Modernisation of Higher Education in Central Asia through New Technologies (HiEdTec)

SUSTAINABLE ACADEMIC NETWORK FOR SHARING EXPERIENCE AND EXCHANGE OF GOOD PRACTICES IN THE FIELD OF INNOVATIVE EDUCATIONAL TECHNOLOGIES AND DIDACTIC MODELS

Project: Modernisation of Higher Education in Central Asia through New Technologies (HiEdTec)

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**Modernisation of Higher Education
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TABLE OF CONTENTS

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models

HiEdTec

3

List of Abbreviations and Meanings

HiEdTec	–	*Modernisation of Higher Education in Central Asia through New Technologies*
QA	–	*Quality assurance*
MG	–	*Management Group*
EB	–	*Evaluation Board*
WP	–	*Work Package*
WP LT	–	*WP Leading Team*
MP	–	*Management Plan*
UR	–	*University of Ruse Angel Kanchev*
ATU	–	*Almaty Technological University*
InEU	–	*Innovative University of Eurasia*
AIU	–	*Ala-Too International University*
IKSU	–	*Issyk Kul State University named after K.Tynystanov*
KSTU	–	*Kyrgyz State Technical University named after I. Razzakov*
KhoSU	–	*Khorog State University named after M.Nazarshoev*
TTU	–	*Tajik technical University named after academician M.Osimi*
TUT	–	*Technological University of Tajikistan*
IUHD	–	*International University for the Humanities and Development*
TITU	–	

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models   HiEdTec   4

Oguz Han Engineering and Technology University of Turkmenistan

SEIT — *State Power Engineering Institute of Turkmenistan*

AndMI — *Andijan Machine-Building Institute*

TSUE — *Tashkent State University of Economics*

TUIT — *Tashkent University of Information Technologies named after Muhammad al-Khwarizmi*

UPV — *Università degli Studi di Pavia*

UL — *University of Luxembourg*

UC — *University of Coimbra*

MES — *Ministry of Education and Science of the Republic of Kazakhstan*

MES — *Ministry of Education and Science of the Kyrgyz Republic*

MES — *Ministry of Education and Science of the Republic of Tajikistan*

MET — *Ministry of Education of Turkmenistan*

MHSSE — *Ministry of Higher and Secondary specialized education of the Republic of Uzbekistan*

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models   HiEdTec   5

EXECUTIVE SUMMARY

This document presents the Sustainable academic network for sharing experience and exchange of good practices in the field of innovative educational technologies and didactic models for the *Erasmus Project 2018 – 3331 / 001 – 001, Modernisation of Higher Education in Central Asia through New Technologies (HiEdTec)*. This deliverable envisages Sustainable academic network for sharing experience in the field of higher education.

The main objectives of deliverable:

As a result of the cooperation in the first several months of the project a sustainable academic network for sharing experience and exchange of good practices in the field of innovative educational technologies and didactic models will be created. At first, the network will comprise of project partner universities from the partner countries, but it will be open for other HEIs in the PCs to join at a later stage. The network will continue functioning after the official end of the project and in this way; it will contribute to the improvement of project impact and sustainability.

Sustainable academic network for sharing experience and exchange   HiEdTec   6
of good practices in the field of innovative educational technologies
and didactic models

1   INTRODUCTION

One of the priorities of EU Commission in the field of Education is the creation of a Higher Education Hub. This action is one of eleven actions adopted in the "Digital Education Plan".

The action plan has three priorities, setting out measures to help EU Member States meet the challenges and opportunities of education in the digital age:

Making better use of digital technology for teaching and learning (Action 1 to 3)

- Action 1 - Connectivity in Schools
- Action 2 - SELFIE self-reflection tool & mentoring scheme for schools
- Action 3 - Digitally-Signed Qualifications

Developing digital competences and skills (Action 4 to 8)

- Action 4 - Higher Education Hub
- Action 5 - Open Science Skills
- Action 6 - EU Code Week in schools
- Action 7 - Cybersecurity in Education
- Action 8 - Training in digital and entrepreneurial skills for girls

Improving education through better data analysis and foresight (Action 9 to 11)

- Action 9 - Studies on ICT in education
- Action 10 - Artificial Intelligence and analytics
- Action 11 - Strategic foresight

The Higher Educations' Hub main aim is to create an online platform for higher education. This platform will be created to support Higher Education institutions (HEIs) in using digital technologies to:
- improve the quality and relevance of learning and teaching;
- facilitate internationalisation;
- support greater cooperation between HEIs across Europe.

The online platform will be a single access point to existing online platforms and improve dissemination of best practice to all HEIs. Digital transformation can bring a range of benefits to HEIs:
- improving the quality and relevance of learning and teaching;

Sustainable academic network for sharing experience and exchange   HiEdTec   7
of good practices in the field of innovative educational technologies
and didactic models

- making higher education more accessible to a wider range of students;
- creating links between higher education institutions, research institutions, employers and the wider community.

The platform will encourage international collaboration and co-creation of knowledge and content.

The platform will provide HEIs with material on:

- training for academic staff on innovative pedagogies and curriculum design;
- exchange of material and best practices;
- blended and digital learning and blended mobility;
- collaboration between HEIs and employers.

Many national platforms on these topics can be found in the Member States; some have a national perspective, others more transnational. This action will scale-up these initiatives to European level.

Sustainable academic network for sharing experience and exchange   HiEdTec   8
of good practices in the field of innovative educational technologies
and didactic models

2 STATE OF THE ART

2.1 CONNECTIVITY - Geant project

GÉANT's pan-European research and education network interconnects Europe's National Research and Education Networks (NRENs). Together we connect over 50 million users at 10,000 institutions across Europe

The first GÉANT network was launched in 2000 and has stayed well ahead of user needs ever since. Funded through the different phases of the GÉANT Project, it remains the most advanced and best connected research and education network in the world. The map below highlights the truly pan-European nature of the network, and shows topology at the time of publishing.

Figure 1. Geant topology map
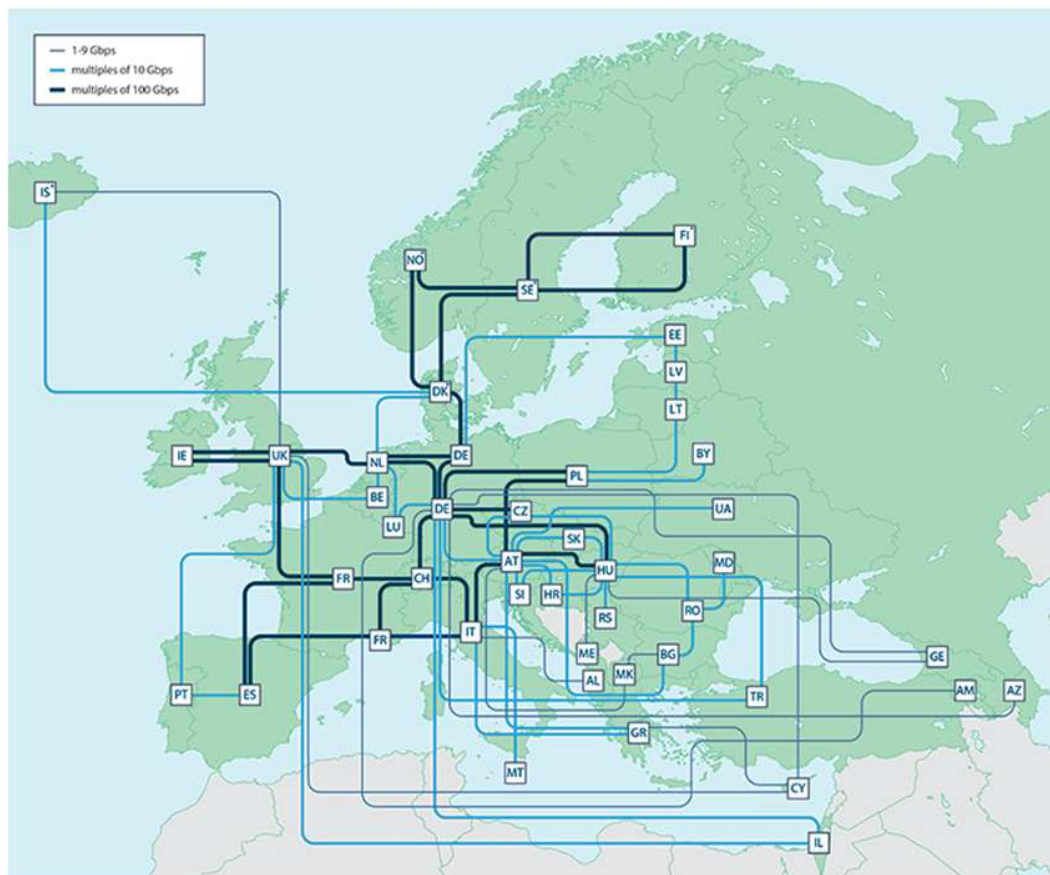
In principal, there are two main networks interesting for HiEdTec close look:

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models

HiEdTec

9

- GÉANT pan-European network
- Asia and Pacific – especially Central Asia

2.1.1 GÉANT pan-European network

GÉANT providing what commercial operators cannot: a high-speed network that pushes the boundaries of networking technology whilst delivering a cost-effective, pan-European infrastructure. Large research projects rely on GÉANT for outstanding service availability and service quality.

A separate ultra-high-speed internet, just for research and education
- Robustness - Over 4,000 terabytes of data are transferred every day via the GÉANT IP backbone,
- Total reliability - 100% average monthly access availability,
- Flexibility - Services and infrastructure can be tailored to individual user requirements,
- Capacity and rapid upscale - 100Gbps (gigabits per second) services are now available across the core network, with a network design that will support up to 8Tbps (terabits per second), ensuring the network remains ahead of user demand and the data deluge,
- Efficient operations - The dedicated GÉANT Operations Centre ensures 99% of cases are reported within 15 minutes of any outage being detected, leading to rapid resolution,
- Services - A wide range of services including IP and dedicated circuits, testbeds and virtualised resources, authentication and roaming, monitoring and troubleshooting, advisory and support services,
- Critical to open science - The network is essential to Europe's e-infrastructure strategy, supporting open science with an exact scale ready e-infrastructure and advanced networking services for trusted access. It offers the highest levels of capacity and security users need, where and when they need it.

2.1.2 Central Asia - CAREN

Co-founded by the European Union and launched in 2010, CAREN sets out to create a regional network across Central Asia, interconnecting researchers, academics and students at research and education institutions in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

The 3rd phase started in June 2016 and resumes regional R&E connectivity after the previous project phase ended in August 2015.

Figure 2. Geant topology map

With 4.5M Euro initial EU co-funding, CAREN3 will initially reconnect Kyrgyzstan and Tajikistan where the governments have signed bilateral financing agreements with the EC. Kazakhstan, Turkmenistan and Uzbekistan are also eligible to join the project subject to EC approval and similar government financing agreements.

Caren aims to:
Establish and operate a high-capacity broadband internet network for research and education in Central Asia.

- Improve intra-regional connectivity across Central Asia by replacing existing low-capacity satellite connections with terrestrial fibre.
- Facilitate R&E collaborations between Central Asia and Europe via connection with GÉANT.

- Seek synergies with user communities in neighbouring regions, i.e. Asia-Pacific (TEIN) and Eastern Partnership countries (EaPConnect).
- Act as a catalyst for the development of sustainable national research networking in the five former Soviet republics of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.
- Decrease the digital divide, combat brain drain and promote regional development and cohesion.
- Support and promote collaborative network applications in areas of high societal impact, such as telemedicine, seismology, distance education, energy and water resources management and environmental studies.
- Pave the way for sustainability of the network after the CAREN project terminates.

2.1.3 CAREN 3 - current situation

CAREN3 is a highly relevant project for the Central Asian countries and promotes regional cooperation between the academic communities in the countries on the basis of advanced high speed research and advanced education networking services. Also, all of the Central Asian countries are landlocked and need reliable connectivity with other academic communities in the world, which is provided by the CAREN project. In a recent SEnECA1 Policy Paper,2 the CAREN project was mentioned as one of the three most important EU-funded Higher Education programmes with Central Asian countries, along with Tempus (Institutional cooperation for the reform and modernization of Higher Education Systems) and Erasmus Mundus/Erasmus+ partnerships.

In this document an overview is presented of the benefits of CAREN project currently enjoyed, mainly by the R&E communities in the partner countries Kyrgyzstan and Tajikistan and the potential consequences for these and the other Central Asian countries of terminating the CAREN this year.

The immediate consequences of terminating the CAREN project are:

1. Connectivity to the global academic community: without the CAREN project academic community will becoming isolated from the global academic community. At the beginning of 2019, KRENA and TARENA, the current formal CAREN project beneficiaries, are providing advanced services to more than 130 institutes with in total more than 650.000 actual users of the CAREN services. These end users will be deprived of the essential tools for their work and study once the CAREN project is terminated.
2. ERASMUS+ projects: In Kyrgyzstan and Tajikistan alone there are more than 18 ERASMUS+ projects that depend on the CAREN project for connectivity to European partners and for the provision of advanced networking services, such as video conferencing, electronic class rooms, eduroam and edugain. Without the CAREN project these ERASMUS+ partners will have to rely on expensive commercial ISP's, that will only

Sustainable academic network for sharing experience and exchange   HiEdTec   12
of good practices in the field of innovative educational technologies
and didactic models

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**Modernisation of Higher Education
in Central Asia through New
Technologies (HiEdTec)**

provide connectivity without the necessary extra services. The consequence of this is that the educational goals of these projects will not be reached.

3. Current research collaboration: scientists in Central Asia collaborate in various disciplines with European partners and the CAREN project, with its connectivity and its advanced services, is essential for the success of these projects.

4. Future research collaboration: besides the existing joint programs that are endangered, there are upcoming initiatives that will be squashed in the bud if the CAREN project is terminated.

5. CAREN CC: at the beginning of 2017 CAREN CC (CAREN Coordination Centre) was established, with funding from the CAREN project. Its aim is to be the Center of Excellence for academic ICT services in the Central Asian region and still needs time to achieve this status. CAREN CC is, amongst other tasks, responsible for the CAREN Network Operation Centre (CAREN NOC), that not only operates the CAREN network, but also trains technicians of the CAREN NRENs and of member institutes of these NRENs. Termination of the CAREN project will most certainly result in the termination of CAREN CC, including the CAREN NOC.

In summary, the termination of the CAREN project would have far reaching consequences for academic collaboration within the Central Asian region and with the global academic community. The consequences are however not restricted to the academic community.

2.2 Content Networking – Learning Hub

One of the key question in HiEdTec Deliverable 1.4 Recommendation was about innovation and lecturer. The respondents answered to this question with multiple answers:

- 100% of the respondents explained it by creativity,
- 92.5% of them consider using innovation; some say that a teacher needs to have the ability to give stimulation to students (90.8%),
- 82.4% of students provide an innovative and stimulating environment as most innovative feature, some the ability of the teacher to encourage students, imagination, judgement and open-mindedness were also in the answers.
- 73.2% said, that providing students tasks that are relevant to their lives and future is most important, 36.0% say the innovation lies in the enthusiasm.

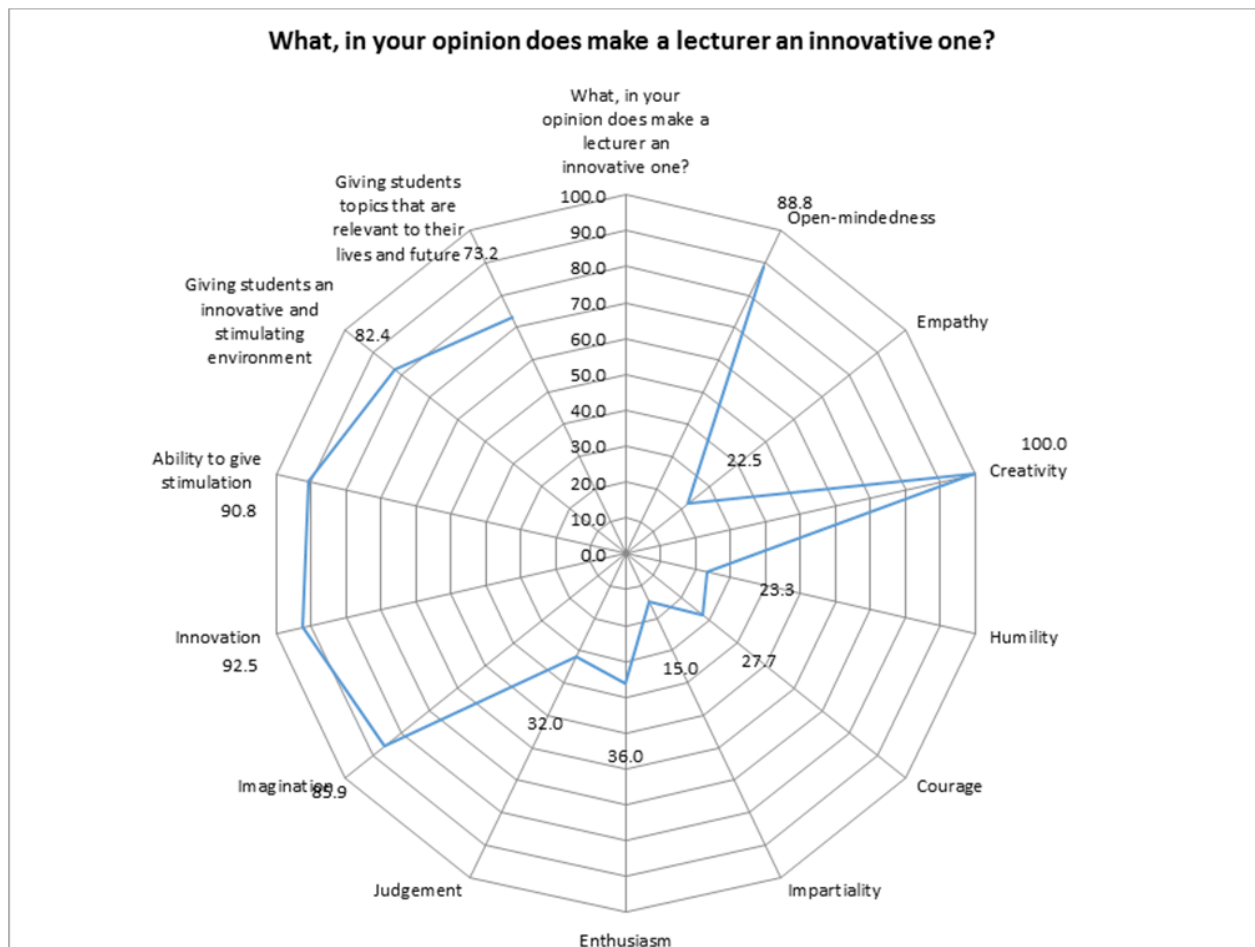The results are shown in figure 3.

Sustainable academic network for sharing experience and exchange   HiEdTec   13
of good practices in the field of innovative educational technologies
and didactic models

Modernisation of Higher Education in Central Asia through New Technologies (HiEdTec)

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Figure 3. Innovation

2.2.1 Open Virtual Mobility Learning Hub Erasmus +

Despite numerous projects on Virtual Mobility there is no single European Learning Environment acting as a central hub for learning about Virtual Mobility and developing VM Skills in HE. This Output is dedicated to designing, implementing and usability testing of an integrated Virtual Mobility Learning Hub for developing VM Skills using Online, Open & Flexible Higher Education Approaches and Practices.

The technical concept and the architecture of the VM Learning Hub incorporates the core components or services as:

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models   HiEdTec   14

- OpenVM Skills – a semantic, machine-readable description of virtual mobility skills including alignment to existing competency frameworks in a competency directory;
- OpenVM Assessment – different forms of digital self-/assessment including digital evidence (such as testimonials, digital assets, e-portfolios, crowd evidencing) applied as elements of open credentials and supporting open, evidence-based assessment;
- OpenVM Credentials – digital recognition of VM skills based on current forms of open digital credentials such as Open Badges and Blockcerts;
- OpenVM Content – User Generated Content, Open Educational Resources and other forms of Open Content to support learning about VM and developing VM Skills;
- OpenVM Activities – Open Learning Activities including learning in and through MOOCs, peer-to-peer activities, virtual/blended collaborations;
- OpenVM Connections – finding cooperation partners for VM activities supported by such tools as the Matching Tool including an algorithm and interface for learning group formation and matching for collaboration of groups;
- OpenVM Data – data about learning pathways and learning outcomes captured by xAPI and feeding into E-Assessment, Open Credentials and recommendations for learning.

The development of Virtual Mobility Learning Hub as a Personal Learning Environment (PLE) furthermore focuses on (a) the development of a responsive interoperable interface, (b) implementation of social software, (c) integration of tools for mobile learning, (d) development of a common working/collaboration space, (e) inclusion of adaptable and semantic features and learning analytics, (f) integrated self-assessment, and (g) validation of open digital credentials.

The development of the Virtual Mobility Learning Hub (VMLH) will imply an interdisciplinary approach from web technologies, mobile technologies, Web 2.0, interactive media and audio-video technologies, open access and tools to semantic technology. It will exist also in all partners' languages (EN, DE, IT, NL, FR, ES, RO) with a possible extension to other languages which will allow communication at European, national and regional levels.

The Virtual Mobility Learning Hub is an innovative multilingual ICT-based environment unique in Europe (as an integrated semantic competency directory of virtual mobility attributes) will promote collaborative learning, connectivist social networking as an instructional method, OERs as the main content, open digital credentials as recognition and validation of VM skills which can be applied to all ages and levels of digital education.

The user-friendly interface as well as the mobile interface will encourage everyone to access it, engage in different open learning activities, connect with others and develop their VM competencies.

Sustainable academic network for sharing experience and exchange   HiEdTec   15
of good practices in the field of innovative educational technologies
and didactic models

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**Modernisation of Higher Education
in Central Asia through New
Technologies (HiEdTec)**

Figure 4. Learning Hub Dashboard

3   HIEDTEC NETWORK - SUSTAINABLE ACADEMIC NETWORK FOR SHARING EXPERIENCE AND EXCHANGE OF GOOD PRACTICES

The academic network should be able to expand indefinitely by including more and more links (scientists, educational structures and associations, institutions, universities), which will give it flexibility and dynamism.

The activities of the academic network will be carried out through an organized and targeted attraction of informational, methodological, innovative and other resources of educational institutions. The network will allow to overcome the autonomy and closeness of all institutions, interact on the principles of social partnership; to build strong and effective horizontal ties not only between professional structures, but between professional teams working on a common problem - the development of innovative educational technologies and didactic models.

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models

HiEdTec

16

The main principle of the academic network is the principle of network interaction, organizing a communication system and allowing developing, testing and offering innovative educational technologies to the professional pedagogical community. This is a kind of way of activities for the joint creation and use of resources (innovative educational technologies, didactic models, learning centers, online platform, etc.).

Horizontal interaction involves the maximum number of connections, multi-bosses, the inclusion of any number of objects. The academic network creates a single information field in which groups for the development of projects and resources are formed.

The key concepts for organizing a network interaction option are trust, cooperation, adaptation, commitment, network position. Coordination between partners in the network is achieved through interaction. The academic network is a space of ethical stability for participants in the network educational process.

The purpose of creating an academic network is to exchange best practices in the field of innovative educational technologies and didactic models, train teachers of innovative pedagogy and curriculum development, adapt the education system to the digital generation, expand academic mobility, and also cooperation between universities and employers.

The results of the functioning of the academic network will contribute to strengthening ties between universities and the socio-economic environment of partner countries, expanding the provision of educational services in the field of higher education.

The established sustainable academic network for the exchange of experience and best practices in the field of innovative educational technologies will serve as a platform for cooperation, and a virtual educational environment for the collaboration of universities and companies for the joint provision of educational services through the implementation of blended learning.
Initially, the academic network will consist of design universities of partner countries, but it will be open for joining other universities of partner countries at a later stage. It will continue to function after the formal completion of the project, thereby contributing to the impact of the project and increased sustainability.

The construction of an academic network should be phased:
First stage

- Equipment supply according to project specifications

Sustainable academic network for sharing experience and exchange   HiEdTec   17
of good practices in the field of innovative educational technologies
and didactic models

- Creation of Centers and active classes (preparation of normative and regulatory documents, staff training, etc.)
- Development of regulatory documents, on-line platforms and network storage.
- Definition of architecture and organization of an on-line platform based on the ATU server for interaction between partner universities, as well as the network storage of the central educational institution. The platform should be open, with free registration of users.

Second phase

- increasing the availability and fault tolerance of the Platform due to the co-location service for the subsequent installation of the main server in the data center of a third-party Internet provider;
- expansion of the academic network by attracting universities with the support of the Republican
- Educational and Methodological Council of the Ministry of Education and Science of the Republic of Kazakhstan;
- organization of network storage for distributed load servers (CDN);
- integration with other academic networks;
- expanding the functionality of the on-line platform to the Portal.

In the partner universities of Kazakhstan, responsible persons for the creation, maintenance and development of a sustainable academic network for the exchange of experience and best practices in the field of innovative educational technologies and didactic models are identified (table 1).

Name of the University	Responsible person for the academic network		Contact details, phone, e-mail address
	Position	Full name	
Almaty technological university	Director of the Center for Innovative Educational	Kalabina Anastasiya Anatolievna	ciet@atu.kz

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models

HiEdTec

18

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Innovative Eurasian University, Pavlodar	Head of the Department of Information Technology and Academic Work	Abykenova Dariya Bolatovna	dariya.abykenova@ineu.kz + 7 7774181483

Table 1 - List of responsible persons of partner universities for the creation of the Academic Network for the exchange of experience and best practices

To create a sustainable academic network within the framework of the project, the following expected results and implementation status from partners of Kazakhstan take place:

- 3 centers for innovative educational technologies (IOT) were created in each partner institution;
- Equipment was supplied as part of the project through the Innovation University of Eurasia (P4).
- The location and network architecture of each partner institution were determined, combining IOT centers, three classes of active learning and a virtual classroom planned for the project.
- The design of active learning classes and the IOT center with thematic design was developed. It is planned to connect the internal academic network of each partner university to the academic network being created as part of the project for the exchange of ideas and best practices in the use of innovative educational technologies through the server, after receiving and installing it.
- On the basis of ATU (P2), as the country leader in creating a sustainable academic network, a server with enhanced characteristics will be installed for the subsequent placement of digital content in the virtual library being created as part of the HiEdTec project. Obtain authorship under a Creative Commons (CC) license, which is one of several public copyright licenses. " The type of CC license is determined by the author (s).

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models   HiEdTec   19

- Provide a sustainable academic network through the distribution of content and interaction through several channels (HiEdTec project website, LinkedIn, Facebook, YouTube)
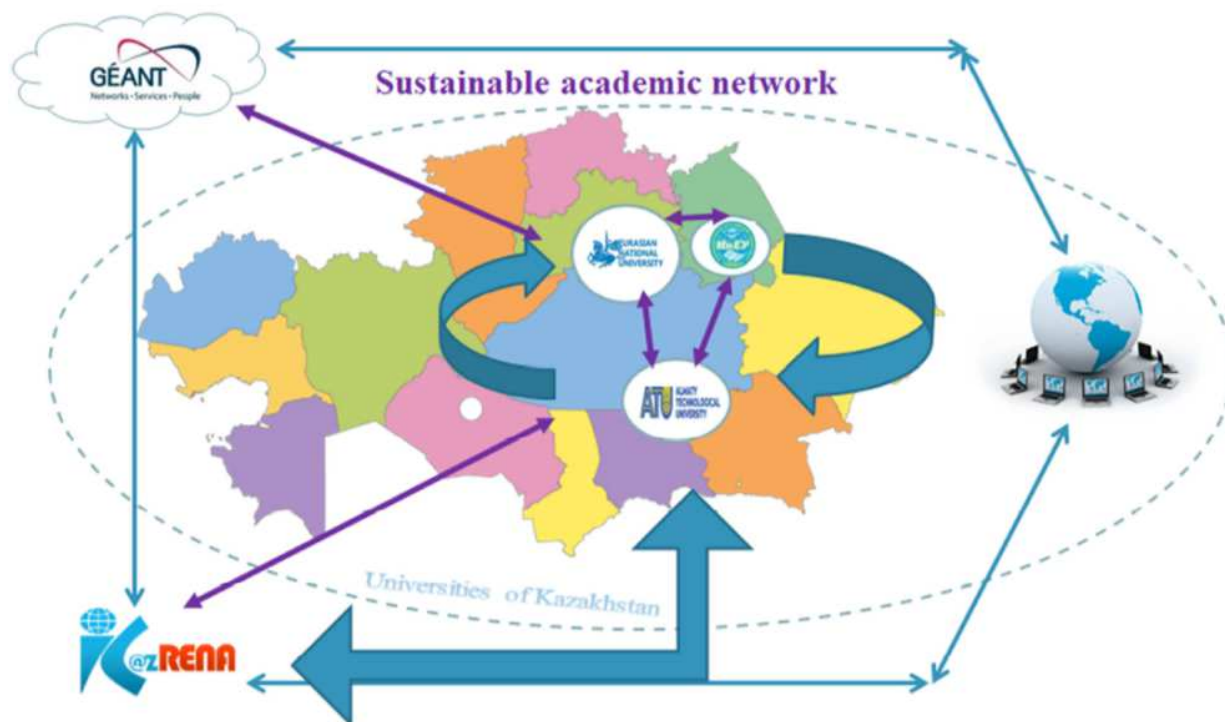

Figure 5. Sustainable Academic Network

3.1 HiEdTec Social Networks for exchange of good practice

Proposal for HiEdTec
   1. LinkedIn - https://www.linkedin.com/groups/8801787/
   2. Twitter - https://twitter.com/HiEdTec1

4 SUSTAINABLE ACADEMIC NETWORK UPDATES AND RECOMMENDATIONS.

There do exist many networking academic groups sharing methodology, best practices etc. In this chapter, we will recommend few technologies to take in account in the process of building sustainable academic network.

Sustainable academic network for sharing experience and exchange   HiEdTec   20
of good practices in the field of innovative educational technologies
and didactic models

4.1 Data exchange

The market nowadays are full of wide range of possibilities for data storage and sharing. Majority of services are payed depending of data volume, security, and count of users. Leaders are companies such Google, Microsoft, Amazon and so on. Anyway, during our research we found very interesting data infrastructure for Europe called Gaia-X.

Gaia-X is in its natural open, transparent and secure digital ecosystem, where data and services can be made available, collated and shared in an environment of trust.

Federated services provide value if they are based on common standards which ensure transparency and interoperability. GAIA-X addresses this requirement by aligning network and interconnection providers, Cloud Solution Providers (CSP), High Performance Computing (HPC) as well as sector specific clouds and edge systems. Here, mechanisms are developed to find, combine and connect services from participating providers in order to enable a user-friendly infrastructure ecosystem. GAIA-X identifies the minimum technical requirements and services necessary to operate the federated GAIA-X Ecosystem. The development of these services will follow the principles of Security by Design and also include the concept of Privacy by Design in order to ensure highest security requirements and privacy protection.

Technical implementation of these Federation Services will focus on the following areas:

- the implementation of secure federated identity and trust mechanisms (security and privacy by design)
- sovereign data services which ensure the identity of source and receiver of data and which ensure the access and usage rights towards the data
- easy access to the available providers, nodes and services. Data will be provided through federated catalogues
- the integration of existing standards to ensure interoperability and portability across infrastructure, applications and data
- the establishment of a compliance framework and Certification and Accreditation services; and
- the contribution of a modular compilation of open source software and standards to support providers in delivering a secure, federated and interoperable infrastructure

4.1.1 Technology requirements

The architecture is used to address the following requirements:

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models   HiEdTec   21

- Interoperability of data and services: The ability of several systems or services to exchange information and to use the exchanged information in mutually beneficial ways.
- Portability of data and services: Data is described in a standardized protocol that enables transfer and processing to increase its usefulness as a strategic resource. Services can be migrated without significant changes and adaptations and have a similar quality of service (QoS) as well as the same Compliance level.
- Sovereignty over data: Participants can retain absolute control and transparency over what happens to their data. This document follows the EU's data protection provisions and emphasizes a general 'compliance-by-design' and 'continuous-auditability' approach.
- Security and trust: Gaia-X puts security technology at its core to protect every Participant and system of the Gaia-X Ecosystem (security-by-design). An Identity management system with mutual authentication, selective disclosure, and revocation of trust is needed to foster a secure digital Ecosystem without building upon the authority of a single corporation or government.

The following design principles underlie the architecture:

- Federation: Federated systems describe autonomous entities, tied together by a specified set of standards, frameworks, and legal rules. The principle balances the need for a minimal set of requirements to enable interoperability and information sharing between and among the different entities while giving them maximum autonomy. The principle defines the orchestrating role of Gaia-X governance elements and implies interoperability within and across Gaia-X Ecosystems.
- Decentralization: Decentralization describes how lower-level entities operate locally without centralized control in a self-organized manner. (The federation principle enables this self-organization by providing capabilities for connectivity within a network of autonomously acting Gaia-X Participants.) The principle of decentralization implies individual responsibility for contributions and no control over the components, which fosters scalability.
- Openness: The open architecture makes adding, updating, and changing of components easy and allows insights into all parts of the architecture without any proprietary claims. In this way, Gaia-X is open to future innovation and standards and aware of evolving technologies. The documentation and specifications of Gaia-X architectures and technologies are openly available and provide transparency as technology choices will be made to encourage the distribution of collaboratively created artefacts under OSD compliant open source licenses.

From our point of interest for creation of academic network is important federated system consist of:

Sustainable academic network for sharing experience and exchange of good practices in the field of innovative educational technologies and didactic models

HiEdTec

22

- The Federated Catalogue constitutes an index repository of Gaia-X Self-Descriptions to enable the discovery and selection of Providers and their Service Offerings. The Self-Description as expression of properties and Claims of Participants and Assets represents a key element for transparency and trust in Gaia-X.
- Identity and Trust covers authentication and authorization, credentials management, decentralized Identity management as well as the verification of analogue credentials.
- Data Sovereignty Services enable the sovereign data exchange of Participants by providing a Data Agreement Service and a Data Logging Service to enable the enforcement of Policies. Furthermore, usage constraints for data exchange can be expressed by Provider Policies as part of the Self-Description.
- Compliance includes mechanisms to ensure a Participant's adherence to the Policy Rules in areas such as security, privacy, transparency and interoperability during onboarding and service delivery.
- Gaia-X Portals and APIs will support onboarding and Accreditation of Participants, demonstrate service discovery, orchestration and provisioning of sample services.
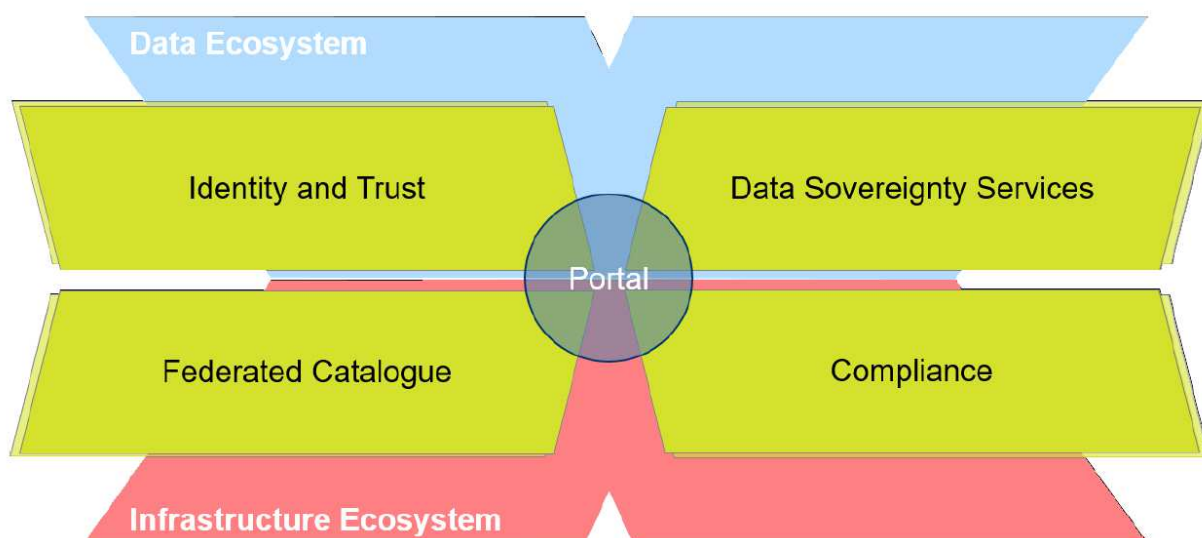

Figure 6. Gaia-X Federation Services and Portal as covered in the Architecture Document

4.1.2 Gaia-X is currently running several uses cases. Our consideration is to Public sector.
Practical example and current challenges:

- Currently, mainly hyperscalers are being considered for the development of solutions for data science or machine learning use cases and the associated data storage. Digital

Sustainable academic network for sharing experience and exchange
of good practices in the field of innovative educational technologies
and didactic models

HiEdTec

23

sovereignty is therefore only possible to a limited extent. Public administration data is not available for all areas or not in suitable quality, or it is particularly protected and cannot be made available as raw da-ta. Instead, public administration data must be processed or aggregated so that start-ups or companies can use it.

- The Data Science & Machine Learning (DSML) Hub stands for openness and use of public administration data (in consideration of data protection) in order to make it available for the development of data science and AI applications. The aim is to create a sustainable solution approach to the challenges of using data science and AI in the public sector. In addition, the hub will support companies, start-ups and scientific and research institutions in innovating and creating value through data science and AI.

- The DSML Hub consists of five building blocks:
  - unlocking the administration's data silos and access to the data for third parties.
  - building an infrastructure for data science and AI with state-of-the-art hardware and common software (including a DSML platform)
  - expansion of the ecosystem currently being built up, consisting of start-ups, public IT service providers, (regional small and medium-sized) enterprises, administration, politics and scientific and research institutions
  - synchronisation with GAIA-X
  - implementation of ten selected innovative projects in administration and companies.

- The DSML platform with the corresponding infrastructure enables access to data and thus the processing of any use cases. Solutions can be developed for one's own needs or for third parties and transferred into operation. The offer is primarily addressed to regional companies, public administration and scientific and research institutions.
- The DSML Hub will strengthen Germany as a business and science location and create data spaces that, in conjunction with the technical infrastructure, will make it possible to transfer data science and AI solutions from research or start-ups to regional companies.

4.1.3 Gaia-X as part of sustainable academic network

Based on previous example from Germany as public use case we can describe functional academic network.

Next figure describe what is GAIA-X and what it is not:

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of good practices in the field of innovative educational technologies
and didactic models

Figure 7. What is Gaia-X

Potential HIEDTEC Network using GAIA-X architecture:
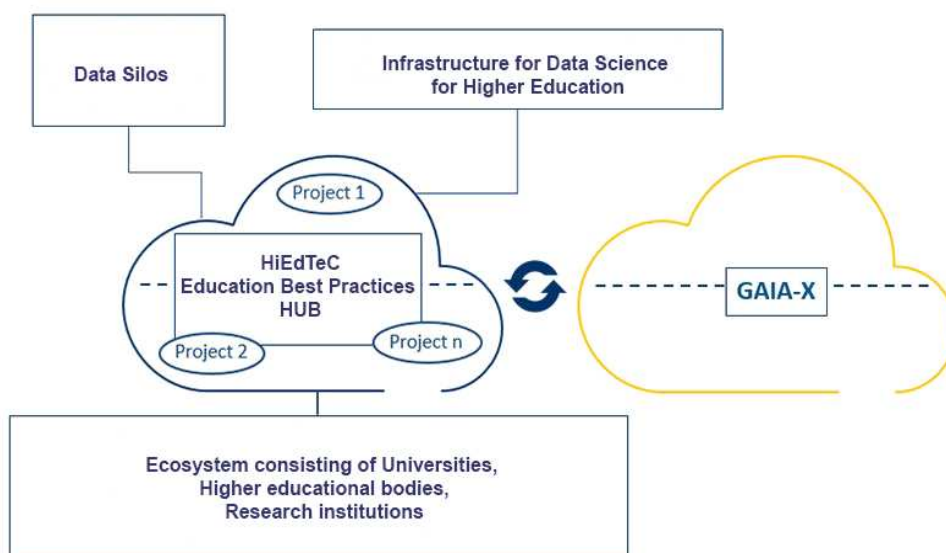

Figure 8. Gaia-X architecture

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of good practices in the field of innovative educational technologies
and didactic models

4.2 Education in post Covid-19 recommendation and lesson learned

The sub-chapter content is from the study of EU "Education and youth in post-COVID-19 Europe – crisis effects and policy recommendations" that is valid for Asian countries as well and it is the way to react for crisis in the case of education to keep and use sustainable academic network.

Key challenges to the provision of practical and interactive education that emerged during the first wave of epidemic remained unaddressed during the second wave. Educational content delivery was often contingent on students having appropriate technology and internet connectivity available at home, as well as the necessary independent learning skills to work remotely.

Challenge	Recommended EU action
Lack of available tools for online learning, and lack of skills regarding the use of digital technologies	The EU should further support national education stakeholders in advancing EU strategies on education and digitalisation to promote high-quality, inclusive, forward-looking education and training systems that harness technology and support all learners, irrespective of gender, age or background. Investments in technological infrastructure and innovation should support the closing of the digital divide and ensure access to education for all families.
Lack of solutions for situations in which online learning is not an option	The planned European Digital Education Hub (presented in the Digital Education Action Plan) could serve as a platform for collaboratively developing new solutions and approaches that effectively combine online and offline education.
Lack of common standards, interoperability, accessibility and quality assurance of digital learning content	The EU should facilitate the creation of spaces, both online and offline, for cooperation and exchange beyond national and beyond European contexts to allow education communities of practice to learn beyond their national contexts and even beyond the European context. At the same time, it is important to identify, support and enlarge existing networks and platforms to promote the development of consistent quality standards. The EU could assist Member States in developing frameworks to measure and assure the quality of virtual education, as part of a coherent, EU-wide strategy.

Most forms of face-to-face education had to be discontinued. The switch to distance learning has had consequences for the accessibility, quality, and equity of education, and revealed gaps in the preparedness of both formal and non-formal education providers. Some institutions were unable to adjust well or fast enough and, as a result, some students were entirely shut out of education.

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of good practices in the field of innovative educational technologies
and didactic models

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26

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Students from disadvantaged backgrounds were particularly affected, while others, the more privileged and affluent, continued their studies through alternative learning methods, predominantly distance and/or online learning (Schleichter, 2020a). It soon became clear that online educational activities were often not inclusive, and of lesser quality without uniform access. These shortcomings generated learning gaps, of which the consequences are yet to be assessed.

The diagram below summarises the main sequence of events and consequent reactions, or the lack thereof, and outcomes:
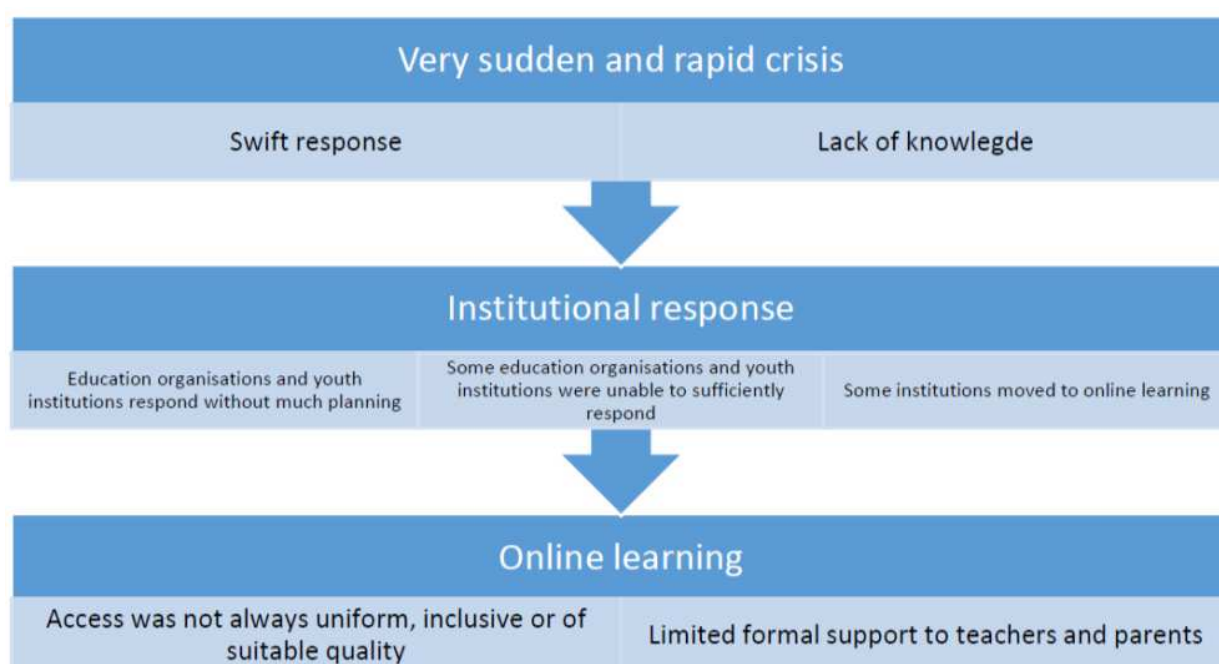
Overall, the COVID-19 crisis has affected institutions, students, and teachers in many ways. Although there was no uniform response to the pandemic across countries, the struggle of teachers and supporting staff at all levels of the education system – from preschools to universities – was similar. It has been a challenge to provide a resemblance of a learning routine for students, while also offering an appropriate support system for parents. Families, and especially parents of small children, also grappled with the unexpected circumstances, which often hit vulnerable communities, minorities, and low-income families the hardest. An overview of the effects and consequences is summarised in the next Table.

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Early childhood education	Compulsory education	Vocational Education and Training	Higher education	Youth sector and mobility
Effects				
Closure of nurseries and kindergartens	Partial or complete switch to forms of distance learning	Partial or complete switch to forms of distance learning.	Partial or complete switch to forms of distance learning	Temporary suspension or alteration of youth mobility programmes
Some child development services moved online	Structure and modes of testing and examination system change	Termination or postponement of apprenticeships and work-based learning	Temporary suspension or alteration of education exchange programmes (e.g. Erasmus+ and others)	Cut activities
In some places, nurseries for essential workers (re-) opened	Extracurricular activities cancelled	Structure and modes of testing and examination system changed	Structure and modes of testing and examination system changed	Job losses
Consequences				
Increase in childcare responsibilities at home		Almost complete loss of practical training, both in institutions and on-the-job	Lower number of (potential) international students and decreased student mobility across Europe	Stress and mental wellbeing deteriorated
Negotiated work hours and reduced income for households		Loss of income gained through apprenticeships	Less study abroad opportunities	Lower disposable income among youth
Children of low-income families lose their school meal programme		Social isolation and missing out on essential social contact		
Parental stress		Vulnerable, low-income and minority students with less access to digital tools		Less opportunities for international mobility
	Inadequate access to or knowledge of ICT tools (teachers and learners)			Economic insecurity

Table 2. Effects and consequences

5 REFERENCES

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3. https://www.openvirtualmobility.eu/learning-hub/2172-the-learning-hub-is-now-online/

Sustainable academic network for sharing experience and exchange of good practices in the field of innovative educational technologies and didactic models

HiEdTec

28

6 LIST OF FIGURES

7 LIST OF TABLES

8 ANNEX - HIEDTEC ACTIVITIES TO ESTABLISH SUSTAINABLE ACADEMIC NETWORK BY COUNTRIES

8.1 KAZAKHSTAN

- **in English**
- **in Russian**

8.2 KYRGYZSTAN

- **in English**
- **in Russian**

8.3 TAJIKISTAN

- **in English**
- **in Russian**

8.4 TURKMENISTAN

- **in English**
- **in Russian**

8.5 UZBEKISTAN

- **in English**
- **in Russian**