



## Deliverable D5.1

**Strategy and Action-Plan for Joint Education, Training and Mobility**

## Document details:

<b>Editor(s):</b>	Andreas Andreou Panayiotis Christodoulou
<b>Contributor(s):</b>	Michalis Pingos, Spyros Loizou, Andreas Christoforou
<b>Date:</b>	July 14, 2020
<b>Version:</b>	5.0

## Document history:

<b>Version</b>	<b>Date</b>	<b>Contributor</b>	<b>Comments</b>
v.1.0	30/06/2020	Michalis Pingos, Spyros Loizou, Andreas Christoforou	First Draft
v.2.0	03/07/2020	Panayiotis Christodoulou, Andreas Andreou	Comments & Corrections
v.3.0	08/07/2020	Andreas Andreou, Panayiotis Christodoulou	Second Draft
v.4.0	10/07/2020	Andreas Andreou Panayiotis Christodoulou	Corrections
v.5.0	14/07/2020	Partners	Approved final version after minor revision

**Contents**

1 INTRODUCTION 4

2 TRAINING 6

3 JOINT-EDUCATION 16

    3.1 Introduction..... 16

    3.2 Means to enhance the “Data Science and Engineering MSc” programme ..... 17

    3.3 Target Courses..... 19

4 MOBILITY PROGRAMME 22

5 SUMMARY 26

# 1 Introduction

This deliverable is directly linked with *D2.3 Research & Innovation Agenda* and outlines the strategy needed to implement DESTINI's strategy and action-plan for joint education, training and mobility.

One of the main objectives of DESTINI is the knowledge acquisition and transfer between the leading partners and the Cyprus University of Technology (CUT). The close cooperation between them through personnel exchanges, expert visits, organization of workshops and summer schools with lectures delivered from ERISS/JADS and UNIROMA1, participation in international scientific conferences/workshops, development of joint training sessions and mobility programmes for early stage researchers, and establishment of strong links with the market/industry, will aid to fulfil the objectives set at the beginning of the project. To this end, this deliverable presents DESTINI's strategy and plan for activities revolving around for training, joint education and mobility.

Training focuses on transferring knowledge and expertise from the leading institutions to members of CUT that will help them form a solid scientific background in the area of Smart Data. The topics for the training seminars are built around the Key Knowledge Areas (KKAs) identified in the Joint Research Areas (JRAs) of the project and integrate research topics with methods, tools, and platforms for the development and assessment of proof-of-concept prototypes and demos.

CUT aims to create with the leading partners a joint supervision/mentoring programme for students at Doctoral level and a training programme for early stage researchers, Masters students and industry/market stakeholders on Smart Data, thereby creating a common culture that will have a profound impact on the future of the field. DESTINI targets to significantly contribute towards producing highly skilled, employable advanced graduate and postgraduate students and researchers. Partners aspire to perform groundwork for developing and offering in the future a joint education degree at graduate level by investigating the number and type of courses, initiating discussions for administration processes and deciding upon details of admission criteria and accreditation. In this deliverable, the partners outline their plan for the formation of new or the modification of existing courses, content, projects, and hands-on exercises at graduate level to complement and enhance CUT's existing master programme in "Data Science and Engineering" (DSE).

Finally, DESTINI aims to plan and execute a mobility programme that targets early stage researchers and advanced student exchanges with the leading universities and beyond, so as

to establish a common research culture, create opportunities for deeper global partnerships and broader access to student and academic talent. In this deliverable, the partners describe how they will promote researcher mobility, explore re-location opportunities, as well as analyze the significant factors to foster the formation of a new scientific and research culture.

The rest of the document is structured as follows: Section 2 outlines the JRAs, sub-JRAs and KKAs for knowledge transfer from the leading partners to CUT, while section 3 describes the actions that need to be taken so as the members of the consortium are able to form joint-education programmes in the future. Section 4 presents the actions towards establishing DESTINI's mobility programme and the means to attract early stage researchers and advanced student exchanges. Finally, the deliverable closes with a brief summary of the deliverable.

## 2 Training

The consortium has identified some indicative areas for transferring knowledge and expertise from the leading institutions to Cyprus University of Technology which are described in Table 1 below, indicating also which of the leading partners has expertise on. Due to the fact that the general area of Smart Data is constantly evolving, it is anticipated that the key knowledge areas below are likely to change and therefore the consortium has defined a flexible scheme so as to incorporate new or revise existing topics as the project progresses.

**Table 1.** Complementarity of scientific knowledge and expertise between the leading institutions on the Key Knowledge Areas of *DESTINI* per JRA

JRA1	ERISS/JADS	UNIROMA1
JRA-1.1: Developing Smart Integrative Solutions	✓	✓
JRA-1.2: Developing Formal Models for the Design of Smart Data Processing Systems and Applications		✓
JRA2	ERISS/JADS	UNIROMA1
JRA-2.1: Developing a Cross-functional, Integrated Analytics Vision		✓
JRA-2.2: Developing Adaptive Self-service Smart-data Platforms	✓	✓
JRA-2.3: Implement an insights-to-Execution Process for Turning Data into Action	✓	✓
JRA3	ERISS/JADS	UNIROMA1
JRA-3.1: Methodology for Smart Data-centric Services and Applications	✓	✓
JRA-3.2: Domain-specific Language for Smart data-centric Services and Applications	✓	✓

The JRAs are also analyzed into sub-areas (see descriptions below), which may also be considered indicative and evolving.

### JRA-1: Smart Data Processing Systems

This JRA includes data ingestion, data aggregation of an enormous variety of structured, unstructured and semi-structured datasets, knowledge-based meta-data representation techniques for the conversion of raw into smart data, data privacy and protection, automated deployment, run-time software performance monitoring and dynamic configuration.

This JRA is divided into the following sub-JRAs and Key Knowledge Areas:

## **JRA-1.1: Developing Smart Integrative Solutions**

### Key Knowledge Areas

- i. Knowledge-based meta-data representation techniques to structure data sets
- ii. Content (semantics) annotation with semantic mechanisms to link them with processes and software services
- iii. Data ingestion and data curation, data aggregations
- iv. Stream processing
- v. Case studies – Small scale experimentation, future research plans
- vi. Models for IoT-based data collection and analytics, with specific focus on digital factories
- vii. Architectures for data-driven digital factories, and case studies

## **JRA-1.2: Developing Formal Models for the Design of Smart Data Processing Systems and Applications**

### Key Knowledge Areas

- i. Universal meta-data abstraction mechanisms (including data storage, replication and transportation, and privacy/security conventions)
- ii. Techniques to represent overall system and application behaviour and performance of the integrated components
- iii. Transformation techniques of high-level models into low-level integration code for integration middleware (e.g. Hadoop, Map Reduce)
- iv. Case studies – Small scale experimentation, future research plans
- v. Ontology-based formal models
- vi. Formal models for digital twins (data processing in smart factories)

## **JRA-2: Systems of Deep Insight**

This JRA focuses on analytic solutions that enable optimization of asset performance in smart data processing systems and is geared towards systems of insight. These are systems that turn data into insights, systematically test insights and find those data that matter to make them contextual and actionable.

This JRA is divided into the following sub-JRAs and Key Knowledge Areas:

### **JRA-2.1: Developing a Cross-functional, Integrated Analytics Vision**

#### Key Knowledge Areas

- i. Probabilistic programming techniques to automate the process of inferring unobserved variables/factors that are crucial to accurate prediction
- ii. Algorithms for contextual multi-armed bandit problems
- iii. Case studies – Small scale experimentation, future research plans
- iv. Stream processing. Technologies and approaches

### **JRA-2.2: Developing Adaptive Self-service Smart-data Platforms**

#### Key Knowledge Areas

- i. Large-scale data analytics
- ii. Self-service techniques to allow users to directly access the big data
- iii. Cross-correlation and cross-functional models
- iv. Design and development of self-service data platform to integrate all smart data elements
- v. Management of data and services by resizing virtual resources repartitioning and migrating applications dynamically
- vi. Machine Learning Operations (MLOps)
- vii. Automated Machine Learning (AutoML)
- viii. Case studies – Small scale experimentation, future research plans
- ix. Digital-twins composition and orchestration
- x. IoT-based process mining techniques, for smart environments

### **JRA-2.3: Implement an insights-to-Execution Process for Turning Data into Action**

#### Key Knowledge Areas

- i. Embedding of digital insights in services
- ii. Actionable, context dependent deep insights
- iii. Decision monitoring and action
- iv. Descriptive, predictive analytics
- v. The analytics challenge as an insight generation (the data-to-insight process) and embedment
- vi. Deep Manufacturing Insights and Informed Action Taking
- vii. Deep Medical Insights and Informed Action Taking



- viii. Case studies – Small scale experimentation, future research plans

### **JRA-3: Methodology for Smart Data-centric Services & Applications**

This JRA targets smart application development techniques by providing a methodology that interlocks elements of smart data processing and systems of deep insight to alleviate complexity and the effect of changes, thus speeding up the entire software development/deployment process.

This JRA is divided into the following sub-JRAs and Key Knowledge Areas:

#### **JRA-3.1: Methodology for Smart Data-centric Services and Applications**

##### Key Knowledge Areas

- i. Smart data applications, using a fusion of an agile, DevOps and MDM environment
- ii. Integrating smart data processing & systems of deep insight in unified data centric applications. (medical big data)
- iii. Case studies – Small scale experimentation, future research plans

#### **JRA-3.2: Domain-specific Language for Smart data-centric Services and Applications**

##### Key Knowledge Areas

- i. Automating the configuration and deployment of smart data applications
- ii. Smart Data-Centric Application and Data/Service Evolution
- iii. IoT Technologies in Support of Application Domains
- iv. Digital-Twin Technologies in Support of Application Domains
- v. Smart Data Processing Systems and the Creation of a Medical Data Lake
- vi. Smart Data Processing Systems for Smart Manufacturing
- vii. Case studies – Small scale experimentation, future research plans

## 2.1 Strategy for Knowledge Transfer

### 2.1.1 Profile of Leading Partners

#### **European Research Institute in Service Science (ERISS) / Jheronimus Academy of Data Science (JADS) / University of Tilburg (UvT)**

The European Research Institute in Service Science that participates in this project is hosted by the University of Tilburg (Netherlands). ERISS/UvT is a multi-disciplinary, internationally renowned research and development institute that is committed to pooling, coordinating and consolidating research activities in service science, management and engineering (SSME) across Europe. To achieve multidisciplinary excellence in SSME, ERISS works closely with other research groups hosted by TiSEM, such as CentER, a world-class economics and business research institute. Tilburg's goal is to become the best education and research institute in the Netherlands and among the top five at the European level in all departments. ERISS undertakes research in service and data science, particularly in the areas of distrusted data management, smart data and services, and globally integrated networks of data and services. The focus of research at ERISS is the real-world challenges facing service networks that demand the use of a wide range of multiple conceptual, methodological and substantive approaches. Recently Tilburg University in cooperation with Eindhoven University launched the Jheronimus Academy of Data Science (JADS) in 's-Hertogenbosch which is home to the Graduate School Data Science and Entrepreneurship. ERISS is an integral part of JADS and will link it with related activities in the DESTINI initiative.

#### **Sapienza Università di Roma**

Sapienza Università di Roma is one of the largest and oldest universities in Italy. It has established itself as one of the most prestigious academic institutions in science and technology in Europe. Dipartimento di Ingegneria Informatica Automatica e Gestionale Antonio Ruberti (DIAG) is a multidisciplinary research center that hosts more than 70 Sapienza faculties and more than 10 research labs from the School in Computer Science & Engineering. DIAG faculties are well-known researchers worldwide and have huge experience working in EU programs. The group working in this project is internationally renowned and has gathered support from the European Commission, the Italian Ministry for Research, the Italian Ministry for Finance, Monte dei Paschi di Siena, Finmeccanica, Telecom Italia, IBM among others.

### 2.1.2 Means for Knowledge Transfer

A short description of the means that DESTINI plans to use for facilitating transfer of knowledge from the leading institutions to CUT is provided below.

**Talk/Lecture:** A talk/lecture is an oral presentation intended to present information or teach people about a particular subject, for example by a university or college teacher (physical presence, live telco).

**Webinar:** Short for web-based seminar, a webinar is a presentation, lecture, workshop or seminar that is transmitted over the web using video conferencing software. A key feature of a webinar is its interactive elements and the ability for a presenter to give, receive and discuss information in real time (live).

**Video Lecture:** A video lesson or lecture is a video which presents educational material for a topic which is to be learned (recorded).

**Tutorial:** Is a method of transferring knowledge and may be used as a part of a learning process. More interactive and specific than a book or a lecture, a tutorial seeks to teach by example and supply the information to complete a certain task (physical presence, document, recorded, live telco).

**Mentoring:** Online mentoring is a supportive, structured relationship, which helps mentees to develop their skills and achieve their goals. Mentees communicate with their mentor through a safe and secure online platform, and the mentoring relationship is supported by a wide range of online resources and activities relating to education and career pathways (physical presence, recorded, live telco)

**Brainstorming:** Brainstorming is a group creativity technique by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its members (physical presence, live telco)

Each partner is responsible to suggest the means of knowledge transfer of each topic based on its expertise and planning.

### **2.1.3 Expected Involvement of Partners in the JRAs**

Training in DESTINI is a living process and will be revised regularly according to international trends. The specific KKAs mentioned in the previous section are representative of what the current trends are in the general area of Smart Data and indicate mostly where DESTINI would like to put emphasis on. During the project, these KKAs, the sub-JRAs as well as the number of topics will be revised according to the latest developments in the area.

In general, the leading partners will be involved in all JRAs but with different roles according to their expertise as outlined in Table 1: Each partner will lead a specific JRA or sub-JRA according to their level of competence, and, consequently, it will be responsible for that area's training. The other partner will support the area leader, complementing the series of training activities to be performed.

At the beginning, each leading partner will present to CUT a general outline of its work in the area being responsible for, including current trends, research performed thus far by its group and other international collaborators, its technological infrastructure, the processes used, best practises, goals & targets, philosophy & culture, and, finally, an outline of the next training and knowledge transfer activities to be performed. The supporting partner will provide feedback and present additional information on its own contribution to the area under investigation so that synergies are revealed. Next, each leading partner will provide a tentative plan of a series of dedicated activities from the list reported in section 2.1.2, which will be regularly revisited to accommodate the latest developments in the area and comply with the interest of the consortium in pursuing research on specific challenges identified. Overall, it is expected that one introductory (1) tutorial will be delivered for each of the sub-JRAs, while one (1) workshop and one (1) summer school will be organized at the end of each JRA. The purpose of the workshops/summer-schools will be threefold: First to summarize the findings of the training process and present an outline of the knowledge gained and the synergies developed between the focus-groups and the leading partners (and potential collaborators). Second, be able to deliver this new knowledge to a wider audience including industrial & market stakeholders and the general public. Third, to lay down the most significant research challenges identified through the training process and paving the way to starting investigating specific research topics in the future for producing high quality research papers.

The leading partners are expected to undertake transfer of knowledge and expertise in DESTINI's areas as follows:

### **ERISS/JADS**

ERISS/JADS will be mostly involved in JRA-1.1: Developing Smart Integrative Solutions, JRA-2.2: Developing Adaptive Self-service Smart-data Platforms, JRA-2.3: Implement an insights-to-Execution Process for Turning Data into Action, JRA-3.1: Methodology for Smart Data-centric Services and Applications and JRA-3.2: Domain-specific Language for Smart data-centric Services and Applications.

### **UNIROMA1**

UNIROMA1 will be mostly involved in JRA-1.1: Developing Smart Integrative Solutions, JRA-1.2: Developing Formal Models for the Design of Smart Data Processing Systems and Applications, JRA-2.1: Developing a Cross-functional, Integrated Analytics Vision, JRA-2.2: Developing Adaptive Self-service Smart-data Platforms, JRA-2.3: Implement an insights-to-Execution Process for Turning Data into Action and JRA-3.1: Methodology for Smart Data-centric Services and Applications, JRA-3.2: Domain-specific Language for Smart data-centric Services and Applications.

#### **2.1.4 Timeframe**

According to the proposal, the timeline and corresponding deadlines for delivering and finalizing each one of the sub-JRAs and JRAs are as follows:

Firstly, taking into consideration JRA1, training starts on M9 (June 2020) and is expected to conclude on M18 (March 2021). More specifically, training activities for *JRA-1.1: Developing Smart Integrative Solutions* will be performed between M9 – M13 (June 2020 – October 2020) and be documented and finalized in M14 (November 2020), while training for *JRA-1.2: Developing Formal Models for the Design of Smart Data Processing Systems and Applications* spans between M13 – M17 (October 2020 – February 2021) and finalized in M18 (March 2021).

Secondly, in the context of JRA2, training starts on M17 (February 2021) and is expected to conclude on M28 (January 2022). More specifically, *JRA-2.1: Developing a Cross-functional, Integrated Analytics Vision*, training is expected to be delivered between M17 – M23 (February 2021 – August 2021) and *JRA-2.2: Developing Adaptive Self-service Smart-data Platforms* between M19 – M23 (April 2021 – August 2021). Both sub-JRAs will be finalized in M24 (September 2021). In addition, *JRA-2.3: Implement an insights-to-Execution Process for*

*Turning Data into Action* will be delivered between M24 – M27 (September 2021 – December 2021) and be finalized in M28 (January 2022).

Finally, in the context of JRA3, training starts on M28 (January 2022) and is expected to conclude on M34 (July 2022). More specifically, *JRA-3.1: Methodology for Smart Data-centric Services and Applications* spans between M28 – M31 (January 2022 – April 2022) and concludes in M32 (May 2022), while *JRA-3.2: Domain-specific Language for Smart data-centric Services and Applications* will be delivered between M32 - M33 (May 2022 – June 2022) and be finalized in M34 (July 2022).

The consortium will make every effort to follow the timeline as planned. Nevertheless, the recent COVID-19 pandemic and the restrictions it posed on normal working processes will surely affect the timeframe. It should be noted that the above deadlines are subject to change due also to the fact that the scientific area of DESTINI is constantly reshaped and reformed. Therefore, the topics addressed, as well as the duration of each sub-JRA and KKA, is highly likely to change according to new trends and innovations encountered internationally.

### **2.1.5 Key Performance Indicators (KPIs)**

At the end of the project, the consortium will assess the results of the knowledge transfer process using a set of KPIs. These KPIs comprise the following criteria and metrics:

- # of people trained per role (e.g. post docs, PhD candidates, researchers etc.)
- # of instructors/trainers per role
- # of lectures, talks, webinars, workshops, live-demos, summer-schools performed
- # of case-studies investigated
- Training material/content produced (number and type, accessibility)

An initial estimation of some of the aforementioned KPIs is as follows:

- 28 people (from CUT) is expected to be trained or be benefitted by the transfer of knowledge and expertise
  - 3 faculty members
  - 3 Post-Docs
  - 10 MSc students
  - 4 PhD students
  - 8 Researchers
- 10 instructors/trainers ranging from faculty positions to post-docs and researchers (from the leading institutions)

- 50-70 lectures, talks, webinars delivered
- 3 workshops and 3 summer schools organized
- 10-12 tutorials delivered
- 10 case-studies investigated
- 4-6 scientific papers/journals initiated or produced
- 2-4 interactive tutorial workshops with ideation sessions
- 4-6 MSc projects/theses
- 4-6 undergraduate projects/theses
- 2-3 experiments/living labs

## 3 Joint-Education

### 3.1 Introduction

The partners in DESTINI will perform groundwork for developing and offering in the future a joint education degree, or supporting and enhancing existing courses at graduate level of CUT's Master programme in "Data Science and Engineering" (DSE). This will primarily be performed by taking the following actions:

- i. Investigate the number and type of courses offered in MDS, and study their content to provide suggestions for revision and reshaping so as to include hot subjects from the area of Smart Data.
- ii. Explore the opportunity for offering a new, joint graduate degree, which may be offered at CUT and be supported teaching wise by the leading institutions. Initiate discussions for administration processes and legal issues, such as accreditation by the corresponding Cypriot body and decide upon details of admission requirements/criteria and accreditation.
- iii. Announce and jointly supervise theses of master and doctoral students. The students will be primarily sourced by CUT, but also students from the leading institutions may join either physically located at CUT or virtually through teleconferencing means. In this context exchange of students between CUY and the leading institutions will be encouraged provided that circumstances in Europe will allow it (e.g. COVID-19 situation during the project's life-span).

The leading institutions will support the above joint education activities by offering their expertise and experience in reshaping CUT's master's programme, suggesting new courses, content, projects and labs, and integrating with their graduate programmes in terms of theses assignment and preparation of webinars and e-learning material based on courses of their own programmes that will be used by CUT graduate students and researchers.

The main output of the aforementioned actions will be measured and assessed by certain KPIs, which include the total number of expected courses and their associated, planned teaching material, the expected number of subjects that will be assigned to students as projects, master thesis, and research topics and, finally, the expected number of students to be enrolled in the new, revised courses and/or programmes.



### 3.2 Means to enhance the “Data Science and Engineering MSc” programme

The Cyprus University of Technology is currently offering an MSc programme on “Data Science and Engineering” (DSE). The following link contains details about this programme:

<https://www.cut.ac.cy/studies/masters/master-programmes/Data+Science+and+Engineering/?!languageId=1>

<b>Modules</b>					
<b>Module Description</b>					
<b>First Year</b>					
<b>FALL SEMESTER</b>			<b>SPRING SEMESTER</b>		
<b>1st Semester</b>	<b>ECTS</b>		<b>2nd Semester</b>	<b>ECTS</b>	
CEI 521 Advanced Topics in Software Engineering	7	Compulsory	CEI 525 Advanced Topics in Architecture and Parallel Computing	8	Compulsory
CEI 522 Advanced and Distributed Operating Systems	8	Compulsory	CEI 526 Advanced Topics in Data Processing Systems	8	Compulsory
CEI 523 Data Science	8	Compulsory	EEN 512 Advanced Digital Signal Processing I	8	Elective
CEI 524 Network Science	7	Compulsory	EEN 544 Advanced Digital Signal Processing II	8	Elective
CEI 527 Research Methods in Computer and Informatics Engineering	7	Compulsory	CEI 563 Advanced Topics in Parallel Processing and Distributed Systems	8	Elective
			CEI 565 Software Project Management	7	Elective
			CEI 569 Computer Security and Cryptography	8	Elective
			CEI 570 Design and Testing of Integrated Circuits	8	Elective
			CEI 571 Project Management & Scheduling	7	Elective
			CEI 543 Digital Image Processing	8	Elective
	<b>Total</b>	<b>30</b>		<b>Total</b>	<b>30</b>
<b>SUMMER PERIOD</b>				<b>ECTS</b>	
CEI 590 Thesis Master				30	
				<b>Total</b>	
				30	

**Table 2.** Compulsory and Elective modules of DSE.

The consortium intends to investigate various means to enhance and enrich the existing MSc programme offered by CUT in terms of new subjects and topics, and/or new courses, from the

broader area of Smart Data, and more specifically by building upon DESTINI'S Joint Areas of Research (JRAs). In addition, MSc and undergraduate theses relevant to DESTINI's JRAs will be announced and assigned to interested students thus increasing the project's local exposure and boosting up its collaboration basis and visibility. The partners will perform meetings, either physical or via teleconferencing means, and will examine in what ways and to what extent the DSE master may be benefitted from DESTINI. The anticipated benefits that will be brought about when revising DSE is to make the programme more attractive to both local and foreign students thus increasing the number of applications received each year, which in turn will lead to increasing the number of students enrolled.

Based on the above, the partners will work closely together performing the activities or steps presented below:

- i. The consortium will investigate and suggest where and how the existing DSE curriculum may be enhanced and strengthened by adding or revising the current teaching modules so as to include topics from DESTINI's JRAs. The relevant courses will be covered during a 13-week teaching period according to the timetable followed at CUT.
- ii. The leading partners will examine the modules' descriptions and associated material and investigate what topics are currently being covered. Then, they will identify and suggest new and hot subjects from the JRAs that can be added to the existing course syllabus. These subjects will be first presented to students in the form of lectures and then individual/group projects will assign to strengthen the theoretical and practical background of students on the suggested subjects.
- iii. Members of the leading institutions and CUT will suggest topics from the JRAs for MSc and undergraduate theses undertaken by students at CUT and jointly supervise them. The leading partners will drive this process utilizing their expertise in the area of Smart Data to identify subjects for the undergraduate and graduate theses which will make a substantial scientific impact. The theses will be supported by the leading institutions by means of facilities (e.g. Cloud resources) and/or datasets already gathered (e.g. in other projects) or to be collected during the project. In addition, effort will be devoted to linking the theses with the local industry and market in the participating countries, engaging stakeholders that will offer their domain expertise at the beginning to define the requirements and assess the end-result at the end.

- iv. Designing of new elective courses that can be offered to MSc students. These new courses will be offered in the context of the “Data Science and Engineering” MSc programme and will be taught by Faculty staff from the leading institutes and supervised by faculty members of CUT. The new courses will be designed to comply with Cyprus regulations in order to be approved by the Cyprus Agency of Quality Assurance and Accreditation in Higher Education (CYQAA). Members of the consortium will be responsible for writing course syllabus and study guide.
  
- v. Ensuring the sustainability of the changes performed beyond the end of the project. The revision of the DSE master will be evaluated by the graduates committee of the Dept. of Electrical Engineering, Computer Engineering and Informatics at CUT, along with the results regarding enrolment. It is anticipated that the latter will be improved and also the quality of the master graduates will be significantly improved in the market of data analysts. The consortium will carefully plan a smooth integration of the changes in the DSE curriculum with instructors being trained or guided to absorb and embody any new material introduced by DESTINI, so as to deliver it independently (i.e. with no further support) to master students after the end of the project.

### 3.3 Target Courses

#### ***CEI 521 Advanced Topics in Software Engineering***

This course teaches advanced topics in Software Engineering revolving around the following four axes: (a) Software Testing, (b) Distributed Software Systems, (c) Software Reuse, (d) Software Project Management. The first axis analyses basic and advanced concepts of software testing, starting from basic behavioral properties and ending with techniques and methods for analysis and testing of specifications and code using structural coverage criteria, as well as data and control dependence graphs. The second axis is concentrated on design and implementation issues of distributed software systems, focusing on distributed, layered architectures, middleware and provision of software as a service. Topics in the third axis cover modern software development approaches based on reusability, describing how components and open source software may be reused and integrated, and discussing their advantages and limitations. Finally, the fourth axis emphasizes on software project management issues and particularly on human resources management and cost estimation.

#### ***CEI 523 Data Science***

This module is about learning from data, in order to gain useful predictions and insights. Separating signal from noise presents many computational and inferential challenges, which

we approach from a perspective at the interface of computer science and statistics. Through real-world examples of wide interest, we introduce methods for: (i) data munging/scraping/sampling/cleaning in order to get an informative, manageable datasets; (ii) data storage and management in order to be able to access data - especially big data - quickly and reliably during subsequent analysis; (iii) exploratory data analysis to generate hypotheses and intuition about the data; (iv) prediction based on statistical tools such as regression, classification, and clustering; and (v) communication of results through visualization, stories, and interpretable summaries. The module comprises both a theoretical part and a series of laboratory exercises.

### ***CEI 525 Advanced Topics in Data Processing Systems***

The need to store and process massive amounts of data has led to the evolution of existing database systems while a new breed of data processing systems has emerged. This course covers a spectrum of topics from core techniques in relational data management to highly-scalable data processing using parallel database systems and MapReduce. First, the course covers the basic principles in database query processing and optimization, including index structures, sort and join processing, query rewrites, and physical plan selection. Next, the course covers topics from parallel and distributed databases, including data partitioning and distributed join algorithms. Finally, the course covers scalable data processing systems such as MapReduce and NoSQL databases (column, document, and key-value stores). The course material will be drawn from textbooks as well as recent research literature. Prerequisite background: Basic database knowledge.

The instructors of the aforementioned courses are part of CUT's team and have already acknowledged the importance of keeping the DSE curriculum as updated and compatible with international trends in data science as possible. To this end, they will work closely with the leading institutions to agree on the revisions and enhancements to be performed. The new form of the DSE (i.e. after revising the content of existing courses and/or the addition of new ones) will be subject to approval by the Cyprus Agency of Quality Assurance and Accreditation in Higher Education (CYQAA) - <http://dipae.ac.cy/index.php/en/>. "CYQAA is the competent Authority in Cyprus responsible for ensuring the quality of higher education in Cyprus and for the support of the processes provided by the relevant legislation, for the continuous improvement and upgrading of higher education institutions and their programs of study". Finally, it should be noted that DESTINI's JRAs are a living scientific container, in the sense that topics, subjects, trends and even sub-areas are likely to change as a result of the evolution observed in the broader area of Data Science. As such, the specific revision to the DSE curriculum cannot be quantified a-priori; the consortium has decided to define the details of

additions or enhancements to the current curriculum as the project progresses and will be finalized nearly at the end of its duration.

## 4 Mobility Programme

DESTINI places emphasis on establishing and executing its mobility programme. To this end the consortium will devote time and effort included in a dedicated workpackage (WP5) that will perform preparatory work and execute mobility activities. More specifically, WP5 will examine researcher mobility and re-location opportunities, as well as analyze the significant factors to foster the formation of a new scientific and research culture. It will provide the means for submitting applications, perform evaluations and recruitments, and offer general support for researchers to relocate to Cyprus for a short period of time (up to 3 months) through a dedicated portal developed for this purpose.

DESTINI has carefully planned a mobility programme that targets Early Stage Researchers (ESR) and advanced student exchanges with the leading universities and beyond, so as to establish a common research culture, create opportunities for much deeper global partnerships and broader access to student and academic talent. The mobility programme plans to recruit ESRs at the Cyprus University of Technology (CUT) and therefore they will become members of CUT's research team for a certain period of time. In order to avoid any confusion, the definition of ESRs follows: "ESRs shall, at the time of recruitment by the host organisation, be in the first four years (full-time equivalent research experience) of their research careers and have not been awarded a doctoral degree." Therefore, ESRs are welcome to apply for DESTINI's mobility programme and join its research team. We are looking for candidates who aim at investigating hot and challenging research problems in the areas of Smart Data Processing and Systems of Deep Insights.

It is anticipated that 8-10 researchers will make use of the mobility programme, and will be smoothly integrated in CUT's, and in DESTINI's, research team. These researchers will be supported financially for an average period of 2-3 months by means of scholarships. DESTINI will also offer a relocation package to researchers. This package includes support for finding accommodation, either in CUT's dorms or in cooperating renting entities in the city of Limassol, guidance for opening bank accounts to local banks, providing maps and information about buses, routes, health facilities & services, restaurants & night life, etc. The researchers will be hosted at the premises of the dept. of Electrical Engineering, Computer Engineering and Informatics, in Saripolou str., Limassol, and more specifically in the Software Engineering & Intelligent Information Systems Research Laboratory at the third floor of the building. Each researcher will be granted access to the computing facilities of CUT, including accounts in the university network and its resources (software & hardware) and will have his/her own part of joint office space to work.

The activities of the mobility programme include, but are not limited to, training and mentoring on particular research subjects, brainstorming, investigation of solutions and piloting, and publication of the work produced in scientific journals, conferences and workshops.

The mobility period will coincide with CUT's academic semesters so that the courses offered by CUT and attended by researchers may be credited by their home-sending institutions, both among the leading partners and beyond, based on bilateral agreements signed and/or integrated between CUT and its strategic partners such as the ERASMUS learning agreement schemes.

To disseminate the mobility programme a website that contains details about the programme as well as a form of interest was development by members of CUT. The website can be accessed using the link [www.destini2020.eu/portal/](http://www.destini2020.eu/portal/) and hosts information about the project and research opportunities, announcements of PhD or research positions and/or scholarships. It also includes information about the city, legislation, taxation system, social life and housing. The portal enables the electronic submission of interest and the correspondence between DESTINI and prospective mobility researchers.

The mobility recruitment programme will be continuously advertised through the Social Network accounts of the project, as well as through the academic and professional network of the consortium members.

The applications submitted submissions will be examined and evaluated in two phases:

- i. During the first phase the candidate will be evaluated according to his/her scientific background and research skills, as well as his/her research work and publications (if any) that are relevant to the research areas/topics of DESTINI.
- ii. During the second phase the candidate will be interviewed by members of the consortium focusing more on his/her targets and goals for joining DESTINI, his/her vision, enthusiasm and personality.

The candidates will then be ranked according to the aforementioned phases and selection will be made based on the top candidate(s) for the number of positions opened. The latter will be defined in the course of the project and may vary according to the period of announcement as the recent covid-19 pandemic has posed restrictions and severe barriers to travelling and mobility. DESTINI will re-evaluate the whole situation in the second year of the project and the consortium will take decisions that will boost mobility or will suggest reforming the mobility programme so that it can be conducted remotely subject to approval by the EC.

DESTINI fully supports the European Union policy on equal opportunities between women and men. To this end, the participation of women is highly welcomed. There will be equal treatment between genders and there will not be any discrimination for recruitment or for any other reason.

The mobility programme will target at investigating specific areas and topics to form a solid scientific background and facilitate future research in these areas. To this end the partners will direct the incoming mobility researchers to these areas in the following way:

- ⇒ Each researcher will be assigned to one or more areas or topics depending on his/her background and sending institution or research group (if any), as well as his/her interests and vision. In this way small focus-groups will be formed, comprising mobility researchers and members of CUT.
- ⇒ Each area and/or topic will be introduced to the focus-group by the leading partner responsible for the JRA it falls into, supported by the other leading partner and CUT.
- ⇒ The scientific and research targets and goals will initially be set for each JRA by the consortium, subject to changes that will be deemed necessary as the project progresses. These will be communicated to the focus-group and a roadmap/schedule will be defined to fulfil them.
- ⇒ The focus group will start working towards enhancing its knowledge and expertise. Also, effort will be devoted to initiating research work along the lines of the topic(s) of interest, as well as to investigate the opportunity of preparing and submitting new proposals for local and EU funding.
- ⇒ At regular intervals (e.g. 1-3 weeks) the progress and output of each focus-group will be monitored and assessed, and corrective actions will be taken in cases of deviation from the roadmap/schedule.
- ⇒ At the end of the mobility period, the corresponding researcher(s) will prepare and submit a report describing the topics with which they have been involved and describe briefly the results produced and targets achieved. This report will also outline any future collaboration of the mobility researchers with DESTINI.

DESTINI's mobility programme will exploit the opportunities and synergies provided by the Erasmus programme. The partners will activate the process of signing bilateral agreements with the universities that will send researchers in the context of DESTINI's mobility programme so that future collaboration with these organisations is feasible thus contributing to establishing its network of collaborators and ensuring sustainability of partnerships and exchange of knowledge and expertise with them even beyond the end of the project.



Furthermore, existing Erasmus agreements will initially be examined as potential pools of candidate mobility researchers to which dissemination material and invitation to join DESTINI's mobility programme will be sent.

DESTINI has defined the following indicative KPIs that will be used at the end of the project to assess how well the programme performed; these KPIs will be regularly assessed and will also be revised when and if necessary:

- #people (ESRs)
- #focus-groups
- #subjects/topics assigned
- #collaborations with other universities (sending institutions)
- #groups/people from other universities (sending institutions)
- #potential future research papers
- #proposals that have been prepared/submitted or will be in the future

## 5 Summary

The purpose of this deliverable was to develop the strategy and action-plan for joint education, training and mobility which is aligned with the joint research agenda outlined in *D2.3 Research & Innovation Agenda*.

Our overall intention is to promote a culture of research excellence at CUT by establishing new cutting-edge lines of multi-disciplinary enquiry that address global challenges and create the right conditions to help CUT excel in science and substantially improve its research capacity.

The partners, through this strategy and action-plan, will work closely together to ensure that CUT acquires new and enhances existing knowledge on the JRAs described above. This will be supported by sharing research experiences and best practices with advanced scientific groups from the leading institutions. The collaboration and exposure of CUT to matured research environments will change the research culture and scientific approach/philosophy of CUT's staff and will enable the production of new research-oriented proposals for European or national funding.

In addition, this deliverable presents the DESTINI's aim to create a joint supervision/mentoring programme for students at Doctoral level and a training programme for early stage researchers to significantly contribute towards producing highly skilled, employable advanced graduate and postgraduate students and researchers.

Finally, the mobility programme described as part of this deliverable targets early stage researchers and advanced student exchanges, so as to establish a common research culture, create opportunities for much deeper global partnerships and broader access to student and academic talent.

To this end, the overall strategy and action-plan for joint education, training and mobility presented in this deliverable will ensure that CUT is on the right track to achieve research excellence, assessing at the same time risks and the associated mitigating actions.