provide resources to organisations which are not GARR members.

As GARR is not currently in the position to directly provide resources to schools, the analysis below estimates what would be the cost to be incurred, for instance, by a regional area network or university consortium aiming to provide the Up2U infrastructure to schools or students in university training activities.

4.4.5.2 *Cost Calculation Parameters*

Unit Costs and Quantity Calculations

This section outlines base unit cost for the services.

- Fixed unit costs are listed in Table B. 1.

- All cost recovery would be subject to VAT if charged to an external party.

Assumptions and Quantities for Service Calculations

- The Up2U toolbox includes: learning management systems, file sync & share, eduOER, SWAN/JupyterHub, video conferencing, video recording and sharing, learning analytics (etc.).
- Total storage per user for all the services is 5GB.
- For the SWAN/JupyterHub:
 - Max. percentage of all users working in SWAN at the same time – 1%
 - Computing power limits per user – 0.5 vCPU, 1 GB RAM ($\frac{1}{8}$ of a virtual machine as outlined in Table 1)

4.4.5.3 Case Analysis

Carrying On After the End of the Project

In this hypothetical scenario the current Up2U service, as it is at the end of the project, is redeployed in a production environment in the GARR Cloud. The costs of this are reported in Table B.2.

Parameter	Value
Number of organisations	4
Number of schools per organisation	35
Number of users per school	30

Table 4.9: Carrying over after the end of the project - assumptions

New National Pilots

This case includes the first hypothetical scenario above, and at least two new Italian pilot organisations (e.g. regional area networks or university consortia) with the same minimal parameters. The costs of this case are reported in Table B.3.

Parameter	Value
Number of organisations	6
Number of schools per organisation	35
Number of users per school	30

Table 4.10: New National Pilots - assumptions

Scaling up, 245 schools

The costs in this case are reported in Table B.4.

Parameter	Value
Number of organisations	7
Number of schools per organisation	35
Number of users per school	50

Table 4.11: Scaling up, 245 schools - assumptions

4.4.5.4 Implementation

As GARR is not currently in the position to directly provide resources to schools, the national infrastructure could be provided to interested secondary schools by a regional area network or university consortium. The costs of the service are reported in the previous sections, based on the current Up2U service, as it is at the end of the project, and redeploying it in a production environment in the GARR cloud. The implementation of the infrastructure depends on the demand in schools and can vary according to case studies reported above.

4.4.5.5 Funding Resources

In the scenario provided, schools could pay directly for the service or choose to become members of the consortia and pay membership fees to have the service granted with no additional costs.

4.4.5.6 Expected Results

Schools already involved in the pilot can continue their activities, while new schools can start with teacher training and student engagement. University consortia or regional area network are to provide the Up2U infrastructure to new schools.

4.5 Up2U Tools for eLearning Platforms

As discussed in Section 2.2, GWDG Academy is the major use case for Up2U tools for e-Learning platforms. In fact, GWDG wants to use the Up2U platform to provide free learning materials for wider groups of learners. In this section, more details about the platform, resources, implementation and timeline are discussed.

4.5.1 Implementation

The main aim of this business model is to exploit the results of UP2U project and to provide a wide range of digital learning materials to university students, high school students or even children. Figure 4.2 shows the structure of the business model in detail. GWDG academy will use the modules, tools and technical solutions of the Up2U platform for the second phase of GWDG Academy to:

- Provide a virtual academy and e-learning materials for a wider range of users.
- Establish a stand-alone instance of the Up2U platform and refine it based on GWDG's needs.
- Integrate with additional services or eliminate some current Up2U services according to the objectives of GWDG Academy.
- Localise the tool based on GWDG's requirements (German language, etc.).

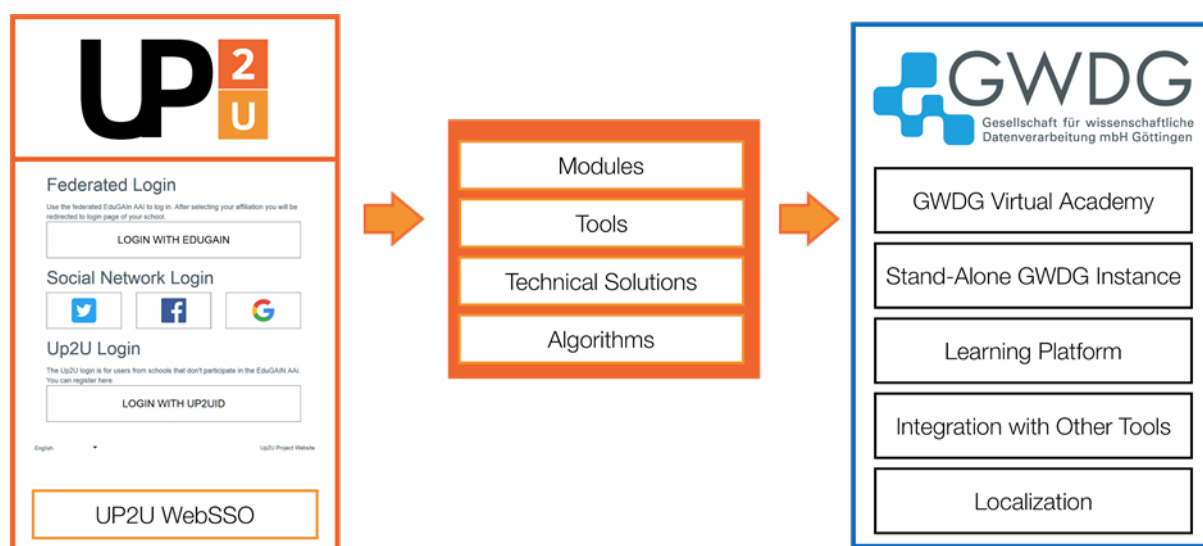


Figure 4.2: Structure of Up2U Tools for eLearning Platforms

GWDG Academy will provide e-learning materials according to a structured framework. The proposed platform structure would be based on three levels:

- **Theme:** The main subject such as programming, security, cloud, etc.
- **Route:** The topics offered for each subject. For example, Python, Java, etc. for the programming subject.
- **Course:** The courses offered for each topic. For example, Java Fundamentals, Java Web-Programming, etc. for the Java topic.

Figure 4.3 shows an example of the Security theme in the proposed structure.

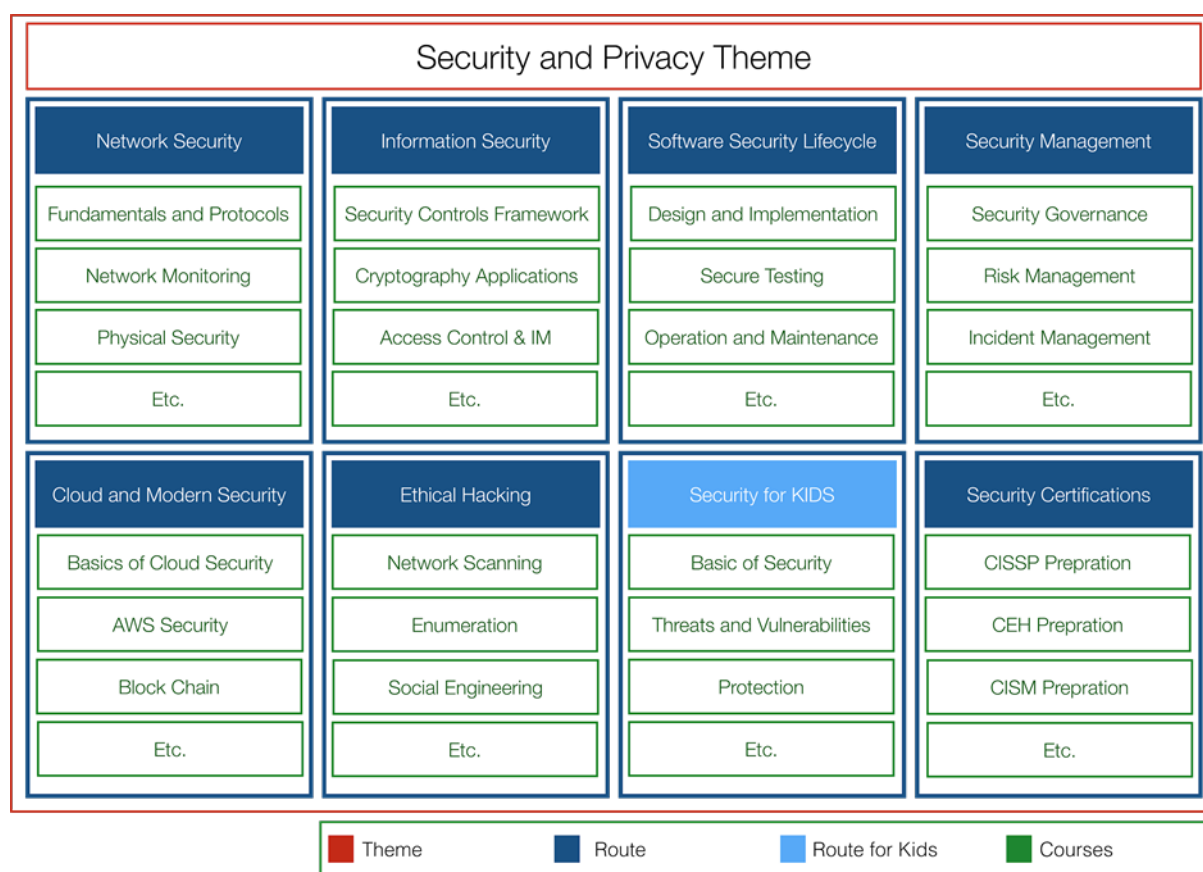


Figure 4.3: Security Theme in GWDG Academy (An Example)

The implementation of the virtual GWDG Academy would be started in mid of 2020 and GWDG agrees to provide the infrastructure required for hosting the platform.

4.5.2 Funding Resources

As discussed, GWDG will provide the infrastructure to host the platform for the academy. GWDG is willing to provide this service for at least two years after the end of the project. After that GWDG will evaluate the platform and consider further plans and actions. Furthermore, GWDG will be looking for external state-based or national funding to ensure that the academy is sustainable after the project concludes.

4.6 Autonomous Use

Regarding autonomous use, Up2U believe that it is possible to identify and produce a list of the visional centres and promote contact with their responsible

To implement this use case it is necessary to plan personal contact with this type of educational centre and ensure that they understand this business model.

Following preliminary informal talks, they appear to be interested in the opportunity to improve their pedagogical approach and generate a profit at the same time.

Up2U believe that these learning centres, which have at least 20 students, will see in this business model not only potential for pedagogical improvements but also a way to distinguish from concurrency that could work as the perfect perspective since they can see that if they apply a small fee to the students they may also benefit with this model.

4.7 Other Cases

4.7.1 UK Case

While the Open University (OU) is the UK's leading distance learning institution and the largest university (by student numbers) in the country, its specific mission and student demographic mean that it does not have significant involvement in secondary education. Unlike a traditional university, the OU has no undergraduate campus with which to form links with nearby schools, nor does the bulk of its undergraduate intake consist of school leavers. Instead, its goal is to serve adult learners who have not typically followed traditional routes of education. Therefore, the potential for engagement with school-based business cases is small.

As the OU is a global research leader in distance education, technical exploitation of the platform and the results of the project have the potential to gain visibility through future research. The OU's contribution to Up2U is from the Knowledge Media Institute (KMi), which primarily conducts technological research and is frequently involved in collaborative international research projects. The OU intend to continue to bid for funding in the area of digital education, and will carry forward the ideas and technologies from Up2U into future projects, as relevant calls and consortia become around. The Up2U infrastructure is flexible and modular, based on an easily configurable and deployable architecture, and as such is adaptable to many use cases beyond those targeted by the project. The main exploitable outcome from the OU's point of view is the integrated platform and adaptable pedagogical scenarios to be used in research and in high-profile demos of developments in technology-enhanced and distance learning. This has two potential sources of sustainability for the project:

- Where the centrally hosted Up2U deployment can be used, extended or modified for research and demo use, Up2U costs could be included in associated funding bids, which could directly benefit the platform's sustainability.
- Where research or use cases are implemented on standalone instances of the Up2U platform, this could be used to promote the project and the central platform, taking advantage of the OU's reputation in this area to attract users to the platform and thus contribute to one of the other business models. As an example of research adaptation, the OU team has already coupled private instances of Up2U with its experimental infrastructure for working with blockchain-backed trustable and automatically verifiable accreditation, related to work in the large-scale UK higher education Institute of Coding project [\[IoC\]](#) and the H2020 project QualiChain [\[QualiChain\]](#), which the OU aim to build on in the future, e.g. with standardisation efforts.

4.7.2 Israel Case

As a public higher education institution, TAU, like the case of UVigo in Spain, cannot be involved in any commercial activity to exploit the results of the project. Unlike other partners, Israel was not intended to be a pilot country with three Continuous Professional Development (CPD) modules, and since IUCC's mandate as an NREN is only for tertiary education, TAU and IUCC have focused mainly on disseminating the project through the channels describe din this section.

4.7.2.1 *Direct Dissemination via the Israeli Ministry of Education*

TAU engaged with their colleagues at the Ministry of Education throughout the project and TAU's contribution to the sustainability of the project centres on two main directions:

- IUCC's efforts to engage an existing pilot of 200 schools throughout the country that focuses on digital competences and will adopt elements of Up2U.
- TAU's Division of Languages has worked with the Chief Inspectorate for English Studies to increase vertical integration between high schools and universities by identifying which vocabulary words high school students should know before they start university, and by curating existing OERs to support acquisition of these target vocabulary words.

Both these initiatives will continue after the project ends.

4.7.2.2 *Teacher Communities*

Teacher communities represent one of the central means of sustainability after the project ends, and IUCC, who has been responsible for communities, will continue to foster teacher networks and learning communities.

One concrete example of these communities is Teacher Educators who work with pre-service teachers. TAU's School of Education and two leading teacher colleges in Israel have been engaged by IUCC. They will introduce their student-teachers to Up2U's platform and support materials, with additional Teacher Educators to follow. Pre-service teachers in their apprenticeship year represent an excellent target group since they are required to teach in schools for at least 10 hours per week, which will enable them to use the Up2U platform to improve their own and their students' digital skills.

4.7.2.3 *Cooperation with other EU Projects*

TAU's contribution to the development of Up2U CPD support materials has included shaping these materials towards addressing the specific areas covered by DigCompEdu's self-assessment project. IUCC has worked on a possible collaboration with this EU project, which aims to enable schools across Europe to identify gaps in their digital competences. In order to promote sustainability, TAU are positioning Up2U's self-paced online CPD materials as a practical and cost-effective means of filling the gaps identified by DigCompEdu's assessment.

4.7.3 Switzerland Case

The Up2U team at CERN IT together with members of the Physiscope team in the Physics Department at the University of Geneva have performed a series of tests to evaluate the integration of the Up2U

platform with the Physiscope outreach programme. This has been described in detail in Deliverable D5.3 *Skills Report and Training Updates* (Section 2.3.6) [D5.3] and Deliverable D3.3 *Federated Cloud Storage and Sharing Platform Interoperability* (Section 4.5) [D3.3]. The successful integration of the Up2U platform into an established scientific outreach programme such as Physiscope could become a key component for the long-term exploitation of the Up2U platform in the Canton of Geneva and beyond, effectively addressing all schools benefiting from the Physiscope outreach programme. In addition, this could become a model for similar outreach programmes under the umbrella of Sciencescope [Sciencescope].

In parallel, CERN is committed to keep maintaining and updating ScienceBox, the software package that is used in Up2U. All of its components are in production for the CERN community, which means that any fix or new feature developed will be available to any Up2U installation of ScienceBox, either centrally managed or not. At the same time, ScienceBox has been chosen as the reference platform for the EU Project CS3MESH4EOSC, increasing the dissemination of this platform beyond the Up2U ecosystem.

4.7.4 ownCloud Case

ownCloud is committed on objectives of Up2U especially with a focus on practical implementation of Up2University project in a context focused on real-life valid applications that ensure valid, prolonged and efficient impact.

The primary commitments of ownCloud are:

- ownCloud is committed to maintaining, developing and evolving the software platform that forms the basis of the Up2University project and its built-in file exchange.

In close collaboration with teams within the project, ownCloud have re-developed and re-factored major parts of the software to ensure that it is optimised for the Up2University school-focused use case at hand. This significant undertaking constituted a joint effort primarily between CERN and ownCloud, and ownCloud will release a production-ready version of the software by August. This is currently in Beta-testing with both parties. The software produced will have globally unique capabilities for the user-group school and scientific community and will be easily scalable to millions of users while allowing full digital sovereignty at a very efficient resource requirement for any European or other public institution wanting to digitalise their e-learning environment in such a manner.

- ownCloud is committed to the development and implementation of real-life applications in the field. ownCloud are convinced that the test of any development project comes with practical applications. Therefore, their main focus is on real-life validation and implementation of the Up2University project in operational, non-consortium environments. ownCloud's activity currently focuses primarily on the German and Scandinavian due to large digitalisation projects for schools. ownCloud are currently in discussion with three major states in Germany regarding the implementation of Up2University components in a newly deployable school cloud environment. The total number of students and pupils in these three states exceeds 5 million.

Furthermore, ownCloud is actively engaged in implementation of Up2University components for school clouds in five German states. This has been already decided and production readiness will be established in the first two of these five states before the end of 2020. ownCloud is fully committed to assisting partners and collaborators of the project in establishing real-life application clouds across the entire spectrum of the project in other European countries and, if necessary, also outside of Europe.

For reasons of confidentiality, ownCloud is not able to provide details of these projects until they have reached production stage. Details can, however, be disclosed to reviewing parties in a private discussion.

- ownCloud is committed to the dissemination to political actors at a national and state level. ownCloud consider this an important factor to enable the real-life valid applications jointly with other members of the Up2U project's own cloud, and, therefore, is heavily engaged in digital sovereignty-related topics that have empowered digital sovereignty and the ability to act independently of non-European technology actors. While this is not a technical point, ownCloud can still consider this one of the keys to ensuring that Up2U will be able to have the impact that the quality of science and technology deserves.

4.7.5 Portuguese Case

4.7.5.1 ISEP Case

As a public higher education institution, ISEP cannot act as a commercial company. This means that they will not be able to provide a national instance of the UP2U platform. Portugal does not have the infrastructure and services to maintain a local instance of the platform.

ISEP reviewed whether it would be possible for them to host a server but the maintenance could not be supported.

After the project concludes, after 2020 it may be sustained based on models proposed by the FCT-FCCN.

4.7.5.2 FCT Case

FCT|FCCN will not be able to provide a national instance of the UP2U project, because as an NREN it is out of scope to support infrastructure and services for secondary education. These activities are the responsibility of DGEEC, the national entity responsible for secondary education. Contacts have been made but, so far, DGEEC have not shown interest in the solution due to lack of the resources required to implement the project at a larger scale.

However, FCT|FCCN explored a few alternative options for sustaining the project after 2020.

- Local installation for schools and universities
Provide the ability to install an UP2U Moodle instance for free in schools, universities and other interested parties. The local installations, infrastructure, maintenance and support will be the responsibility of the interested parties.

- Central model approach supported by GÉANT
Give schools and universities the option to pay for the service using the central model approach supported by GÉANT. In this approach each interested institution will be able to pay GÉANT to use the UP2U Platform. The central infrastructure, maintenance and support will be the responsibility of GÉANT.
- UP2U national instance supported by DGEEC
A national instance of UP2U can only be supported by DGEEC, the governmental entity responsible for schools in Portugal.

Although several contacts with DGEEC have been made since the beginning of the project, so far there is no indication of interest in adopting a national infrastructure for all schools in Portugal. Currently every school is responsible for installing, maintaining and supporting their own LMS infrastructure autonomously using their own resources.

FCT|FCCN will present the UP2U project outcomes at their national event in Portugal in April 2020 and explore the viability of the first two options with their community.

There are still schools that are interested in using the service but for now FCT|FCCN cannot guarantee sustainability after project ends in 2020. The central instance supported by GÉANT is being used by 10 schools and 1 university.

4.7.6 Spanish Case

4.7.6.1 UVIGO Case

As a public higher education institution, UVigo cannot be involved in any commercial activity to exploit the results of the project. The fact that the Spanish NREN (Red Iris) was not incorporated as a partner of Up2U precluded the possibility of launching a major pilot with schools in Spain and therefore there are no Spanish students directly linked to Up2U so far. If at any time the Spanish NREN decides to contribute to boosting Up2U in Spain, UVigo will be ready and eager to collaborate.

UVigo did actively participate in the definition of the platform both at the level of intellectual property requirements and support of free software licenses for the contents hosted in the platform, and in working with a group of Spanish secondary school teachers on the definition and testing of the audio-visual tools developed for the project by the TELTEK company. UVigo have also started actions to engage teachers with classroom applications of virtual and augmented reality. UVigo will keep working in that direction, as those capabilities will attract more audience to the Up2U platform.

Despite not having planned to use a complete Up2U ecosystem, UVigo is already incorporating Up2U solutions for the self-production of audio-visual content such as PODDIUM and its Personal Recorder in the e-learning platform of the institution. UVigo's collaboration with Teltek through the use of the Personal Recorder has been very enriching to both sides. Due to the use of these tools, UVigo will be able to contribute to their conservation and upgrade them after the completion of the project. This will ensure the continuous improvement of these solutions, which will remain available to institutions that deploy and use the entire Up2U ecosystem.

UVigo also appreciate the technical results of the project and are very interested in adding supporting material should the Up2U platform be implemented in Spanish high schools in the near future by Red Iris. UVigo have extensive experience in creating audio-visual material to help their students bridge the gap between high school and university, having packaged the relevant material in a special course format (zero-courses) to be taken by incoming students on starting their first semester. Those courses are offered to all students of UVigo's online platform and have proven to be useful, particularly in science and engineering disciplines. The implementation of the Spanish Up2U platform by Red Iris would have the added value of all materials UVigo are continuously generating for their future students.

4.7.6.2 Teltek Case

For Teltek Video Research SL, the participation in the UP2U project has meant the definitive confirmation of video self-production tools in the educational field, and has highlighted the suitability of a multi-stream recorder available to teaching staff at all times.

At the beginning of the project, Teltek provided their extensive experience with video for education, especially in using multi-stream technology to record classes. Teltek has already provided services to several universities in Europe and the rest of the world, through its multicast recorder Galicaster, and Galicaster PRO, its professional version. Some of these universities were already adding more than 100 recording classrooms with this technology.

However, this open source recording platform seemed limited for the use cases proposed by UP2U, since the designed platform did not include video recording in classrooms. Therefore, within the framework of this project, Teltek proposed, designed and provided a multi-stream recording tool that can be launched from any personal computer via a web browser.

This tool should provide a user experience similar to the one previously provided by Galicaster, i.e. simultaneous and completely synchronous recording of two video sources:

- the actual image of the presenter, registered in this case by a webcam
- the computer screen or at least some of the application windows

Once the video is recorded, it can be stored and classified for later publication. The user can then view the video and choose between watching one of the two video sources or a combination of both, depending on their interests.

The multistream personal recording tool developed as part of this project was called Galicaster Personal Recorder and is currently in the marketing phase at Teltek Video Research SL. The company already offers this service in several European universities to complement the services provided by the GalicasterMediaServer multimedia resource management platform, based on opensource platforms such as PuMuKIT and Opencast.

To complete the experience of the Galicaster Personal Recorder in the UP2U project, and as indicated in Section 2.2.2. of this document, Teltek designed and developed the Poddium platform.

Today, Teltek provides the Galicaster Personal Recorder in the cloud to UNED Abierta, a platform for Spanish-speaking MOOC courses. Platforms have also been based entirely on Poddium in other Spanish universities, e.g. University of La Coruña and Rey Juan Carlos University (URJC).

Teltek has also improved some of its main products, such as the GalicasterMediaServer due to the technological advances derived from the creation of the UP2U project tools. GalicasterMediaServer is a multimedia resource management platform that Teltek provides, both on premise and in the cloud, to numerous universities around the world, such as the University of the Republic of Uruguay and the University of Granada.

5 Industrial Engagement

In this section, some of the new industrial engagement activities have been described. Previous activities can be found at D8.3.

5.1 Teltek Video Research SL

Teltek Video Research SL has already begun to commercialise the tools developed for the project in its business models, both in integrations with existing client platforms and in cloud platforms managed by the company. The clients that currently have Teltek services are indicated in previous sections of this document

Both the Galicaster Personal Recorder and the Poddium-based platforms are already fully consolidated solutions in the company's service catalogue. Teltek has high growth expectations for these solutions in the coming years, judging f their great reception in the last year.

5.2 New CERN Project Dealing with Open Content and New Cloud infrastructures

The new project is described as follows on the CERN page dedicated to the involvement of the Research Centre into European projects:

“The CS3MESH4EOSC: Interactive and agile/responsive sharing mesh of storage, data and applications for EOSC

CS3MESH4EOSC implements a service for the European Open Science Cloud (EOSC) with a built-in sustainability model using the on-premise service delivery by utilizing existing key technology enablers: Open Cloud Mesh (OCM) standardized protocol and EduGAIN service. It consolidates and integrates the existing application ecosystem by promoting vendor neutral APIs and protocols following the open-source strategy for delivering services - a platform for a thriving application ecosystem in EOSC.”

The CS3MESH4EOSC project can be joined by some of the partners of Up2U, being in some way an abstract extension of the Up2U project to a more generalised vision of interoperability of contents in a variety of cloud environments. CERN and PSNC are participating in this project, with CERN as the project leader. The experience made within the domain of open educational contents in Up2U should be transferable to the new project. Educational and pedagogical objectives could lead to join the new project in order to experiment with a new framework of explicable intraoperatively. CERN are applying to the INFN partner of the project to determine if some part of the infrastructure developed by Up2U could be of interest for CS3.

However, CERN can also provide Up2U services on an experimental basis to autonomous groups (like those involved through secondary schools teachers that hold informal activities, i.e. those contacted in the U-Hub sub-project) with an economic return for the universities that have a specialised role in moderating the dissemination of educational content.

University consortias, like, for example, the Civis Alliance, are eligible to respond to an offer of services that are based on an international infrastructure like Up2U.

CERN are preparing a specific offer of international educational and technological services for the Civis Alliance as described by the following text:

“CIVIS - An Alliance of European Universities

Sapienza is a member of CIVIS, the alliance with Aix-Marseille Université, Ethniko kai Kapodistriako Panepistimio Athinon, Universitatea din București, Universidad Autónoma de Madrid, Eberhard Karls Universität Tübingen, Université libre de Bruxelles and Stockholms Universitet to develop an integrated university space uniting 400,000 students and 55,000 academic and technical-administrative staff and promote multilingualism and the diversity of European culture”.

5.3 GN4-3

GN4-3 have introduced a new piece of work to the work of Work Package 4 *Online Services Development and Delivery* related to the operation and evolution of an online learning platform developed in part by the community under the UP2U project.

The EU-funded Up2U project has developed a trusted, remote learning platform to be made available to all schools and universities across Europe, and there is a clear and immediate demand for such services to be continued and supported by the EC in view of the current COVID-19 pandemic, and, most likely, beyond as reliance on remote learning platforms increases.

The Up2U platform is a Next Generation Digital Learning Environment (NGDLE). It is modular, interoperable, highly customisable, and portable, and is being launched now as ‘openUp2U’. OpenUp2U will include an initial portfolio of services, i.e.:

- Moodle (Course management)
- eduMEET (webRTC based Video Conferencing service already developed under the GN4-3 project)
- SWAN (turn-key digital notebooks)
- CERNbox (SYNC and Share storage)

The imperative of launching the platform at scale is part of the community’s rapid response to the pan European and increasingly global lockdown during this COVID19 pandemic. This has been done at an unexpected and significantly accelerated pace with the result that there are still some necessary due processes in adopting the service formally into GN4-3 as part of the overall service portfolio. GN4-3 believe the introduction of the service is necessary and demonstrates the communities ability to respond dynamically and rapidly in this critical time. Formally, the work can be accommodated within

the existing GN4-3 Task structure of WP4 and other support WPs (WP2, 3 etc.) and within the existing overall budget. There is no immediate need for any amendment, but it may in the future require some budget change request to transfer some budget allowance between WPs.

5.4 REIN Project

The Redistribution of Educational Innovation Network (REIN) project aims to improve the adoption of e-learning solutions by integrating solutions using a bottom-up approach, which involves active learning processes where learners play a central role.

The REIN project will build on the results of the former CRISS project. The role of Up2U would be that its production platform is one of the e-learning technologies used in the REIN project.

The REIN-project has asked GÉANT Association to join as a project partner, as the expected grants for the project would not be sufficient to include more Up2U consortium partners in the call. Together with the GÉANT Project Management Office it was decided that the overheads to support the REIN project would be too high to benefit from this call. Further consultations with the REIN project were therefore discontinued.

5.5 openUp2U

The openUp2U initiative was funded by the GN4-3 project. The aim is to offer openUp2U until the end of the COVID-19 pandemic, or at a minimum until the end of the academic year.

openUp2U is offered on a best effort basis: it is free to use by any level of education, with limited technical and pedagogical support from the project partners. Besides the technical platform based on a completely new architecture based on AWS, the project developed user guides, an entirely new Single-Sign On (SSO) instance, including parental consent check, and a Privacy Notice and Fair Use policy. The instance is GDPR-compliant by design.

6 Conclusions

This deliverable:

- Introduced the Up2U business models to ensure that Up2U will be sustainable after the project concludes. These business models are based on a centralised framework for Up2U in Europe, five national business plans based on different requirements, and three sub-plans (i.e. Up2U as an e-learning platform, university as a hub and autonomous use).
- Detailed the results of a market analysis on popular e-learning platforms and associated tools.
- Described the implementation process of each business model on a centralised or national level, including funding resources, sustainability period and timeline.

The document, furthermore, described Up2U's sustainability and exploitation plans for each country to ensure each partner has an individual or common sustainability plan, and can exploit the results of Up2U appropriately.



TASK 8.1	Design & Implementation of Business Models	Up2U for NREs and Schools	University as a Hub
		Up2U for e-Learning Platform	Autonomous Use
TASK 8.2	Eco-System Analysis	Popular e-Learning Platforms	Market Analysis
		Associated Tools	Stakeholders Analysis
TASK 8.3	Industry Engagement	Poddium	REIN
		CERN's New Project	GN4-3
TASK 8.4	New Schools	Up2U for NREs and Schools	

Most of the business models have already been implemented and used, while the rest are planned to be implemented over the next few months. Based on these strategies, Up2U aim to ensure that the results of the project are exploited properly, and that Up2U will be sustainable after the project comes to an end.

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Glossary

ARC	Annual Recurring Costs
BM	Business Model
CPD	Continuing Professional Development
CPU	Central Processing Unit
FCT	Fundação para a Ciência e a Tecnologia
FTE	Full Time Employee
GCMS	Galicaster Media Server
GWDOG	Gesellschaft für wissenschaftliche Datenverarbeitung mbH Göttingen
ISEP	Instituto Superior de Engenharia do Porto
IUCC	Interuniversity Computation Centre
IaaS	Infrastructure as a Service
IdP	Identity Provider
KIFÜ	Kormányzati Informatikai Fejlesztési Ügynökség
KTU	Kauno Technologijos Universitetas
LMS	Learning Management System
LRS	Learning Records Service
MM	Man-Month
MOOC	Massive Open Online Course
MRC	Monthly Recurring Costs.
MoU	Memorandum of Understanding
NGDLE	Next Generation Distance Learning Environment
NRC	Non Recurring Costs
NREN	National Research and Education Network
NTUA	National Technical University of Athens
OS	Operating System
OU	The Open University
PSNC	Poznan Supercomputing and Networking Center
R&D	Research & Development
R&E	Research & Education
RAM	Random Access Memory
SME	Small Medium Enterprise
SPOC	Small Private Online Courses
SSO	Single Sign On
SaaS	Software as a Service
TAU	Tel Aviv University
UROMA	Universita Degli Studi di Roma la Sapienza
UVIGO	Universidad de Vigo
Up2U	Up to University
VLE	Virtual Learning Environment
WP	Work Package

WebSSO Web Single Sign-On