## Midterm (2<sup>nd</sup>) Technical report on progress of the project

The period 15.11.2019 – 15.05.2021.

## 609557-EPP-1-2019-1-LV-EPPKA2-CBHE-JP

Development of practically-oriented student-centred education in the field of modelling of Cyber-Physical Systems", Acronym "CybPhys".

Name of the partner: Kharkiv National Automobile and Highway University

Name of the contact person: Andrii Hnatov

Position: Head of Vehicle Electronics Department

Place: Kharkiv, Ukraine

Date: 15.06.2021

## 3.2) Sub tab Horizontal Issues

## 3.2.1) Previous recommendations/follow up

If applicable, explain how the recommendations given by the Agency (in the expert's assessment of the application, in the feedback from monitoring visits, in monitoring exchanges with the Agency, etc.) have been followed up

The suggestions received from of the monitoring visit was discussed in depth during the during the next several online meetings. Below for each recommendation, the action taken is described:

• to inform constantly the national coordinator and coordinator on any risks, delays, so, the coordinator will communicate to the EACEA on the changes required on time;

ACTION: All Ukrainian partner universities constantly inform the national coordinator and coordinator on any risks, delays that arise during the implementation of the project. This communication takes place monthly at online meetings with the participation of all partners, as well as individually via Skype and WhatsApp.

• based on the flexibility, to keep adjusting the project workplan to newly set by the pandemic situation timeframes in order to reach all expected objectives and goal of the project;

ACTION: The monthly online meetings discuss current affairs and adjust the project work plan in accordance with the new time frame set for the pandemic situation, in order to achieve all the expected goals and objectives of the project.

• for the course development or modernization, it is highly recommended to review after the piloting for the use of the modern resources of the EU partners, innovative methodologies and to comply with the Law of Ukraine on Higher Education requirements using the Bologna tools.

ACTION: To develop or modernize courses, Ukrainian partners use modern resources of EU partners, innovative methodologies and comply with the requirements of the Law of Ukraine on Higher Education using the Bologna instruments.

• to ensure the quality of the above-mentioned approaches, the NEO-Ukraine video materials on modernization of HEIs study programmes and HERE-Ukraine video "Study programmes: development, description, accreditation" are helpful;

ACTION: During the development and modernization of courses and curricula, Ukrainian partners use the NEO-Ukraine video materials on modernization of HEIs study programs and HERE-Ukraine video "Study programs: development, description, accreditation".

• to ensure the highest expected sustainability level for the CybPhys curricula developed by all Ukrainian partners, if required, to get CybPhys modernized master's programmes accredited by the National Agency for Higher Education Quality Assurance (NAQA), Ukraine;

ACTION: KhNAHU is committed to providing the highest expected level of sustainability for CybPhys' developed dual degree programs in Electric Vehicles and Energy Saving Technologies. The accreditation of the master's program by the National Agency for Higher Education Quality Assurance (NAQA), Ukraine is scheduled for autumn 2021.

• to speed up the equipment purchase, monitor the project funds payments, and make sure that the sufficient project funds are available;

ACTION: KhNAHU завершила закупку запланированного оборудования и своевременно производит выплаты заработной платы. Контроль за выплатой средств проекта продолжается.

• in case of the equipment purchase by each UA partner universities individually, the reason should be justified to the coordinator to submit request for authorization from EACEA is required;

ACTION: All Ukrainian partners have agreed on the equipment procurement plan with the project coordinator and with EACEA. All necessary documents have been received.

• facing the challenges with the current situation in Belarus, in order to mitigate the risk with the e-library storage in the Belarusian State University, consider an opportunity to buy additional e-storage equipment via possible reallocation of the saved funds initially planned for the 1st year mobility activities;

ACTION: This issue was discussed at several online meetings. All Ukrainian partners, together with the project coordinator, decided that the Chernihiv Polytechnic National University buy additional e-storage equipment via reallocation of the saved funds initially planned for the 1st year mobility activities.

• to post the expected project deliverables and results on the CybPhys project website once they are available; regularly update the website on the project progress and achievements;

ACTION: All achieved results on the CybPhys project are regularly published on the project web page of the KhNAHU website. This information is regularly updated.

• to recommend to the Ukrainian partners, to create separate CybPhys results sections on their HEIs websites/project webpages to be easily found and openly available;

ACTION: KhNAHU has created a separate page for the CybPhys project on the university website.

• regularly update their Universities' webpages and focus on the project progress and achieved results and outcomes;

ACTION: The CybPhys project page on the KhNAHU website is regularly updated.

• to adjust the project Dissemination and Exploitation Plan taking into account the worldwide Covid-19 situation and possible implications caused with the quarantine restrictions;

ACTION: The plan for the distribution and operation of the project, taking into account the global situation with Covid-19 and the possible consequences of quarantine restrictions, is constantly being adjusted. This happens at monthly online meetings of all project participants.

• to intensify the dissemination activities to strengthen the project sustainability effects via all available and possible on-line channels – Ukrainian partners HEIs' NEO-Ukraine websites, websites of the Ministries of Education and Science, social media etc.;

ACTION: KhNAHU intensify the dissemination activities to strengthen the project sustainability effects via all available and possible on-line channels - Ukrainian partners HEIs' NEO-Ukraine websites, social media: Twitter, Facebook, Linkydin, Instagram.

• to continue strong cooperation with external stakeholders to reach the planned CybPhys results and outcomes.

ACTION: KhNAHU continue strong cooperation with external stakeholders to reach the planned CybPhys results and outcome.

#### 3.2.2) Transversal Issues

If applicable, describe how and to what extent the project addresses transversal (/cross-cutting) issues relevant for the EU and its partner countries (e.g. gender balance, sustainable development, unemployment, social cohesion, etc.

Gender balance is fully respected among the students involved in the masters and staff involved in the project. KhNAHU team foreseen more than two women.

#### 3.2.3) Involvement of people with fewer opportunities

If applicable, describe how and to what extent the project addresses issues related to the involvement of people with fewer opportunities (migrant, refugees, internal displaced people, people with disabilities...)

SybPhys students and teachers with fewer opportunities are pointed out. In particular, according to the calls for students and teachers in mobility for experiencing European academic environments, people with fewer opportunities have the priority (e.g. from less advantaged socio-economic backgrounds, who going abroad for the first time and less experience rather than more experienced staff members will have priority). The considered people with fewer opportunities are: economically disadvantage groups, which belong to the Low-income families in accordance with Ukrainian legislation; persons with disability I and II groups in accordance with Ukrainian legislation and etc.; persons who suffered from the Chernobyl disaster; participants in hostilities; citizens belonging to preferential population groups in accordance with Ukrainian legislation.

## 4) Award Criteria

#### **SECTION 1: Relevance**

1) Relevance to the objectives

In comparison to the original proposal, describe **any change that may have affected the project relevance** and added value for the partner countries involved.

Explain or justify in particular:

☑ how the consortium dealt with internal and/or external constraints (e.g. legislative changes, labour market needs, lack of motivation/commitment of partners, lack of availability of staff, cultural differences, visa issues, exchange rate fluctuations etc.);

It to what extent the project is **still relevant to their national context** (how does it address the national strategies and policy development)

 $\square$  how the activities implemented are contributing to reaching the project objectives as specified in the proposal in accordance with the following topics:

Improving quality of education and teaching (priority B)

Improving management and operation of HEIS (priority C)

#### Developing HE sector within society at large (priority D)

The constantly growing number of hybrid and electric vehicles requiring a completely new approach to the development of infrastructure for maintaining and repair work proofs this fact. This approach should be based on the implementation of contemporary, innovative energy-saving (ES) and EE systems. Monitoring of existing educational programs for Master's degrees in motor vehicles specialities has shown that relevant knowledge and skills of ES and energy efficient technologies in transport and electric vehicles are actually not provided by any technical educational institution in Ukraine. However, several EU Universities have already studied new master programs related to exploitation and maintenance of hybrid- and electro transport vehicles.

The action specific activity of SybPhys is "curriculum development" and thus to develop new and innovative education programs aiming at improving the quality of higher education and its relevance for the labor market and society. This has been obtaining by merging the knowledge of Programme and Partner Country institutions, and the Partner Country needs from society, through the use of a bottom-up approach in developing curricula.

To plan and implement the stable development of EE road transport infrastructure the specially trained staff - specialists are required and they should be capable to develop and design such systems, as well as carry out the necessary maintenance and repair work of not only hybrid and electric vehicles but electric, electronic and information systems of this infrastructure.

The implementation into the educational process of such joint (for RTU and KhNAHU Double Degree master program "Electric Vehicles and Energy-Saving Technologies" (EV & EST)) educational program will result in standard (double, multilateral) Master's diplomas in EV & EST. This conforms to the key national priorities of Ukraine in higher education (Category A: «Curriculum development projects»: Transport services) and regulated by Law of Ukraine on Higher Education, 2014, №1556-VII. The consequences of these innovations will encourage the modernization of higher education and the improvement of its quality and efficiency as well.

Monitoring of present-day graduates' employment has revealed that masters in ES technologies in transport are now in great demand on the labour market.

The project focuses on a curricula modernisation taking into account the results of the labour market needs analysis, forecast of its development in close future, recommendations of nongovernment bodies, High-Tech companies and Design Centres, research institutions and HEIs in Belarus and Ukraine.

For this purpose, in December 2018 - January 2019, we arranged a preliminary survey of research institutions, professional associations, companies and HEIs of Belarus and Ukraine. The answers to questionnaires were analysed and used for the development of the list of courses and education programs for this project.

We analysed professional field of respondents, the experience in work on the projects related to computer modelling of physical processes and CPS systems, experience in modelling of CPS, and professional skills. We asked questions related the Fields of CPS of systems application, Fields of computer modelling application, about the tools and modelling languages, etc.

The analyses of the answers revealed very high interest of the employers to the knowledge and skills of graduates, required for development and application of CPS. We have found differences of the answers between Belarusian and Ukrainian respondents: all Belarusian respondents had experience in modelling of CPS, however only ¼ of Ukrainian respondents had such experience. This fact is because Belarusian respondents represented mostly research institutions of the Academy of Science, in it turns, Ukrainian respondents represented mostly transport, logistic and

mining industry. Related to the professional background of respondent, the areas of application of modelling of CPS also differed. Application of modelling of CPS for control of different processes in the fields of applied physics was preferable for Belarusian responders, however, for Ukrainian ones it was application for control of the processes in transportation, energy production and manufacturing.

The results of these pre-project surveys have been utilised by BY and UA universities for the development of the list of new and modernised courses for students.

The second survey was conducted in early 2020 during the first year of the project.

Comparison of the answers in the year 2018 and the year 2020 reveals that the general perception of Ukrainian industry representatives about the fields of application of CPS became more optimistic, since the difference between the average means equals +0.5271, i.e. +14.1%. The growth of perception is noticed especially related to Complex physical systems (+39.2%), Building automation (+32.8%) and Management of production processes (+23.3%). The topic Robotics is still recognized as a most important field of application of CPS (2st place in 2018 and 1st – in 2020). It is worth noting that the participation of CNTU in 2020 in some way impacted the results of the survey, since in general the representatives selected by CNTU had work experience on projects related to CPS. Additionally, the growth of the positive perception is also partially achieved thanks to the promotion of the CybPhys project targets among industrial partners.

So, a comparative analysis of current curricula at BY and UA universities underlines the competences that are missing at BY and UA partners, competences that CybPhys addressed with the help of the EU partner universities. Fruitful discussions with local academics and stakeholders pointed out need for European cooperation. One of the identified problems was the isolation from the international research and teaching, this isolation leads to a need to update courses and methods, and research topics. In particular, emerged the need to link more in-depth local curricula with BY and UA transport and logistics requirements. Therefore, the large experiences in this field of the selected European partners can be transferred to BY and UA and hence can help to reduce their gaps.

#### **SECTION 2: Quality of the project implementation**

#### 1) Description of the activities implemented

Summarize the activities implemented so far addressing in particular the following issues: Extent to which these activities are in line with (or diverge from) the work programme, timetable and partners' share of responsibilities presented in the application;

<sup>2</sup> The applicability, added value and impact for the partner countries involved in the activities implemented so far

#### Describe any obstacle/difficulty encountered and the measures taken to address them

At the pre-project stage RTU and KhNAHU arranged a preliminary analyses of education programs and courses of both universities in order to develop common Double Degree master program (DDMP) that is relevant for application of CPS.

According to the preliminary analyses the master-level program "Computerised control of electrical technologies" at RTU and master-level "Electric Vehicles and Energy-Saving Technologies" were selected as a basis for the common DDMP.

The activities:

- To develop curriculum of the DDMP. (Done)

Developing and translating to teaching language MCs level study programs and courses on modelling and simulation of CPS will be done. In a frame of this activity 4 members of academic staff visit RTU in M3, year 1. (Done)

- Developing flexible and modular training courses, methodological tools for control and adjustments of the educational process, development and improvement lecture courses and compatible teaching (didactic) materials (lecture synopsises, presentations, labs guides, etc.) will be done. WS8 held in Kharkov is devoted to DDMP issues.

- The training of students will be based on the Bilateral Agreements between RTU - KhNAHU. The Agreement will be signed between the partners by M12, year 2. The progress of Double Degree master program will be presented at MC meetings. (Done)

- KhNAHU will validate and accredit Double Degree master program at the Ministry of Science and Education of Ukraine by M12, year 2. RTU will make adjustments in the existing master program, which do require accreditation in the Ministry of Education and Science of Latvia.

- RTU and KhNAHU start preparation to the student admission (practical arrangements, visa arrangement, etc). The MS student admission Guide will be developed to help students to navigate through enrolment process and provide useful information.

All planned events are held in accordance with the approved plan. Matter arising on the implementation of the project in KhNAHU are resolved on a routine basis. At the moment, there are no particular difficulties.

#### 2) Quality Assurance

*Please describe the quality assurance (QA) measures applied to the activities implemented so far as well as the measures foreseen for upcoming activities.* 

You should address in particular the following elements:

Provide the electronic link to the project quality assurance plan, if available;

Describe the functioning of the internal QA (i.e. composition of the team(s), roles and actors involved; type and frequency of measures envisaged; feedback mechanisms in place; etc.), the measures already implemented and the remedial actions taken if any;

Describe the functioning of the external QA (i.e. identity of the external evaluator(s) and criteria used for their selection; type and frequency of measures envisaged; feedback mechanisms in place; etc.), the measures already implemented and the remedial actions taken if any;

The Quality Assurance Plan (QAP) approved by the MC in the beginning of the project. QAP used for the monitoring activities and periodic review of the project and its outputs. It will ensure that:

-Intended learning outcomes are developed and published in the new syllabi.

-Industry (professional associations, etc.) representatives and students participate in syllabi design. -The curriculum and programme design and content, output of WPs Development, is reviewed and evaluated by involved parties and stakeholders; suggestions are offered and follow-up procedures are determined.

-Specific needs of different modes of delivery (e.g. lecturing, lab work, e-learning) and target groups are taken into account.

-Learning resources are available to the teachers and students.

-Formal programme approval procedures by the university authorities are initiated and completed timely.

-Monitoring of the progress and achievements of students is in place.

A Project Manual is created, procedures and communication inside and outside project are confirmed, and a reporting system is established.

The "Project Manual" is a summary of rules, methods and tools that fixes:

- the project objectives and their analysis in terms of products, tasks and necessary resources (personnel, financial and material);

- a related reliable time and financial schedule;

- the specific project procedures in accordance with Erasmus+ programme requirements;

- the measures to reach cost and delay objectives of the project.

The partners nominated the Project Quality Assurance and Monitoring Team (QAMT) at the kick-off meeting. For internal evaluation processes, each partner appointed to QAMT one academic staff (Andrii Hnatov from KhNAHU). The QAMT developed the Project Quality Assurance plan (PQAP), which approved by the MC in the beginning of the project. Additionally, a working group for internal quality control activities created at KhNAHU (Andrii Hnatov and Oleksandr Dziubenko).

PQAP will establish the quality measures, and will be used for outcomes evaluation against the benchmarks and indicators.

Quality assessment and monitoring will be arranged internally and also by external experts. Internal QA process:

-Internal QAMT will establish the quality measures, which will be used for outcomes evaluation against the benchmarks and indicators.

- Reporting system on the QA

- Methodology for obtaining a feedback from the employers (research institutions, high-tech companies, professional associations) on new developed curricular though involvement in the elaboration of curricula at preparation stage of the project, consultations in the development stage and involvement in evaluation of the developed courses and programs during validation and tuning process.

- Teachers and students training events and sessions, which will be arranged during the project, will be evaluated to the quality assurance. The evaluation will be arranged in the form "self-evaluation". The QAMT teams under the leader WP4 will develop a methodology for "self-evaluation": criteria of evaluation, questionnaires, the analysis form of the answers etc. The QAMT report to WP4 leader and to Management team at MC meetings. External QA process:

-For the external quality control and monitoring, two experts from non-participating EU institutions will be subcontracted by the project and carry out external quality control activities. -The external evaluation will take place in the second and third project year, before and after the course implementation.

-The state of quality of the project deliverables will be measured by Interim and Final Quality Reports from partners with the inputs from PQAP, as well as reports provided by external experts.

## 3) Visibility

☑ Please indicate the address of the **project website** and describe briefly its structure (including the purpose and content of sections restricted to the beneficiaries), the maintenance and updating plan in place, as well as the actions implemented for ensuring its visibility to all interested stakeholders.

Describe and, if applicable, provide the electronic link to any information and support material produced by the project for visibility and promotion purposes.

I Explain how the consortium ensures that the visibility, exploitation and publicity obligations described in the grant agreement are respected.

- 1. The address of the project website: <u>https://cybphys.rtu.lv/</u>
- 2. The structure of the website SybPhys:
- . . .

TO BE COMPLETED BY RTU

KhNAHU has created a web page for the project. This web page is constantly updated. All the basic information on the project is duplicated on the web page and materials on the project are posted.

KhNAHU: <u>https://www.khadi.kharkov.ua/en/erasmus/ka2/development-of-practically-oriented-student-centred-education-in-the-field-of-modelling-of-cyber-physical-systems-cybphys/</u>

SybPhys e-library: <u>https://eduphys.bsu.by/mod/folder/view.php?id=2257</u>

Linkedin: https://www.linkedin.com/groups/12355821/

Facebook: https://www.facebook.com/groups/227194018274534

RTU, BSU and UCY are responsible to complete the project website in Ukrainian, English and Russian.

The Erasmus emblem and the inscription «Co-funded by the Erasmus+ Programme of the European Union» is indicated on all material produced. Participants from RTU to check whether the SybPhys emblem on the official websites of all PC universities.

The announcement of activities and information about them is placed in free access on Facebook (https://www.facebook.com/groups/227194018274534) & Linkedin (https://www.linkedin.com/groups/12355821/) groups and in each own website of participants.

Facebook & Linkedin Groups have been created to disseminate all the materials and information about the SybPhys activities, events and achievements with free access in order to have quick and real time communication with users.

KhNAHU regularly makes publications on the CybPhys project pages in social media: Facebook; Twitter and Instagram.

## Links Twitter:

https://twitter.com/Kafedra AE/status/1389837423182548993 https://twitter.com/Kafedra\_AE/status/1381892533375152131 https://twitter.com/Kafedra\_AE/status/1371731276366020608 https://twitter.com/Kafedra AE/status/1367081428329132035 https://twitter.com/Kafedra\_AE/status/1367081179808223233 https://twitter.com/Kafedra AE/status/1349253820296142849 https://twitter.com/Kafedra\_AE/status/1348698625455644672 https://twitter.com/Kafedra\_AE/status/1343931399859032064 https://twitter.com/Kafedra AE/status/1336288834292736001 https://twitter.com/Kafedra\_AE/status/1323326824903036929 https://twitter.com/Kafedra AE/status/1322120210409803776 https://twitter.com/Kafedra\_AE/status/1313187700003012608 https://twitter.com/Kafedra AE/status/1303300923779842051 https://twitter.com/Kafedra\_AE/status/1232417367940116481 https://twitter.com/Kafedra\_AE/status/1238849523969150985 https://twitter.com/Kafedra AE/status/1238848825428762625 Links Facebook:

https://www.facebook.com/%D0%9A%D0%B0%D1%84%D0%B5%D0%B4%D1%80%D0%B0-%D0%B0%D0%B2%D1%82%D0%BE%D0%BC%D0%BE%D0%B1%D1%96%D0%BB%D1 %8C%D0%BD%D0%BE%D1%97-%D0%B5%D0%BB%D0%B5%D0%BA%D1%82%D1%80%D0%BE%D0%BD%D1%96%D0

%BA%D0%B8-%D0%A5%D0%9D%D0%90%D0%94%D0%A3-1416605481982390

## Links Instagram:

https://www.instagram.com/avto\_elektron/

All materials about CybPhys events are also disseminated by website CybPhys, Facebook Linkedin Groups, Twitter & Instagram. (KhNAHU).

Beneficiaries inform properly the public, the press and the media about their activities (including the Internet). The information clearly indicate "with the support of the Erasmus + European Union Program" and contain graphic logo.

If an action, or part of it, involves publication, this mention and graphic logo must be placed on the cover or first pages after the editor has been specified.

If activities require public events, signs and posters related to this activity the logo of EU is always reported.

## 4) Equipment

Describe the equipment(s) already acquired by the project and, if applicable, present the timetable and type(s) of equipment still to be acquired (by and for whom).

I Justify how equipment items have been used in the project activities (for teaching, learning, research, the provision of new services, etc.) for the different target groups (specifying the nature of these target groups and the estimated number of final beneficiaries of the equipment on a yearly basis) and describe the actions implemented (/foreseen) for maximising their usage;

Indicate where it has been installed.

As compared to the proposal, what changes have occurred (/do you foresee) for the purchase and/or usage of equipment?

Under the project, KhNAHU acquired all the planned equipment:

- 1) Computer classroom for 15 places (Artline Business; monitor 24"; Keyboard + Mouse).
- 2) Notebooks 2 units: Xiaomi Mi Notebook Pro 15.6.
- 3) Interactive kit Newline NLE-805.
- 4) Complex for teaching and practical research on electric vehicles:
- lithium-ion battery;
- Electric Vehicle System (EVS) (EVS includes: Motor; Inverter unit; Vehicle Control Module

(VCM); DC/DC converter; Onboard charger; Onboard charger connector; Trickle charge cable); - electric vehicle transmission;

- ELM327 Bluetooth mini OBDII (CAN-BUS V.2.1);
- Launch EasyDiag 2.0;
- HP Pavilion Gaming 17 2 units.

New equipment is for students training on 6 new/modernised courses

Equipment will be used by the Vehicle Electronics Department to:

- developing the training modules (standards) and curricula of the educational program "Electric Vehicles and Energy-Saving Technologies" (EV & EST);

- developing the lab "Laboratory of Energy-saving technologies in transport".

Target groups: Students, Academic and teaching staff.

The purchased equipment installed in two separate and specially equipped classrooms. This will ensure the high quality of the educational process, both in the conduct of lectures, and in the creation and technical support of laboratory and practical classes.

Annually, on the purchased under the project equipment, KhNAHU will train 10 master's students in the educational program EV & EST and 60 bachelors by the educational program "Electrical power engineering, electrical engineering, and electromechanics".

The implementation into the educational process of such joint educational program will result in standard (double, multilateral) Master's diplomas in EV & EST. This conforms to the key national priorities of Ukraine in higher education (Category A: «Curriculum development projects»: Transport services) and regulated by Law of Ukraine on Higher Education, 2014, №1556-VII. The consequences of these innovations will encourage the modernization of higher education and the improvement of its quality and efficiency as well.

Created on the base of purchased equipment, the new laboratory classes will be fully integrated into existing teaching/ learning infrastructure of the partners that give the opportunity to develop additional modernized labs practicums.

#### The project includes activities relating to Curriculum Development

5) Higher education: promoting internationalisation, recognition and mobility, supporting changes in line with Bologna principles and tools

Explain to what extent the new curriculum takes into account the principles set out in the Bologna process (e.g. integration in the 3 cycles, definition of learning outcomes in accordance with a national or European Qualification Framework EQF, application of student-centred approaches, compatibility with European Credit Transfer System ECTS and with the European Standards and Guidelines ESGs for QA, etc.)

The CybPhys project aims to achieve results that help UA universities to modernize existing programmes (in this area of expertise), or to develop a new, innovative EV & EST educational programme in accordance with the demand of the UA labour market. Also, according to the national priorities of Ukraine, the project is aimed at improving methods of training and teaching, modernizing educational and methodological materials in energy-saving, energy-efficient technologies in transport and smart manufacturing.

One of the main aims of this project is to improve the quality of education system and culture according to the European model. Implementing the developed CybPhys project into the educational process of UA universities will improve the governance and management of the educational process as a whole, which directly corresponds to the national priorities of Ukraine. This project involves attracting employers to the educational process by integrating in the consortium of affiliated partners. All this directly corresponds to the UA national / regional priorities (Category A: "Curriculum development projects": Transport services). Moreover, this area of education is specifically described in the Law of Ukraine on Higher Education, 2014, No. 1556-VII and Law of Ukraine on Education, 2017, No. 2145-VIII. Consequently, the CybPhys project not only meets the UA national / regional priorities, but also has unconditional government support and legislative framework (Section XI "International Cooperation", Articles 82 - 84, Law of Ukraine on Education, 2017, No. 2145-VIII).

Educational training program for specialists of the second (master's) level of higher education in specialty 141 «Electricity, electrical engineering and electromechanics» developed in accordance with the Law of Ukraine «On Higher Education» adopted on July 01, 2014 № 1556-VII, Resolution of the Cabinet of Ministers of Ukraine adopted on November 23, 2011 «On Approval of the National Qualifications Framework» adopted on December 30, 2015 No. 1187, «On Approval of Licensing Conditions for Implementing Educational Activities of Educational Establishments» adopted on December 20, 2015 Methodological Recommendations «Development of Educational Programs. Guidelines» (2014).

The educational program determines the prerequisites for access to training, the orientation and main focus of the program, the amount of ECTS credits required to obtain a master's degree, a list of general and special (professional) competences, the normative and variant content of specialist training, formed in terms of training results and requirements for the quality control of higher education.

## 6) New/updated courses

For each of the courses intended to be developed (/updated) for the benefit of the partner country Higher Education Institutions (HEIs), specify I The title of the course, its volume (when applicable, in ECTS),

<sup>2</sup> The HEIs (or other type of training organisation) that will include the course in their curricular/training offer, and the degree/diploma it will be part of

2 The level of development reached as compared to the final product

<sup>2</sup> Describe for each of the partner countries involved, the recognition and accreditation procedures to be followed and the activities already implemented in this respect. In case the Partner Countries involved are Bologna signatory countries, explain to what extent the accreditation process will be done in accordance with the EQAR (European Quality Assurance Register) Guidelines.

Globally (i.e. for the totality of the courses intended to be developed/updated) and as compared to the proposal, express in percentage the level of achievement so far concerning 2 The development/update tasks

☑ The recognition/accreditation tasks

#### <sup>2</sup> The percentage of courses already implemented/delivered to the target group(s)

#### KhNAHU

During the implementation of the project, 2 new courses on the educational program EV & EST is developed:

- Energy-saving technologies in transport;
- The structure of hybrid and electric vehicles;

and 4 modernised courses:

- Electric systems of environmentally friendly vehicles;
- Methods of planning scientific research on vehicles;
- Mathematical modelling and methods of optimization;

- Intelligent information technologies and systems in transport.

# The training programs and courses developed and accredited in the project CybPhys

University	Course/Lab title	Updated or totally new	Level (Bachelor, Master 5-year course)	ECTS credit points	The teaching/training methodologies developed/adopte d e.g. e-learning/ training modalities, practical placements in enterprises, etc.	The link to the university' webpage	Date of accredita tion	The status / document of accreditation
KhNAHU	Energy- saving technologies in transport	New	Master	8,5	Lecture, practicals, lab practicals	http://dl.k hadi.khark ov.ua/cour se/view.ph p?id=1331	autumn -winter 2021	Completed, autumn 2020
KhNAHU	The structure of	New	Master	4	Lecture, lab	https://dl.k hadi.khark	autumn -winter	Completed,

	hybrid and electric vehicles				practicals	ov.ua/cour se/view.ph p?id=1630	2021	autumn 2020
KhNAHU	Electric systems of environment ally friendly vehicles	Updated	Master	4	Lecture, lab practicals	http://dl.k hadi.khark ov.ua/cour se/view.ph p?id=1356	autumn -winter 2021	Completed, autumn 2020
KhNAHU	Methods of planning scientific research on vehicles	Updated	Master	5,5	Lecture, practicals, lab practicals	https://dl.k hadi.khark ov.ua/cour se/view.ph p?id=1363	autumn -winter 2021	Completed, autumn 2020
KhNAHU	Mathematic al modelling and methods of optimization	Updated	Master	3	Lecture, lab practicals	https://dl2 022.khadi. kharkov.u a/course/vi ew.php?id =1733	autumn -winter 2021	Completed, autumn 2020
KhNAHU	Intelligent information technologies and systems in transport	Updated	Master	8,5	Lecture, practicals, lab practicals	http://dl.k hadi.khark ov.ua/cour se/view.ph p?id=1357	autumn -winter 2021	Completed, autumn 2020

All developed and implemented modules were recognised by Scientific and Methodological Councils of the universities. Recognition and accreditation procedures for Master programme modules included the following steps:

1. Internal reviewing syllabus and methodological materials by head of the Department of Universities, by Scientific and Methodological Council of Universities.

2. External reviewing syllabus and methodological materials by European partners.

3. External reviewing syllabus and methodological material by Public Authorities and other stakeholders.

4. Accreditation procedure Master programme by Ministry of Education and Science in Ukraine in 2021. Ukraine has been a Governmental Member of EQAR since February 2008. At the beginning of 2019 in Ukraine started to operate National Agency for Quality Assurance in Higher Education (NAQAHE). Accreditation will be done in accordance with the NAQAHE in Ukraine.

## **Teaching / Training Activities**

7) Mobility for Teaching, Training and/or project research activities1

Describe the type and objectives of the teaching / training / research carried out and the mobility flows linked to them.

*Explain the methodologies adopted by the partnership for informing, identifying and selecting the participants who have been or will be involved in these activities.* 

- Organisation of trainings for academic/teaching and technician staff of KhNAHU on curricula topics, new ICT tools, advanced educational technologies will be arranged. The group of teachers (4 persons) will pass 7 days training in RTU. KhNAHU teachers after returning home will organize the cascade training for the sharing of EU experience.

- Regional 3 days' seminars that include master classes, which will be provided by EU partners will be held: 1 - in Gomel; 1 - in Chernihiv.

- Students training on curricula and study programs topics in EU universities (9 students). 2 week trainings in RTU, UCY and KU Leuven. Before the training public selection of the candidates will be arranged. The candidates will be selected based on academic results, English language knowledge and motivation.

- Since the beginning of the development of training programs it is planned to conduct regular videoconferences for teachers involved into the new bachelorand master-level curricula and programs. They will be devoted to the methodology, content, technological and organizational aspects of the teaching/ learning process.

The members of teaching staff will be selected based on wide experience in their field of studies. In KhNAHU will be selected 4 trainees. Intensive English language preparation will take place at home universities. Training will be arranged by KU Leuven experienced foreign language professional. Teaching training materials will be used after the training at home universities. It is planned that all selected teachers will continue the English language improvement during the whole project as self-studies.

## **SECTION 3: Quality of cooperation**

1) Project management

Describe the project management procedures and in particular

I The process for finalising the Partnership Agreement and, if applicable, the difficulties encountered (and solutions found) in this process

**I** The management tools used (e.g. dashboards/roadmaps, data/information collection and sharing systems, etc.)

☑ The performance indicators established

The internal communication mechanisms adopted (i.e. language, meetings, on-line...) and the decisionmaking processes chosen.

# $\ensuremath{\mathbbmath$\mathbbms$}$ Explain any modification or adaptation of the project management approach as compared to the application

RTU, as project coordinator, is carrying out all the main activities coordinating the different WPs. In particular, RTU is also in charge of WP1, WP7.

Moreover, RTU is also strongly supporting the administrative management of the UA and BY universities providing them with clear indications on how to manage and report the activities of the project. Before each meeting and key activities, a detailed form (guidelines) reporting expected outcomes and procedures to discusses are provided to participants. The needs of each partner are always discussed during coordination meetings or before preparation of training seminars/internships. The special program is developed before visits of the staff. This allowed maximising outcomes from the visit and the working meetings.

Concerning the decision making process, it is consensus based and generally during the project meetings, RTU proposes a set of activities to be undertaken according to the plan foreseen and the obstacles incurred during the development of the project. These activities are discussed by all the partners (revised if necessary) and approved. Then, the minutes with actions to implement are shared through the website in the reserved room.

Even if a voting system and a conflict resolution procedure is foreseen in the Partnership Agreement, until now main decisions were taken unanimously by all partners.

The real problems related to the management is that not all partners know well the EU co-funded project rules and have few or no experience in managing such projects. This is the reason why, often RTU supports partners in management and administrative activities.

## 2) Involvement of partners and stakeholders

Describe the share of **responsibilities between partners** and in particular the role given to Partner country partners.

☑ Explain how **less experienced partners** are involved and, if applicable, why some partners are less (/not) involved.

**Explain** how the **partner country needs** (for HEIs, the target groups or the society at large) are taken into account by the management teams

Explain how and to what extend the Public Authorities (at national, regional or local level) from the partner countries have been involved in the project implementation. Specify their role and the nature of their contribution.

Explain how and to what extent **students and other external stakeholders** are involved in the project management and/or implementation. Specify the type of stakeholders, their number, their role and the nature of their contribution

*Explain to what extent the project contributes to increased cooperation between universities and non-academic sectors of the society?* 

The allocation of tasks amongst the partners is as follows:

RTU - The leader of WP7 Management and WP1 Preparation, develops and maintains the project Web Portal, is a Coordinator of two e-books, arranges training of PCs students and teaching staff, assists to UCY at QA of the project management. KU Leuven – leader of WP3: Implementation of innovative ICT based teaching and learning environment. Coordinator of e-library development, on-distance lectures environment creation. Training PCs students and teaching staff. Coordinator of one e-book. English language courses for lecturers. UCY - WP5 Quality Assurance leader. Coordinator of one e-book. PCs students and teaching staff training in the UCY university. Methodical support for BSU at WP4. BSU - leader of WP2: Development of curricula and WP4 Development of Sharing Modelling and Simulation Environment (SMSE) platform Coordinates Belarusian consortium. Coordinator of two ebooks. Arranges new study programs accreditation by the Ministry of Education. Hosting and maintenance of e-Learning platform during and beyond the project. KhNAHU – Coordinator of one e-book. Arranges new study programs accreditation by the Ministry of Science and Education of Ukraine.

RANI – WP6 Dissemination and Exploitation - leader. As industrial partner provides consultation relating job marked needs, development of study programs and courses; participates in the reviewing of the developed curricula, supports students practice and master degree thesis preparation. SU, MSPU (leader of e-book "Computer modelling of Physical processes), CNTU, KNU as the other PCs partners contribute to development of study programs, courses, lectures and didactic materials; purchase of hardware & software for virtual and physical laboratories for creation and exploitation SMSE, acquisition of a virtual and experimental labs, validate and accredit new study programs, arrange dissemination events for stakeholders.

Taking into account that the main target of the project is practically-oriented student-centred education in the field of modelling of Cyber-Physical Systems feedback from main target groups will be obtained during the 3rd year.

- The input to this activity will be provided by WP5 Quality Assurance. In a frame of WP5 the methodise for collecting feedback will be developed, the questionnaires will be created and translated to the teaching/ learning languages of PCs universities. Different methods will be used: face-to-face interviews, round tables for stakeholders – employers of graduates, etc.

- The methodology for measuring and evaluating of the feedback from different groups of stakeholders will be introduced by WP5.

- Creation of questionnaires for different groups of stakeholders.

## 3) Management of the grant

Describe the **grant management procedures** in place and explain how the partners have been familiarized with the rules for managing the grant.

If applicable, describe how the specific **concerns**, **needs or constraints of the partners** (particularly from Partner countries) have been taken into account

How is the project coordinator informing the consortium members on the use of the grant?
Please specify the internal methodology used to communicate the financial reports on the use of the grant.

**Explain any difficulty encountered (or that could be encountered) concerning the management** of the grant (transfer of funds to partners, reimbursement of costs, tender procedure...).

At MC1 Management Committee (MC) members accepted the detailed development of Project Activity Schedule, which firstly was drafted and discussed at Kickoff meeting. PAS implementation and actualisation is in agenda of all MC meetings. The Project Coordinator is responsible for elaborating a Project Manual (PM) according, e.g. ISO 9001:2000, which is a summary of rules, methods and tools that fixes:

- The project objectives and their analysis in terms of deliverables, tasks and necessary resources (personnel, financial, etc.)

- A related reliable time and financial schedule;

- The specific procedures in accordance with Erasmus+ requirements;

- The measures to reach objectives of the project within allocated budget and without of delay.

The Project Manual has been accepted at MC1

All MC meetings are arranging together with WS. Durations of the MC/WS meeting is usually 2 days plus days for the trip, because the responsible persons are also academic/ teaching staff, which participate in the workshops usually are held in parallel with MC meetings:

- MC meetings are nominated in advance and well prepared. Agenda and presentation are prepared in advance and disseminated among the partners. At the end of each meeting, the minutes will be written, signed by managers and uploaded on project site on public section

MC1 / WS2 – Riga, Latvia, RTU, M7.

MC2 / WS3 – Chernihiv, Ukraine, CNTU. It will be devoted to set up Quality (WP5), M13.

MC3 / WS4 – Nicosia, Cyprus, UCY, M20.

MC4 / WS5 – Bruges, Belgium, KU Leuven, M25.

MC5 / WS6 – Minsk, Belarus, BSU, M31.

MC6 / WS9 – Kryvyi Rih, Ukraine, KNU. M35.

Local project coordinators BSU – for Belarusian consortium and CNTU – for Ukrainian consortium arrange meetings for coordination the work of the partners in their country. As more experience partners they provide support for colleagues.

Due to the covid-19 pandemic, it was decided to hold monthly project management meetings on the zoom platform. These meetings are held regularly. They discuss all issues related to project management, as well as discuss current problems and difficulties that arise during the implementation of the project.

## **SECTION 4: Impact and sustainability**

1) Awareness raising, dissemination, sustainability and exploitation of the project results

Explain briefly the actions already taken (as well as those envisaged until the end of the project) for raising awareness and contributing to the dissemination, exploitation and sustainability of the results achieved (/products delivered) by the project. In particular:

Provide an electronic version of the project **Dissemination and sustainability/exploitation** if available;

**Explain the role (and commitment) taken by the partner country beneficiaries in this respect and the concrete measures taken for:** 

ensuring the visibility of the project at **all levels** (i.e. department and faculty, institution, local and regional, national, international);

☑ guaranteeing the **sustainability** of the project outcomes beyond the project lifetime (specify the funding sources if known) ...)

2 Please add a list of realised deliverables/project products

*Explain and justify any change as compared to the dissemination and sustainability measures envisaged in the application.* 

The main website of the project was created with free access and full materials of the project exploitation: <u>https://cybphys.rtu.lv/</u>. Each university site has a link to the project site. All information concerning news, events, results, meetings are placing on the main website and university's site, Facebook, Linkedin, Instagram and Twitter by each university with logo Erasmus +.

The list of realised deliverables/project products is following:

- Publications: leaflets of the Master programme, Curricula, Syllabi.

- Conferences, Seminars and Presentations: Information days in each PC university concerning presentation of the project, Open days of SybPhys programme at each PC university.

- ELECTRONIC PRODUCTS:
- Facebook: <u>https://www.facebook.com/groups/227194018274534</u>
- Linkedin: https://www.linkedin.com/groups/12355821/
- Instagram: https://www.instagram.com/avto\_elektron/
- SybPhys e-library: <u>https://eduphys.bsu.by/mod/folder/view.php?id=2257</u>
- Twitter: https://twitter.com/Kafedra\_AE/status/1232417367940116481
- https://twitter.com/Kafedra\_AE/status/1238849523969150985
- https://twitter.com/Kafedra\_AE/status/1238848825428762625
  - KhNAHU: <u>https://www.khadi.kharkov.ua/en/erasmus/ka2/development-of-practically-oriented-student-centred-education-in-the-field-of-modelling-of-cyber-physical-systems-cybphys/</u>

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#### PROJECT OUTCOMES BEYOND THE PROJECT LIFETIME

Impact at individual (professional) level: Joining to the Bologna process is important and necessary for UA&BY Education and University system because of the need to solve the problem of recognition the Diplomas abroad, to improve the efficiency and the quality of education.

- Socio-economic integration of UA&BY into the European area will allow increasing the mobility of members of the educational society, employment opportunities, improving the competitiveness of UA&BY universities.

- Give an opportunity to Universities to develop its own educational Masters programmes and PhD programmes in Electric Vehicles and Energy-Saving Technologies able to meet the current real country transport needs.

- CybPhys could also guide the process for developing new PhD Programmes in this field. CybPhys will also implement the innovative living laboratory approach in UA&BY, which could also contribute to develop researches by PhD students.

## 4.3) Statistics and Indicators

*4.4) Meeting, trainings and mobilities 4.4.1) Consortium meetings:* 

4.4.2) Training and mobilities table

## KhNAHU took part in the following meetings:

- Kick-off meeting in Minsk, 5-6th December 2019;
- Double Degree Master program study visit of academic staff KhNAHU to RTU, 17-18th February 2020;
- Workshop WS1, WP1: Preparation MC1: Management meeting in Minsk, 10 11th March 2020;
- Zoom meeting 27.07.2020;
- Zoom meeting 03.08.2020;
- Zoom meeting 07.09.2020;
- Zoom meeting 05.10.2020;
- Zoom meeting 02.11.2020;
- Zoom meeting 07.12.2020;
- Zoom meeting 12.01.2021;
- Zoom meeting 08.02.2021;
- Zoom meeting 01.03.2021;
- Zoom meeting 12.04.2021;
- Zoom meeting 04.05.2021.

## **English language course for teachers:**

- Online meeting 11.01.2021;
- Online meeting 22.02.2021;
- Online meeting 15.03.2021;
- Online meeting 12.04.2021.

Event	Purpose	Type of participants	Gender	Number of partic.	Country of origin	Country of destinat.	Duration weeks
Kick-off meeting in Minsk Dec. 2019	WS	Teachers, managers	M, Fem	All		Belarus	1
Double Degree Master program – study visit: 2 members of academic staff visit RTU, February 2020	MC and WS	Teachers, managers	M, Fem	P1, P9	Ukraine	Latvia	1
Workshop WS1, WP1: Preparation MC1: Management meeting in Minsk, March 2020	MC and WS	Teachers, managers	M, Fem	All	Belarus	Belarus	1
Zoom meeting 27.07.2020	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
Zoom meeting 3.08.2020	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1

Zoom meeting 07.09.2020	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
Zoom meeting 05.10.2020	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
Zoom meeting 02.11.2020	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
Zoom meeting 07.12.2020	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
Zoom meeting 12.01.2021	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
Zoom meeting 08.02.2021	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
Zoom meeting 01.03.2021	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
Zoom meeting 12.04.2021	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
Zoom meeting 04.05.2021	MC and WS	Teachers, managers	M, Fem	All	Latvia	-	1
English language course for teachers Online meeting 11.01.2021	WS	Teachers,	M, Fem	All	Belgium	-	1
English language course for teachers Online meeting 22.02.2021	WS	Teachers,	M, Fem	All	Belgium	-	1
English language course for teachers Online meeting 15.03.2021	WS	Teachers,	M, Fem	All	Belgium	-	1
English language course for teachers Online meeting 12.04.2021	WS	Teachers,	M, Fem	All	Belgium	-	1