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Theoretical fundamentals

of Ph.D. Programme in SmaLog

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Document Title: Concept note for theoretical fundamentals of Ph.D. Programme in SmaLog

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Summary: The document describes the conceptual framework planned for the development of the Ph.D. Programmes in of UA&GE Universities within the SmaLog project WP3.

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Summary

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List of abbreviations

AI	Artificial Intelligence
BSMA	LEPL Teaching University-Batumi State Maritime Academy
CCAM	Cooperative, connected and automated mobility
CWUR Ranking	The Center for World University Rankings
ECTS	The European Credit Transfer and Accumulation System
EU	The European Union
GE	Georgia
GTU	Georgian Technical University
ITS	Intelligent Transport Systems
LPNU	LVIV Polytechnic National University
NTU	National Transport University
NUUE	O.M. Beketov National University of Urban Economy in Kharkiv
PC	Partner Countries
Ph.D.	Doctor of Philosophy
QA	Quality Assurrance
QS Ranking	Quacquarelli Symonds Ranking
UA	Ukraine
VP	Visiting Professor
WP	Work Package
ZSTU/ZPSU	Zhytomyr State Technological University / Zhytomyr Polytechnic State University

Introduction

Generally, Doctoral (PhD) courses are reserved for a limited number of students, who upon successful completion of their program receive the title of PhD. The Doctoral course is usually three years with a final thesis to be written in English, and defended in front of a Final Examination Board, made up of professors in the relevant scientific area. In addition to the final thesis, doctoral students are expected to participate in training activities to acquire transferable skills, (such as communications skills, research career development, research management and project funding, methodological skills) and doctoral training in cooperation with industry and other employment sectors.

The research programs and procedures are designed to ensure that a research scholar will be able to:

- gain fundamental knowledge in the chosen discipline.
- acquire in-depth knowledge in the field of research.
- use both analytical and practical research tools of the field.
- develop skills and capabilities to conduct original research.

The program shall enable the research scholar to prepare himself for a career in independent and original research and also to make a significant contribution in his/her field and profession. The testing and examination procedures to measure the achievement of the objective is prescribed in these regulations under appropriate headings. The objective of this document is to introduce the features, rules and regulations to be followed by all the stakeholders of the research programs.

Therefore, the Concept Note for the Theoretical fundamentals of Ph.D. Programme developed in SmaLog describes the conceptual framework planned for the development of the Ph.D. Programmes in of UA&GE Universities. The main goal of the Concept Note is to describe the objectives of WP3 as well as the research agenda of all the steps needed to develop the Ph.D. programme.

The document is divided into 5 main chapters. In the Chapter 1, the WP3 is described: its main aims, structure approach, activities, and the set-up of the Panel of Experts. In the Chapter 2, Smalog Ph.D. Conceptual framework is presented with several steps that are foreseen to be undertaken during the project duration. In the Chapter 3, the overview of the relevant universities is carried out, the leading universities list is defined concerning some criteria, and general information about durations, research areas, and entry requirements of the defined leading universities are highlighted and analyzed. Chapter 4 describes the review on research needs in Partner Countries, existing PhD courses, their specifications, problems, and different barriers, and finalized main findings. In the Chapter 5, the Fundamentals of the Ph.D course are elaborated including the programme overview, candidate site selection process, candidate curriculum studiorum, evaluation scale for the qualification exam, the PhD course format and requirements, proposed contents and curriculum, learning outcomes and final output, committee set-up process, risk and limitations, students' evaluations, QA process and guidelines to support an involvement of Industry and Society.

All the data and information used in this document is places in Annexes. In Annex 1, there are provided the descriptions of International PhD courses, in Annex 2 there are provided information about existing

PhD courses in PC (translated from Ukrainian to English), in Annex 3 the questions the survey for PC universities about research needs are provided with the answers in the Annex 4.

1 WP3 Overview

The general objective of WP3 is to contribute to the harmonization of the Higher Education Systems between European Union (EU) and the Partner Countries Ukraine (UA) and Georgia (GE), by **introducing a Ph.D. programme on Smart Transport and Logistics in UA and GE Universities** and providing methodological and technological support of the theoretical fundamentals of such Programme. The structure and the topics of the programme developed and the implementation approach (e.g., potential support from industrial and academic sectors) will be jointly evaluated and approved by the Scientific Council of Local Universities at first stage; the approval by Independent/National Quality Assurance Agency or Local Ministries of Education (external approval) is foreseen in a second stage (Figure 1-1).

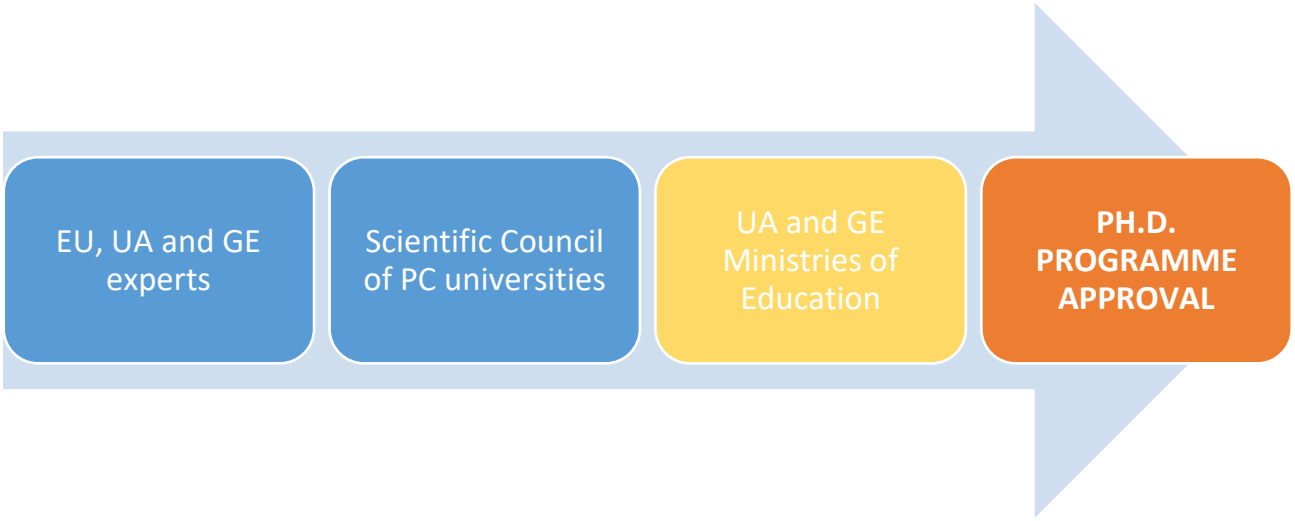

Figure 1-1 Steps of the approval process

1.1 Activities

The logical block diagram of activities to be performed in WP3 is depicted in Figure 1-2.

The first activity of WP3 is the draft of an Inception Note defining objectives, expected outcomes and methodology to be applied in the definition of the Ph.D. programme. The second step concerns a desk research on relevant examples of Ph.D. programme at international level on Smart Transport and Logistics as well as the analysis of the current situation of Ph.D. courses in UA and GE Universities. This allows to draft the theoretical fundamentals of the Ph.D. to be reviewed by a Panel of experts (see next paragraph) involving project partners and by the Scientific Council of Partner Countries Universities. The draft programme will be then presented during a first Progress seminar, whereas the final and approved version during the project final conference. The final step of WP3 consists of the

elaboration of guidelines that will support Local Universities in the potential implementation of the Smalog Ph.D. Programme.

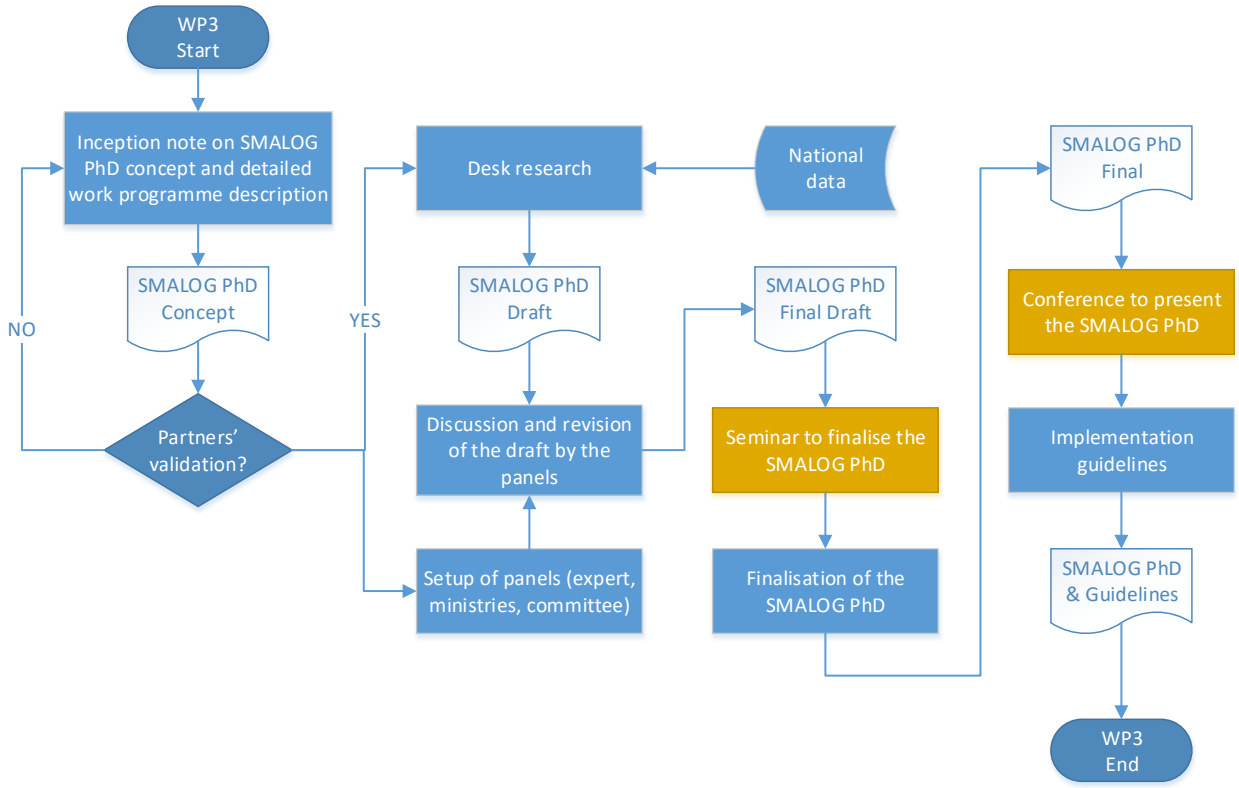

Figure 1-2 Logical block diagram of the approach

1.2 Panel of Experts

The aim of the Panel of Experts is to assess the Ph.D. programme developed in Smart Transport and Logistics. The Panel includes Quality Board Members (selected for the Quality Assurance Task in WP8) and comprises at least one academic involved in the project from each of the four EU Universities, five Ukrainian Universities, two Georgian Universities.

Table 1-1 Panel of Experts

Partner	Organization	Contact Person	Email
P1	Università Degli Studi di Roma Tor Vergata	Prof. Agostino Nuzzolo Prof. Antonio Comi Prof. Umberto Crisalli	nuzzolo@ing.uniroma2.it comi@ing.uniroma2.it crisalli@ing.uniroma2.it
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		Associate Prof. Dmytro Roslavtsev	
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P5	Zhytomyr State Technological University/Zhytomyr Polytechnic State University	Prof. Mamray Vasyl As. Prof. Volodymyr Shumliakivskyi	vmamray@rambler.ru shumliakivskyiv@gmail.com
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P7	Georgian Technical University	Prof. Dr. Giorgi Doborjginidze Temur Ugulava	g.doborjginidze@gtu.ge temugulava@gmail.com
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P11	Hochschule Wismar	Prof. Nobert Gruenwald	norbert.gruenwald@hs-wismar.de

In particular, the Panel of Experts will review the following documents that will be drafted in the field of WP3:

- Inception Note;
- SmaLog Ph.D. concept draft;
- SmaLog Ph.D. concept final draft.

Work Package leaders will facilitate the Panel and consider its recommendations and findings before giving an outcome (granting or declining).

2 Smalog Ph.D. Conceptual framework

The overall approach proposed for the Ph.D. Programme development is to combine best practices of Ph.D. Programmes from leading Universities in the world with the current Ph.D. courses delivered in UE and GA universities.

To develop an overarching Ph.D. course several steps are foreseen to be undertaken:

1. Perform a comprehensive analysis of existing Ph.D. courses in the leading universities in the world within the Smart Transport and Logistics topics and related ones;
2. Perform an analysis of existing of the current regulation of Ph.D. courses in UA and GE Universities;
3. Define research needs for the developing course (e.g., duration, entry and admission requirements, possible research areas, scholarship possibilities, key competences of the program, mandatory and elective modules, their outcomes, educational methods, requirements for Ph.D. thesis, fundaments for mobility and scientific cooperation);
4. Develop a Curriculum in terms of contents organization, delivery methods (e.g., online/face-to-face lectures, reading/writing assignment, group work, participation to workshops/seminars/international conferences) and assessment/feedback mechanisms;
5. Develop a possible outline (e.g., lessons, topics, sessions) of training courses to attend within the Ph.D. programme, a synoptic table of modules (Syllabus);
6. Develop a Work Plan for all the years stipulated for the course;
7. Define of the bodies that should be identified in each university, such as the doctoral committee, aimed to fulfill the requirements for the accreditation of doctoral courses and locations, establishment, duration and operation of doctoral courses, admission of scholarships, etc.;
8. Define the final output that students have to provide to complete the course, including the requirements for Ph.D. thesis;
9. Define the program resources that will be needed, including faculty/staff, physical space, equipment, materials, etc. to enhance program cohesiveness and align facilities with specific programmatic needs;
10. Provide guidelines of continual formative (ongoing) evaluation checks to measure program effectiveness and measurable performance criterion for assessing learning outcomes, ensuring that the assessment aligns with the original performance objectives;
11. Define possible risks and limitations that may occur during the course delivery, and correspondent mitigation actions;
12. Provide guidelines of support services to enable the largest number of potential students to participate and partnerships with other universities, research centers, organizations, and private companies to strengthen recruitment, retention, and motivation.
13. Provide guidelines to support an involvement of Industry and Society, to find out their needs to enhance education, training and employment opportunities;
14. Provide guidelines of international accepted Quality Assurance process.

During the process of defining the theoretical fundamentals of Ph.D. Programme in SmaLog, additional elements to be addressed may be introduced.

3 International review of relevant Ph.D. courses

The Ph.D. programs focus on scientific improvements by using more professional, and multidisciplinary ways with providing higher qualification. There are lots of Ph.D. program opportunities around the world. In this Concept Note, one of the steps to approach proposed for the Ph.D. Program development is to define the best practices of Ph.D. Programs from leading universities in the world according to their preferability, academic background, and ranking platforms, concerning the programs that are related to smart intelligent transport and urban logistics. Therefore, it was performed a comprehensive analysis of existing Ph.D. courses in the leading universities in the world within specifically on topics of "Smart Transport" and "Smart Logistics" and some others that are the sub-topics on Freight Transport and Logistics. The detailed information on results is provided in Annex 1.

The overview of the relevant universities is carried out by starting the definition of the leading universities list concerning some criteria such as academic situations and locations to include as much universities as possible all over the world. After that, general information about durations, research areas, and entry requirements of the defined leading universities are highlighted and analyzed.

3.1 Introduction

The Ph.D. programs are highlighted at the chosen universities around the world. These universities are considered according to their locations, preferabilities, ranking scores, academic background, and popularity at the national or international levels.

For the locations of the universities, various continents and countries are considered to support the coverage of all continents and different types of countries based on their socio-economic perspectives.

After that, another parameter is rankings, which are mentioned on the website by concerning preferences and academic backgrounds of the universities. For this purpose, two online ranking platforms, which are namely QS Ranking and CWUR, are chosen. Some details of these ranking platforms are the following:

1. QS Ranking: QS World University Rankings is an annual publication of university rankings by Quacquarelli Symonds (QS). Previously known as Times Higher Education–QS World University Rankings, the publisher had collaborated with Times Higher Education (THE) magazine to publish its international league tables from 2004 to 2009 before both started to announce their own versions. QS then chose to continue using the pre-existing methodology, while THE adopted a new methodology to create their rankings. In partnership with Elsevier, the QS system now comprises the global overall and subject rankings (which name the world's top universities for the study of 51 different subjects and five composite faculty areas), alongside five independent regional tables (Asia, Latin America, Emerging Europe and Central Asia, the Arab Region, and BRICS). The platform uses some indicators and weighting (total is 100%), in the methodology, that are:
    - Academic peer review (weighting: 40%),

- Faculty/Student ratio (weighting: 20%),
- Citations per faculty (weighting: 20%),
- Employer reputation (weighting: 10%),
- International student ratio (weighting: 5%),
- International staff ratio (weighting: 5%).

2. CWUR: The Center for World University Rankings is a leading consulting organization providing policy advice, strategic insights, and consulting services to governments and universities to improve educational and research outcomes. Since 2012, CWUR has been publishing the only academic ranking of global universities that assesses the quality of education, alumni employment, quality of faculty, and research performance without relying on surveys and university data submissions. CWUR uses seven objective and robust indicators grouped into four areas to rank the world's universities:
    1. Quality of Education, measured by the number of a university's alumni who have won major academic distinctions relative to the university's size (25%)
    2. Alumni Employment, measured by the number of a university's alumni who have held top executive positions at the world's largest companies relative to the university's size (25%)
    3. Quality of Faculty, measured by the number of faculty members who have won major academic distinctions (10%)
    4. Research Performance:
        i. Research Output, measured by the total number of research papers (10%)
        ii. High-Quality Publications, measured by the number of research papers appearing in top-tier journals (10%)
        iii. Influence, measured by the number of research papers appearing in highly-influential journals (10%)
        iv. Citations, measured by the number of highly-cited research papers (10%)

According to these parameters, the chosen universities, as leading universities, are represented in Table 3-1concerning their ranking positions on the platforms.

Table 3-1 QS and CWUR rankings of chosen universities

Institution	**QS Ranking**	**CWUR Ranking**
University of Leeds	91	101
Sapienza University of Rome, Italy	171	113
Tallinn University of Technology, Estonia	651-700	1447
Technical University of Denmark, Denmark	103	196
University of Stavanger, Norway	*N/A*	1360
The Hong Kong University of Science and Technology	27	229
New Jersey Institution of Technology, US	*N/A*	948
Institute of Transport and Logistics Studies at University of Sydney in Australia	40	98
NYU Shanghai, China	*N/A*	*N/A*
Johannes Kepler University Linz Austria	362	926
University of Twente (UT), Netherlands	197	411
Molde University College (HiM), Norway	*N/A*	*N/A*
The University of Zaragoza, Spain	501-510	453
Macquarie University, Australia	214	380

University of Rome Tor Vergata, Italy	494	263

Table 3-1 shows that considered universities are mainly lined up with positions from 50 to 500 around the world. However, there are some universities that are in better or worse positions because of the coverage of different trending universities around the world. In the leading list, there are universities from the UK to Australia, from Italy to the USA for supporting the reference universities to highlight various entry requirements, educational purposes, university characteristics, and academic systems. Meanwhile, the leading reference universities are also highlighted concerning *higher* and *lower* (based on ranking scales) academic qualification levels to mention differences between the universities according to academic qualification and preferences.

In addition to this, there are some universities that are out of range (N/A) on the ranking platforms as the University of Stavanger, the Molde University College, and the NYU Shanghai. These out-of-range universities represent that they are not ranked by the platforms because they are not sufficient to be considered in the chosen range that is defined by the ranking platform.

3.2 Duration of the courses

After the definition of the leading universities, the document interests in the durations of the Ph.D. programs that are provided by the universities in Smart Transport and Logistics. The official average durations of the leading universities are represented in the following Table 3-2.

Table 3-2 Ph.D duration in the leading universities

Institution	**Duration**
University of Leeds	3 years
Sapienza University of Rome, Italy	3 years
Tallinn University of Technology, Estonia	4 year
Technical University of Denmark, Denmark	3 years
University of Stavanger, Norway	3 years
The Hong Kong University of Science and Technology	3-4 years
New Jersey Institution of Technology, US	
Institute of Transport and Logistics Studies at University of Sydney in Australia	3 years
NYU Shanghai, China	4-5 years
Johannes Kepler University Linz Austria	3 years
University of Twente (UT), Netherlands	4 year
Molde University College (HiM), Norway	3-4 years
The University of Zaragoza, Spain	4 year
Macquarie University, Australia	3 years
University of Rome Tor Vergata, Italy	3 years

According to the table, most of the prevalent duration of the Ph.D. programs at the leading universities are between 3-4 years. The duration of the programs is mostly preferred as 3 years. However, there are some programs that are last up to 5 years, but this duration is not so much preferred. The longer Ph.D. courses (the case of NYU Shanghai) have some additional issues or programs such as an exchange

program. The Ph.D. program at the university of NYU Shanghai has an exchange program that carries out in New York (in the USA), so, the program is longer than other references.

3.3 Area of research

The leading universities are the representatives of the Ph.D. programs in their regions. All these universities are interested in the arguments on Smart Mobility and City Logistics. The following examples highlight the academic purposes and research areas of the reference universities with respect to the arguments.

The **University of Leeds** has a clear perspective about sustainable and intelligent transport studies. The university has a research center for mobility that is the Institute for Transport Policies. The institute is working on impact upon transport policy and practice and contribute to the wider economy and society. The research aim is to support the development of intelligent mobility systems that are connected, inclusive, productive and resilient. The research themes are Virtuosity, Rail Centre, Choice Modelling Centre, Connected and Shared Mobility, Energy, Global South, Automation, and Digital Futures. Moreover, the institute has research groups to study on Choice Modelling, Economics and Appraisal, Human Factors and Safety, Spatial Modelling and Dynamics, and Social and Political Sciences by using the support of the institute's Driving Simulator. Based on increasing popularity of Micromobility, because of Covid-19 pandemic, the institute is involved in the UK's first micromobility research fund in the end of 2020.

Another reference is the **Sapienza University of Rome** that has a Ph.D. Course in Infrastructures and Transport aims to train a professional, multidisciplinary, highly qualified, and integrated scientific purpose. The program interests in preferable topics on the infrastructures and human settlement planning and management; the acquisition, analysis, and management of geographic and spatial information; the integrated mobility; the construction and the operational service of the infrastructures and conventional and innovative transport systems, focusing on those with improved environmentally friendly performances. Moreover, the program also would be related to specifically the course of Freight Transport and Logistics that is to acquire knowledge on the determinants of the mobility of goods through the analysis of business logistics and likely trends. The program has several objectives that support advanced design and construction methods for transportation infrastructures, especially regarding construction processes and integrated design procedures, with the aim to ensure the increase of safety and the preservation of environment, the measure of economic or financial resources employable and retractable; construction materials recycling and re-use, by means of the analysis of mechanical and ecological characteristics of waste products. Moreover, the program has a curriculum in "Transport and land-use planning" that includes the research areas: design of transport networks; design of transport systems and their components; transport demand modelling; simulation of transport networks; integration of land use and transportation planning; integrated planning of transport systems and public space; transport networks for environmental and landscape quality; policies, plans, and assessment tools for transport and land use planning; territorial analysis, according to methodologies and geomatics techniques that, through the acquisition, management (modeling and analysis) and dissemination of territorial information, allowing study of the territory in the design and service phases of civil infrastructures and monitoring their impact; and environmental sustainability of infrastructures, especially referred to hydro-geological problems, with the aim to recognize – also in advance – interactions between territory and transportation networks.

After that, the **Tallinn University of Technology** offers a Ph.D. program that aims to study possibilities of integration of motor freight transport concerning the compatibility options of other modes of transportation. The program is interested in the aspects of mobility, optimization of the capacity and use of cargo spaces, seaports, smart solutions, and last-mile operations.

The **Technical University of Denmark** has a Ph.D. program in Transport Network Modelling that aims to develop and apply methods that allow realistic and computationally attractive modeling of transport networks. The program includes the topics of empirical analysis of data, theoretical models of behaviors, algorithms for large-scale network applications, real-life application.

In the **University of Stavanger**, the Ph.D. program is named Sustainable Urban Mobility that is dealing with undergoing several revolutions, e.g., the electrification and automation of vehicular transport, "green" transportation, increase of shared mobility and micro-mobility, Mobility As A Service (MAAS), promoting active travel and walkability, and a stronger focus of environmental sustainability and social equality and justice. The research interests of the program areas urban environment and modes of travel, urban mobility and travel behavior, sustainable transport policy, micro-mobility, new mobilities and their consequences, innovations on urban transport policy and technology. The research topics are opened to be extended by the program candidates and researchers.

Another Ph.D. program is considered at the **Hong Kong University of Science and Technology** by namely Intelligent Transportation. The program targets to provide a well-rounded education as well as rigorous research training to support the candidates for versatile and knowledgeable professionals in intelligent transportation engineering and technologies. The research topics would be considered as computational modeling, floating car / floating cellular data, inductive loop/video vehicle/Bluetooth detection, information fusion from multiple traffic sensing modalities, collision avoidance systems, safety and security of the unmanned aerial vehicle, green aviation technologies, public transportation systems such as railway systems, connected vehicles (CV), autonomous vehicles (AV), and shared mobility.

After that, **New Jersey Institution of Technology**, where is in the USA, is an interesting program for the candidates who would like to plan, design, construct, operate, and improve transportation systems and infrastructure, focusing on elevating safety, mobility, and level of service associated with all modes of transportation concerning aspects of environmental issues, changes in technology, regulatory and legal frameworks. The program offers a well-balanced mixture of theoretical studies and experimental research. In the research activities, the challenges are expected to be complex issues, effective formulation of difficult problems, new methodologies, and achievement of new and exceptional results.

The **University of Sydney**, in Australia, has a Ph.D. program in the Institute of Transport and Logistics Studies. The program is offering topics on transport, and logistics and supply chain management to develop a modeling capability in support of policy on the sitting and design of intermodal container terminals in metropolitan areas. The research activities are interested in transport network models, with a specific focus on freight, inter-modal networks, and network design. It is essential that the recipient has a strong background in network models and object-oriented computer programming, with an interest in applying these skills to the design of metropolitan inter-modal freight networks. The logistics and supply chain research are dealing with freight modeling and supply chains, with a specific focus on organizational structures and processes. Moreover, the program also concerns some areas such as statistical modeling, and is interested in developing a background in logistics, discrete choice techniques

or a cognate field as well as a demonstrated interest in a case study, interviewing or survey methodologies.

Another reference university is **NYU Shanghai**, in China, that offers a Ph.D. program in Transportation Planning and Engineering. The program is dealing within the Connected Cities for Smart Mobility toward Accessible and Resilient Transportation (C2SMART) by cooperation with the Tandon School of Engineering, to work closely with research activities from other disciplines to conduct basic and applied research funded by the National Science Foundation, U.S. DOT, and other agencies.

The **Johannes Kepler University**, in Linz (Austria), offers a Ph.D. program that is dealing with research and teaching activities focus on the development of applications that rely on automated, connected technologies, for a sustainable transport development. The program aims to provide transport solutions for a low environmental impact using sensor and communication technologies for data exchange between vehicles, infrastructure, and people. By relying on Internet of Things and the vision of "physical Internet", the course targets also to investigate the interaction between the elements of the networked system by taking also into account human behavior.

Another one of the leading universities is **University of Twente**, in Netherlands, considers a Ph.D. program that is in IoT (Internet of Things) solutions for Smart transport and logistics. This research area is focusing on the Blockchain technology and IoT security for logistics sector. In particular, the research program focuses on distributed blockchain technologies that are embedded in the smart objects that constitute the modern smart logistics. The Blockchain technology offers several benefits. While many consider its implications to mainly include simple asset tracking and transparency to real-time feedback from customers, the true scope of its benefits is not known, and it has the potential to become one of the most remarkable breakthroughs in the supply chain history. With a world that is becoming more connected daily, Blockchain technology will inherently develop into a symbiotic relationship with the Internet of Things and today's advanced logistics and supply chain management systems. IoT solutions can help long-haul cargo operators and last-mile delivery providers efficiently manage the transportation and distribution of freight and merchandise. The introduced efficiency has various economical, societal, and environmental impacts.

The **Molde University College**, in Norway, offers a Ph.D. program in Logistics. The field of logistics allows for a rich set of research topics, but especially encourage propositions within the following areas: energy logistics, transport planning under deep uncertainty, IT-applications within logistics, sustainable logistics, logistics of marine industries (fisheries, fish farming, etc.), humanitarian logistics, strategic purchasing, and supply chain management, under complexity.

The **University of Zaragoza**, in Spain, has a Ph.D. program in Logistics and Supply Chain Management. The program follows the international quality standards for doctoral studies, from the rigorous admissions process, continuous high-performance control process, to the comprehensive exam and thesis defense, enabling graduates to take faculty positions at leading universities around the world or to become innovation leaders for international companies.

Another reference is the **Macquarie University** that is in Australia. The university is offering a Ph.D. program namely Collaboration and competition between transport and logistics modes in supply chains. The program aims to examine the complex ecosystem of competing modes of transport and logistics in the context of sustainable supply chains in Australia. Road, rail, aviation, and coastal shipping are all

under consideration, along with warehousing and distribution systems. Shipping ports are a primary focus for the research as a key/common focus for movements of goods in and out of the country.

The **University of Rome Tor Vergata** offers a Ph.D. in Business/Enterprise Engineering with the duration of 3 years. The PhD in Business Engineering provides the skills necessary to carry out highly qualified research activities in public and private entities, as well as qualifying skills also in the exercise of the liberal professions, contributing to the creation of the European Higher Education Area European Research Area. The Doctoral Program in Business Engineering provides for disciplinary, interdisciplinary and linguistic and IT improvement training activities, also thanks to the presence of multimedia laboratories and libraries and the constant support of the entire Board of Professors and the Coordination Structure. The multidisciplinarity and the multiplicity of courses, seminars and methodological approaches offer an innovative, diversified and complete course of study.

In conclusion, the leading references consider 15 universities around the world. The research areas are widely spread as the Internet of Things, Supply Chain, Logistics, Collaboration and Competition between Transport and Logistics Modes, Smart Transport and Logistics, Sustainable Transport and Logistics, Intelligent Transportation, Transport Network Modelling, Design-Construct-Operating of Transportation, Integration of Smart Transport in Cities, Supply Chain Management, Infrastructure and Smart Transport, and Connected Automated Cities for Smart Mobility concepts.

3.4 Entry requirements

The leading universities list starts with the **University of Leeds** that has the following initial requirements for Research Degree applications:

- All applicants are required to meet certain minimum academic and non-academic standards for entry; however, the University recognizes that how these requirements are met may vary by individual applicant.
- *General Entry Requirements*: Applicants to research degree programmes should normally have at least a first class or an upper second class bachelors honors degree in an appropriate discipline. The criteria for entry for some research degrees may be higher: for example, several faculties also require a Masters degree. Applicants are advised to check with the relevant School prior to making an application. Applicants who are uncertain about the entry requirements for a particular research degree are advised to contact the Graduate School prior to making an application. Applicants who are uncertain about the entry requirements for a particular research degree are advised to contact the Graduate School prior to making an application.
- *Academic Requirements*: The University considers a wide range of qualifications for entry, and qualifications from across the world are assessed for acceptability through a formal process undertaken by the University's qualifications groups, and with ultimate ratification by the University's Postgraduate Researcher Recruitment Group.
- *English Language Requirements*: Supervision, assessment and support will take place in English, unless otherwise stated. Schools must be confident that applicants have the proficiency in English language necessary to succeed on their chosen research degree program and that, where relevant, they meet the UKVI (UK Visas and Immigration) minimum requirements to obtain a Student visa.

- *Non-Academic Requirements*: Higher education and professional qualifications, Confirmation of Acceptance for Studies (CAS) and Student visa, English qualifications, English language requirements, References, Research proposal.

After that, the **Sapienza University of Rome** requires some qualifications to consider Ph.D. program applications as follows:

- Graduation date and grade of the Master's degree
- detailed list of exams including completion dates and scores of Masters's degree
- History of Scholarships, Research Grants (or similar)
- Certificates of Foreign Languages (ENGLISH)
- Certificates of participation in post-graduate university courses
- certificates of Participation in research groups
- certificates of Participation in internships
- Other University Awards/Degrees (e.g.: awards in competition, second degree)
- Computer skills
- Publications' list

Another reference university is the **Tallinn University of Technology** that has some requirements for the Ph.D. applications concerning the candidates with a wide range of backgrounds in logistics and transportation, both with practical and project related (research) competences. High level of motivation towards developing transportation systems on a regional level with the tight focus on carrying out the results in practice as well as a deep understanding of optimization methods used in transportation is required.

The **Technical University of Denmark** expects the following requirements to consider Ph.D. applications:

- Candidates should have a MSc degree (120 ECTS points) in Transportation Modelling or Engineering, Computer Science, Applied Mathematics and Statistics, Computer Science, Behavioural or Experimental Economics, or related
- Good programming capabilities in at least one language such as Matlab, Java or Python
- Transportation Modelling disciplines in the education background is favoured
- In addition to these, soft skills are also important
    - Curiosity and interest about how transportation networks operate and perform
    - Good communication skills in English, both written and orally
    - Willingness to engage in group-work with a multi-national team

In the **University of Stavanger** requires, for Ph.D. applications, from all applicants with a strong academic background who have completed a five-year master's degree (3+2) within spatial or urban planning or transport planning/ -engineering. If you have relevant experience in mobility, a master's degree within architecture, or human geography or environmental psychology or equivalent may be relevant. Your education must provide a basis for successfully completing a doctorate and must preferably be acquired recently. Work experience in transport and mobility will be emphasized. Requirements for competence in English; A good proficiency in English is required for anyone attending the Ph.D. program. International applicants must document this by taking one of the following tests with the following results: TOEFL (Minimum 90); IELTS (Minimum 6.5); Certificate in Advanced

English (CAE) or Certificate of Proficiency in English (CPE) from the University of Cambridge; PTE Academic (Minimum 62). To be eligible for admission to the doctoral programs at the University of Stavanger both the grade for your master's thesis and the weighted average grade of your master's degree must individually be equivalent to or better than a B grade.

For the Ph.D. applications at the **Hong Kong University of Science and Technology**, the applicants should meet the following requirements: (General Admission Requirements) Applicants seeking admission to a doctoral degree program should have obtained a bachelor's degree with a proven record of outstanding performance from a recognized institution; or presented evidence of satisfactory work at the postgraduate level on a full-time basis for at least one year, or on a part-time basis for at least two years. For the English Language Admission Requirements: TOEFL-iBT: 80; TOEFL-pBT: 550; TOEFL-Revised paper-delivered test: 60 (total scores for Reading, Listening and Writing sections); IELTS (Academic Module): Overall score: 6.5 and All sub-score: 5.5. Exceptionally, applicants are not required to present TOEFL or IELTS score if: their first language is English, or they obtained the bachelor's degree (or equivalent) from an institution where the medium of instruction was English.

The **New Jersey Institution of Technology** considers the Ph.D. applications if the candidates have adequate preparation in mathematical and other analytical techniques, and substantial knowledge of the ideas and techniques of synthesis. A thorough understanding of the social and economic factors intrinsic to the functioning and development of transport in urban areas also is necessary. It is expected that students will have earned a minimum GPA of 3.5 in a master's degree program in engineering, planning, or business administration from an accredited university. Outstanding students with baccalaureate degrees also may be accepted. All applicants must take the GRE. All international students must also achieve a minimum TOEFL score of 550 for the paper-based exam. or a minimum score of 6.5 with no sub-score lower than 6.0 for the IELTS exam. Full-time study is preferred for doctoral studies.

The following reference is the **University of Sydney** that requires for consideration of Ph.D. applications, in Institute of Transport and Logistics Studies, as any disciplinary background is in principle acceptable for either scholarship, the university encourages the applications from graduates in economics, econometrics, operations research, mathematics, engineering, physics or geography. It is expected that applicants will have strong quantitative skills in their respective discipline areas. Successful applicants for both scholarships must have good written and oral communication skills. There will be opportunities to assist in tutorial work with graduate students. The logistics and supply chain scholarship are for a research student interested in freight modeling and supply chains, with a specific focus on organizational structures and processes. It is essential that the recipient has skills in areas such as statistical modeling and is interested in developing a background in logistics, discrete choice techniques or a cognate field, and a demonstrated interest in a case study, interviewing, or survey methodologies.

The **University of NYU Shanghai** expects the applicants who meet the requirements to be eligible for consideration to any Tandon MS or Ph.D. program, they must hold a bachelor's degree from an accredited institution, which includes a minimum of four years of full-time study. Bachelor of Engineering degrees (based on 180+ ECTS credits) may also be considered. All applicants to the NYU Tandon School of Engineering for graduate study must demonstrate excellent English language skills in reading, writing, speaking, and comprehension. Proficiency will be determined by the Test of English

as a Foreign Language (TOEFL), International English Language Testing System (IELTS), Cambridge English: Advanced (CAE), or Pearson PTE Academic exams. The applicants must submit the English language proficiency scores electronically via the testing agency.

The **Johannes Kepler University** requirements start with expectations from the successful candidate must hold a Diploma/Master's degree in computer science, mechatronics, electrical engineering, electronics and automation or a related field. The applicants are also expected to possess a strong academic background in intelligent transportation systems; to provide Professional Experience in the development of solutions for intelligent transportation systems (i.e. sensor data fusion, data analysis, wireless communication technologies, autonomous and cooperative systems, computational intelligence, data analysis, optimization techniques, microscopic traffic simulation, data exchange in Internet of Things) and its effect on users; to show Excellent Publication Record in international peer-reviewed scientific journals and at top-tier conferences; to have Strong programming skills (C/C++/C#/Java/Python/HTML/PHP), and Experience with Robot Operating System (ROS), MATLAB, Mathematica, LabVIEW, and Excellent command of English (spoken and written).

Another leading reference is the **University of Twente** requires, for consideration of a successful Ph.D. application, a sound theoretical background in mathematics, data mining, and machine learning with a MSc degree in Computer Science or Statistics. The university welcomes ambitious candidates with strong communication skills who like to present their work at conferences and project meetings. Fluency in English is required. All applicants need to provide IELTS test results (minimum score 6.5), TOEFL-iBT (minimum score 90) or Cambridge CAE or CPE. An interview and a scientific presentation will be part of the selection procedure.

After that, the **Molde University College** is expecting to seek candidates with a strong background in business logistics, transportation, management science, informatics, health care logistics or other relevant subject areas. The applicants' higher education must equate five years of full-time studies on top of the entry requirements for first cycle studies (bachelor's degree) in Norway. For some countries, this means that the applicants must have more than five years of what is called higher education in their home country. The applicants' master's degree (or equivalent) must constitute at least one full year of studies (60 ECTS), and must contain an individual piece of student work, normally a master's thesis. The minimum average grade of the master's degree must be grade B, or better, on the ECTS grading scale, or an equivalent average grade on other grading scales. The university will also emphasize personal qualities and English fluency. Amongst other things, the applicants are dedicated, cooperative and systematic.

The **University of Zaragoza** requires filling an application form, providing a Curriculum vitae/Resume, a Copy of your passport, the Official GRE scores (it is a must for all candidates), the language prove by using Official TOEFL / IELTS or another similar English test (if not a native speaker), the Official transcripts/diploma (both Master and Bachelor's degree are required). Additionally, three letters of recommendation and a Statement of objectives are expected.

The reference organization of the **Macquarie University** is expecting that the suitable applicant will have strong research and experiential background in supply chain management, transport and logistics and regional development, and should be interested in writing a doctoral thesis in close conjunction with the Port of Newcastle. Issues of data analytics, automation and workforce development may also emerge during the research.

The **University of Rome Tor Vergata** PhD course in Business Engineering can be accessed through a competition, the test of which consists in the presentation and discussion of a research project and in the assessment of knowledge of the English language. Once admitted to the course, the student is assigned a scientific tutor, chosen from among the members of the Academic Board, who will supervise the study and research activities for the entire duration of the study cycle. At the end of each year, the Academic Board is called to evaluate the quality of the work carried out by the doctoral student to decide on admission to subsequent years.

In conclusion, the leading universities have similar entry requirements that are mainly based on previous academic qualifications and language requirements. The programs are related to the doctorate degree. So, the academic qualification should include Bachelor's and Master's degrees. The scientific language (common/shared language) is English, so, the required language is English (at least level of intermediate).In addition to academic background and language requirements, there are non-academic and previous knowledge aspects such as computer skills, references from previous works/educations, research proposals, general university applications requirements (depend on each university).

3.5 Summary of main findings

After the given information, the main key results of the research are stated below.

The leading references are described by choosing 14 institutes/universities all over the world concerning various continents, regions, and countries. The leading universities are placed in UK, Italy, Estonia, Denmark, Norway, Hong Kong, USA, Australia, China, Austria, Netherlands, and Spain.

The leading universities are positioned between 50-500 by online ranking platforms based on some criteria. In addition to this, some universities are chosen to be representatives of their regions/continents instead of their ranking positions (even if they are placed out of range 50-500).

Another finding of the leading universities in the durations of the programs. The program duration of these universities is highlighted averagely between 3 or 4 years. These durations can be extended if there are any necessities such as the Covid-19 pandemic, etc.

The programs of the defined leading universities are mainly focusing on the topics of Internet of Things, Supply Chain, Logistics, Collaboration and Competition between Transport and Logistics Modes, Smart Transport and Logistics, Sustainable Transport and Logistics, Intelligent Transportation, Transport Network Modelling. In addition to these preferred topics, there are new trends such as Intelligent Transport and Infrastructures, Supply Chain Management, Connected Automated Cities with Smart Mobility, Designing-Constructing-Operating of Transportation, and Intelligent Logistics Services and Sustainability.

The leading universities have common entry requirements that are dealing with previous academic qualifications and language requirements. The academic requirements are mainly expecting a good level of graduation from Bachelor's and Master's degrees (for some cases, with Honors), and at least B level of English Language knowledge and its certification. Moreover, the leading universities are also expecting some more requirements from candidates such as computer skills, a well-prepared research

proposal, previous professional experiences, backgrounds (such as logistics-related, supply chain, transport network programming, etc.)

4 Analysis of the existing Ph.D. Courses in Ukrainian and Georgian universities

4.1 Introduction

The specific aim of WP3 was to identify the research needs and to develop study programs on smart transport and logistics in Partner countries. The work was based on universities' needs and existing Ph.D. activities and courses in Partner countries.

In this chapter it is described the review on research needs in Partner countries, existing courses, their specifications, problems, and different barriers, and finalized main findings.

4.2 Review of the Ph.D. courses in Partner countries

As stated above, several universities already have their Ph. D courses developed. The programs' descriptions are placed in Annex 2.

To complete the task of developing fundamentals to a Ph. D course, an analysis of those available programs was performed, and the main points and findings are described below.

The duration and ECTS of the courses are set up as 2 years (LPNU) – 60 ECTS, 4 years (NTU) – 60 ECTS and 4 years (NUUE) with only 45 ECTS. The language of teaching the program is only Ukrainian.

Prerequisites for the enrolment to the Ph. D courses are similar amongst the universities: Master's degree or educational qualification level of a specialist.

Assessment methods and criteria are claimed to be consistent with learning outcomes and types of learning activities. Therefore, there are exams, tests, oral presentations, defense of the theoretical part of the dissertation of the Doctor of Philosophy. In Ukrainian Universities it is foreseen the check of the thesis work for plagiarism by the Regulation "On the system to ensure the academic integrity of teaching, research and teaching and research staff and applicants of higher education in the National Transport University».

The tools and methods of teaching provided in the universities are mostly a combination of lectures with practical classes, independent and research work on the basis of normative literature, textbooks, lecture notes and experimental research, consultations with teachers, preparation of dissertations.

General and professional competencies are covering all the crucial elements needed such as ability to communicate in writing and orally in Ukrainian and English, ability to perceive the acquired knowledge of the subject area and to integrate it with existing ones, ability to produce new scientific and scientific-applied ideas, to show creativity, ability to think systematically, search and analyze information from various domestic and foreign scientific sources, ability to effectively use in scientific practice various theories in the field of scientific and applied research in the specialty. Among them there are also ability to solve scientific and applied problems and make appropriate informed decisions; have the skills to

develop and manage projects to ensure a high level of efficiency in the implementation of various types of projects in the field of transport.

4.3 Online survey and its outcomes

An online survey was held among the representatives of 6 universities in partner countries. The 6 following Ukrainian and Georgian (UA and GE) universities are:

- O.M. Beketov National University of Urban Economy in Kharkiv,
- LVIV Polytechnic National University,
- Zhytomyr State Technological University,
- National Transport University,
- Georgian Technical University,
- LEPL Teaching University-Batumi State Maritime Academy.

The aim of the survey was to understand the local conditions and needs and figure out how to deliver the Ph.D. courses in UA&GE considering also the current administrative and academic structure of Local Universities. The contents of the survey are described in Annex 3 and responses are provided in Annex 4.

The survey was programmed with Google Modules and consisted of five main parts including main information, current local situation, current local needs, administrative barriers, skills, or aspects to be included in the Ph.D. curriculum (see Annex 3). The questionnaires were made available in English and spread to the partners with the request to be filled at least by one representative from each university.

4.4 Research needs

Based on the survey held, research needs for UA and GE universities were defined.

Below there is some general information for each topic and question addressed with revealed gaps and problems.

4.4.1 Available courses of Ph.D. in UA and GE universities.

In NTU, NTUA, LPNU there are available Ph.D. courses on “Transport technologies” with main obligatory topics studied as Transport logistics of cities, Modeling of transport systems, Theory of transport flows, Traffic management and control systems.

Problems: there are no Ph.D. courses taught in ZSTU and BSMA, courses in NTU, NTUA, LPNU are taught only in Ukrainian language and contain 60 ECTS.

4.4.2 Entry requirements for students to attend these Ph.D. courses

In NTU, NTUA, LPNU the entry requirements are Master's degree and entry exams.

Problems: in BSMA the internal regulation for Ph.D. program is on the implementation stage, there are no Ph.D. courses taught in ZSTU for Smart Transport technology.

4.4.3 Availability of laboratory activities

In BSMA there is used a simulation software. In NUUE there are used such softwares as Anylogic, PTV Visum, PTV Vissim (from 2021 year). In LPNU are used modern software applications, software systems "Kardiosens", "Neyrokom" to study the physiological properties of the drivers; specialized software products Vissim, Visum manufacturer PTV Vision for research of parameters of transport flows and design of passenger correspondence and public transport routes; MatCad and Statistica for mathematical processing of research results.

Problems: not clear information for NTU. Due to unavailability of "Transport technology" Ph.D course in ZSTU all laboratory activities in transport area are conducted only in "Automobile transport" Ph.D course.

4.4.4 Availability of in-field activities

In NTU there are held several conferences and compulsory teaching practice (6 ECTS).

In NUUE there are held several lectures on topical transport problems of the city, country and private companies, working meetings on transport and logistics problems of the city.

In LPNU such activities are held in a Research Laboratory of the Department "Transport Technologies" and the Traffic Control Center of Lviv Municipal Enterprise "Lvivavtodor".

Problems: not clear information for BSMA. Due to unavailability of "Transport technology" Ph.D course in ZSTU all laboratory activities in transport area are conducted only in "Automobile transport" Ph.D course.

4.4.5 Availability of informatics labs

In NTU there are two available informatics labs:

1. In the Department of Information-Analytical Activity and Information Security with installed modern software (for algorithmic languages and programming environments, database management systems: MS SQL, MySQL, Access; computer graphics and animation systems: Adobe PhotoShop CS, MS Publisher; computer mathematics systems and statistical packages: Mathcad; market infrastructure information support systems: MS Office, MS Outlook; specialized programs: Electronics Work bench, Promt, FosDoc, Kompas 16).
2. In the Department of Information Systems and Technologies a specialized laboratory "Systems of satellite technologies of navigation and telecommunications in transport", equipped with specialized navigation, telecommunications equipment, and software.

In NUUE there are laboratories: of transport research, for ergonomic research, a scientific center "Megapolis", NUUE library, where there are available software and programs (vehicle detector, PTV VISUM software (professional and student versions), AnyLogic software (student version), Software "Ant Logistics", access to open scientific publications (SCOPUS, WoS), software for assessing the psychophysiological characteristics of a person).

LPNU is equipped with the Laboratory of Department of Motor Vehicle Transport "Research of ecological indicators on motor transport".

Problems: not clear information for BSMA. Due to unavailability of "Transport technology" Ph.D course in ZSTU all laboratory activities in transport area are conducted only in "Automobile transport" Ph.D course..

4.4.6 Assessment of a currently implemented research in smart transport and logistics

The average score is 6/10 with the lowest point (5/10) for BSMA and ZSTU, and highest (7/10) NUUE and LPNU.

4.4.7 The most important issues at local level that need to be addressed in terms of research in smart transport and logistics

For NTU the most important issues to be covered with the research program are intelligent methods for managing urban passenger and freight traffic, optimization of traffic flow conditions on city highways through intelligent control methods and study of environmental situations in cities. To solve such a request the university proposes a training of specialists of the required level for solving narrowly focused tasks related to these issues, including the basis of cooperation with European specialists and scientists.

For BSMA the main issue to be developed is a course for Maritime logistics.

For ZSTU the main questions are optimization of the public transport system, solving of traffic problems in the city and studying parking problems.

NUUE requests an improvement in a research of associated with sustainable mobility of the population (low-mobility groups, low-income groups of the population, gender characteristics), optimization of the traffic network load in conditions of high rates of motorization, an increase in the density of development of existing territories and further urbanization. To solve such a request, it is proposed to perform an analysis of the practice of solving such problems, research of the possibility of their application at the local level, and include modeling of transport processes and study of their patterns.

For LPNU it is to be improved the research of capabilities of the existing automated traffic control systems.

4.4.8 The most important issues al local level that need to be addressed in terms of higher education in smart transport and logistics

The most important issue raised for NTU and LPNU is gaining practical experience through internships both on the territory of Ukraine and abroad with the aim to study world scientific approaches and practices. The introduction of special internship programs and inter-university cooperation is foreseen.

BSMA needs to increase the quality of master program and development the module of Maritime Logistics for Maritime Affair Ph.D. program. This issue could be addressed by assessing the markets needs and involvement of Industry representatives.

ZSTU aims to increase the number of students and their engagement in the research work.

NUUE issues to be addressed in terms of higher education is updating the educational program based on advanced research experience, and training of specialists who are proficient in methods and tools for conducting complex research to solve transport and logistics problems of cities and assess the effectiveness of such solutions.

4.4.9 The most important issues al local level that need to be addressed in terms of equipment for supporting research and higher education in smart transport and logistics

All the interviewed universities are in need of the state-of-the-art software (simulations and study of traffic flows, e.g., professional version of PTV VISSIM, professional version of AnyLogic, StatGraphics software), equipment for monitoring and collecting statistical information on the road network and passenger flows.

This need is treated by purchasing a professional versions of software at the expense of the Universities.

4.4.10 The most important road safety fields to be combined and reinforced in terms of improving research

The general tendencies observed for the interviewed universities are:

- Scientific substantiation of methods for safer movement of pedestrians and cyclists in the city,
- Reducing the severity of road accidents
- Safety and Environmental Management Issues
- Traffic management of freight and passenger transport,
- Passive and active safety of vehicles,
- Transport infrastructure aimed at improving the safety of pedestrians and road traffic.

4.4.11 The most relevant administrative barriers at local level of delivering the Ph.D. courses

The barrier is the compliance with regulations and requirements of quality educational enhancement and standards of Higher education. The solution foreseen is to adapt program to national qualification framework.

4.4.12 Skills or aspects to be included in the Ph.D. curriculum to improve the employment opportunities of Ph.D. graduates at local level?

Skills agreed by all the universities are:

- Expertise in modern and targeted software,
- skills in using macro and micro modeling tools of transportation of goods and passengers,
- Solving practical problems and substantiating design solutions in the field of transport systems, technologies, and logistics,
- Knowledge of methods of operational management.

4.4.13 Fields in smart transport and logistics to be you combined in the Ph.D. curricula to improve the employment opportunities at local level of the Ph.D. graduates

The fields to be improved and reinforced scientifically are subdivided to several sections:

- Road safety:
  - development of transport infrastructure, intelligent transport systems, artificial intelligence systems for traffic control,
  - substantiation of requirements for the application of methods and means of automation of traffic control,
  - study of the particularities, problems and their solutions of transportation of goods and passengers in mixed traffic;
- Traffic management:
  - regularities of formation of transport flows and development of the theory and methods for traffic organization systems and their management,
  - identification and substantiation of factors of efficiency of transport systems;
- Logistics:
  - solving complex logistics management issues related to transportation, warehousing, cargo handling, order placement, and inventory.

All the research is envisaged to be carried out using the modern software products and the state-of-the-art scientific activity approaches using the best practices not only within the same country but worldwide.

4.5 Summary of main findings

Out of five inspected universities in Ukraine and Georgia only 3 have the relevant Ph.D. Courses: 2(4)-years courses in NTU, NTUA, LPNU taught only in Ukrainian language containing 60 or 45 ECTS only. No Ph.D. course is taught in ZSTU and BSMA, however the course in BSMA is on the implementation stage. Existing programmes are covering both transport and logistics areas with obligatory topics studied as Transport logistics of cities, Modeling of transport systems, Theory of transport flows, Traffic management and control systems. However, the study programs are to be reinforced and supplemented with Road Safety section (transport infrastructure, ITS in cities, in management and in flow management, AI for traffic control, safety and environmental management

issues), Traffic management (passenger and freight traffic flows management and regulation) and Logistics (Maritime Logistics, warehousing, cargo handling, order placement, and inventory).

To build a sufficient Ph.D. program, universities need to increase the quality of existing programs, update them based on advanced research experience with overall objective to include studies of state-of-the-art world scientific approaches, methods, practices, and tools to conduct a complex research to solve transport and logistics problems of cities and assess the effectiveness of such solutions.

All the interviewed universities are in need of the state-of-the-art software (simulations and study of traffic flows, e.g., professional version of PTV VISSIM, professional version of AnyLogic, StatGraphics software), equipment for monitoring and collecting statistical information on the road network and passenger flows.

All the research is envisaged to be carried out using the modern software products and the state-of-the-art scientific activity approaches using the best practices not only within the same country but worldwide.

5 Fundamentals of the Ph. D course

5.1 Programme overviews

The Ph. D study programme is designed for highly motivated students. The broad spectrum of course contents offer in-depth knowledge in the Smart Transport and Logistics and is aimed to prepare students in the best possible way for a future in research and teaching. The focus areas of study in Smart Transport and Logistics are in the fields of sustainable mobility, road safety, behavior of road users, automation, CCAM, Mobility As A Service (MaaS), Logistics As A Service (LaaS), transport policies, and others. This option of pursuing a focus area of study as part of the programme enables students to gain thorough, scientifically founded qualifications in a specific area.

All courses are to be held in Partner Country's language as well as in English to support the programme's international approach. Each course concentrates on research topics in various fields. A special emphasis is laid on methodical approaches and on research-based courses. In this way students will have access to high-grade, state-of-the-art research knowhow and technology. The Ph.D programme also includes an integrated internship which can be carried out at an external research institution or a private company at home or abroad.

Table 5-1 Programme Overview

Degree	**Doctor of Philosophy in Smart Transport and Logistics**
Programme start	1st semester
Period of study	From 6 semesters to 8 semesters (3/4 study years, depending on University)
Application period	01.06 – 30.07
Admission restrictions	yes
ECTS	120 (**180 Georgia)**
Number of available places	To be defined by each University
Number of Scholarships	To be defined by each University

5.2 Committee

The role of Ph.D. Committee is to provide frequent feedback and advice to the Ph.D. candidate. The Committee shares the responsibility of guiding the student's research to successful completion. Students should not view the committee as obstacles, but rather as additional mentors and possible promoters of their thesis research. When applying for jobs, Committee members are often the first choice for seeking recommendation letters. It is expected that the Ph.D. advisor works closely with the student in determining the most appropriate Committee Members.
Committee members may easily be added or removed during the time from the qualifying exam to the final exam (thesis defense).

The Ph.D. committee must satisfy the requirements imposed by the University:

- There must include three to five people, who are appointed by the head of the institution of higher education (scientific institution). It is fairly common to have more committee members than the minimum of three. This helps to further enhance the quality and visibility of the work);
- At least two and no less than half of the members must be members of the Faculty;
- At least one member must be from outside of the Faculty/Department (it is highly recommended for all students). The outside committee member must have independent publications that occurred after earning their Ph.D. The outside member must have a Ph.D. and does not need to be a university faculty member. For example, this member could belong to an industrial or government research lab. If necessary, teleconferencing technology may be used for any exam. For approval of the outside member, the Faculty/Department require their CV and a brief statement of why they were chosen;
- The members should be chosen fairly and in correspondence to the Gender equality strategy set up by the European Commission (the reference is **Gender Equality Strategy 2020-2025**)

These requirements above are also imposed on the Ph.D. committee for the Final Exam (although the committees may be different).

5.3 Candidate selection process

The procedure of students' selection is oriented to quality and successful study and research fulfilment. Students' selection involves a rigorous evaluation of knowledge, skills, and motivational aspects. The process of selection includes the presentation of the application and an interview (in presence or online (by Skype or similar)) with the candidate where the merits are assessed. Before the interview, the selection committee analyses the Master Degree to assess its validity for the research activities to be performed in Ph.D programme. Based on that, some candidates could be screened out based on the documentation received and the complete fulfilment of the procedure
It is required that all the Partner Countries Universities consider the University Undergraduate Degree of the candidates according to the regulations of the country of each partner University. The list of the documents to be provided for an application are listed in the following section.

In order to assess their English language level, the candidate should take a test (writing and oral) and may be tested either by the Committee. Test should be done in presence or online (by Skype or similar).

It is suggested to be provided documentation of advanced English language skills, minimum level B2 of the Common European Framework of Reference for Languages, documented by either:

- TOEFL-Test (Test of English as a Foreign Language), minimum 90 points (internet based);
- Cambridge First Certificate in English, minimum grade C;
- IELTS (International English Language Testing System), minimum result: band scale 6;
- Successful completion of a courses held in English in a previous study programme;
- Certificate from any language school with corresponding level of English (B2 and higher).

However, the certificate of English language skills is optional.
For the final interview (Qualification Exam), students have to present a proposal (research project) on the chosen research area, planned research activities and outcomes that are foreseen to be implemented during their Ph.D course.

Therefore, the Committee interviews the candidates and carries out the exam to assess previous knowledge and skills related to the discipline, qualification of the candidate, reasons to follow the doctoral program, research and scientific interests of the candidate and his ability to carry out research activities, and the student's proposal.

Afterwards, the Committee establishes a ranking considering the applicant's merits. The Evaluation Scale is presented in the following chapters.

5.4 Candidate curriculum studiorum

Within the application, the candidates should attach the following information:

- Graduation date and grade of the Master's degree;
- Detailed list of exams including completion dates and scores of Masters's degree;
- History of Scholarships, Research Grants (or similar, if any);
- Certificates of Foreign Languages (if any);
- Certificates of participation in post-graduate university courses (if any);
- Certificates of Participation in research groups (if any);
- Certificates of Participation in internships (if any);
- Other University Awards/Degrees (e.g.: awards in competition, second degree, if any);
- Computer skills (list all the competences);
- Publication's list (if any);
- Documentation of work experience (if applicable)

Required documentation to be presented:

- Research project (mandatory)

The project must not exceed the maximum length of 10 pages preferably consist of such chapters as Introduction to the problem, a preliminary literature review, proposed methodology, work plan, and other.

- List of publications

5.5 Evaluation Scale for the Qualification Exam

Qualification, research project and oral exam to be evaluated according to the following criteria:

1. CV and professional titles

University final degree mark, max 5 points (suggested):

Mark		Points
Ukrainian system	Georgian system	
95-100/100	(95-100/100) / A	5
90-95/100	(90-95/100) / A	4
85-90/100	(85-90/100) / B	3
80-85/100	(80-85/100) / B	2
75-80/100	(75-80/100) / C	1
<75/100	(<75/100) / <C	0

Students who have not obtained their title by the application deadline will be evaluated on the average grade resulting from the list of the exams.

2. Scientific Publications

For each publication presented 1 point is assigned, if no publications are available no points are added.

3. Research Experience

Description	Points
Experience abroad (at least 2 months, including Erasmus)	2.5
Collaboration contracts	1
Training courses for researchers	0.5

4. Research Project (max 45 points)

In the research project, the candidate must demonstrate clear abilities to design, organize and develop the scientific research in total autonomy. The full text must not exceed 10 pages. This project could be changed in the future research activity of the winning participants.

Description	Points
Knowledge of the state of the art	10
Innovative aspects of the project	10
Clarity and completeness of the specific objectives, research strategy, attainability	10
Feasibility of the project	10
Relevance of the project to the educational goals of the PhD program	5

5. Interview (max 60 points)

The minimum score of the Qualification and the Research Project for the admission to the oral exam is 40/60. The oral test is intended to deepen the topics presented in the qualification and in the research project.
During the oral test will be deepened and clarified aspects regarding the qualification presented and the project. The scores will be distributed as follows:

- Discussion of research project topics (40 points);
- Discussion of the candidate's background and project: clarity of presentation, capacity for synthesis and scientific interest (10 points);
- Foreign language – English (10 points).

The minimum score to pass the oral exam is 40/60.

The total minimum score for the admission to the Ph. D Course is 80/120.

5.6 Fee particulars

On selection for admission, candidates shall be required to pay the prescribed fee as determined by the University from time to time.
Generally, the fee and deposits have to be paid on or before the stipulated dates regularly every semester, till the successful completion of the program and submission of thesis or cancellation of then admission as is the case maybe. If the fee is not paid by the stipulated due date, and late fee will be levied. Nonpayment of the prescribed fee beyond the extended due date will lead to the cancellation of admission.
However, the regulation of fee payment can be different both within the countries (Ukraine, Georgia) and within individual universities. It is recommended leaving the issue of fee payment for regulation by each university separately, within the framework of the Regulations on the procedure for preparing Ph.D. at each university.
There is a possibility of financing education by the state (budgetary place, state order). The cost of contract education is determined by each university independently.

5.7 Research Supervisors

After the interviews and the selection of candidates, tentative allotment of research scholars to Research Supervisors will be made taking into consideration the preferences of the research scholars and guides with their mutual consent obtained in writing. The list of selected candidates along with their Research Supervisors is forwarded to the Dean (Admissions), after satisfying all the admission procedures. If any candidate did not find a suitable Research Supervisor within the department, he/she can seek for Research Supervisor from within the University. If not, the candidate can appoint a Co-Supervisor from other related Institutions, approved by the University.

Any regular Professor of the University with at least five research publications in refereed journals (SCI/SCI-E/Scopus) and any regular Associate/Assistant Professor of the University with a Ph.D. degree and at least two research publications in refereed journals (SCI/SCI-E/Scopus) may be recognized as Research Supervisor.

In case of topics which are of inter-disciplinary nature where the Department concerned feels that the expertise in the Department has to be supplemented from outside, the Department may appoint a Research Supervisor from the Department itself, who shall be known as the Research Supervisor, and a Co-Supervisor from outside the Department/ Faculty/University on such terms and conditions as may be specified and agreed upon by the consenting Institutions/ Colleges/Industry.

Any change of Research Supervisor(s) under appropriate request, either from the Research Supervisor or from the scholar, the Committee will evaluate the merit of the case and may recommend the approval.

5.8 Course format and requirements

The program lasts 3 years and is divided into three stages (presented in Figure 5-1):

1. During the first year, students take seminars that introduce the major transport questions and methodologies of various fields and that develop their research skills. At the end of the first year, students have to pass the oral exam presenting their work done in the first year and the work plan for the following years and be admitted for the next year.
2. During the second year, students take more specialized seminars that introduce the specific transport questions. During the second year, students have to perform teaching activities of 10 hours of lectures/practical lessons per year totally. At the end of the second year, students have to pass the oral exam presenting their work done and the work plan for last year and be admitted for the next year.
3. During the third year, after passing the examinations by the end of their fourth semester, students start developing their thesis. Students have to perform teaching activities of 10 hours of lectures/practical lessons.

Students have to present in the three-year course of the Ph. D at least:

- bibliometric SSDs - an article in a peer-reviewed journal included in the Web of Science or Scopus databases

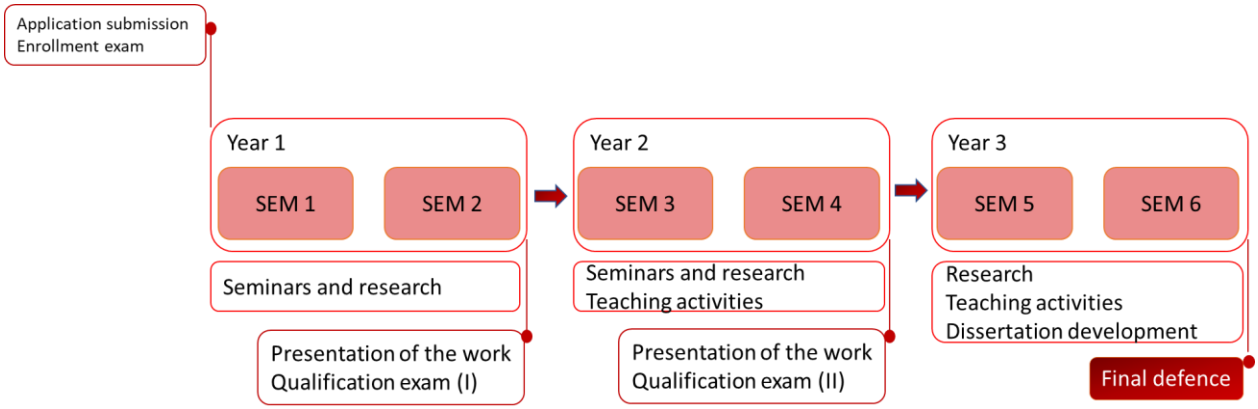

Figure 5-1 Diagram of the course format

Ph. D candidates are to be provided with an adequate research environment that allows them to appropriately carry out their research projects.
The annual report to be presented at the qualification exam includes how the plan set by the head was fulfilled, which disciplines were passed, and which parts of the research work were completed. The timing dedicated to research activities should be no less than 30 ECTS per year. Research activity should be provided throughout the entire training period.

5.9 Proposed course contents and curriculum

The proposal is formulated with the intention of enhancing the training pathway of PhD students, increasingly aimed at a job market not only in the academic field. The proposal might be expanded to include topics ranging from systems for the valorization and management of

research results, the protection of intellectual property, the ethical implications of research, communication in research, knowledge of and participation in European funding programmes, and the introduction of scientific computing tools and Big Data.

Following the experience of Sapienza University of Rome, the teaching activities for PhD students could be subdivided in 4 levels:

1. I level – the seminar is open and is provided for students from several universities (as of the same country as internationally),
2. II level – the seminar is held for all the PhD students at the same university but different programmes,
3. III level – in the seminar the entire doctoral team of the same department participates,
4. IV level – the seminar is held only for PhD for Smart Transport and Logistics course.

Training of I and II levels s the so-called "transversal skills" or "soft skills", it enriches the curriculum of doctoral candidates and fosters greater autonomy and awareness of the tools to support their careers, in line with the principles of the European Charter for Researchers and the European Union policies aimed at enhancing the human capital engaged in research activities. It also enables the development of competences and skills that can be applied in the academic and extra-academic fields, increasing and diversifying post-doctoral career possibilities.

The training activities has to be carried out in English and to be open also to PhD students from other institutions in order to enhance the University's participation in the Alliance with the aim of contributing to create concrete opportunities for knowledge exchange, networking and virtual mobility among National and International Partners.

The transversal training is proposed to take place over 6 weeks in order to allow the widest possible participation of PhD students.
The webinars - which might take place as well online via different platforms - should be recorded in order to allow the training modules to be used and documented for those who have followed the modules.
A certificate of attendance should be issued to PhD students who have attended at least 75% of the hours foreseen for each module.
The training modules (thematic areas) include 8-12 hours of lessons corresponding to 1 CFU and are open to all doctoral students. It is considered to be repeated annually.

The III level teaching activities might be performed to the entire doctoral team of the same department if there are present diverse PhD programmes (e.g., in Sapienza within the same department of Civil Engineering there are courses provided for closely related PhD programs such as courses for transportation and infrastructures, geomatics, railway, urbanistic and other). Courses provided for students in neighboring disciplines can enable them to develop additional skills and knowledge to broaden their horizons and opportunities for further work on their own project.

The university department might offer several types of seminars of IV level for PhD students:

1. Proposed Mandatory Seminars (offer students a broad overview of a field of research, totally 21 ECTS):
    a. Foreign Language (English) in scientific communication;
    b. Methodological bases of scientific research of transport problems ;
    c. Basic concepts and current state of scientific knowledge of transport systems development;
    d. Scientific and methodological bases of conceptual development of transport technologies and systems;
    e. Transport modelling;
    f. Logistics in cities (road, rail, maritime, air);
    g. System analysis of multimodal transport processes for cargo and passengers;
    h. Other.
2. Proposed Elective Seminars (offer students the opportunity to explore a particular theoretical/methodological frame in a perspective of their chosen research area) to be selected 3 courses (totally 9 ECTS):
    a. Mathematical Programming;
    b. Probability Models and Stochastic Processes;
    c. Statistical Analysis;
    d. Ecological transport: decarbonization, alternative fuels;
    e. Autonomous Mobility-on-Demand;
    f. Digitalization in Shipping Operations & maritime and nautical systems;
    g. Sustainability and green thinking in maritime and nautical industry;
    h. Optimization of port, terminal and ship operations;
    i. Simulation and emulation of port, terminal, ship operations and container flow/goods flow;
    j. Managing risks, ships safety and legal regulation.
3. Special Topics Seminars, Colloquiums, Workshops, Thematic Seminars with invited professors and experts (including international possibilities)

Some of the topics to be provided during seminars might include: modeling and simulation approaches for future mobility; discrete choice models and their application to travel choices and driving behavior; predicting traffic congestion; traffic flow models and simulation methods (microscopic, mesoscopic, and macroscopic); automated and connective vehicles in mixed traffic; alternative dynamic traffic assignment methods; and calibration of large scale simulation systems. In addition, the course should cover the most recent developments in modelling, simulation, operations of smart mobility services, and machine learning applications in transportation.

The training program includes educational and scientific components with a total volume of 120 ECTS. The educational component includes compulsory and elective parts with a total volume of at least 30 ECTS. Research activities are provided throughout the entire period of study.

5.10 Proposed learning outcomes, final output that students have to provide to complete the course

5.10.1 Implementation of transversal skills into the curricula

According to the third edition of the World Economic Forum's Future of Jobs Report, which maps the jobs and skills of the future, tracking the pace of change and direction of travel, half of us will need to reskill in the next five years, as the "double-disruption" of the economic impacts of the pandemic and increasing automation transforming jobs takes hold. But the very technological disruption that is transforming jobs can also provide the key to creating them – and help to learn new skills. The Forum estimates that by 2025, 85 million jobs may be displaced by a shift in the division of labour between humans and machines. But even more jobs – 97 million – may emerge that are more adapted to the new division of labour between humans, machines and algorithms.
Therefore, critical thinking and problem-solving top the list of skills that employers believe will grow in prominence in the next five years. But newly emerging this year are skills in self-management such as active learning, resilience, stress tolerance and flexibility.

Figure 5-2 Top 10 skills for 2025. Reference: World Economic Forum

The platform says it could take just one to two months to acquire one of its top 10 mastery skills in emerging professions across people and culture, content writing, and sales and marketing.

It could take two to three months for learners to expand their skills in product development and data and AI. While a four-month learning programme could help people move into roles in cloud and engineering.

Such figures suggest that although learning a new skill set is increasingly accessible through digital technologies, individuals will also need the time and funding to be able to pursue new opportunities, the report notes.

Therefore, current guidelines for Ph.D. fundamentals intend to address skills development for the students enrolled on the program course, which are listed in the next section.

5.10.2 Learning Outcomes

On successful completion of the Ph.D. program, graduates will be able to:

- Demonstrate mastery of knowledge in traffic management systems and transportation engineering and technologies;
- Identify scientific and engineering significances in intelligent smart transportation technologies and smart logistics including computational and analytic models, tools, solutions, and techniques;
- Demonstrate critical thinking and analytical skills that are essential for problem-solving in areas of transportation engineering;
- Conduct, present and publish results of research high-quality original research independently in areas of transportation engineering and technology, provide a substantial scientific contribution to the discipline;
- Translate and transform fundamental research insights effectively in academic fields and industry;
- Apply cross-disciplinary knowledge and skills to enhance the transportation systems and develop new technologies;
- Develop complex problem-solving skills and demonstrate them during all the course and especially final examination;
- Improve their self-management skills such as resilience, stress tolerance and flexibility, time management, active learning strategies, and their leadership competences;
- Being able to present and convey scientific information to the audience. This applies to lectures, scientific conferences, reports in practical classes and during the defense of the final PhD thesis (conciseness of the material, setting tasks, their relevance, consistency and outcome, formulation of conclusions, etc.);
- Being able to logically and consistently present scientific results in presentations (delivering information, structuring content, logical presentation of material, completeness of conclusions, etc.);
- Gain and demonstrate the ability of correct of registration of scientific articles, abstracts of conferences, final PhD thesis (use of abbreviations, choice of key words, writing of annotations, preparation of figures, tables, formulas and references to them, etc.);
- Present a correct use of scientific terminology in the field of research;
- Demonstrate the ability of formulation of the general conclusions on work.

It is suggested to pay attention to planning and modern approaches to conducting experimental research. In particular, it is essential to use new information and communication technologies for obtaining initial data (e.g., from mobile network operators to study the mobility of population) for further transition to computer modeling of urban passenger transport processes. Models of urban transport systems that are being developed or studied should consider the human factor, contemplating the behavior of participants in the transport process in the selected city or region. As the result of this approach, it will be easier to find a customer for a science-intensive product, to implement thesis findings in the real sector of the economy.

5.10.3 Final exam

As was mentioned in the section above, in Semester 2 and 4 students have to present the work done by the Ph.D. students during the last year of the course to the scientific board for the passage to the following year.
For Ph. D. students of the 3rd year, it is mandatory to pass the Final exam. The Final Exam represents the last significant opportunity for the Ph.D. Committee to ask questions and provide comments on the thesis work. It also serves to disseminate the work to the public (including faculty, students, colleagues, friends, and family). In many ways it represents a celebration of the completion of the work. Unlike the Preliminary Exam, which is closed, the Final Exam is open to the public and announced along with other public seminars.

The deadlines are proposed further:

- By the end of Semester 6 (dates to be set up by university) students have to deliver the final thesis version to reviewers (the mode of delivery to be managed by university),
- Within 1 month after (dates to be set up by university), the process of formalization by reviewers of their own judgment has to be completed to allow the admission to the final examination and discussion of the thesis or postponement up to a maximum of 6 months from that date;
- Within 2 weeks after (dates to be set up by university), presentation of the work done by the PhD students during the 3 years of the course to the scientific board for admission to the final exam has to be provided to the Committee;
- Within 2 weeks after (dates to be set up by university), the final deadline for the final exam for the degree of Ph.D. with an internal Committee and a commission external to the PhD scientific board.

The defense itself usually proceeds as follows:

- a few minutes of private discussion by the committee;
- a public presentation presented by the Ph.D. candidate, typically lasting up to 30 minutes;
- questions from the committee, in front of the public;
- questions from the public (if any);
- private discussion by the committee;
- outcome decided and announced to the candidate.

5.10.4 Requirements for Ph. D thesis

During the seminar, the presentation must cover the following aspects:

1. Objectives and scope of the study
2. Literature survey
3. Identification of the research gaps based on literature review
4. Problem formulation
5. Research methodology

6. Experimentation/ Data collection/Analysis General conclusions
7. Specific contributions and conclusions
8. Details of publications in journals and conferences
9. Further scope of research
10. References

The presentation should mainly concentrate on the candidate's work/contribution. The suggestions given during the seminar may be appropriately taken up in consultation with the guide.
In case of any malpractice such as plagiarism etc. are reported/ observed and proved, then the Committee shall recommend that the thesis submitted for the award of Ph. D degree shall be forfeited and his/her research registration shall be terminated. He/ She shall be debarred to register for any other program in the University. Also, the recognition of his/her guide shall be withdrawn for a period of five years and the guide and co-guide (if any) shall be debarred from guiding the research scholars for any research program in University till such period.

Notwithstanding anything mentioned in the above said rules and regulations, the University Research Board reserves the right to modify any part or all of the above said regulations from time to time.

5.11 Risks and limitations

In the academic field research is categorized into in two categories:

- Minimal risk; or
- Greater than minimal risk

Researchers are responsible for identifying any possible risks of the research and minimizing risks to subjects whenever possible.
Therefore, the following process of identification and mitigation of potential risks should be carried out during all the period of the course:

1. Identification – This process includes the listing of all potential risks involved in the project and logging them into an organized format based on the discipline affected by the potential risk.
2. Assessment – This process is used to determine the probability and potential impact that the identified risk may have on the project.
3. Mitigating strategy – This process involves the strategy necessary to correct the potential risk.
4. Monitoring and control – This is the process that tracks the progress of the potential risk and implements the prescribed control procedures to mitigate the identified risk.

Below in the Table 5-1 there are shown actions to mitigate the consequences of potential risk.

Table 5-1 Risk management

Risk	Context	Mitigation action
Risks associated with students		
Communication problems between students and teachers	Teachers fail to create engaging lessons and struggle to connect with their students on a one-to-one basis. Students also have unaddressed language or speech difficulties which lead to poor communication. Personality differences and peer pressure add to the mix, making some classroom interactions feel awkward or forced.	Encourage the talk, talk about positive aspects of learning (including what was good about good work). Persuade students that communication is helpful to their learning. Help students to develop productive ways both of asking for help and responding to help that was given. Disentangle the underlying message in communication from students and avoid making unwarranted assumptions about the motives behind their queries.
Illness and social problems, anxiety, stresses	Extreme fatigue, high levels of stress which are strongly correlated with psychological health, relationships with family members, mood, and need for learning accommodations.	Provide a tool to collect feedback from the students, an open communication to know how they are emotionally and make decisions based on their mental health and capacity during confinement. When developing a schedule and setting a classwork pace, teachers should build in some time to check their students' status and motivate them to share their concerns.
Motivation level low	Students with a low EI constantly compare themselves with their peers and fear the mockery or criticism to which they can be subject because of mistakes they may make while speaking	Teachers try to create a secure environment in which students feel confident, prevent any mockery immediately, and use classroom activities to reduce students' anxiety and increase their self-confidence.
Scheduling/time management problems	Students are: 1. failing to prioritize their tasks, 2. ineffectively schedule their activities, 3. procrastinating, 4. failing to manage distractions, 5. multitasking, 6. perfectionism, 7. skipping breaks 8. Undervaluing the time something will take to finish	1. Use the tools like Action Priority Matrix or Google Keep can help prioritize and maintain a stable productivity level, 2. find out what the peak time is and allocate that time for doing top-priority work instead of spreading it on completing some less important, repetitive tasks. 3. Use several techniques, breaking the task into several manageable pieces. 4. Turn off all the notifications, schedule time free from interruptions, and minimize the time to be spent on things that don't have much impact on work. 5. forget about multitasking and focus on one task at a time. This will help to produce high-quality work and give a sense of completion. 6. Try to prioritize and manage the time. 7. step away and do something not related to the job—eat, go for a quick walk, exercise, or simply do nothing and relax. This should help to clear your thoughts and gain more psychological energy for the work to come. 8. Write down the amount of time that is needed to complete each one of the tasks on your to-do list. It is also recommended doubling that time.
Lack of required knowledge	Students may lack the background knowledge to fully comprehend tasks.	Teachers should contact students and vice versa in case something is unclear to provide more materials and support.

Unclear requirements	Students may receive unclear requirements for their tasks, exams, and other activities	Identifying the causes of poor quality of reportable information and documentation, a clear setting of responsible persons for its filing, double-contact and be available for any clarifications and support
Lack of resources	Students lack adequate resources (especially for remote learning), study reveals, materials, books, lecture slides and other documentation	Provide to the students access to all the teaching materials available and support them in finding and obtaining any lacking documentation
Privacy concerns	Unwanted reveal of private data, confidential information	Assure that all the private communication between students and teachers, ideas, drafts of the work are protected, held in confidence and not shared with third parties but only with necessary parties such as parents, other teachers, and administrators. Finally, teachers have to keep student data both private and confidential by establishing clear security practices in their classrooms.
Economic harm	Lack of economic resources to continue following the programme	Students should consider any costs they would have to bear in order to participate in the study such as travel, food, etc. Students should be made aware of the amount of time it will take to participate in a study, particularly if it is time that they would spend away from their employment. Payment can be made to compensate for time and other expenses that the participant may incur.
Risk associated with programme establishment		
Lack of teaching materials and other documentation	Lack of instructional materials such as syllabi and textbooks to use during teaching, non-availability of materials, laziness of the teachers, lack of skill and strategies,	Plan the teaching activities, collect all the data needed in advance, have briefings with other teachers, use different techniques to promote teaching activities.
Unclear criteria of assessment of students	No criteria, vague criteria	Set up adequate assessment standards, find out criteria and their descriptions, inform students on the assessment procedure accordingly

5.12 Students evaluation

All Ph.D students in the department are to be evaluated by their coordinator (tutor/supervisor) and Committee for good standing at the end of each academic year. The evaluation process should serve as an opportunity to offer constructive advice. However, students found to not be in good standing are at risk of loss of funding and dismissal from the program.

For students, the following rules shall apply:

- **First-year and second-year examination**. The Committee will provide grades and feedback on the student's exam performance for the evaluation. For any student whose performance is marginal or fails according to at least one Committee member, the relevant member(s) of the examination Committee, in consultation with the doctoral coordinator, will determine remediation activities, which may range from some form of remedial work to a re-take of the specific exam. Re-takes are subject to the same

time constraints as the original exam. At the end of the re-examination or remediation period, the relevant members of the Committee will again assess the student and provide feedback for the evaluation. Any student who the Committee unanimously declares to have passed the exam and who has maintained the required grade standard will be deemed to have met the academic standard for continuation in the program. Should grade or exam performance be marginal or unacceptable, the Committee will jointly decide, following a simple majority voting rule, whether to dismiss the student from the program or to establish additional remedial work. This vote will also take into consideration feedback from the student's first-year research supervisor as well as written feedback from any other faculty members who have significant information concerning the student's progress. In the event of a tied vote, the doctoral coordinator will cast the deciding vote.

- **Final examination**. All course requirements must be fulfilled with no incompletes of any type on record. The Committee will review the performance of any student who has not met these considerations and decide, following a simple majority voting rule, whether to retain or dismiss the student. The Committee will solicit input from faculty serving as advisors or readers for the second-year paper, from other faculty involved with the student in collaborative research, and faculty instructors for any classes taken during the third year, as well as information from the first- and second-year evaluations. In the event of a tied vote, the doctoral coordinator shall cast the deciding vote.

The evaluation scale to be applied for the examinations might be the same as the evaluation Scale for the Qualification Exam described in Chapter 6.4.

5.13 Quality Assurance Process

Quality Assurance (QA) involves the systematic review of educational provision to maintain and improve its quality, equity and efficiency. It encompasses school self-evaluation, external evaluation (including inspection), the evaluation of teachers and school leaders, and student assessments.

The faculty/HEIs offering the structured doctoral programme has to pass regulations documenting the rights and duties of the doctoral candidates as well as relevant organizational arrangements. The faculty should collect data related to individual progression, net research time, completion rate, dissemination of research results, and career tracking and use this data to continuously assess the quality of the structured doctoral programme.

Necessary documentation has to be provided:

- Regulations and Guidelines for structured Ph. D programme;
- Internal regulations about quality management (quality assurance regulation etc.);
- Sample information material about the quality management and its results which the higher education institution regularly uses for its internal and external communication (e.g. link to specific web pages, reports, flyer)
- Quantitative and qualitative statistical data from evaluations, study progression statistics, number of graduates etc.

Therefore, the QA Process might include:

- Setting up the basic elements for the internal quality assurance cycle: plan, do, check and act.
- Describing the controls for each element of the quality assurance system as to "what", "when", "where", "who", and "how" the service, which can be audited, is being implemented.
- Implementing and setting out key features of the internal QA system based on the University's strategic approach to quality management.
- Defining quality & standards framework for academic as well as for administration activities and services.
- Evaluating and assessing academic standards, quality of learning opportunities, research & scholarly activities, community involvement, and effectiveness of quality management.
- Monitoring periodically educational resources, teaching methods, course evaluation, and student's assessment.
- Conducting quality activities aiming at improvement.
- Using certain parameters to measure the level of compliance with predefined standards, in order to demonstrate, assure and develop quality of education.

There are several ways of gathering information to access the QA objectives. The following tools show how internal evaluation can be performed:

- Observations & participations: during the partners' or monitoring meetings etc.
- Questionnaires: efficient and strong on confidentiality or anonymity, which brings the advantages of quantitative tools: it is easy to gather a lot of data at once and easy to objectively evaluations and prepare conclusions.
- Documentation and evaluation reports: project documentation represents the subject to evaluate and the evaluation product as well. Interim and final internal evaluation reports are mandatory and important outcomes of the project.
- Public activities & feedback analyses: meeting or contacting the stakeholders or public represent the unique opportunity to gather the external view and feedback on project content and its aims.
- Surveys and questionnaires: can identify what should be changed, altered, maintained, improved, or expanded.
- Capstone Projects: integrates knowledge, concepts, and skills that students are to have acquired during the course of their study. Capstones provide a means to assess student achievement across a discipline.
- Entrance/Exit Interviews for students and academics: Interviews are conducted with students when they enter a course and when they leave. These interviews can be used to learn about students' perceptions, gather feedback, on various college services, activities, etc.
- SWOT Analysis: a facilitated analysis of the internal strengths & weaknesses of the course, program, department as well as the external threats & opportunities.
- Syllabus Review: reviewing a syllabus involves determining if the course is meeting the goals and outcomes that have been established.

Based on the tools developed for QA, the main areas for the Quality Assessment Process might be the following sections.

Module specifications
The Ph. D programme is to be delivered in modules for which a module specification will need to be submitted to the Quality Board (Committee) for review. For each module the specification will include aims and objectives, intended learning outcomes, method of delivery, assessment and feedback criteria, student contact time.
Tool: module specification is to be provided according to a scheduled timetable by filling out the questionnaires.

Student assessments and Feedback
Student assessment is an on-going cycle through which staff design, set, mark, engage in dialogue about performance, review and develop assessments. Assessment should provide the students with an assessment of current learning and future learning needs and for the teachers it should provide an assessment of achievement against intended learning outcomes. The achievement of intended learning outcomes will contribute to marking and grading students for the award of Ph. D in Smart Transport and Logistics. The language used for setting any student assessments should be commensurate with level knowledge attainment and deep learning, for example 'evaluate' and 'critically analyse'. Furthermore the degree-awarding body should have clear marking and guideline schedules that are transparent to students and teachers to ensure standards are adhered to.
Student feedback is necessary to maintain the relevance and teaching standards of the Ph. D programme. Feedback given to students needs to be developmental throughout the course allowing for progressive learning to take place. Feedback from the students to be obtained at the end of the academic years (summative). The formative feedback will enable the Quality Board (Committee) to assess how the delivery of the course is perceived by the students on a modular basis and also it will be an opportunity to recommend alterations if necessary particularly if learning outcomes are not being met at that stage. A summative evaluation of the whole course will be obtained at the end of the academic years to review the course as a whole and identify any gaps for the following year.
Tool: Students' feedback is to be provided according to a scheduled timetable by filling out the questionnaires.

Delivery of the programme
An observation of lectures will be made by visiting academics from the Quality Board during the programmes. The aim of the observations is to ensure educational standards of teaching are maintained and students are engaged with the subject.
Tool: a peer review observation report.

Student reports and course evaluation
There will be an emphasis at this stage on assessing the knowledge attained by the Ph. D students to ensure a Level 7 standard has been reached across the Universities in accordance with FQ-EHEA. This will entail reviewing the students reports to ensure that key assessment criteria have been met and also that the students have attained a specific set of masters graduate characteristics listed below:

- Subject / specific attributes

1. In-depth knowledge and understanding of the discipline informed by current scholarship and research, including a critical awareness of current issues and developments in the subject.
2. The ability to complete a research project in the subject which may include a critical review of existing literature of other relevant scholarly outputs

- Generic attributes (including skills relevant to an employment setting)

1. Use initiative and take responsibility
2. Solve problems in creative and innovative ways
3. Make decisions in challenging situations
4. Continue to learn independently and to develop professionally
5. Communicate effectively, with colleagues and a wider audience in a variety of media.

Tool: a questionnaire fulfilled by academics assessing students' reports.

Local University examination boards

To assist the Quality Board with the review of the programme and its contents it is needed to know what the processes and dates are at each University for programme approval, examination moderation and examination board procedures. The other key area for quality assessment is ensuring the teachers are current in their knowledge consequently the Universities will need to provide some evidence that teaching skills are up to date to maintain standards.

Tool: assessment of teachers' skills is to be done according to a Report to the European Commission on improving the quality of teaching and learning in Europe's higher education institutions.

5.14 Guidelines to support an involvement of Industry and Society

According to literature, the perceived barriers to firms recruiting Ph.D. qualified candidates are frequently cited as being lack of commercial awareness, being too specialised and their difficulty in adapting to non-academic settings (McCarthy and Simon 2006). This has in turn led to lower employability and lower starting salaries for Ph.D. graduates due to the amount of additional training in transferable skills required for new employees. Enterprise training would clearly be of help to these researchers who will eventually seek employment in the commercial world.

Therefore, it is highlighted the need for a radical increase in the involvement of industry at national and local levels in engineering education to ensure that the degrees are fit for the future, meeting the needs of industry and the expectations of students. The need to supplement the study with practical, workable suggestions for universities, industry and professional engineering institutions is raised to help them deliver and benefit from effective industrial engagement.

Common ways that industry is involved in the delivery of engineering education in universities are:

1. Visiting professorships/visiting teaching fellowships.

2. Sponsored competitions - A popular and well-established approach to industrial engagement in engineering education is for companies to get involved in engineering-themed student competitions
3. Ad-hoc lectures or participation in projects by industrialists — these arrangements often arise from requests from academics through their personal networks.
4. Engineering societies in universities.
5. Young Members' groups within professional engineering institution.
6. Work placements — both as a structured part of the programme or arranged on a more ad-hoc basis.
7. Industrial mentors — these can be either long-term relationships that operate over several years, or short-term relationships set up in support of a particular module or design project.
8. Provision of free or discounted educational materials.
9. Provision of free or discounted engineering software or equipment.
10. Sponsorship and bursaries.
11. Provision of free or discounted memberships of professional institutions.
12. Site visits — for example to construction sites or factories.
13. Participation in department or faculty industrial advisory boards.
14. Student prizes — for example, in support of academic merit.
15. Careers fair and recruitment talks.

To foster relationships between industry and academia there could be held several activities:

1. Promote networking — Hold events designed to provide opportunities for academics and industrialists to meet. These events could be specifically focused on opportunities for educational collaboration, or they could have a more free-form agenda. Consider facilitating events that aim to link up staff at similar stages in their careers.
2. Build a campaign — To help build momentum, staff motivation and funding, build a campaign to illustrate to industry the benefits of industrial engagement in education. Make celebrating the success stories part of that campaign. Use newsletters and social media channels to help raise awareness of new and existing initiatives. Offer regular prizes that recognise the contributions of individuals and organisations.
3. Make the most of student membership — Student membership of University research group in itself can play an important part in preparing students for industry because it can make students feel part of a community of practice and expose them to role models who may demonstrate the professional behaviour that industry wants them to aspire to. In addition, once students are involved with research groups, they can play an important role in seeding new ideas and relationships that will grow over time. Providing strong support for graduate and student groups and networks of academic liaison staff will also help to build and maintain active student membership.
4. Enhance the network — University research groups are often the hub of industrial engagement networks. These networks often consist of dozens of direct relationships between industrialists, academics and students brought together through the institution. The first priority should be growing, training and motivating their networks of liaison officers, both in industry and academia. An important area of training should be in social media, where many of the new connections and networks are being formed and awareness of these networks is patchy, often relying on bilateral relationships.

University research groups should take steps to learn about and harness the vast potential social capital that they have through their members. Pay attention to managing and keeping motivated networks of liaison officers in all universities and important employers, and harness more informal links through active use of social media.

5. Link industrial liaison to accreditation and qualification — one way to encourage engagement between industry and universities that some Universities already use is to recognise this sort of activity in qualifications for individuals (such as professional qualification or fellowship) and in accreditation for teaching institutions.
6. Link experience to chartership — encourage student motivation to seek out work experience and work placements by highlighting to them the contribution it can make towards achieving professional registration.

Industrial engagement in engineering education tends to be based on linkages at a personal level rather than at an organisational or institutional level. Increasing the number of industrial engagement initiatives in engineering education will inevitably increase the number of direct linkages. Usually, it is not expected to be able to coordinate all this activity at the scale of individual initiatives but professional engineering institutions (universities) should provide more high-level coordination.

In practice, it is important to coordinate the activities of visiting professors (VPs). There are hundreds of visiting professors appointed from industry to academic institutions. Since VPs are usually senior personnel from industry, and they tend to liaise with senior members of teaching staff, VPs are perhaps the most obvious vector for influencing industrial engagement. To this end, University should:

- Identify VPs in their sector and what their activities are.
- Identify appropriate themes for programmes of activity linked to availability of funding.
- Establish new VPs programmes as necessary to address themes not currently covered.
- Establish communities of practice in which best practice can be shared, perhaps involving an annual conference.
- Run an annual conference — This conference would be exclusively dedicated to industrial engagement in education, helping to set the agenda, identifying key issues, promoting best practice, signposting resources and celebrating participation.
- Offer training for engagement.
- Audit – University could conduct an audit of industrial engagement initiatives to help identify best practice, opportunities for wider collaboration, and places where further support or funding is needed.
- Coordinate development of e-learning resources — e-learning resources are one of the most effective ways to achieve high impact in industrial engagement because of the experience-led learning outcomes that can be addressed and the high dissemination levels that can be achieved.

Therefore, making strategic use of academics' and industrialists' time is important for overcoming several of the challenges identified at the start of this guide: staff availability; different approaches to accounting for time; limited funding; and the difficulty for industrialists to commit a long way in advance to timetabling requirements.

In practice:

- Appoint an administrator — Universities should consider appointing an administrator whose role it is to manage and coordinate the activities of industrialists coming into the engineering department. Doing so takes the burden of coordination off academic staff and helps to ensure that all participants have the information that they need in a timely fashion. An administrator would be in a good position to promote activity, share good practice and keep looking for opportunities for new collaborations.
- Involve industrialists in curriculum design — If senior academics' and senior industrialists' time is limited, then perhaps the most effective forum for their engagement is in curriculum setting, as this is where their input is likely to have the greatest impact.
- Avoid detailed assessment — Getting industrialists involved in detailed assessment of student work is not an effective use of their time, nor do they necessarily have the appropriate skills or experience of teaching to make them good assessors. Alternatives are to use automated tools for formative assessment, such as multiple choice quizzes, and to use a simple traffic light system where summative assessment of project work is needed.
- Support design projects and project-based learning — Another place where industrialists can have a high level of impact is in the setting of briefs for design projects or setting the parameters in project-based learning. Even if industrialists are not able to be fully involved in the subsequent facilitation of these activities, their involvement at the start can help to make sure the activity is relevant and well-tuned to real practice.
- Bridge the gap with technology — When face-to-face contact is not possible, either because the industrialists are based too far away, or because timetables and calendars can't be aligned, use online technologies such as Skype or webinars to bridge the gap.

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Annex 1 World Ph.D. courses overview

N	1
Name	Transport Studies (Research)
Institution	University of Leeds
Link	
Duration	3 years
Areas of research	network modelling; transport and environment; economics and behavioural modelling; transport policy and safety; urban and inter-urban transport; air transport; behavioural aspects of transport; network models; economic appraisal and assessment of schemes; planning, policy and organisational issues; traffic management; information systems; accident analysis; road safety; transport economics; demand forecasting; transport regulation; policy studies; environmental impacts; social aspects of transport; statistical modelling, analysis and forecasting of transport data.
Entry requirements	

N	2
Name	The Ph.D. Course in Infrastructures and Transport
Institution	Sapienza University of Rome
Link	https://Ph.D. .uniroma1.it/web/concorso36.aspx?i=3508&l=EN
Duration	3 years
Areas of research	Therefore, scientific and educational objectives of the Curriculum “Infrastructures, transport systems and geomatics” are: - advanced design and construction methods for transportation infrastructures, especially regarding construction processes and integrated design procedures, with the aim to ensure the increase of safety and the preservation of

	environment, the measure of economic or financial resources employable and retractable. - construction materials recycling and re-use, by means of the analysis of mechanical and ecological characteristics of waste products.The curriculum in “Transport and land-use planning” includes the following lines of research: - design of transport networks - design of transport systems and their components - transport demand modelling - simulation of transport networks - integration of land use and transportation planning - integrated planning of transport systems and public space - transport networks for environmental and landscape quality - policies, plans, and assessment tools for transport and land use planning - territorial analysis, according to methodologies and geomatics techniques that, through the acquisition, management (modeling and analysis) and dissemination of territorial information, allowing study of the territory in the design and service phases of civil infrastructures and monitoring their impact. - environmental sustainability of infrastructures, especially referred to hydro-geological problems, with the aim to recognize – also in advance – interactions between territory and transportation networks.
Entry requirements	Graduation date and grade of the Master's degree detailed list of exams including completion dates and scores of Masters's degree History of Scholarships, Research Grants (or similar) Certificates of Foreign Languages (ENGLISH) Certificates of participation in post-graduate university courses certificates of Participation in research groups certificates of Participation in internships Other University Awards/Degrees (e.g.: awards in competition, second degree) Computer skills Publications list

N	3
Name	Ph.D. Position in Transportation and Logistics
Institution	Tallinn University of Technology, Estonia
Link	https://taltech.glowbase.com/positions/147
Duration	4 year
Areas of research	Doctoral research aims to study possibilities of integration of the motor freight transport concerning the compatibility options of other modes of transportation in Estonia mostly. Sample scenarios, as a result, will be produced for monitoring the implementation of the Estonian transport policy and transport development plan shortly. Following aspects as mobility; optimization of the capacity and use of cargo spaces; seaports; smart solutions; and the last mile are considered. Sea transport, rail and air transport developments have been included in the evaluation of scenarios, where possible, as well as developments concerning Rail Baltic.
Entry requirements	candidates with a wide range of backgrounds in logistics and transportation, both with practical and project related (research) competences. High level of motivation towards developing transportation systems on a regional level with the tight focus on carrying out the results in practice as well as a deep understanding of optimization methods used in transportation is required.

N	4
Name	Ph.D. scholarship in Transport Network Modelling
Institution	Technical University of Denmark, Denmark

Link	https://scholarshipdb.net/scholarships-in-Denmark/Ph-D-Scholarship-In-Transport-Network-Modelling-Technical-University-Of-Denmark=HYDKBecH6xGUXgAlkGUTnw.html
Duration	3 years
Areas of research	The research topics you may investigate include the following Empirical analysis of data: Exploration and statistical analysis of a Big Data set stemming from GPS units, investigating the route choice preferences of travellers and possible network characteristics of routes chosen/not chosen Theoretical models of behaviour: Development of consistent theoretical model exploiting the insights gained from the empirical analysis, e.g. limiting the set of considered routes due to criteria on detours Algorithms for large-scale network applications: Devise solution algorithms that can solve large-scale networks within reasonable computation time, facilitated by consistently reducing the complex network to a limited set of considered alternatives Real-life application: Implement algorithms on large-scale case, perform calibration and validation using Big Data set of GPS observations.
Entry requirements	Candidates should have A MSc degree (120 ECTS points) in Transportation Modelling or Engineering, Computer Science, Applied Mathematics and Statistics, Computer Science, Behavioural or Experimental Economics, or related Good programming capabilities in at least one language such as Matlab, Java or Python Transportation Modelling disciplines in the education background is favoured The following soft skills are also important Curiosity and interest about how transportation networks operate and perform Good communication skills in English, both written and orally Willingness to engage in group-work with a multi-national team

N	5
Name	Ph.D fellowship in Sustainable Urban Mobility
Institution	University of Stavanger, Norway
Link	https://scholarshipdb.net/scholarships-in-Norway/Ph-D-Fellowship-In-Sustainable-Urban-Mobility-University-Of-Stavanger=LiUxZYQE6xGUXgAlkGUTnw.html
Duration	3 years

Areas of research	The selected applicants will be conducting research within sustainable urban mobility. Urban mobility is currently undergoing several revolutions, e.g. the electrification and automation of vehicular transport, “green” transportation, increase of shared mobility and micro mobility, Mobility As A Service (MAAS), promoting active travel and walkability, and a stronger focus of environmental sustainability and social equality and justice. This research project attempts to exploreoffers a range of complex challenges for urban planners, policy makers and mobility providers when trying to accomplish sustainable urban mobility. The Ph.D. project may investigate effects and consequences of these transport developments, as well as perceptions of and attitudes of current urban traffic environments and urban mobilities. Possible research topics could be, but are not limited to: the relationship between the urban environment and modes of travel the relationships between perceptions and attitudes of urban mobility and travel behaviour the effects of sustainable transport policy (on travel mode change) the effects of micro-mobility (on the physical urban environment) the introduction of new mobilities and their consequences for cities recent innovations on urban transport policy and technology and how those may contribute to sustainable urban mobility

Entry requirements	applicants with a strong academic background who have completed a five-year master degree (3+2) within spatial or urbanplanning or transport planning/ -engineering. If you have relevant experience in mobility, a master's degree within architecture, or human geography or environmental psychology or equivalent may be relevant. Your education must provide a basis for successfully completing a doctorate and must preferably be acquired recently. Work experience in transport and mobility will be emphasized. Requirements for competence in English A good proficiency in English is required for anyone attending the Ph.D. program. International applicants must document this by taking one of the following tests with the following results: TOEFL – Test of English as a Foreign Language, Internet-Based Test (IBT). Minimum result: 90 IELTS – International English Language Testing Service. Minimum result: 6.5 Certificate in Advanced English (CAE) og Certificate of Proficiency in English (CPE) from the University of Cambridge PTE Academic – Pearson Test of English Academic. Minimum result: 62 The following applicants are exempt from the above requirements: Applicants with one year of completed university studies in Australia, Canada, Ireland, New Zealand, United Kingdom, USA Applicants with an International Baccalaureate (IB) diploma Applicants with a completed bachelor's and / or master's degrees taught in English in a EU/EEA country To be eligible for admission to the doctoral programmes at the University of Stavanger both the grade for your master's thesis and the weighted average grade of your master's degree must individually be equivalent to or better than a B grade.

N	6
Name	Ph.D. in Intelligent Transportation
Institution	The Hong Kong University of Science and Technology
Link	https://www.Ph.D. studies.com//Ph.D. -in-Intelligent-Transportation/Hong-Kong/HKUST/
Duration	3-4 years
Areas of research	The Doctor of Philosophy (Ph.D.) Program in Intelligent Transportation aims to provide a well-rounded education as well as rigorous research training to prepare students to become versatile and knowledgeable professionals in intelligent transportation engineering and technologies. Areas of research may include computational modeling, floating car / floating cellular data, inductive loop/video vehicle/Bluetooth detection, information fusion from multiple traffic sensing modalities, collision avoidance systems, safety and security of the unmanned aerial vehicle, green aviation technologies, public transportation systems such as railway systems, connected vehicles (CV), autonomous vehicles (AV), and shared mobility.
Entry requirements	i. General Admission Requirements of the University Applicants seeking admission to a doctoral degree program should have obtained a bachelor's degree with a proven record of outstanding performance from a recognized institution; or presented evidence of satisfactory work at the postgraduate level on a full-time basis for at least one year, or on a part-time basis for at least two years. ii. English Language Admission Requirements TOEFL-iBT: 80* TOEFL-pBT: 550 TOEFL-Revised paper-delivered test: 60 (total scores for Reading, Listening and Writing sections) IELTS (Academic Module): Overall score: 6.5 and All sub-score: 5.5 * refers to the total score in one single attempt Applicants are not required to present TOEFL or IELTS score if: their first language is English, or they obtained the bachelor's degree (or equivalent) from an institution where the medium of instruction was English.

N	7
Name	Ph.D. in Transportation Program
Institution	New Jersey Institution of Technology
Link	https://civil.njit.edu/Ph.D. -transportation-program
Duration	
Areas of research	
Entry requirements	Students should have adequate preparation in mathematical and other analytical techniques, and substantial knowledge of the ideas and techniques of synthesis. A thorough understanding of the social and economic factors intrinsic to the functioning and development of transport in urban areas also is necessary. It is expected that students will have earned a minimum GPA of 3.5 in a master's degree program in engineering, planning, or business administration from an accredited university. Outstanding students with baccalaureate degrees also may be accepted. All applicants must take the GRE. All international students must also achieve a minimum TOEFL score of 550 for the paper-based exam. or a minimum score of 6.5 with no sub-score lower than 6.0 for the IELTS exam. Full-time study is preferred for doctoral studies.

N	8
Name	Ph.D. Positionsin Institute of Transport and Logistics Studies at University of Sydney in Australia
Institution	Institute of Transport and Logistics Studies at University of Sydney in Australia
Link	https://scholarship-positions.com/2013-Ph.D. -scholarships-in-institute-of-transport-and-logistics-studies-at-university-of-sydney-in-australia/2013/01/29/
Duration	3 years

Areas of research	Transportation professionals function in very complex environments characterized by ever-going changes in technological, regulatory, and legal frameworks. Transportation engineers plan, design, construct, operate, and improve transportation systems and infrastructure, focusing on elevating safety, mobility, and level of service associated with all modes of transportation. This program offers a well-balanced mixture of theoretical studies and experimental research. A student must demonstrate creative thinking, self-motivation, and ability to do independent research. In their research, students are expected to deal with complex issues, effectively formulate difficult problems, devise new methodology, and achieve new and exceptional results.
Entry requirements	Although any disciplinary background is in principle acceptable for either scholarship, we encourage applications from graduates in economics, econometrics, operations research, mathematics, engineering, physics or geography. It is expected that applicants will have strong quantitative skills in their respective discipline areas. Successful applicants for both scholarships must have good written and oral communication skills. There will be opportunities to assist in tutorial work with graduate students. The logistics and supply chain scholarship is for a research student interested in freight modeling and supply chains, with a specific focus on organisational structures and processes. It is essential that the recipient has skills in areas such as statistical modeling, and is interested in developing a background in logistics, discrete choice techniques or a cognate field as well as a demonstrated interest in case study, interviewing or survey methodologies.

N	9
Name	Transportation Planning and Engineering Ph.D. Program
Institution	NYU Shanghai is China's first Sino-US research university and the third degree-granting campus of the NYU Global Network. We were founded in 2012 by New York University and East China Normal University with the support of the city of Shanghai and the district of Pudong.
Link	https://shanghai.nyu.edu/academics/graduate/transportation-planning-and-engineering-Ph.D. -program
Duration	4-5 years

Areas of research	The Ph.D. program in Transportation Planning and Engineering pairs students with world experts in apprenticeships to solving real problems facing society. You can become researchers within the Connected Cities for Smart Mobility toward Accessible and Resilient Transportation (C2SMART) in the Tandon School of Engineering, where you get to work closely with researchers from other disciplines to conduct basic and applied research funded by the National Science Foundation, U.S. DOT, and other agencies.
Entry requirements	To be eligible for consideration to any Tandon MS or Ph.D. program, you must hold a Bachelor's degree from an accredited institution, which includes a minimum of four years of full-time study. Bachelor of Engineering degrees (based on 180+ ECTS credits) may also be considered. All applicants to the NYU Tandon School of Engineering for graduate study must demonstrate excellent English language skills in reading, writing, speaking, and comprehension. Proficiency will be determined by the Test of English as a Foreign Language (TOEFL)*, International English Language Testing System (IELTS), Cambridge English: Advanced (CAE), or Pearson PTE Academic exams. You must submit your English language proficiency scores electronically via the testing agency.

N	10
Name	Ph.D. Position in Intelligent Transportation Systems at the Chair Sustainable Transport Logistics 4.0
Institution	Johannes Kepler University Linz Austria
Link	https://euraxess.ec.europa.eu/jobs/362562
Duration	
Areas of research	Our research and teaching activities focus on the development of applications that rely on automated, connected technologies, for a sustainable transport development. Sponsored by the Federal Ministry Republic of Austria for Climate Action, Environment, Energy, Mobility, Innovation and Technology BMK, the Austrian Research Promotion Agency FFG, the Austrian Post AG, the automotive industry IAV Automotive Engineering, and the University of Applied Sciences Technikum Wien, we aim at providing transport solutions for

	a low environmental impact using sensor and communication technologies for data exchange between vehicles, infrastructure, and people. By relying on Internet of Things and the vision of "physical Internet" we investigate the interaction between the elements of the networked system by taking also into account human behavior.
Entry requirements	The successful candidate must hold a Diploma/Master's degree in computer science, mechatronics, electrical engineering, electronics and automation or a related field n Possess a strong academic background in intelligent transportation systems n Professional experience in the development of solutions for intelligent transportation systems (i.e. sensor data fusion, data analysis, wireless communication technologies, autonomous and cooperative systems, computational intelligence, data analysis, optimization techniques, microscopic traffic simulation, data exchange in Internet of Things) and its effect on users. n Excellent publication record in international peer-reviewed scientific journals and at top-tier conferences n Strong programming skills (C/C++/C#/Java/Python/HTML/PHP) n Experience with Robot Operating System (ROS), MATLAB, Mathematica, LabVIEW n Excellent command of English (spoken and written)

N	11
Name	Ph.D. positions in IoT solutions for Smart transport and logistics

Institution	University of Twente (UT), Netherlands
Link	https://euraxess.ec.europa.eu/jobs/222562
Duration	4 year
Areas of research	The Blockchain technology offers a number of benefits. While many consider its implications to mainly include simple asset tracking and transparency to real-time feedback from customers, the true scope of its benefits is not known, and it has the potential to become one of the most remarkable breakthroughs in the supply chain history. With a world that is becoming more connected on a daily basis, Blockchain technology will inherently develop into a symbiotic relationship with the Internet of Things and today's advanced logistics and supply chain management systems. IoT solutions can help long-haul cargo operators and last-mile delivery providers efficiently manage the transportation and distribution of freight and merchandise. The introduced efficiency has various economical, societal, and environmental impacts. The next wave of intelligent transportation systems must gather, analyze, and act upon massive volumes of data in a highly efficient and reliable manner. By gathering and analyzing data from on-board sensors to track containers and packages, and to monitor environmental conditions, quality assurance guarantees can be provided for on-time and at right place delivery of goods. The transport and logistic sector are known to have various disjoint systems, each of which being efficient and optimized to some extent. However, the optimization and efficiency across the whole chain can be significantly improved through combining both local and global analysis of bottlenecks and business processes. This Ph.D. research will focus on the Blockchain technology and IoT security for logistics sector. In particular this research will focus on distributed blockchain technologies that are embedded in the smart objects that constitute the modern smart logistics.
Entry requirements	A sound theoretical background in mathematics, data mining, and machine learning with a MSc degree in Computer Science or Statistics. We welcome ambitious candidates with strong communication skills who like to present their work at conferences and project meetings. Fluency in English is required. You need to provide IELTS test results (minimum score 6.5), TOEFL-iBT (minimum score 90) or Cambridge CAE or CPE. An interview and a scientific presentation will be part of the selection procedure.

N	12
Name	Ph.D. Scholarship Position(s) in Logistics
Institution	Molde University College (HiM), Norway
Link	https://scholarshipdb.net/scholarships-in-Norway/Ph-D-Scholarship-Position-S-In-Logistics-Of-Pos-3-Molde-University-College-Hi-M=0WXhizoV6xGUXgAlkGUTnw.html
Duration	3-4 years
Areas of research	Molde University College announces up to three Ph.D. scholarships in logistics. The field of logistics allows for a rich set of research topics, but we especially encourage propositions within the following areas: a) energy logistics b) transport planning under deep uncertainty c) IT-applications within logistics d) sustainable logistics e) logistics of marine industries (fisheries, fish farming etc.) f) humanitarian logistics g) strategic purchasing and supply chain management, under complexity
Entry requirements	We are seeking candidates with a strong background in business logistics, transportation, management science, informatics, health care logistics or other relevant subject areas. Your higher education must equate five years of full-time studies on top of the entry requirements for first cycle studies (bachelor's degree) in Norway. For some countries, this means that you must have more than five years of what is called higher education in your home country. Please confer the GSU-list for relevant information pertaining to your home country: https://www.nokut.no/en/surveys-and-databases/nokuts-country-database/GS... . Your master's degree (or equivalent) must constitute at least one full year of studies (60 ECTS), and must contain an individual piece of student work, normally a master's thesis. The minimum average grade of the master's degree must be grade B, or better, on the ECTS grading scale, or an equivalent average grade on other grading scales. We will also emphasize personal qualities and English fluency. Amongst other things, you are dedicated, cooperative and systematic.

N	13
Name	Ph.D. Position in Transportation and Logistics
Institution	Tallinn University of Technology, Estonia
Link	https://scholarshipdb.net/scholarships-in-Estonia/Ph-D-Position-In-Transportation-And-Logistics-Tallinn-University-Of-Technology=ooCFBLL96hGUXgAlkGUTnw.html
Duration	4 year
Areas of research	Proposed doctoral thesis topic: "Integration of the freight process of Estonian internal and transit road transport in relation to the compatibility options of other modes of transport". As an output of the doctoral thesis, sample scenarios will be produced for monitoring the implementation of the Estonian transport policy and transport development plan. These scenarios are evaluated primarily from the perspectives of mobility; optimization of the capacity and use of cargo spaces; seaports; smart solutions; and the last mile. In addition to sea transport, rail and air transport developments have been included in the evaluation of scenarios, where possible, especially from the perspective of developments concerning Rail Baltic. The main focus of the created system is on motor transport and its compatibility with other modes of transport.
Entry requirements	Qualifications Master´s degree The call is open for candidates with a wide range of backgrounds in logistics and transportation, both with practical and project related (research) competences. High level of motivation towards developing transportation systems on a regional level with the tight focus on carrying out the results in practice as well as a deep understanding of optimization methods used in transportation is required.

N	14
Name	Ph.D. in Logistics and Supply Chain Management
Institution	The University of Zaragoza, Spain

Link	https://www.zlc.edu.es/education/Ph.D. -in-logistics-and-supply-chain-management/#overview
Duration	4 year
Areas of research	This full-time program follows the highest international quality standards for doctoral studies, from the rigorous admissions process, continuous high-performance control process, to the comprehensive exam and thesis defense, enabling graduates to take faculty positions at leading universities around the world or to become innovation leaders for international companies.
Entry requirements	Application form Curriculum vitae / Resume Copy of your passport Official GRE scores (it is a must for all candidates) Official TOEFL, IELTS or other similar English test (if not a native speaker) Official transcripts/diploma (both Master and Bachelor degree are required). Three letters of recommendation Statement of objectives

N	15
Name	Collaboration and competition between transport and logistics modes in supply chains across Australia
Institution	Macquarie University, Australia
Link	https://scholarshipdb.net/jobs-in-Australia/Collaboration-And-Competition-Between-Transport-And-Logistics-Modes-In-Supply-Chains-Across-Australia-Macquarie-University=ODp0Nuvz6hGUXgAlkGUTnw.html
Duration	3 years

Areas of research	This project aims to examine the complex ecosystem of competing modes of transport and logistics in the context of sustainable supply chains in Australia. Road, rail, aviation and coastal shipping are all under consideration, along with warehousing and distribution systems. Shipping ports are a primary focus for the research as a key/common focus for movements of goods in and out of the country.
Entry requirements	The suitable applicant will have a strong research and experiential background in supply chain management, transport and logistics and regional development, and should be interested in writing a doctoral thesis in close conjunction with the Port of Newcastle. Issues of data analytics, automation and workforce development may also emerge during the research.

N	16
Name	Ph.D. in Business/Enterprise Engineering
Institution	University of Rome Tor Vergata, Italy
Link	http://dottoratoimpresa.dii.uniroma2.it/
Duration	3 years
Areas of research	DIGITAL INFORMATION LAW (Blockchain and smart contract, Contract law, Privacy), KNOWLEDGE MANAGEMENT (Sustainability and CSR, Green Marketing, Knowledge Management, Intellectual Capital, Innovation Management, Performance Management and Innovation), OPERATION & SUPPLY CHAIN MANAGEMENT (Supply chain risk management, Public procurement, Regional growth and development, Operations & Supply Chain Management, Production Planning & Inventory Control, Lean Production & Process Improvement), OPERATION RESEARCH (Operations research, Manufacturing systems, Logistics and transportation, Project management and scheduling, Transportation and logistics, Routing and scheduling), RESEARCH EVALUATION (Bibliometrics, Evaluative scientometrics, Research evaluation, Evaluative scientometrics, Research evaluation), SERVICE management (Service management and economics, Sustainability management and innovation, Control systems and performance management, Sustainability and CSR, Green Marketing, Knowledge Management, Service management and economics, Sustainability management and innovation, Control system and performance management, Human Behaviour), SUSTAINABILITY (Service management and economics, Sustainability management and innovation, Control systems and performance management, Sustainability and CSR, Green Marketing, Knowledge Management, Investment Analysis, Economic Regulation, Sustainable Development and Renewable Energy,

	Service Management and economics, Sustainability management and innovation, Control Systestem ad performance Management, Energy Management and Economics, Energy Commodities and Geopolitics, Renewables Engineering and Design, Product and process innovation, Manufacturing systems, Sustainability and innovation), TRANSPORT SYSTEMS (City logistic, Intelligent transport system –ITS, Transport System simulation, Transport planning modelling)
Entry requirements	The PhD course in Business Engineering can be accessed through a competition, the test of which consists in the presentation and discussion of a research project and in the assessment of knowledge of the English language. Once admitted to the course, the student is assigned a scientific tutor, chosen from among the members of the Academic Board, who will supervise the study and research activities for the entire duration of the study cycle. At the end of each year, the Academic Board is called to evaluate the quality of the work carried out by the doctoral student to decide on admission to subsequent years.

Annex 2 Existing Ph.D courses in Partner countries

University	LPNU
Name	Doctor of Philosophy in Transport by Specialty of Transport technologies
ECTS	60
Type of diploma and scope of educational program	Ph.D. Degree, single, 60 ECTS, term of studies 2 years
Level FQ-EHEA	3
Level EQF-LLL	8
Background	Master's degree
Language	Ukrainian
Aim of the educational program	To deepen theoretical knowledge and practical skills in the field of Transport in the specialty of Transport Technologies (by type), to develop philosophical and linguistic competencies, to form universal skills of a researcher sufficient for conducting and successfully completing scientific research and further professional research
Characteristics of the educational program. Subject area (industry, specialty)	The educational and scientific program is based on regulations and results of modern research on transport technologies, transport systems, passenger and freight systems, features of traffic flow management, safety and the direction of the applicant to solve current problems and problems in the field of transport.
The main focus of the educational-scientific program	provides languages and competencies and universal skills of the researcher, as well as the depth of knowledge in the chosen specialty. Key words: foreign language, philosophy, methodology, pedagogy, scientific bases, system analysis, transport, technological processes, traffic, transportation, project management.
The educational component of the program	Implemented over 4 semesters, lasting 60 credits and has disciplines in the relevant 3 cycles, which provide: language competences, universal skills of the researcher, knowledge of the free choice of the applicant, including from master's programs. programs Features of the program in the chosen specialty, disciplines
Teaching	Mediation of lectures, practical classes, consultations, independent work on solving problems, consultation with teachers, preparation of the theoretical part of the dissertation of the doctor of philosophy.
Assessment	Exams, tests, oral presentations, defense of the theoretical part of the dissertation of the doctor of philosophy.

Programs of competence	The ability to solve the composition of scientific examples of the problem and make decisions about the use of results in the practice of subdivisions of institutions in the field of transport, because in the educational processes of scientific research programs, the application of theories and methods of transport technologies are characterized by complexity and uncertainty.
General competence	1. Ability to communicate in writing and orally in Ukrainian and English; 2. Ability to learn, to perceive the acquired knowledge of the subject area and to integrate them with existing ones; 3. Ability to be critical and self-critical to understand the factors that have a positive or negative impact on the commune). and the ability to identify and take into account the factors of specific communication situations: 4. Ability to plan and manage time 5. Ability to show awareness of the level of opportunity and gender issues; 6. Ability to produce new scientific and scientific-applied ideas, to show creativity, ability to think systematically; 7. Ability to search and analyze information from various domestic and foreign scientific sources. 9. Acquisition of a beam way of thinking, which will make it possible to understand and solve scientific and applied research, while maintaining a critical attitude to established scientific concepts; 10. Ability to effectively use in scientific practice various theories in the field of scientific and applied research in the specialty "Transport Technology (by type)"; 11. Ability to solve scientific and applied problems and make appropriate informed decisions; 12. Ability to conduct research at the level of doctor of philosophy, have research skills, form (making presentations or presenting reports) new scientific ideas and current challenges in the field of transport, choose appropriate areas and appropriate methods for their implementation, taking into account available resources; 13. Ability to work independently and in a team, the ability to communicate with colleagues in the field of transport on scientific achievements, both at the general level and at the level of a professional scientist; 14. Knowledge and understanding of the subject area and understanding of the problems of the transport sector, B 15. Ability to work in an international context 16. Ability to act on the basis of ethical considerations; 17. Ability to communicate effectively at the professional and social levels: manifested in ability. 18 Ability to think abstractly, the ability to analyze and synthesize, which allows you to formulate conclusions for different types of complex management tasks, to plan, analyze, control and evaluate their own work and the work of others; 19. Scientific and pedagogical spirit, initiative through the ability to effectively use in practice the development of theory in the management of science and in the field of business administration; | 20. Interaction skills and interpersonal skills; | 21. Have the skills to develop and manage projects to ensure a high level of efficiency in the implementation of various types of projects in the field of transport; 22. Ability to act with social responsibility and civic consciousness; 23. Definiteness and persistence in the performance of the received tasks and catchability for the quality of work performed3; 24. Proper understanding and respect for multiculturalism and diversity; 25. Skills in the use of information and communication technologies, development and implementation of computer programs and the use of existing in the field of transport, B 26. Application for the protection and preservation of the natural environment; 27. Ability to adapt and work in new situations 28. Ability to evaluate and maintain the quality of work performed3; 29. Ability to motivate lullabies and move towards a common goal.
Professional competencies of the specialty	1. In-depth knowledge of basic sciences, necessary for the development of disciplines that provide knowledge of the chosen specialty and the discipline of free choice of graduate student; 2. In-depth knowledge in the field of transport, necessary for mastering the disciplines that provide knowledge in the chosen specialty and disciplines of free choice of graduate student: 3. In-depth knowledge of scientific concepts, theories and methods needed to understand the principles of operation and functionality of equipment and tools in transport : 4. In-depth knowledge of challenging regulations and reference materials, current standards and technical conditions, instructions and other regulations in the field of transport; 5. Ability to compile, design and operate documentation of the transport sector during the formation and implementation of transport technologies: 6. Knowledge of the basics of labor protection, industrial sanitation and fire safety in the organization of transport technologiesB 7. Ability to organize spider teaching and the process of creating and developing transport technologies : 8, Ability to understand and take into account social, scological,

	ethical. economic aspects that affect the formation of current and future decisions; 9. The ability to determine the causal links, analyze and summarize the external and internal management information for the implementation of planning, organization, motivation 10. Ability and practical skills to solve scientific and applied problems of scientific specialty%; 11. Ability to identify, classify and describe work. related use of analytical methods and modeling methods: 12. Ability to conduct business communications, knowledge and understanding of the subject area and understanding of the scientific specialty to determine the structure of research in the field of transport; 13. Ability to determine the motives of scientific and pedagogical activities.
Programmed learning results	1. Possession of sufficient knowledge to improve tools, technologies and conditions of transportation of cargoes and passengers, and also methods of Knowledge of operative management of loading and unloading processes that will give the chance to critically analyze a situation in the field of transportations; 2. Obtaining knowledge for research and development of a complex of technical means of development of transport systems, determining the patterns of the natural environment; 3. Understanding of tools and strategy. related to the organization and technology of maintenance. diagnostics and repair of vehicles, problems of safety of grants and patterns of influence of the human factor on transport processes. 4. Knowledge and understanding of scientific principles underlying the formation of demand for transport services; 5. Knowledge of the basics of the formation of the national transport mayor, interaction with the transport systems of other countries; 6. Deeper knowledge of the laws of formation of travel and passenger flows, the organization of their management and the development of methods for organizing transport processes based on the principles of logistics; 7. Knowledge and skills in the development and implementation of new rational systems of complex mechanization and automation of loading and unloading transport terminals and points; 8. Knowledge and understanding of methodologies for designing methods, technologies and technical means of transportation for the organization of intermodal transportation in accordance with the regulatory requirements of applicable standards and specifications; 9. Knowledge of modern achievements of innovative technologies in the field of international, mixed, combined, traffic, transport management, regulation of traffic flows; 10. Understanding the impact of technological progress in social, economic, social and environmental contexts; 11. Knowledge of the basics of transport economics; 12. Acquisition of in-depth knowledge and understanding related to the specialty Transport technologies (by types), which will be sufficient to successfully organize and conduct research and successfully publicly defend the results at scientific seminars and specialized scientific councils.
Skills	1. Apply the acquired and understanding to identify, formulate and solve problems of development of the transport complex, using modern scientific methods; 2. Apply knowledge to solve problems of analysis and synthesis in transport systems; B 3. Systematically comprehend and apply creative abilities to the formation of fundamentally new ideas in the transport industry; 4. Apply knowledge of technical characteristics, technological features of the formation and sale of transport products; 5. Calculate, design, study the street and road network, organization and regulation of traffic, transport and processes of freight and passenger transportation, loading and unloading, to conduct marketing analysis; 6. Search for information in various scientific and applied sources to solve problems in the field of transport; 7. Work effectively both individually and in a creative group; 8. Identify, classify and describe the production activities in the field of transport: 9. Understand the theory and practice, as well as make decisions and develop strategies for solving scientific and industry-based transport values, social, state applied problems of human production hypernets. 10. Perform current research and apply research skills in the field of transport; 11. Critically evaluate the results of research, and reasonably make and defend catch decisions; 12. To use in scientific and pedagogical practice knowledge of transport technology, tools of knowledge, to analyze the results of research in the framework of emerging theories, to make reasonable you- to apply methodological innovations.
Communication	1. Ability to communicate, including oral and written communication in Ukrainian and foreign English, B 2. Ability to use a variety of methods, including modern information technology, for effective communication at the professional and social levels.

Autonomy and responsibility	1. Ability to adapt to new situations and accept and take decisions; 2. The ability to realize the need for lifelong learning in order to deepen the acquired and acquire new knowledge; 3. Ability to treat the work responsibly, to make decisions independently, to achieve the goal in compliance with the requirements of professional ethics; 4. Ability to demonstrate understanding of the basic environmental principles, labor protection and safety of life, their application.
Attestation of postgraduate students	Attestation of graduates of the degree of Doctor of Philosophy will be carried out by a specialized academic council, permanent or formed for one-time defense, on the basis of public defense of scientific achievements in the form of a dissertation. Mandatory condition for admission to the defense with the successful implementation of the graduate student's individual curriculum. Applicants for the degree of Doctor of Philosophy defend their dissertations, as a rule, in a permanent specialized scientific council in the relevant specialty, which operates in the higher educational institution where the graduate student was trained. The Academic Council of a higher education institution has the right to submit to the National Agency for Quality Assurance in Higher Education documents for accreditation of a specialized academic council established for one-time defense, or apply to another higher education institution with a permanent specialized academic council in the relevant specialty. . The volume of the main text of the dissertation of applicants for higher education of the degree of Doctor of Philosophy in the specialty 275 "Transport Technologies (by types)" should be set in the amount of 4.0-5.0 author's sheets.
Subjects of scientific researches on a specialty 275 Transport of technology (by type)	1. Improvement of means, technology of conditions of transportation of freights, passengers and luggage, methods of operative management of processes of an overload in knots of a transport network. 2. Research and development of a set of technical means for the development and effective use of elements of transport systems in the external environment. 3. Determining the patterns of mutual influence of transport systems and the study of patterns of demand for transport services for the carriage of passengers and goods. 4. Development of models of decision-making by the subjects of transport markets on delivery of various cargoes in regional, interregional and international connections 5. Identification and substantiation of factors of efficiency of transport systems, development of the theory and methods of the organization of management of development of transport systems. methods of organizing the transport process, based on the principles of logistics, the formation of appropriate systems of freight forwarding services. 7. Regularities of formation of passenger flows, construction of transport passenger systems of cities, rural areas and regions. 8. Substantiation of technological processes of passenger cargo transportation, their organization and management in the integrated systems and systems

University	NTU
The official name of the educational program	Educational and scientific program "Transport Technologies on road transport » third (educational and scientific) level of higher education in specialty 275 "Transport technologies (in road transport)"areas of knowledge 27 Transport
Type of diploma and scope of educational program	Doctor of Philosophy, single, 60 ECTS credits, term of study 4 years
FQ-EHEA cycle	third cycle
EQF-LLL level	8 level

Language	Ukrainian
Prerequisites	Master's degree, educational qualification level of a specialist
The purpose of the educational program	Training of scientific and pedagogical staff of the highest qualification in the profile of transport technologies for the needs of state industry, science and education. Training involves the formation of future doctors of philosophy skills of independent research, in-depth study of the basics of theory and methodology of transport technology, improving philosophical education, honing the skills of foreign languages in the field of professional terminology and research. Training of doctors of philosophy in the specialty 275 "Transport technologies (by road)" is aimed at the formation of a scientific school at the level of academic research and applied development
The object of study	science and technology that deals with the theoretical and experimental research on the development and implementation of auto transport s technologies and and processes in integrated production systems to achieve new results in innovative use of modern transport technology and justification effectively s decisions b in unusual situations.
Learning objectives	training of specialists in transport technologies, able to solve complex problems in the field of professional and / or research and innovation in the field of modernization and use of transport technologies in transport systems , which involves a deep rethinking of existing and creation of new holistic knowledge and / or professional practices
Theoretical content of the subject area	fundamental knowledge from the sections of science and technology, which study and combine connections and patterns in the theory of systems analysis and synthesis of transport technologies as objects of innovative development
Methods, techniques	analytical, numerical and experimental methods of research of functioning of integrated transport systems, methods of long-term, short-term and operative management of innovative development of motor transport technologies , methods of estimation of resource efficiency of transport technologies and services
Tools and equipment	computer and software, multimedia; modern devices for control of passenger and cargo transportation , control of transport systems operation, test and simulation analysis and synthesis of innovative transport technologies ; field samples and models of infrastructural objects of the transport industry
The main focus of the educational program	The object of professional activity is the training of researchers capable of solving complex complex problems and practical problems in various areas of the modern transport industry. Programm is focused on the following activities of graduates: - research and design; - production-technological and production-management; - experimental research.
Teaching and learning	Teaching and learning methods: lectures, practical and laboratory classes, pedagogical practice, elements of distance (online, electronic) learning. Independent work on the basis of textbooks and abstracts, conducting experimental research, consultations with teachers and leading experts in the field of transport , preparation of dissertations. nTo form students' social skills, some practical classes take the form of discussions, debates, dialogues, business games, and so on. The educational process is carried out in accordance with the Regulations "On the organization of the educational process at the National Transport University" (http://vstup.ntu.edu.ua/pro_orhanizatsiyu_osvitnoho_protsesu.pdf) in the following main forms: explanatory-illustrative-reproductive, problem-based, programmed and research. Methods and forms of teaching and learning are based on the principles of academic freedom of students. Non-formal education for the programme takes place through non- credit trainings and seminars according to the schedule approved by the Academic Council of the faculty.

Evaluation	Assessment methods and criteria are consistent with learning outcomes and types of learning activities. Assessment methods - entrance testing and current control , modular control , exams , etc. Formats assessment methods: testing of knowledge or skills; Reports from virtually s Rob and t; analysis of texts or data; reports on pedagogical practice; REPORT b intermediate results of the thesis work. The amount was not assessment methods (total control), exam (written or in an open test form); test (based on the results dads regulatory control), thesis work. Dissertation work check is ARE for plagiarism by the Regulation "On the system to ensure the academic integrity of teaching, research and teaching and research staff and applicants of higher education in the National Transport University» (http://vstup.ntu.edu.ua/polozhennyantu_dobroch.pdf)
General Competences	Ability to solve complex problems in the field of professional and / or research and innovation, which involves a deep rethinking of existing conceptual and methodological provisions and the creation of new holistic knowledge in the field of research and / or professional practice. LC 0 1 - the ability to initiate and perform (individually or in a scientific group) research that leads to new knowledge ; LC 02 - ability to work in national and international research groups planning research, development and management I projects of innovative transport technologies in road transport ; LC 03 - ability to communicate freely on issues related to the field of scientific and expert knowledge, with colleagues, the general scientific community, society as a whole ; HCC 0 4 - of usefulness to generate creative ideas, deepen yuvaty cognitive and practical ability / skills, craftsmanship and innovation at the level required to solve complex problems and specialized practical problems in professional work or study ; LC 05 - the ability to be responsible for making and making decisions in unpredictable work and / or learning contexts , to assess and ensure the quality of work performed
Professional competencies (FC)	FC 0 1 - ability to perform original research, achieve scientific results that create new knowledge in the field of transport technologies and related interdisciplinary areas, the results of which can be published in leading scientific journals on the effective use of transport technologies in transport systems and related industries ; FC 0 2 - ability to scientific and educational activities in the System of Higher th l and in compliance with the methodological unity in the paradigm of knowledge about transport ; FC 0 3 - the ability to identify, pose and solve research problems in the field of transport technology, evaluate and ensure the quality of research ; FC 0 4 - ability to continuous self-development and self-improvement and development of innovative research projects in the field of transport technologies in road transport and their management ; FC 0 5 - ability to apply appropriate mathematical methods, models, computer technologies, as well as the principles of standardization and certification to solve complex problems in the field of transport technologies in road transport ; FC 0 6 - acquisition of language competencies sufficient to present and discuss the results of their research in a foreign language (English or other according to the specifics of the specialty) orally and in writing, as well as to interact with foreign experts in transport systems and technologies and related to her interdisciplinary directions. PCF 01 - ability to use scientific and methodological basis of systems analysis to achieve new innovative results in the field of conceptual development management Auto transport technologies continue training with a high degree of autonomy; PCF 02 - ability to apply the acquired skills and knowledge of professional and scientific activities in the development and implementation of innovative processes in road transport in an integrated production system from taking into account the principles of conceptual integration of fragmented knowledge about transport , solve complex problems in a wide or m anagem disciplinary contexts ;

	FKP 03 - ability to use innovative methods of research of the organization of movement of motor vehicles, to carry out the intellectual analysis of the received results, to solve problems in new or unfamiliar environments in the presence of incomplete or limited information; FCP 04 - the ability to apply in scientific and research activities the methodology of a systematic approach to the implementation of transport and technological processes in road transport , to perform a critical understanding of problems in the transport industry and at the boundaries of knowledge; FKP 05 - ability to use simulation modeling of implementation of scientific projects on development of resource-saving technologies on motor transport and in the spheres of professional activity connected with it, to integrate knowledge for original carrying out of scientific researches; FCP 06 - the ability to apply innovative methods of logistics management of passenger and freight transport by road , to conduct a comprehensive analysis of innovative projects, clearly communicate their knowledge, conclusions and arguments to specialists and non-specialists.
Program learning outcomes	0 1 - freely present and discuss with specialists and non-specialists the results of research, scientific and applied problems of transport systems and technologies in the state and foreign languages, qualified to reflect the results of research in scientific publications in leading international scientific journals ; 0 2 - formulate and test hypotheses; use appropriate evidence to substantiate the conclusions, in particular, the results of theoretical analysis, experimental research (surveys, observations , etc.) and mathematical and / or computer modeling, available literature data ; 0 3 - to develop and explore a conceptual, mathematical and computer models of processes for automobile th transport and and component transportation systems , effectively using them to acquire new knowledge and / or the creation of innovative products in the field of transport technology in transport systems and relevant interdisciplinary directions ; 0 4 - to plan theoretical and / or experimental developments in the field of transport technologies on motor transport , to know and adhere to the basic provisions and directions of initiation, realization and adjustment of consistent process of thorough scientific research with observance of proper academic integrity ; 05 - to deeply understand the general principles and methods of technical sciences, as well as the methodology of scientific research, to apply them in their own research in the field of transport technologies in transport systems and in teaching practice ; 0 6 - use the methods necessary to solve significant problems in the field of professional activity, science and / or innovation, expansion and reassessment of existing knowledge and professional practice in the field of transport technologies for the development of innovative concepts and development of transport technologies ; 0 7 - to carry out teaching activities in higher education institutions, using innovative forms, tools and technologies in the development of methodological support of the educational process and during educational work, including by developing students' skills to acquire knowledge independently . 0 8 - to use innovative methods of system research for critical analysis of the activities of production structures in road transport with complex processes that require new integrated and conceptual strategic approaches; 0 9 - advanced predictive analysis of the auto transport companies for evaluation and synthesis of innovative processes with unpredictable results, evaluate the performance of the teams and groups; 1 0 - implement systematic methodology for technical and technological development of auto transport industry to introduce new ideas in the context of professional and advanced research activities, taking into account aspects of social and ethical responsibility.

Staffing	Preparation of PhD on programme carry six university departments. Implementation of educational -production program provided scientific - pedagogical staff of NTU, which have a scientific degree and the rank of the specialties included in the list of specialties 275 "Transport technology (for road transport)" . All the teachers have strong practical experience in the field of transport technologies in road transport and relevant certificates of professional development.
Logistics software	The training uses modern technologies of leading transport companies, as well as licensed software for calculations and design of transport processes in general and its individual elements . NTU has 16 multimedia computer classes, which allow to implement modern innovative learning technologies and to provide informatization of the educational process; laboratories and offices equipped with modern equipment, devices, measuring and diagnostic equipment, personal computers, which provides a modern level of training. University buildings have classrooms for lectures, seminars, course design, group and individual consultations, independent work and premises for storage and preventive maintenance of educational equipment. Premises for independent work are equipped with computer equipment with the possibility of connection to the free network WI - FI with access to the electronic information and educational environment of NTU.
Information and educational and methodical support	Provision of educational process graduate students teach l noyu and reference books, instructional and teaching materials, as well as regulatory documentation meets the applicable standards of security contingent of students on a specialty. The teaching uses both the library fund of NTU and the electronic database of the library with WEB-access mode, as well as the own educational and methodical developments of teachers of NTU departments. The University has sets of licensed and licensed specialized software (composition is determined in the work programs of disciplines). Electronic information and educational environment of NTU is able to provide: ● access to curricula, work programs of disciplines, practices, publications of electronic library systems and electronic educational resources specified in the work programs; ● recording the course of the educational process, the results of intermediate certification and the results of mastering the program of training a doctor of philosophy ; ● interaction between participants in the educational process through the Internet. Update of information and educational and methodical support takes place annually taking into account the trends of development of the specialty and is approved by the relevant collegial bodies of the faculty.
Attestation of postgraduate students	The intermediate attestation process takes place through the reporting of graduates of the degree of Doctor of Philosophy on the progress of the individual work plan at scientific seminars. Scientific seminars are organized for graduating s Departments s NTU. Scientific seminars for intermediate attestation of higher education candidates for the degree of Doctor of Philosophy are held at least twice a year - semi-annual and annual intermediate attestation. A prerequisite for admission to the defense of the dissertation is the successful completion of the graduate student's individual curriculum. The state of readiness of the graduate student's dissertation for defense is determined by the supervisor. The final certification of applicants for higher education under the educational and scientific program "Transport technologies in road transport" at the third (educational and scientific) level of higher education in the specialty 275 "Transport technologies (by road)" is carried out in the form of open and public defense of the dissertation. current or specialized scientific council, which is formed for one-time defense, and ends with the issuance of the Ministry of Education and Science of Ukraine a standard document on awarding the degree of Doctor of Philosophy in Transport Technology in specialty 275 "Transport Technology (by road)" .

	Thesis work of graduate checked for plagiarism by the Regulation "On the system to ensure the academic integrity of teaching, research and teaching and research staff and applicants of higher education in the National Transport University» (http://vstup.ntu.edu.ua/polozhennyantu_dobroch.pdf) .

University	NUUE
The official name of the educational programme	Transport technologies (by modes)
Type of diploma and scope of educational program	Ph.D. Degree, single, 45 ECTS, term of studies 4 years
FQ-EHEA cycle	Third Cycle
EQF-LLL level	Level 8
Language	Ukrainian
Prerequisites	Existence of the second (Master) Degree or educational qualifying level of specialist
The purpose of the educational program	The purpose of the educational programme is to conduct original scientific research aimed to gain new knowledge in the field of transport technology with the writing and defense of scientific achievements in the form of Ph.D. thesis.
Learning objectives	The educational and scientific programme is designed to provide comprehensive scientific knowledge, necessary practical skills and research activities in the field of "Transport".
Theoretical content of the subject area	1. Improvement of means, technology and conditions of cargoes, passengers and luggage transportation, methods of operational management of congestion processes at the nodes of the transport network. 2. Research and elaboration of a set of technical means for the development and effective use of transport systems elements, determining the patterns of mutual influence of transport systems and the external environment, justification of requirements for transport facilities and their equipment. 3. Research on patterns of demand for passenger and goods transport services. 4. Justification, development and improvement methods, technologies and technical means of transport for the organization of international, mixed, combined, intermodal cargo and passenger transportation. 5. Development of decision-making models by the subjects of transport markets for the delivery of various goods in regional, interregional and international traffic. 6. Identification and substantiation the factors of transport systems efficiency, development the theory and methods of organization and managing development of transport systems. 7. Development the theory and scientific foundations of transport processes and systems organization. 8. Solving complex problems of logistics management related to transport, warehousing, cargo handling, placing orders and stocks.

	9. Formation of the national transport network, its interaction with the transport systems of other countries. 10. Development the scientific bases for the formation, organization and functioning of the national network of international transport borders and its integration into the world and European transport system. 11. Regularities of cargo flows formation, organization of their management, development methods of transport process organization which are based on the principles of logistics, formation of transport and forwarding service appropriate systems. 12. Regularities of passenger flows formation, construction of transport passenger systems of cities, rural districts and regions. 13. Problems of interaction of different types of transport in the transportation of goods and passengers. 14. Substantiation of technological processes of passenger and freight transportation, their organization and management in integrated systems and systems of different modes of transport: aviation, automobile, water, railway. 15. Development of rational systems and justification of the means of complex mechanization and automation for load and unload works in a point of coincidence different types of transport. 16. Regularities of transport flows formation and development of the traffic organization systems and technology of their management. 17. Justification of the requirements for the application of methods and means of traffic control automatization, the principles of synergistic integration of the interaction of different vehicles and systems. 18. Problems of transport safety. Regularities of human factor influence on transport processes.
Methods, techniques	
Tools and equipment	
The main focus of the educational program	
Teaching and learning	Student-centered learning, self-study, learning through scientific activities
Evaluation	Combination of lectures, practical classes, independent and research work on the basis of normative literature, textbooks, lecture notes and experimental research, consultations with teachers, preparation of dissertations.
General Competencies	GC 1. Ability to define the basic concepts at the field of expertise, to critically comprehend the problems of the field of expertise and problems at the boundaries of subject areas, to identify and characterize the theoretical / empirical and fundamental / applied dimensions of the field of expertise. GC 2. Ability to adhere to ethical principles both in terms of professional honesty of the scientist and in terms of understanding the possible impact of scientific achievements on the socio-economic and spiritual spheres of society. GC 3. Ability to plan and solve problems of own professional development. GC 4. Ability to conduct own original research, which contains scientific novelty, have important theoretical and practical significance. GC 5. Ability to work with literary catalogs, databases in the specialty and scientometric databases. GC 6. Ability to participate in interdisciplinary projects and the ability to use the results of research in other fields of science to achieve the goals of their own research.

	GC 7. Ability to use effectively modern methodology of scientific knowledge and the latest methods of scientific research. GC 8. Public presentation and defense of scientific research in the Ukrainian language. GC 9. Ability to work in a large research group, to respect national and cultural traditions, the ways in which other members of the group work, understanding the responsibility for the results of the work, as well as taking into account budgetary costs and personal commitments. GC 10. Ability to use modern information technologies in scientific activities. GC 11. Ability to apply modern approaches to the organization and conduct of various types of classroom and extracurricular educational activities of students. GC 12. Ability to register intellectual property rights. GC 13. Ability to fully understand foreign scientific texts in the relevant specialty. GC 14. Ability to write in a foreign language own scientific works of different content and volume (scientific article, abstract, conference abstracts, scientific report, request for a scientific grant, cooperation agreement, report on scientific work, dissertation, etc.); GC 15. Ability to communicate effectively with special and general audiences (in particular, using foreign languages), as well as to present complex information in a convenient and understandable way orally and in writing.
Professional competences of the specialty (PC)	PC 1. Ability to pose and solve research problems in the field of transport technologies. PC 2. Ability to evaluate and ensure the quality of research. PC 3. Ability to apply appropriate mathematical methods, models for solving problems in the field of transport systems and technologies. PC 4. Ability to study transport technologies based on modeling of transport processes. PC 5. Ability to study and evaluate the parameters of traffic flows. PC 6. Ability to optimize the operation of the transport system taking into account traffic flows.
Programme learning outcomes	PLO 1. To know the history of development and the current state of scientific knowledge in the field. PLO 2. To use theoretical knowledge of public administration and administration in practice. PLO 3. To analyze, identify, solve complex problems in the industry. PLO 4. To plan and timely solve tasks related to professional development, in particular in the field. PLO 5. To carry out scientific research and analysis of information sources, as well as identify promising areas of research. PLO 6. To use modern information technologies in conducting research. PLO 7. To organize effective communication with special and general audiences (in particular, using foreign languages), as well as present complex information in a convenient and understandable way orally and in writing. PLO 8. To study domestic and foreign scientific texts. PLO 9. To organize and conduct research. PLO 10. To apply the method of preparation of dissertation research. PLO 11. To apply innovative approaches in solving problems of organizing research in the field. PLO 12. To organize expert research and select the necessary information technology. PLO 13. To apply the legal framework for the regulation of innovation and technology transfer. PLO 14. To prepare design solutions. PLO 15. To carry out teaching activities in the main educational programmes in the field.

	PLO 16. To apply innovative approaches to solving problems of organizing research in the field of transport technologies. PLO 17. To perform systematic analysis in the field of transport technologies, set and investigate problems, assess the quality and adequacy of the results. PLO 18. To use and develop modern methods of modeling transport systems. PLO 19. To determine the optimal modes of operation of transport facilities based on the results of assessment of their parameters.
Support of personnel and equipment	The membership of the programme is characterized by research and teaching staff who have degrees and academic titles. Staffing of the educational process is based on the selection and training of highly qualified specialists in the field of transport technologies. The qualification of teaching stuff will be improved by conducting internships in relevant organizations and educational events in Ukraine and Europe. Leading specialists of the region, who have extensive experience in transport technologies, are involved in the teaching of special professional disciplines. Lectures are held in classrooms with multimedia equipment. Practical classes are held in specialized computer classes with the use of information and communication equipment, information systems and software products used in transport technologies. The laboratory of the SmaLog training center "Smart transport and logistics for cities" is equipped with modern equipment, devices, measuring and diagnostic equipment. Many of these products have already been introduced or are being actively introduced into the educational process: MS Project, Teamwork, Teamlab, Open Workbench., GanttProject, dotProject., EverNote, Nirvana, Wunderlist, Toggl, Office 365. Document. Online, AllFusion Process Modeler 7, MS Visio. LibTe office Impress, Mind42, ViSta, MacANOVA, Matrixer. Software for modeling Anylogic i Vissum, Vissim, Copert.
Information and educational and methodological support	All educational components of the educational programme "Transport technologies (by types)" are provided with the following educational and methodical materials: textbooks; handbooks; lecture notes; methodical instructions and recommendations; individual tasks; collections of situational tasks (cases); examples of solving typical problems or performing typical tasks; computer presentations; illustrative materials; resource catalogs, etc.

Annex 3 Questions of the survey for PC universities about research needs

SMALOG WP3 User Needs Analysis for Academics

The objective to understand the local conditions and needs and understand how to deliver the Ph.D. courses in UA&GE considering also the current administrative and academic structure of Local Universities.

*Obligatory field

1. Email address *

2. Which university are you from?

- NUUE, UA
- LPNU, UA
- ZSTU, UA
- NTU, UA
- GTU, GE

BSMA. GE

Current local situation

3. Are there any available Ph.D. courses on ‘Smart Transport’, ‘Transport’ in general or on ‘Smart Logistics’? (if yes please provide the curricula of these courses and a short description) *

4. What are the entry requirements for students to attend these Ph.D. courses? *

5. In these Ph.D. degrees are there any laboratory activities (e.g. use of simulation software, if yes - which)? *

6. Are there any in-field activities (if yes what kind of activity and is the infrastructure in place to undertake in-field activities)? *

7. Are there any available informatics labs (if yes what is currently available in these labs for student to access)? *

Current local needs

8. To what extent (scale of 10), in your opinion, is research in smart transport and logistics currently implemented? *

	1	2	3	4	5	6	7	8	9	10	
Very bad	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Excellent

9. At local level, what are the most important issues that need to be addressed in terms of research in smart transport and logistics? *

10. How would you address these issues?

11. At a local level, what are the most important issues that need to be addressed in terms of higher education in smart transport and logistics? *

12. How would you address these issues?

13. At a local level what are the most important needs in terms of equipment for supporting research and higher education in smart transport and logistics? *

14. How would you address these needs?

15. In terms of improving research in smart T&L, which are the most important road safety fields to be combined and reinforced? *

Administrative barriers

16. At local level, what are the most relevant administrative barriers in order to deliver the Ph.D. courses within the time frame of the project? *

17. What is, in your opinion, the best approach in order to overcome these barriers within the timeframe of the project?

Skills or aspects to be included in the Ph.D. curricula

18. In order to improve the employment opportunities at local level of the Ph.D. graduates which skills or aspects would you include in the Ph.D. curricula? *

19. Would you consider some of the skills to be more crucial to include than others?

20. In order to improve the employment opportunities at local level of the Ph.D. graduates which fields in smart transport and logistics would you combine in the Ph.D. curricula? *

Annex 4 Responses of the survey for PC universities about research needs

1. Email address and universities

№	Email	University
1	o.kunytska@gmail.com	NTU, UA
2	n.kurshubadze@bsma.edu.ge	BSMA. GE
3	begerskiy@gmail.com	ZSTU, UA
4	d.roslavtsev@gmail.com	NUUE, UA
5	zhukmm65@gmail.com	LPNU, UA
6	-	GTU, GE

Partners from GTU do not have such a program so they were excluded from the survey.

Current local situation

Are there any available Ph.D. courses on 'Smart Transport', 'Transport' in general or on 'Smart Logistics'? (if yes please provide the curricula of these courses and a short description) *

№	Answer
1	When preparing a Ph.D. in speciality 275 "Transport technologies (by type)", the following disciplines are studied on the requested topics: - Scientific and methodological bases of the conceptual development of transport technologies and systems - Process modelling in intelligent transport systems - Transport logistics of cities The curriculums are available only on Ukrainian
2	N/A
3	not
4	NUUEs current Ph.D. program on Transport technologies includes three obligations and six elective courses. Obligations: Systemology in transport, Modeling of transport systems, Theory of transport flows

	Elective: Efficiency of transport technologies Directions for improving the efficiency of the transportation process Logistics management on transport Logistics in the transport system The human factor in transport Means of assessing the impact of the human condition on the parameters of transport technologies
5	Yes. Ph.D. program "Transport technologies (by types)" https://lpnu.ua/sites/default/files/2021/3/12/paragraphs/17028/onp-2020275tt.pdf

What are the entry requirements for students to attend these Ph.D. courses? *

№	Answer
1	Requirements for the previous level of education of Ph.D. students: A person has the right to obtain the degree of Doctor of Philosophy provided that he/she has a master's level of higher education.
2	the internal regulation for Ph.D. program is on the implementation stage
3	Our university does not have such programs
4	Master's degree, entry exams
5	Level of higher education "Master"

In these Ph.D. degrees are there any laboratory activities (e.g. use of simulation software, if yes - which)? *

№	Answer
1	Yes, within the study disciplines
2	yes, BSMA has simulation software
3	Our university does not have such programs
4	We are including Anylogic, PTV Visum, PTV Vissim from this year
5	Using modern software applications, software systems "Kardiosens", "Neyrokom" to study the physiological properties of the drivers; specialized software products Vissim, Visum manufacturer PTV Vision for research of parameters of transport flows and design of passenger correspondence and public transport routes; MatCad and Statistica for mathematical processing of research results

Are there any in-field activities (if yes what kind of activity and is the infrastructure in place to undertake in-field activities)? *

№	Answer
1	- Participation in the annual conference of the National Transport University - Participation in international conferences held at the National Transport University - Compulsory teaching practise (6 ECTS)
2	yes, currently for bachelor and master students
3	Our university does not have such programs
4	Review lectures on topical transport problems of the city, country and private companies are regularly held (Director of the Infrastructure Department of the Kharkiv City Council, Utility managers, Heads of transport and logistics companies). Recently, several working meetings were held on transport and logistics problems of the city (participants - Kharkiv City Council, Utility managers, NUUE, GIZ, Egis, Dornier Consulting). The infrastructure of the Kharkiv City Council and NUUE are used.
5	Research Laboratory of the Department "Transport Technologies" is used at the University. The Traffic Control Center of Lviv Municipal Enterprise "Lvivavtodor" is also used.

Are there any available informatics labs (if yes what is currently available in these labs for student to access)? *

№	Answer
1	Available informatics labs: 1. Department of Information-Analytical Activity and Information Security: Lab site: http://iaais.ntu.edu.ua/compclass.html 2. Department of Information Systems and Technologies:

	Specialized laboratory "Systems of satellite technologies of navigation and telecommunications in transport", equipped with specialized navigation, telecommunications equipment and software. Lab site: https://spacelibrarynews.wordpress.com/%d0%bb%d0%b0%d0%b1%d0%be%d1%80%d0%b0%d1%82%d0%be%d1%80%d1%96 % d1% 8f-% d1% 81% d1% 83% d0% bf% d1% 83% d1% 82% d0% bd% d0% b8% d0% ba% d0% be% d0% b2% d0% b8% d1% 85-% d1% 81% d0% b8% d1% 81% d1% 82% d0% b5% d0% bc /
2	yes
3	Our university does not have such programs
4	There are laboratories: - laboratory of transport research; - laboratory for ergonomic research; - scientific center "Megapolis"; - NUUE library In laboratories available to students: - Vehicle detector - PTV VISUM software (professional version); - PTV VISSIM software (student version); - AnyLogic software (student version); - Software "Ant Logistics"; - Microsoft Office; - Access to open scientific publications (SCOPUS, WoS); - Sound level meter; - Intelligent glasses (fixing the points of concentration); - Software for assessing the psychophysiological characteristics of a person.
5	Laboratory of Department of Motor Vehicle Transport "Research of ecological indicators on motor transport"

Current local needs

To what extent (scale of 10), in your opinion, is research in smart transport and logistics currently implemented? *

№	Answer
1	6
2	5
3	5
4	7
5	7

At local level, what are the most important issues that need to be addressed in terms of research in smart transport and logistics? *

№	Answer
1	Introducing intelligent methods for managing urban passenger and freight traffic. Optimization of traffic flow conditions on city highways through intelligent control methods Improving the environmental situation in cities
2	Maritime Logistics
3	Optimization of the functioning of the public transport system. Solving traffic problems in the city Parking problems
4	A complex of problems associated with sustainable mobility of the population (low-mobility groups, low-income groups of the population, gender characteristics), optimization of the traffic network load in conditions of high rates of motorization, an increase in the density of development of existing territories and further urbanization. The actual direction in the field of organization and road safety is the organization of pedestrian and bicycle traffic, traffic using personal mobility devices. Issues of increasing the efficiency of freight traffic and cargo distribution systems.

5	Expanding the capabilities of the existing automated traffic control system

How would you address these issues?

№	Answer
1	Training of specialists of the required level for solving narrowly focused tasks related to these issues, including the basis of cooperation with European specialists and scientists.
2	Develoment of modules
3	
4	Analysis of the practice of solving such problems, research of the possibility of their application at the local level. Modeling of transport processes and study of their patterns.
5	Cooperation with foreign universities and Stakeholders

At a local level, what are the most important issues that need to be addressed in terms of higher education in smart transport and logistics? *

№	Answer
1	Gaining practical experience, including through internships both on the territory of Ukraine and abroad, in order to study world scientific approaches and practices.
2	increase the quality of master program and development the module of Maritime Logistics for Maritime Affair PnD program
3	Increase the number of students Increase student engagement in research work
4	Updating the educational program based on advanced research experience to solve transport and logistics problems of cities. Training of specialists who are proficient in methods and tools for conducting complex research to solve transport problems and assess the effectiveness of such solutions.
5	Mobility of students and teachers

How would you address these issues?

№	Answer
1	The introduction of special internship programs and inter-university cooperation
2	assessing the markets needs and involment of Industry representatives
3	
4	The implementation of the SmaLog program advanced us in resolving this issue. SmaLog Ph.D. can significantly enhance the existing result in certain areas and consolidate the general level of training of specialists.
5	

At a local level what are the most important needs in terms of equipment for supporting research and higher education in smart transport and logistics? *

№	Answer
1	-
2	the appropriate simulation software and state-to-the art teaching and learning materials
3	Software for the study of traffic flows based on information from traffic cameras
4	- professional version of PTV VISSIM; - professional version of AnyLogic; - StatGraphics software; - equipment for monitoring and collecting statistical information on the road network and passenger flows.
5	Transport research software

How would you address these needs?

№	Answer
1	-
2	N/A
3	
4	The issue of purchasing a professional version of PTV VISSIM at the expense of the University is being considered. Free analogs are used to process statistical information.

5	

In terms of improving research in smart T&L, which are the most important road safety fields to be combined and reinforced? *

№	Answer
1	Introduction through scientific substantiation of methods for safer movement of pedestrians in the city and reducing the severity of road accidents, through the use of research in smart T&L
2	Safety and Environmental Management Issues
3	Traffic management Organization of the movement of transit freight and passenger transport Increasing the level of passive and active safety of vehicles Increasing the level of environmental safety of vehicles Transport infrastructure aimed at improving the safety of pedestrians and road traffic
4	organization of cycling and movement using personal mobility devices
5	Joint research of transport infrastructure, transport technologies and artificial intelligence systems

Administrative barriers

At local level, what are the most relevant administrative barriers in order to deliver the Ph.D. courses within the time frame of the project? *

№	Answer
1	There are no such barriers
2	assurance the complience with regulations of National centre of quality educational enhancement
3	There are no such barriers.
4	We do not see any administrative barriers at the NUUE level in the context of project tasks
5	Regulatory requirements of the standard of Higher education

What is, in your opinion, the best approach in order to overcome these barriers within the timeframe of the project?

№	Answer
1	-
2	ensure complience and adapt program to national qualification framework
3	
4	
5	Development and implementation of changes to regulations

Skills or aspects to be included in the Ph.D. curricula

In order to improve the employment opportunities at local level of the Ph.D. graduates which skills or aspects would you include in the Ph.D. curricula? *

№	Answer
1	Study of modern special software
2	practical skills
3	Practical skills in transport management Practical navaki on the study of traffic flows
4	skills in using macro and micro modeling tools, solving practical problems and substantiating design solutions in the field of transport systems, technologies, and logistics
5	Knowledge of improving the means, technologies and conditions of transportation of goods and passengers, as well as methods of operational management

Would you consider some of the skills to be more crucial to include than others?

№	Answer

1	
2	yes
3	
4	
5	

In order to improve the employment opportunities at local level of the Ph.D. graduates which fields in smart transport and logistics would you combine in the Ph.D. curricula? *

№	Answer
1	Our program is already designed to combine such fields as the organization and management of passenger and freight transport, as well as road safety. We believe it would be useful to add the study of modern software products and the study of approaches to scientific activity in other countries.
2	yes
3	All about road safety Everything related to solving logistic problems
4	Regularities of formation of transport flows and development of traffic organization systems and technology of their management. Problems of the interaction of different types of transport in the transportation of goods and passengers. Identification and substantiation of factors of efficiency of transport systems, development of the theory and methods of the organization, and management of development of transport systems. Solve complex logistics management issues related to transportation, warehousing, cargo handling, order placement, and inventory. Substantiation of requirements for the application of methods and means of automation of traffic control.
5	Transport infrastructure, intelligent transport systems, artificial intelligence systems