

# Building Skills 4.0 through University and Enterprise Collaboration

## SHYFTE 4.0

### WP5: WP Management

#### D5.2: Project management coordination and reporting vs:3.0.0

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This document is the final report of the project, it includes a final publishable summary report comprising a description of the main results, potential impact and main dissemination activities.

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This deliverable is subject to final acceptance by the EACEA.

## Further Information

<http://www.shyfte.eu/>

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## Project Partners:



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## 1. Executive Summary

The main objective of this deliverable is to summarize the main results, the potential impacts and main dissemination activities of the Shyfte 4.0 project.

The project framework, goals, objectives and scope were provided in the approved application form. The scope of Deliverable D5.2 is to describe what is ultimately delivered in the project and the key outcomes of the Shyfte 4.0 project.

## 2. Shyfte 4.0 summary & objectives

The main motivation of Shyfte 4.0 was to bring together the targeted countries with their specific skills in ICT to optimize and manage productivity, human labour, safety and social issues related to Industry 4.0. Asian Partner Countries (PCs) involved in this proposal are facing rapid radical changes in their industrial systems, due to the high expectation from their stakeholders to be efficient, costs efficient by following the 4th wave of industrial revolution to improve their skills and competencies. Asian PCs need better learning and teaching methodologies to get clear instructions on how to prepare workforce for the industry of the future, and for HEIs, in association with SMEs, to bridge the skills gap and boost the job market at regional, national and int. level.”

### **The overall aims of Shyfte 4.0 project were:**

- To support academic and administrative staff in Asian HEIs to design and implement new methodology and learning materials to enhance and improve the competencies and skills related to Industry 4.0. This will enable HEIs organizations to align their learning program strategy both to the expectation of the regional industry and the global labor market.
- To build and strengthen links between HEIs and Industry and promote the job market by reducing the skills gap.
- To build Skills 4.0 Labs or Learning centers of excellence in Asian Partner's countries to enable them to become the reference center in their respective countries and disseminate the results of the project nationally and regionally.

Shyfte 4.0 provides the basic and novel skills development strategy in both EU and Asia, focusing on four research domains:

1. Industrial Engineering and Management,
2. Software Engineering and Big Data Analytics,
3. Wireless and Networks Analytics,
4. Artificial Intelligence.

The Specific Project Objectives were to:

- Analyse the gap between the skills acquired in HEIs and the skills required by the industry of the future (WP1),

- Develop a Skills 4.0 based learning framework (WP1),
- Design and implement teaching programs and learning materials for four domains of expertise (WP1 & WP2),
- Implement four Pilots, based on the four domains of expertise, in the HEIs of the Asian partners (WP2),
- Develop a Skills 4.0 based Training and Learning Center of Excellence in each Partner country (WP2),
- Define a Quality Assurance Plan for the learning programs based on quality audits to ensure the sustainability (WP3).
- Develop a successful Exploitation and Dissemination strategy (WP4)

## 2.1 Project Work plan and Deliverables

Shyfte divided the 3 years activities into 3 stages and 5 inter-related work packages.

**Part 1:** a prospective review was conducted, M1-8. A literature review on Industry 4.0 and required skills in Asia and Europe. A set of questions will be conducted and compiled in questionnaires and reported by the target partners. A report (M8) consists of an overview on Skills 4.0 vision in both Europe and Asia and the Skills needed to empower Asian HEIs and Industries. A workshop grouping trainers/teachers and academic institution will be set up in Thailand to complete the vision of the skills needed for HEIs in association with Industry 4.0.

Methodology: Top-down approach mixing literature review and conducting questionnaires to identify the real requirements in developing skill sets in the target partner's countries

**Part 2:** dedicated to developing the learning programs and materials for training and teaching, M12-M24. Shyfte proposed 4 meta-training programs:

1. Skills needed for Industry 4.0.
2. Skills to implement in HEIs.
3. Advanced teaching and learning strategies for trainers and for students.
4. Quality assessments (audits) for trainers and students.

These programs were implemented in 4 specific pilots:

**Pilot 1:** Industrial Engineering and Management in Thailand (CMU/KU with all partners),

**Pilot 2:** Software Engineering & and Big Data Analytics in China (CUIT/CDU with all partners),

**Pilot 3:** Wireless and Networks Analytics in Malaysia (UPM and all partners),

**Pilot 4:** Artificial Intelligence in Malaysia (UTM and all partners).

**Methodology:** The training programs addressed both “train-the-trainer” and “train-the-students” types of training. The development followed the appropriate adaptive learning approach for skills enhancement.

A Skills 4.0 based Training and Learning Center of Excellence was developed in each Partner country (WP2) to disseminate and sustain the outcomes of the project.

During the project, **214 trainers** and **400 students** benefited from the Shyfte 4.0 trainings. With this approach, skills and knowledge transfer will be fast and efficient.

**Part 3:** Shyfte 4.0 was engaged in a quality assessment training process. The EU countries developed the quality certification for trainers to validate the skills and develop standard/procedures of the programs.

Five Work Packages were defined (WPs):

- WP1 Preparation
- WP2 Development
- WP3 Quality Plan
- WP4 Dissemination and Exploitation
- WP5 Management

The final adjusted work and time plan of the project is described in the following tables:



WP1	CMU & COGNITUS	DELIVERABLES	PREPARATION	Due date	New Due date (extension 10 months)	End date
T1.1	ULL	D1.1 v1	Literature review of Industry4.0 in Europe, Asia and over the world	14 May 2019		14 May 2019
			Literature review: Definition of Industry 4.0 + Analysis of existing concepts & models + Analyze of the current teaching and learning methods in EU & Asia (per domain)			
T1.2	UNS	D1.1 v2	Identify the skills requested by Industry4.0	14 May 2019		14 July 2019
			Define the maturity model and the framework of the questionnaire + validation + deployment + Summarize the survey			
T1.3	UNL	D1.2	Analyse the gap by overlapping the skills4.0 with the existing skills in HEIs. Develop an emerging model (emerging skills; disparate skills, shift skills,...)	14 November 2019		14 November 2019
			Analyse the gap by overlapping the skills4.0 with the existing skills in HEIs. + Develop an emerging model: Refinement of Skill Model 4.0			
T1.4	UNL	D1.3	Develop the Skills 4.0 learning framework - Identify the relationship between the Skills & the SHYFTE 4 domains	14 November 2019		14 November 2019
			Develop the Skills 4.0 learning framework + Identify the relationship between the skill4.0 and the SHYFTE 4 domains			
T1.5	ULL	D1.4	Design teaching programs and learning materials for the 4 domains.	14 April 2020		14 June 2020
			Define the learning programs + the Syllabus of the modules to develop			

WP2	ULL & UPM		DEVELOPMENT (implementation of shyfte4.0 framework - Learning and training	Due date	New Due date (extension 10 months)	End date
T2.1	KU-CMU	D2.1	Pilot in Domain1- Industrial engineering and management (Training materials)	14 March 2021	14 September 2022	14 September 2022
			Learning Materials development: theoretical part, industrial use case, equipment used, infrastructure, material preparation... + Validation by the group of expert: Internal (1 or more expert per university partner) + External + Training of the trainer's sessions + Learning Materials assessment & update + Student's maturity level assessment + Training of the students + Learning Materials assessment			
T2.2	CUIT-CDU	D2.2	Pilot in domain2 - Software Engineering and big data analysis (Training materials)	14 March 2021	14 September 2022	14 September 2022
			Learning Materials development: theoretical part, industrial use case, equipment used, infrastructure, material preparation... + Validation by the group of expert: Internal (1 or more expert per university partner) + External + Training of the trainer's sessions + Learning Materials assessment & update + Student's maturity level assessment + Training of the students + Learning Materials assessment			
T2.3	UPM	D2.3	Pilot in domain3 Wireless networks analytics (Training materials)	14 March 2021	14 September 2022	14 September 2022
			Learning Materials development: theoretical part, industrial use case, equipment used, infrastructure, material preparation... + Validation by the group of expert: Internal (1 or more expert per university partner) + External + Training of the trainer's sessions + Learning Materials assessment & update + Student's maturity level assessment + Training of the students + Learning Materials assessment			
T2.4	UTM-CUIT	D2.4	Pilot in Domain4 - Artificial Intelligence (Training materials)	14 March 2021	14 September 2022	14 September 2022
			Learning Materials development: theoretical part, industrial use case, equipment used, infrastructure, material preparation... + Validation by the group of expert: Internal (1 or more expert per university partner) + External + Training of the trainer's sessions + Learning Materials assessment & update + Student's maturity level assessment + Training of the students + Learning Materials assessment			
T2.5	UNL	D2.5	Develop the skills4.0 training and learning center	14 November 2021	14 September 2022	14 September 2022
			Define the protocol of operation and internal articulation of the Learning Center of Excellence,			
	UNL	D2.6	Learning Center as Innovation Lab.	14 June 2021	14 September 2022	14 September 2022
			Report the Lab set-up for applications developments and devices use and testing in prototypes.			
	UNL	D2.7	Develop the skills4.0 training and learning center	14 June 2021	14 September 2022	14 September 2022
			Report the methodology for the technical and business evaluation of innovative technological solutions			

WP3	CUIT & UNS		QUALITY PLAN	Due date	New Due date (extension 10 months)	End date
T3.1	UNS	D3.1 v1	Strategic Quality Plan Quality plan to verify the effectiveness of the learning program	14 November 2019		14 November 2019
			Validation of the learning program by the companies (advisory board) + Validation of the learning program by the academics + Define an evaluation questionnaire for the trainers & for the students			
T3.2	UNL	D3.1 v2	Formation Quality Plan (FQP)	14 June 2021	14 September 2022	14 September 2022
			Define the Formation Quality Plan and the quality indicators to evaluate the transfer of skills			
T3.3	CUIT	D3.2	Quality audits to analyse and evaluate the transfer of skills4.0 Measuring the impact of these skills in SME	14 July 2021	14 September 2022	14 September 2022
			Design a set of indicators to measure the potential impact of these skills in the SMEs			
T3.4	CMU	D3.3	Sustainability assurance plan	14 October 2021	14 September 2022	14 September 2022
			Design a sustainability plan to ensure the continuation beyond the end of the project.			

WP4	UNL & CDU		DISSEMINATION AND EXPLOITATION	Due date	New Due date (extension 10 months)	End date
T4.1	UNS	D4.1	Dissemination and exploitation strategy (Create strategic plan)	14 February 2019		14 February 2019
			<i>Visibility: identify a set of public/private entities where to make a presentation of the project + Dissemination: identify the events where to communicate the results; dissemination meetings + Dissemination: identify the external universities where to propose the results of the project + Exploitation: identify the industries where to present the new professionals formed</i>			
T4.3	UNL	D4.2	Project Website	29 March 2019		29 March 2019
			<i>Develop Website prototype, first version, test, final version of the website</i>			
T4.3	UNL	D4.3	Publicity	14 November 2020		14 November 2020
			<i>Report on leaflets, press releases, etc. Participation in social networks</i>			
T4.3	UNL	D4.4	Formal & informal meetings, conference days...	14 November 2021	14 October 2022	14 October 2022
			<i>Report on formal and informal meetings, coffee type, workshops, days, etc.</i>			
T4.2	CDU	D4.5 v1	Awareness dissemination and acceptance of emerging skills4.0	14 November 2019		14 November 2019
			<i>Report on dissemination activities for action.</i>			
T4.2	CDU	D4.5 vf	Awareness dissemination and acceptance of emerging skills4.0	14 November 2021	14 October 2022	14 October 2022
			<i>Report on dissemination activities for action.</i>			
T4.4	ULL	D4.6	Learning Centres and observatory exploitation.	14 June 2021	14 October 2022	14 October 2022
			<i>Design and create what will be the network of centres and the Industry 4.0 observatory for the region.</i>			
T4.4	ULL	D4.7	Scientific and technical dissemination (Conferences, workshops, seminars, ...)	14 November 2021	14 October 2022	14 October 2022
			<i>Report on scientific dissemination: publication in indexed journals, participation in national and international conferences</i>			

WP5	ULL		MANAGEMENT	Due date	New Due date (extension 10 months)	End date
TS.1 TS.2	ULL	D5.1	Project management coordination and reporting & Quality, Risk and Innovation management	29 March 2019		29 March 2019
			<i>Project Handbook &amp; Quality Plan</i>			
TS.1	UNS	D5.3 v1-v3	Project management coordination and reporting	14 November 2021	14 October 2022	14 October 2022
			<i>SHYFTE Periodic Reports</i>			
TS.1	ULL	D5.2	Project management coordination and reporting	14 November 2021	14 October 2022	14 October 2022
			<i>SHYFTE Final Report</i>			

The initial travel plan of the project was defined based on the WPs and the possible associated events:

N°	Year	WP	Location	Nb days	Physical Meetings
1	1	WP5 Management	Lyon	5	21/01/2019 to 25/01/2019
2	1	WP1 Preparation	Chiang Mai	5	25/03/2019 to 29/03/2019
3	1	WP1 Preparation	Lisbon	5	27/05/2019 to 31/05/2019
4	1	WP1 Preparation	Chengdu	5	28/10/2019 to 01/11/2019
5	1	WP1 Preparation	Benevento	5	09/12/2019 to 13/12/2019
6	2	WP2 Development	Lyon	5	03/02/2020 to 07/02/2020
7	2	WP2 Development	Benevento	5	01/06/2020 to 05/06/2020
8	2	WP2 Development	Bangkok	5	02/03/2020 to 06/03/2020
9	2	WP2 Development	Chengdu (CDU)	10	12/10/20 to 21/10/20
10	2	WP2 Development	Kuala Lumpur	10	07/12/20 to 11/12/20 Meeting + Skima 12/12/20 to 16/12/20 Training
11	2	WP5 Management	Paris	5	16 to 20 november 2020
12	3	WP2 Development	Kuala Lumpur	10	Beg 03/2021
13	3	WP3 Quality Plan	Benevento	5	Beg 03/2021
14	3	WP2 Development	Bangkok	15	Beg 02/2021
15	3	WP2 Development	Chiang Mai	10	Beg 05/2021
16	3	WP2 Development	EU <--> ASIA	20	Beg 07/2021
17	3	WP4 Dissemination	Lisbon	5	Beg 11/2021

Due to the Covid-19 pandemic, we were forced to cancel most of the planned travels (8). We started the project in November 2018, the Kick-off took place in Lyon in January 2019. We organized 6 physical meetings (2 industrial workshops, 3 company visits...) before January 2020 and the beginning of the crisis.

We adapted our way of working, switching from physical meetings to virtual meetings (44 virtual meetings organized from February 2020 to April 2022). We have validated with our project manager and the EACEA Agency a 10-month extension to be able to organize some of the project activities (face-to-face training sessions with students, dissemination activities...).

We were finally able to hold 4 more physical meetings from April 2022 to August 2022 and the official end of the project on September 14, 2022. The travels finally made are the following:

	DESTINATION	PERIOD	FROM	TO	LINKED-WPS	
<b>Period 1 - November 2018-March 2020</b>	LYON-France	Jan-19	21/01/2019	25/01/2019	WP5	PHYSICAL
	CHIANG MAI-Thailand	Mar-19	25/03/2019	29/03/2019	WP1	PHYSICAL
	LISBON- Portugal	May-19	27/05/2019	31/05/2019	WP1	PHYSICAL
	CHENGDU-China	Oct-19	28/10/2019	01/11/2019	WP1	PHYSICAL
	BENEVENTO- Italy	Dec-19	09/12/2019	13/12/2019	WP1	PHYSICAL
	LYON- France	Feb-20	03/02/2020	06/02/2020	WP2	PHYSICAL
<b>Post Covid</b>	LISBON-Portugal	Apr-22	27/04/2022	28/04/2022	WP4	PHYSICAL
	KUALA LAMPUR- Malaysia	Jun-22	20/06/2022	24/06/2022	WP2	PHYSICAL
	LISBON-Portugal	July-22	18/07/2022	22/07/2022	WP4	PHYSICAL
	CHIANG MAI-Thailand	Aug-22	29/08/2022	02/09/2022	WP2	PHYSICAL

The 8 travels cancelled are the following:

	DESTINATION	LINKED-WPS		P_DAYS
<b>VIRTUAL MEETING /CANCELLED</b>	BENEVENTO- Italy	WP2	ALL	5
	BANGKOK- Thailand	WP2	ALL	5
	Chengdu-China	WP2	ALL	10
	KUALA LAMPUR- Malaysia	WP2	ALL	10
	PARIS- France	WP5	ALL	5
	BENEVENTO- Italy	WP3	ALL	5
	BANGKOK- Thailand	WP2	ALL	15
	EU <--> ASIA	WP2	EU PARTNERS	20

We validated with our PO that we can use part of this remaining budget for Staff Costs, less than 10% of the staff cost budget (see the Financial Statement). These staff costs correspond to an increase in the workload, mainly for the WP2 and the development of Learning materials in the framework of distance work.

During the 4 years of the project, despite the disruption due to Covid-19, we were able to organize ourselves to accomplish all the tasks planned.

In order to summarize the project activities, we will first present the measurement of the main performance indicators defined.

## 2.2 Measurement of main KPI's

The main Indicators of achievement and performance of the project, with their objectives, were defined according to three levels of detail:

- Overview of short- and long-term Impact indicators (page 34 of the proposal)
- The Logical Framework Matrix (LFM, page 39 of the proposal)
- The Quality Assurance Matrix and Indicators (QAM, page 30 of the Deliverable D5.1)

In the following tables, we present the results and measurement of these three achievement and performance indicators levels:

## 2.2.1 Short term Impact indicators

Shyfte Short term impact	Target groups beneficiaries	Quantitative indicators: Target	Quantitative indicators: Results
To develop skill sets in Asian partner countries in-line with HEIs and Industry 4.0 for boosting the job market at regional, national and international level	Academic researchers, administrative staff, PhD and Postdoc students	<ul style="list-style-type: none"> <li>- Questionnaires will be prepared with the analysis of skill sets with respect to associated needs of HEIs and Industry</li> <li>- 30% Asian curriculum has embedded Skills 4.0 in their curriculum</li> <li>- 10% Improvement in graduate employability including self-employability</li> </ul>	<ul style="list-style-type: none"> <li>• Number of literatures referenced: <b>67</b></li> <li>• Number of SMEs surveyed in partners countries: <b>295</b></li> <li>• The 4 pilots in the partners countries developed <b>35</b> new modules</li> <li>• Most of these modules will be integrated in the university's curriculum.</li> <li>• The employability is not yet measurable (the last training sessions took place in August 2022)</li> </ul>
To promote the skills for the capacity building in the HEIs in Asia	Trainers/staff/administrative/academic and collaborators	<ul style="list-style-type: none"> <li>- 12 trainings to train and prepare the teachers/trainers</li> <li>- 24 awareness workshops, seminars and Teleconferences for realizing the importance of the current industrial demands.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>37</b> training of the trainers' sessions were organized</li> <li>• <b>33</b> awareness workshops, seminars and meetings were organized</li> </ul>
To develop the curriculum in collaboration & coordination of HEIs, SMEs and Industries	Trainers/staff/administrative/academic and collaborators	- To prepare material and manuals with rigorous explanation of novel skill learning and developing strategies	<ul style="list-style-type: none"> <li>• <b>1</b> Learning Center guideline for teachers is defined (per domain)</li> <li>• <b>1</b> Learning Center guideline for students is defined (per domain)</li> </ul>
Strengthening the trainers/teachers skills	Teachers, Trainers, Students, HEIs	To boost the job market by enhancing the skills	<ul style="list-style-type: none"> <li>• <b>214</b> trainers trained from different universities and companies</li> </ul>
Have a solid expertise in the addition of Skills 4.0	Trainers, Teachers HEIs,	- Number of trainers/teachers trained during SHYFTE project	<ul style="list-style-type: none"> <li>• <b>194</b> trainers trained from different universities</li> </ul>

		- number of students trained by the trainers/teachers	<ul style="list-style-type: none"> <li>• <b>400</b> students trained in the partner's universities</li> </ul>
To enhance the knowledge and awareness of the Asian partner countries about the emerging role and importance of the Skills4.0 according to the market needs.	HEIs, Teachers/trainers, Students	To get rid of the conventional teaching and learning methodologies due to less improvement in the skills and hence the job market and hard to compete at national and international level	<ul style="list-style-type: none"> <li>• A new Skill model and Learning Framework proposed for the universities</li> <li>• <b>35</b> new modules developed</li> </ul>
To inclined with the European agenda in the field of Skills 4.0 according to global vision and perspective.	Skills4.0 LABs and center of excellence in both Asia level / Europe Level	Transform the conventional learning methods with the technology-oriented ones.	<ul style="list-style-type: none"> <li>• The equipment purchased for the project is used for the use-cases, hands-on...</li> <li>• The <b>35</b> new modules used the equipment</li> </ul>
Research outputs after learning and adopting innovative teaching and learning strategies	Researchers, Students, HEIs	Number of publications in journals/conferences	<ul style="list-style-type: none"> <li>• <b>20</b> papers presented in international conferences</li> <li>• <b>7</b> papers published in international journals (indexed)</li> <li>• <b>2</b> papers submitted in 2022 in international journals</li> </ul>



## 2.2.2 Logical Framework Matrix indicators (per WP)

WP1 PREPARATION: Skills 4.0 Analysis and Design of Teaching and Learning material	
1. The assigned tasks start and finish on time	→ Yes
2. Reporting documents will be ready by the deadline with the proper content	→ Yes
3. The number and the quality of the references	→ 67 references; 92% are recent; 78% is mean value of citations of literature referenced
4. The number of SME's involved in the survey per country	→ 295 SMEs surveyed in partners countries; 265 companies replied to the survey
5. A new Skills model is proposed and validated	→ Yes (see the Deliverable D1.3)
6. The number of modules defined per domain	→ 79 modules defined
7. A syllabus is defined for each module	→ 40 modules syllabus defined
8. A learning strategy is defined per domain	→ Yes (see the Deliverable D1.4)
9. The pilots are defined per domain	→ Yes (see the Deliverable D1.4)
10. The sessions for the training of the trainers are scheduled	→ 30 Training of Trainers scheduled
11. The sessions for the training of the students are scheduled	→ 32 Training of Students scheduled
12. Number of potential trainers trained	→ 33 potential Trainers will be trained
13. Number of potential students trained	→ More than 300 students to be trained
WP2 DEVELOPMENT: Implementation of shyfte4.0 framework - Learning and training	
14. Number of modules developed	→ 35 modules developed for the four domains (Pilots)
15. Number of potential trainers	→ 33 potential Trainers supposed to be trained
16. Number of trainers trained	→ 214 Trainers trained during the project (This number has exploded due to virtual training sessions, which has reached more people)

- |   |   |
|---|---|
| 17. Number of potential students                                    | → More than 300 students to be trained for the four domains (Pilots)          |
| 18. Number of students trained                                      | → 400 students trained for the four domains (Pilots)                          |
| 19. Pilots implementation (number of learning sessions, modules...) | → 37 training of trainer's sessions & 28 training of student's sessions       |
| 20. Quantity and quality of self- assessment documents              | → 70% (out of 400) of students filled the surveys; 80% are globally satisfied |
| 21. Number of Skills 4.0 Learning center implemented                | → 4 Learning Centers implemented (1 per pilot)                                |

### WP3 QUALITY: Quality Plan

- |   |   |
|---|---|
| 22. Handbook  | → Yes (see the Deliverable D5.1)  |
| 23. Number of trainers trained on Quality Management System                         | → 12 trainers trained on QMS  |
| 24. Number of trainers certified  | → 0 trainers certified (The delay due to the Covid 19 crisis did not allow for the external certification of trainers Number of trainers trained) |
| 25. Number of Quality Audits carried out per Learning Center                        | → 132 trainers completed the quality assessment for the four Pilots   |
| 26. Number of SME's involved & surveyed   | → 13 companies involved & surveyed the Learning Center material   |
| 27. % of SME's satisfied by the Learning Centers services (per domain, per country) | → 82% of the companies are globally satisfied   |
| 28. % of SMEs that would recommend Learning Centers                                 | → 84% would recommend the Learning Center   |

### WP4 DISSEMINATION : Dissemination and Exploitation

- |  |  |
|--|--|
| 29. Number of contacts based on the dissemination of the project       | → 33 other universities, 7 companies, 1 gov. agency (see Deliverable D4.1) |
| 30. Number of scientific and technical publications                    | → 20 papers in international conferences                                   |
| 31. Number of publications and EU reports on Industry4.0's challenges  | → 7 papers in international journals (2 others are submitted).             |
| 32. Number of events/activities per partner in the Map                 | → 30 industrial workshops, seminars, company visits, meetings organized    |
| 33. Number of Enterprise networks & professional associations involved | → 56 companies and professional associations involved                      |



#### WP5 MANAGEMENT: Management

- |   |   |
|---|---|
| 34. The assigned tasks start and finish on time         | → Yes (considering the extension of 10 months due to the Covid-19 crisis) |
| 35. The project Handbook is defined and validated       | → Yes (see the Deliverable D5.1)  |
| 36. The Quality Assurance Plan is defined and validated | → Yes (see the Deliverable D5.1)  |
| 37. The project meetings are scheduled                  | → Yes (see the Deliverable D5.1)  |
| 38. The minutes of the meetings are done and validated  | → Yes (see the Deliverable D5.3)  |
| 39. The Quality Plan is defined                         | → Yes (see the Deliverable D3.1)  |
| 40. The periodic reports are done on time               | → Yes (see the Deliverable D5.3)  |
| 41. The final report is ready on time                   | → Yes (see the Deliverable D5.2)  |

### 2.2.3 The Quality Assurance Matrix and Indicators (per WP)

A Quality Assurance Matrix was defined at the beginning of the project. This matrix is presented in deliverable **D5.1 Project Handbook**. Main indicators are detailed in a table of KPI. Every task and activity have indicators which are filled out by the task's leaders:

- **WP1: 28** indicators (7 for T1.1, 7 for T1.2, 4 for T1.3, 5 for T1.4, 5 for T1.5)
- **WP2: 32** indicators (8 for T2.1, 7 for T2.2, 7 for T2.3, 7 for T2.4, 3 for T2.5)
- **WP3: 23** indicators (7 for T3.1, 5 for T3.2, 8 for T3.3, 3 for T3.4)
- **WP4: 26** indicators (8 for T4.1, 7 for T4.2, 8 for T4.3, 3 for T4.4)
- **WP5: 11** indicators (4 for T5.1, 7 for T5.2)

The detailed results are described in the table of achieved results, they are summarized per WP and Task in the following table:

WP1/Task	Quality Assurance Indicator	Evaluation	Measurable Indicators
WP1 – T1.1	The quality of the literature review referenced <ul style="list-style-type: none"> <li>• High relevance between the subject of the literature and project topic.</li> <li>• The referenced articles are peer reviewed</li> <li>• The referenced articles have been selected from tier-1 and tier-2 conferences and journals.</li> <li>• The referenced articles are taken from well reputed research databases</li> </ul>	- Internal	<ul style="list-style-type: none"> <li>• Number of literatures referenced: <b>67</b></li> <li>• <b>92%</b> of the referenced articles have been published in recent years</li> <li>• Mean value of total citations of literature referenced: <b>78%</b></li> </ul>
		- Internal	<ul style="list-style-type: none"> <li>• <b>26</b> curricula and programs studied</li> </ul>
		- External	<ul style="list-style-type: none"> <li>• Number of teaching methods analyzed for the four domains in EU: <b>14</b></li> <li>• Number of teaching methods analyzed for the four domains in Asia: <b>19</b></li> </ul>

	<ul style="list-style-type: none"> <li>- The learning method analyzed for the four domains</li> <li>- A study of knowledge and skill requirements</li> </ul>		<ul style="list-style-type: none"> <li>• Number of learning method analyzed for the four domains: <b>14</b></li> </ul>
WP1 – T1.2	<ul style="list-style-type: none"> <li>- A questionnaire is developed in collaboration with industry</li> <li>- The number of SMEs surveyed in partners countries</li> <li>- The sectors and size of the SME's</li> <li>- The number of replies returned</li> <li>- Number of workshops</li> <li>- Quality of the reports studied/investigated</li> <li>- Maturity model defined successfully in collaboration between the industry and academic partners</li> <li>- A quality analysis is completed successfully</li> <li>- Quality of the recommendations based on this analysis</li> </ul>	<ul style="list-style-type: none"> <li>- External</li> <li>- External</li> <li>- Internal</li> </ul>	<ul style="list-style-type: none"> <li>• Number of SMEs surveyed in partners countries: <b>295</b></li> <li>• Number of small companies surveyed: <b>47</b></li> <li>• Number of medium and big size companies surveyed: <b>218</b></li> <li>• The global number of replies: <b>265</b></li> <li>• Number of replies per partner country: <ul style="list-style-type: none"> <li>• China: <b>87</b></li> <li>• Malaysia: <b>86</b></li> <li>• Thailand: <b>92</b></li> </ul> </li> <li>• Number of relevant reports studied/investigated: <b>8</b></li> <li>• Number of workshops organized in PC country: <b>4</b></li> </ul>
WP1 – T1.3	<ul style="list-style-type: none"> <li>- A quality gap analysis is completed successfully</li> <li>- Quality of the recommendations based on this analysis</li> <li>- The curricula coverage according to the importance of the topics for companies</li> <li>- A high-quality skill model is developed.</li> <li>- The new skill model allows to quantify and qualify knowledge transference based on KPIs associated to the maturity in the 4 Shyfte domains.</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- External</li> <li>- Internal</li> <li>- Internal</li> <li>- Internal</li> </ul>	<ul style="list-style-type: none"> <li>• Number of topics offered by HEIs Asian curricula that correspond to Industry 4.0 required skills studied: <b>35</b> <ul style="list-style-type: none"> <li>• <b>6</b> are vital for companies</li> <li>• <b>9</b> are of very high importance for companies</li> <li>• <b>8</b> are of high importance for companies</li> <li>• <b>4</b> are not very important for companies</li> <li>• <b>7</b> are not important for companies</li> <li>• <b>1</b> has not yet been considered by companies</li> </ul> </li> <li>• Curricula coverage according to the importance of the topics for companies: <b>12</b> <ul style="list-style-type: none"> <li>• On 6 which are vital, <b>4</b> are covered</li> <li>• On 9 which are of very high importance, <b>3</b> are covered</li> <li>• On 8 which are of high importance, <b>3</b> are covered</li> <li>• On 4 which are not very important, <b>1</b> is covered</li> <li>• On the 8 last (not important, not yet been considered) <b>1</b> is covered</li> </ul> </li> <li>• Number of recommendations based on the gap analysis: <b>12</b></li> <li>• Number of publications: <b>7</b> publications in conferences for the WP1-T1 to T3</li> </ul>

WP1 – T1.4	<ul style="list-style-type: none"> <li>- The relationships between the skills and the Shyfte four domains are defined</li> <li>- The "required" skill set are identified</li> <li>- The "required" maturity levels of the trainees are identified</li> <li>- An efficient learning framework is defined</li> <li>- The modules' syllabus are defined</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- External</li> <li>- Internal</li> <li>- Internal</li> </ul>	<ul style="list-style-type: none"> <li>• Number of skills set per domain: <ul style="list-style-type: none"> <li>• Industrial Engineering Management: <b>7</b></li> <li>• Software Engineering and Big Data Analytics: <b>4</b></li> <li>• Wireless and Networks Analytics: <b>5</b></li> <li>• Artificial Intelligence: <b>3</b></li> </ul> </li> <li>• Number of modules defined per domain: <ul style="list-style-type: none"> <li>• Industrial Engineering Management: <b>29</b></li> <li>• Software Engineering and Big Data Analytics: <b>18</b></li> <li>• Wireless and Networks Analytics: <b>17</b></li> <li>• Artificial Intelligence: <b>15</b></li> </ul> </li> <li>• Numbers of generic/per sector modules</li> <li>• Number of modules' syllabus: <ul style="list-style-type: none"> <li>• <b>9</b> modules syllabus defined for IE domain</li> <li>• <b>7</b> modules syllabus defined for Business Mgt domain</li> <li>• <b>5</b> modules syllabus defined for SE&amp; Bigdata domain</li> <li>• <b>6</b> modules syllabus defined for Wireless domain</li> <li>• <b>13</b> modules syllabus defined for AI domain</li> </ul> </li> <li>• Number of publications: <b>2</b> publications in conferences for the WP1-T4</li> </ul>
WP1 – T1.5	<ul style="list-style-type: none"> <li>- A learning strategy per domain is defined</li> <li>- The sessions for training of the trainers are scheduled</li> <li>- The sessions for training of the students are scheduled</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- Internal</li> <li>- Internal</li> </ul>	<ul style="list-style-type: none"> <li>• Number of detailed syllabus defined per domain <ul style="list-style-type: none"> <li>• <b>16</b> detailed syllabus defined for domain 1</li> <li>• <b>5</b> detailed syllabus defined for domain 2</li> <li>• <b>6</b> detailed syllabus defined for domain 3</li> <li>• <b>13</b> detailed syllabus defined for domain 4</li> </ul> </li> <li>• Number of training sessions of the trainers scheduled <ul style="list-style-type: none"> <li>• <b>14</b> ToT sessions scheduled for domain 1</li> <li>• <b>4</b> ToT sessions scheduled for domain 2</li> <li>• <b>6</b> ToT sessions scheduled for domain 3</li> <li>• <b>6</b> ToT sessions scheduled for domain 4</li> </ul> </li> <li>• Number of training sessions for the students are scheduled <ul style="list-style-type: none"> <li>• <b>12</b> ToS sessions scheduled for domain 1</li> <li>• <b>4</b> ToS sessions scheduled for domain 2</li> <li>• <b>6</b> ToS sessions scheduled for domain 3</li> <li>• <b>10</b> ToS sessions scheduled for domain 4</li> </ul> </li> <li>• Number of potential trainers projected</li> </ul>

			<ul style="list-style-type: none"> <li>• <b>12</b> trainers identified for domain 1</li> <li>• <b>5</b> trainers identified for domain 2</li> <li>• <b>6</b> trainers identified for domain 3</li> <li>• <b>10</b> trainers identified for domain 4</li> <li>• Number of potential students projected: <b>&gt;300</b> <ul style="list-style-type: none"> <li>• <b>100 to 120</b> students trained from CMU &amp; KU (domain1)</li> <li>• <b>100 to 120</b> students trained from CDU&amp; CUIT (domain2)</li> <li>• <b>40 to 50</b> students trained from UPM&amp; UTM (domain3)</li> <li>• <b>40 to 50</b> students trained from UTM&amp; UPM (domain4)</li> </ul> </li> </ul>
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WP2/Task	Quality Assurance Indicator	Evaluation	Measurable Indicators
WP2 – T2.1	<ul style="list-style-type: none"> <li>- The modules identified for the Industrial Engineering domain (based on the skills set and level of the trainees)</li> <li>- The modules identified for the Business Mgt domain (based on the skills set and level of the trainees)</li> <li>- The training session for the trainers occurred</li> <li>- The maturity level is defined for each category of students</li> <li>- The training session for the students occurred</li> <li>- Quality assessment of the training session</li> <li>- Analysis of the training quality questionnaire</li> <li>- One improvement plan per module is defined</li> <li>- All the modules are updated</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- External</li> <li>- Internal</li> <li>- External</li> <li>- Internal</li> <li>- Internal</li> </ul>	<ol style="list-style-type: none"> <li>1. Number of modules developed for IE domain: <b>6</b></li> <li>2. Number of modules developed for Business Management domain: <b>5</b></li> <li>3. Number of trainers trained from CMU &amp; KU: <b>111</b></li> <li>4. Number of staff per partner trained: <b>8</b></li> <li>5. Number of staff completing quality assessment: <b>75</b></li> <li>6. Number of students trained from CMU and from KU: <b>137</b></li> <li>7. Number of students completing quality assessment: <b>82</b></li> <li>8. Number of students satisfied: <b>93.45%</b> of the students are globally satisfied</li> </ol>
WP2 – T2.2	<ul style="list-style-type: none"> <li>- The modules identified for Software Engineering and bigdata analytics domain (based on the skills set and level of the trainees)</li> <li>- The training session for the trainers occurred</li> <li>- The maturity level is defined for each category of students</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- External</li> <li>- Internal</li> </ul>	<ol style="list-style-type: none"> <li>9. Number of modules developed for Software Engineering and bigdata analytics domain: <b>5</b></li> <li>10. Number of trainers trained from CDU &amp; CUIT: <b>31</b></li> <li>11. Number of staff per partner trained: <b>5</b></li> <li>12. Number of staff completing quality assessment: <b>28</b></li> <li>13. Number of students trained from CDU and from CUIT: <b>142</b></li> </ol>

	<ul style="list-style-type: none"> <li>- The training session for the students occurred</li> <li>- Quality assessment of the training session</li> <li>- Analysis of the training quality questionnaire</li> <li>- One improvement plan per module is defined</li> <li>- All the modules are updated</li> </ul>	<ul style="list-style-type: none"> <li>- External</li> <li>- Internal</li> <li>- Internal</li> </ul>	<p>14. Number of students completing quality assessment: <b>92%</b></p> <p>15. Number of students satisfied: <b>91%</b> of the students are globally satisfied</p>
WP2 – T2.3	<ul style="list-style-type: none"> <li>- The modules identified for wireless and network analytics domain (based on the skills set and level of the trainees)</li> <li>- The training session for the trainers occurred</li> <li>- The maturity level is defined for each category of students</li> <li>- The training session for the students occurred</li> <li>- Quality assessment of the training session</li> <li>- Analysis of the training quality questionnaire</li> <li>- One improvement plan per module is defined</li> <li>- All the modules are updated</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- External</li> <li>- Internal</li> <li>- External</li> <li>- Internal</li> <li>- Internal</li> <li>- Internal</li> </ul>	<p>16. Number of modules developed for wireless and network analytics domain: <b>7</b></p> <p>17. Number of trainers trained from UPM: <b>56</b></p> <p>18. Number of staff per partner trained: <b>3</b></p> <p>19. Number of staff completing quality assessment: <b>31</b></p> <p>20. Number of students trained from UPM: <b>69</b></p> <p>21. Number of students completing quality assessment: <b>72%</b></p> <p>22. Number of students satisfied: <b>92,5%</b></p>
WP2 – T2.4	<ul style="list-style-type: none"> <li>- The modules identified for Artificial Intelligence domain (based on the skills set and level of the trainees)</li> <li>- The training session for the trainers occurred</li> <li>- The maturity level is defined for each category of students</li> <li>- The training session for the students occurred</li> <li>- Quality assessment of the training session</li> <li>- Analysis of the training quality questionnaire</li> <li>- One improvement plan per module is defined</li> <li>- All the modules are updated</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- External</li> <li>- Internal</li> <li>- External</li> <li>- Internal</li> <li>- Internal</li> <li>- Internal</li> </ul>	<p>23. Number of modules identified for Artificial Intelligence domain: <b>12</b></p> <p>24. Number of trainers trained from UTM: <b>53</b></p> <p>25. Number of staff per partner trained: <b>13</b></p> <p>26. Number of staff completing quality assessment: <b>31</b></p> <p>27. Number of students trained from UTM: <b>50</b></p> <p>28. Number of students completing quality assessment: <b>73%</b></p> <p>29. Number of students satisfied: <b>95%</b> of the students are globally satisfied</p>
WP2 – T2.5	<ul style="list-style-type: none"> <li>- The architecture of the 4 learning centers is defined</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> </ul>	<p>30. Number of Skills 4.0 learning center implemented: <b>4</b></p>

	<ul style="list-style-type: none"> <li>- the functionalities and main services are described (communication, identification, selection, registration, evaluation...).</li> <li>- The interactions between the global website and the local ones are identified</li> <li>- A dissemination strategy is proposed</li> <li>- A methodology for creation and testing is defined for the 4 Learning centers</li> <li>- A Business plan is defined for each Learning Center</li> <li>- A Knowledge-based framework is defined for each learning center</li> <li>- A methodology for technical and business evaluation is defined for the Learning centers</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- Internal</li> <li>- Internal</li> <li>- External</li> <li>- External</li> </ul>	<p>31. Number of guidelines for teachers are defined (one per domain): <b>1</b></p> <p>32. Number of guidelines for students are defined (one per domain): <b>1</b></p>
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WP3/Task	Quality Assurance Indicator	Evaluation	Measurable Indicators
WP3 – T3.1	<ul style="list-style-type: none"> <li>- Validation of the learning program by the companies (advisory board, experts...)</li> <li>- Define an evaluation quality questionnaire for the trainers (per domain)</li> <li>- Define an evaluation quality questionnaire for the students (per domain)</li> </ul>	<ul style="list-style-type: none"> <li>- External</li> <li>- Internal</li> <li>- Internal</li> </ul>	<ul style="list-style-type: none"> <li>• Number of professional experts per domain <ul style="list-style-type: none"> <li>• Domain 1: <b>6</b></li> <li>• Domain 2: <b>5</b></li> <li>• Domain 3: <b>7</b></li> <li>• Domain 4: <b>2</b></li> </ul> </li> <li>• Number of external academic experts per domain/HEIs: <ul style="list-style-type: none"> <li>• Domain 1: <b>4</b></li> <li>• Domain 2: <b>5</b></li> <li>• Domain 3: <b>5</b></li> <li>• Domain 4: <b>2</b></li> </ul> </li> <li>• Number of quality indicators defined: <b>14</b></li> <li>• Number of questions per questionnaire: <b>22</b></li> <li>• Number of trainers filling the evaluation questionnaire: <b>165</b></li> <li>• Number of students filling the evaluation questionnaire: <b>70%</b> (out of 400)</li> <li>• % of the students that are globally satisfied: <b>80%</b></li> </ul>



WP3 – T3.2	<ul style="list-style-type: none"> <li>- Define a Training Quality Plan</li> <li>- Develop a Quality Management System (QMS) training session for trainers</li> <li>- Organize and Schedule quality audits to evaluate the skills 4.0 transfer and measuring the impact of these skills in SME's</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- Internal</li> <li>- External</li> </ul>	<ul style="list-style-type: none"> <li>• Number of indicators defined in the TQP per domain (pilot): <ul style="list-style-type: none"> <li>• <b>22</b> questions to evaluate the training</li> <li>• <b>5</b> specific questions per domain (Pilot)</li> <li>• <b>4</b> specific questions for the trainers</li> <li>• <b>14</b> indicators of Skills 4.0 transfer</li> </ul> </li> <li>• Number of trainers trained on QMS: <b>12</b></li> <li>• Number of trainers satisfied by the QMS training: <b>88%</b> globally satisfied</li> <li>• Number of potential quality managers per Learning Centers: <b>4</b> in domain 1; <b>2</b> in domain 2; <b>3</b> in domain 3 and <b>3</b> in domain 4</li> <li>• Number of training quality audits scheduled per Learning Centers: <b>132</b> trainers trained during the ToT filled the quality questionnaires.</li> </ul>
WP3 – T3.3	<ul style="list-style-type: none"> <li>- Implementation of the Learning Centers audits</li> <li>- Evaluation of the Impact indicators</li> <li>- Assessment of the QMS system and continuous Improvement</li> <li>- Audits of SMEs in the Partners Countries with impact indicators conducted.</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- External</li> <li>- External</li> <li>- External</li> </ul>	<ul style="list-style-type: none"> <li>• Number of trainings of the trainer's quality audits carried out: <b>37</b> Training sessions were audited</li> <li>• Number of indicators of Skills 4.0 transfer: <b>14</b></li> <li>• Number of Trainers certified: <b>214</b></li> <li>• Number of non-conformities: <b>NA</b> (the audits did not reveal any real non-conformity)</li> <li>• Number of improvement actions defined: <b>1</b> improvement plan per module</li> <li>• Number of improvement actions implemented: <b>1</b> improvement plan implemented per module</li> <li>• Numbers of SME's involved <b>13</b></li> <li>• Number of companies salaries audited: <b>7</b> trainees from companies filled the quality questionnaires</li> </ul>
WP3 – T3.4	<ul style="list-style-type: none"> <li>- A sustainability assurance plan is designed with the HEIs partners and SMEs.</li> <li>- A SME's survey is done to assess the Learning Centers indicators</li> <li>- The sustainability plan ensures that the activities of the Learning Centers will continue beyond the end of the project.</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- External</li> <li>- Internal</li> </ul>	<ul style="list-style-type: none"> <li>• Number of companies globally satisfied by the Learning materials (per domain, per country): <b>82%</b></li> <li>• Number of companies globally satisfied by the Learning Centers services (per domain, per country): <b>82%</b></li> <li>• Number of SMEs that would recommend learning centers (per domain, per countries): <b>84%</b></li> </ul>



WP4/Task	Quality Assurance Indicator	Evaluation	Measurable Indicators
WP4 – T4.1	<ul style="list-style-type: none"> <li>- Shyfte project dissemination to other universities</li> <li>- Shyfte project dissemination to companies</li> </ul>	<ul style="list-style-type: none"> <li>- External</li> <li>- External</li> </ul>	<ol style="list-style-type: none"> <li>Number of entities where the project was spread: <ul style="list-style-type: none"> <li>Domain 1: <b>22 entities in Thailand</b></li> <li>Domain 2: <b>12 entities in China</b></li> <li>Domain 3: <b>11 entities in Malaysia</b></li> <li>Domain 4: <b>8 entities in Malaysia</b></li> </ul> </li> <li>Number of external universities identified to disseminate the project <ul style="list-style-type: none"> <li>Domain 1: <b>18 universities in Thailand</b></li> <li>Domain 2: <b>6 universities in China</b></li> <li>Domain 3: <b>7 universities in Malaysia</b></li> <li>Domain 4: <b>6 universities in Malaysia</b></li> </ul> </li> <li>Number of external industries identified to disseminate the project: <ul style="list-style-type: none"> <li>ToT sessions: <b>9</b></li> <li>Seminars &amp; Workshops: <b>20</b></li> <li>Visits: <b>4</b></li> </ul> </li> <li>Number of Shyfte proposed activities in universities: <b>5</b> seminars &amp; exhibitions</li> <li>Number of Shyfte proposed activities in industry: <ul style="list-style-type: none"> <li><b>10</b> industrial workshops</li> </ul> </li> <li>Number of events where the project was spread: <ul style="list-style-type: none"> <li><b>1</b> Keynote speaker in Int. conference</li> <li><b>1</b> Special session in Int. conference</li> <li><b>5</b> academic seminars</li> <li><b>10</b> industrial workshops</li> <li><b>7</b> papers in indexed int. journals</li> </ul> </li> <li>Number of conferences, formal, informal meetings...: <ul style="list-style-type: none"> <li><b>20</b> international conferences</li> <li><b>10</b> physical Plenary or PMB meetings</li> <li><b>44</b> virtual Plenary or PMB meetings</li> </ul> </li> </ol>

			<p>8. Number events/activity per partner in the Map:</p> <ul style="list-style-type: none"> <li>• France: <b>5</b></li> <li>• Italy: <b>4</b></li> <li>• Portugal: <b>3</b></li> <li>• Thailand: <b>7</b></li> <li>• China: <b>7</b></li> <li>• Malaysia: <b>9</b></li> </ul>
WP4 – T4.2	<ul style="list-style-type: none"> <li>- Awareness dissemination and acceptance of emergent skills</li> <li>- Development of a COST (European Cooperation in Science and Technology) proposal aligned with the dissemination of the Centers of Excellence;</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- External</li> </ul>	<p>9. Number of awareness dissemination events: <b>47</b></p> <p>10. Number of partners involved: <b>37</b> other universities involved in the partners countries</p> <p>11. Number of external entities involved: <b>33</b></p> <p>12. Number of Shyfte seminars &amp; workshop: <b>20</b></p> <p>13. Number of partners: more than <b>60</b> external partners involved</p> <p>14. COST proposal acceptance: Collaboration with <b>3 EU projects</b>: (1) Erasmus+ Enhance, (2) Erasmus+ ETAT, and H2020 SME 4.0</p> <p>15. Number of initiatives argue to the COST: 3 seminars</p>
WP4 – T4.3	<ul style="list-style-type: none"> <li>- The Website is online</li> <li>- The Website is updated regularly</li> <li>- The events organized</li> <li>- Social Networks created and updated</li> <li>- Cluster of blogs indicators developed</li> <li>- Publication indicators</li> <li>- Conferences indicators</li> </ul>	<ul style="list-style-type: none"> <li>- External</li> <li>- Internal</li> <li>- External</li> <li>- External</li> <li>- Internal</li> </ul>	<p>16. Number of website visitors: <b>NA</b> (a technical problem did not allow us to measure the nb of visitors since the beginning of the project).</p> <p>17. Average time on page: <b>NA</b> (a technical problem did not allow us to measure the nb of visitors since the beginning of the project).</p> <p>18. Number of events organized: <b>30</b> seminars, workshops, visits, meetings...</p> <p>19. Number of events (conference, seminars, workshops...) in which Shyfte partners participate: more than <b>80</b> events (conferences, seminars...)</p> <p>20. Social networks number of follows: <b>106</b> followers on Facebook</p> <p>21. Social networks number of likes: <b>98</b> likes on Facebook</p> <p>22. Social networks number of shares</p> <p>Cluster of blogs indicators: <b>NA</b> (a technical problem did not allow us to measure the nb of visitors on the website since the beginning of the project).</p> <p>23. Number of visitors: idem</p> <p>24. Number of topics: around <b>18</b> topics covered</p> <p>25. Number of posts: <b>35</b> posts published</p>

			<p>26. Number of papers published Conferences indicators: <b>20</b> papers presented in int. conferences</p> <p>27. Number of people: more than <b>600</b> people (average of 30 people per session)</p> <p>28. Number of organizations: more than <b>300</b> organizations concerned</p> <p>29. Nb of Industrial companies: <b>NA</b> (difficult to measure the nb of companies involved in the int. conferences; especially online)</p>
WP4 – T4.4	- Scientific and technical dissemination	<p>- Internal</p> <p>- Internal</p> <p>- Internal</p>	<p>30. Number of papers in scientific conferences (per domain):</p> <ul style="list-style-type: none"> <li>Domain 1: <b>4</b> conferences</li> <li>Domain 2: <b>5</b> conferences</li> <li>Domain 3: <b>4</b> conferences</li> <li>Domain 4: <b>4</b> conferences</li> </ul> <p>31. Number of publications in international scientific journals (per domain)</p> <ul style="list-style-type: none"> <li>Domain 1: <b>2</b> journals</li> <li>Domain 2: <b>3</b> journals</li> <li>Domain 3: <b>1</b> journal</li> <li>Domain 4: <b>2</b> journals</li> </ul> <p>32. Number of workshops &amp; seminars organized: <b>15</b></p>

WP5/Task	Quality Assurance Indicator	Evaluation	Measurable Indicators
WP5 – T5.1	<ul style="list-style-type: none"> <li>The assigned tasks start and finish on time</li> <li>The project Handbook is defined and validated</li> <li>The project meetings are scheduled</li> <li>The minutes of the meetings are done and validated</li> <li>The deliverables are finished and validated on time</li> <li>The periodic reports are done on time</li> <li>The final report is ready on time</li> </ul>	<p>- Internal</p> <p>- Internal</p> <p>- Internal</p> <p>- Internal</p> <p>- Internal</p>	<p>1. The number of physical meetings: <b>10</b></p> <p>2. The number of virtual meetings: <b>44</b></p> <p>3. The duration of each task is respected: <b>All</b> tasks have been completed on time overall (considering the 10 months extension of the project).</p> <p>4. Number of deliverables finished on time: <b>24</b> deliverables are delivered on time</p>
WP5 – T5.2	<ul style="list-style-type: none"> <li>The Quality Assurance Plan is defined and validated</li> <li>The Quality Assurance Procedures are defined</li> </ul>	<p>- External</p> <p>- Internal</p>	<p><b>Quality Evaluation system</b> indicators:</p> <p>5. Number of QA procedures defined: <b>4</b> main processes/procedures defined (registration, maturity level, training program, evaluation)</p> <p>6. Number of PMB reports: <b>14</b></p>

	<ul style="list-style-type: none"> <li>- A work plan with clear division of tasks and responsibilities between partners and timetable is produced</li> <li>- Conflicts are identified and resolved by the partners</li> <li>- Monitoring of the innovation being developed through the project</li> </ul>	<ul style="list-style-type: none"> <li>- Internal</li> <li>- Internal</li> <li>- External</li> </ul>	<ul style="list-style-type: none"> <li>7. Number of travel reports: <b>113</b></li> <li>8. Number of Timesheets produced (per person, per category): <b>125</b></li> <li>9. Number of conflicts solved: <b>1</b></li> <li>10. Number of publications in international conferences: <b>20</b></li> <li>11. Number of international journals submitted: <b>7</b> accepted + <b>2</b> submitted</li> </ul>
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### 3. Shyfte 4.0 Main Results

Based on the Quality Assurance Matrix and Indicators, the following sections of the document describe the details of the KPI's per category.

#### 3.1 Learning Materials

For the four domains defined in the project, a total of **35 modules** have been developed.

T2.1 – Domain 1: Industrial Engineering and Business Management

- **6** modules developed for Industrial Engineering
- **5** modules developed for Business Management

T2.2 – Domain 2: Software Engineering and Big data analysis

- **5** Modules developed for SE & Bigdata analysis

T2.3 – Domain 3: Wireless networks analytics

- **7** Modules developed for wireless networks analytics

T2.4 – Domain 4: Artificial Intelligence

- **12** Modules developed for Artificial Intelligence

#### 3.2 Training of the Trainers Sessions

During the project, for the four domains, **37 Training for the Trainers sessions** were organized.

They allowed the training of **214** trainers.

. Domain 1: CMU 49 trainers ; KU 25 trainers

. Domain 2: 31 trainers from CDU and CUIT

. Domain 3: UPM 56 trainers

. Domain 4: UTM 53 trainers

Among these trainers, 24 trainers from partner universities have been trained.

Among these trainers, 20 persons from different companies have been trained.

A summary of these training sessions is presented in the following tables.

*The details of each of these training sessions are presented in **Deliverables D2.1 to D2.4***

N°	Domain	Module	Partner	Date	Nb Trainees
1	1	Introduction to Industry 4.0, Part 1	CMU	23/7/2021 (Fri)	41
2	1	Introduction to Industry 4.0, Part 2	CMU	17/8/2021 (Tue)	41
3	1	Cloud ERP, Part 2	CMU	22/7/2021 (Fri)	7
4	1	Integrated Simulation and Optimization, Part 1	CMU	20/7/2021 (Tue)	10
5	1	Integrated Simulation and Optimization, Part 2	CMU	23/7/2021 (Fri)	10
6	1	Data Collecting System	CMU	13/8/2021 (Fri)	6
7	1	Automatic Data Collecting System	CMU	16/8/2021 (Mon)	7
8	1	Decision Making with Big Data	CMU	10/8/2021 (Mon)	10
9	1	Business Intelligence – Part 1	KU	2/7/2021 (Fri)	16
10	1	Business Intelligence – Part 2	KU	9/7/2021 (Fri)	16
11	1	Human resource management for Industry 4.0, Part 1	KU	16/7/2021 (Fri)	14
12	1	Human resource management for Industry 4.0, Part 2	KU	24/7/2021 (Fri)	14
13	1	New Product Development, Part 1	KU	20/8/2021 (Fri)	13
14	1	New Product Development, Part 2	KU	27/8/2021 (Fri)	13
15	1	Role of Data for Future Organization, Part 1	KU	19/1/2022 (Wed)	10
16	1	Role of Data for Future Organization, Part 2	KU	26/1/2022 (Wed)	10
17	1	Digital Communication, Part 1	KU	9/2/2022 (Wed)	8
18	1	Digital Communication, Part 2	KU	16/2/2022 (Wed)	8
19	2	Data Mining Ideology and Technology, Part 1	CDU	29/6/2021 (Tue)	12
20	2	Critical Thinking Oriented Big Data, Part 1	CDU	30/6/2021 (Wed)	12
21	2	Principle and Application of Big Data Technology, Part 1	CDU/CUIT	12/7/2021 (Mon)	7
22	2	Data Mining Ideology and Technology, Part 2	CDU	30/7/2021 (Mon)	12
23	2	Critical Thinking Oriented Big Data, Part 2	CDU	30/7/2021 (Mon)	12
24	2	Principle and Application of Big Data Technology, Part 2	CDU/CUIT	15/8/2021 (Thu)	7
25	2	Comprehensive Training of Artificial Intelligence	CUIT	11/01/2022 (Tue)	20

26	2	Smart Decision Making with Big Data	CUIT	11/02/2022 (Tue)	10
27	3	Introduction to Cyber Security	UPM	28/7/2021 (Wed)	34
28	3	Introduction to Energy Management	UPM	29/7/2021 (Thu)	22
29	3	Data Acquisition and Analysis, Part 1	UPM	30/7/2021 (Fri)	22
30	3	Data Governance and Management	UPM	2/8/2021 (Mon)	17
31	3	Data Acquisition and Analysis, Part 2 (Hands-on session)	UPM	11/1/2022 (Mon)	17
32	3	Renewable energy for Wireless Network	UPM	12/1/2022 (Wed)	107
33	3	Green Energy Wireless Network, Part 2	UPM	13/4/2022 (Wed)	22
34	4	Introduction to AI Application	UTM	25/7/2021 (Sun)	22
35	4	AI for Computer Vision, Part 1	UTM	26/7/2021 (Mon)	23
36	4	AI for Industry	UTM	27/7/2021 (Tue)	37
37	4	AI for Computer Vision, Part 2 (Hands-on session)	UTM	8/2/2022 (Tue)	7
38	4	Supervised and Unsupervised Learning	UTM	15/2/2022 (Tue)	7
39	4	Convolutional Neural Network	UTM	27/2/2022 (Sun)	8
40	4	Advance Machine Learning for Big Data	UTM	28/2/2022 (Mon)	7

Table 1. Training of the Trainers Sessions

### 3.3 Training of Students Sessions

During the project, for the four domains, **28 Training of Students sessions** were organized.

They allowed the training of **400** students.

- . Domain 1: **137** students from CMU and KU attended the different courses (94 CMU & 43 KU)
- . Domain 2: **144** students from CDU and CUIT attended the courses (120 CUIT & 24 CDU)
- . Domain 3: **69** students from UPM attended the different courses
- . Domain 4: **50** students from UTM attended the different courses

A summary of these training sessions is presented in the following table.

*The details of each of these training sessions are presented in **Deliverables D2.1 to D2.4***

SHYFTE 4.0 - Training of the Trainers Sessions					
N°	Pilot in Domain 1: KU - Industrial Engineering & business Management (	Level (B, I, E)	Module Delivery	Date ToS	Nb Stud.
1	Human Resource Management for Industry 4.0	B	Lecture / Case Study	14 January 2022	41
2	Role of Data for Future Organization	I	Lecture and Demonstration Class discussion	18 February 2022	45
3	Digital Communication	B,I	Lecture / Case Study Workshop	25 February 2022	41
4	Business Intelligence	E	Lecture and Demonstration Class discussion	28 January 2022	43
5	New Product Development	E	Lecture / Case Study / Workshop	11 February 2022	46
	Pilot in Domain 1: CMU - Industrial Engineering & business Management	Level (B, I, E)	Module Delivery (Learning method)	Date ToS	Nb Stud.
6	Introduction to Industry 4.0	B	Case study, Project assignment, Team working group	28, 30 June 2022 and 5 July 2022	45
7	Cloud ERP	B	Case study, simulation game, project assignment	4, 11 July 2022	40
8	Integrated Simulation and Optimization	E	Case study, project assignment	7, 14 July 2022	17
9	Data Collecting System	B	Case study, project assignment	30 Jun, 1 July 2022	15
10	Automatic Data Collecting System	I	Practical assignment, project assignment	4 - 5 July 2022	15
11	Decision Making with Big Data	I	Case study, group assignment, project assignment	25 - 26 July 2022	30

Table 2. Training of the Students Sessions (CMU/KU)



	<b>Pilot in Domain 2: CDU-CUIT Software Engineering and big data analysis</b>	<b>Level (B, I, E)</b>	<b>Module Delivery</b>	<b>Date ToS</b>	<b>Nb Stud.</b>
12	Principle and Application of Big Data Technology	B	Lecture, Case study, Group discussion, Group work, Project assignment	8-9 April 2022	74
13	Comprehensive Training of Artificial Intelligence	I	Lecture, Case study, Group discussion, Group work, Project assignment	24 March-15 April 2022	74
14	Critical Thinking Oriented Big Data	I	Lecture, Case study, Group discussion, Group work, Project assignment	14-15 May 2022	10
15	Smart Decision Making with Big Data	E	Lecture, Case study, Group discussion, Group work, Project assignment	18 April - 20 June 2022	40
16	Data Mining Ideology and Technology	E	Lecture, Case study, Group discussion, Group work, Project assignment	21-22 May 2022	10

Table 3. Training of the Students Sessions (CUIT/CDU)

	<b>Pilot in Domain 3: UPM - Wireless Network and Analytics</b>	<b>Level (B, I, E)</b>	<b>Module Delivery (Learning method)</b>	<b>Date ToS</b>	<b>Nb Stud.</b>
17	Introduction to Cybersecurity	B	Lecture, Case study, Group discussion, Group work, Project assignment	13 June 2022	23
18	Data Acquisition and Analysis	I	Lecture, Group discussion, IoT hands-on project, Group work, Case study	16 June 2022	43
19	Data Governance and Management	E	Lecture, Role play, Problem-based learning, Group work	13 June 2022	15
20	Introduction to Energy Management	B	Lecture, Group discussion, Case study, Project assignment	15 June 2022	43
21	Renewable Energy for Wireless Networks	I	Lecture, Group discussion, Case study,	14 June 2022	43

			Group work, Project assignment, Academic Visit		
22	Green Energy Wireless Network	E	Lecture, Group discussion, Problem-based learning, Group work and gamification, Blended learning	17 June 2022	7

Table 4. Training of the Students Sessions (UPM)

	Pilot in Domain 4: UTM Artificial Intelligence	Level (B, I, E)	Module Delivery	Date ToS	Nb Students
23	Supervised and Unsupervised Learning	B	Lecture presentation, Case study, Project Group Work.	27 June 2022	59
24	AI for Computer Vision	I	Lecture presentation, Case study, Project Group Work and hands-on activities	5 July 2022	51
25	AI for Computer Vision (hands-on session)	I	Lecture presentation, Case study, Project Group Work and hands-on activities	6 July 2022	51
26	AI for Industry	E	Lecture presentation, Case study, Group Work	28 June 2022	49
27	Fundamental of AI	B	Lecture presentation, Case study, Group Work.	26 June 2022	60
28	Metaheuristic Optimization	E	Lecture presentation, Case study, Simulation, Group Presentation.	2 August 2022	46

Table 5. Training of the Students Sessions (UTM)

### 3.4 Learning Centers

As part of the project, we developed 4 learning centers, one for each Pilot (domain):

- Domain 1: Industrial engineering and management
- Domain 2: Software engineering and Bigdata analytics
- Domain 3: Wireless networks analytics
- Domain 4: Artificial Intelligence

These Learning centers allow the students and companies employees to retrain or upgrade their skills (re-skill or up-skill), based on knowledge related to Industry 4.0.

The Learning Centers of Excellence developed for the partner country universities are designed based on the following architecture:

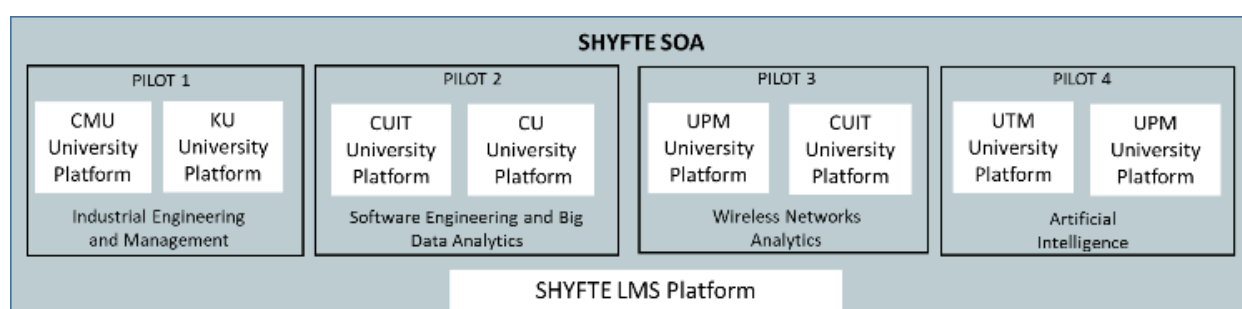


Figure 1. Shyfte Service Oriented Architecture

Shyfte SOA (Services Oriented Application) was implemented through the use of the main LMS platform represented by the Shyfte Centres of Excellence. Federation is known to allow the integration of different components in a flexible way that allows to integrate or combine existing teaching-learning materials from universities with those developed specifically for the Centres of Excellence. Additionally, it is a step forward to allow the life continuity of the Centres, which may be located in Lisbon and replicable in France, and to ensure the maintenance of the SHYFTE platform.

The main objective was to develop a Service Oriented Application with different layers (Fig. 2.):

- Presentation Layer: the four portals defined for the partners: one for CMU/KU (domain 1), one for CDU/CUIT (domain 2), one for UPM (domain 3) and one for UTM (domain 4)

- Business Processes Layer: services provided for the registration, the training administration and the training enrolment services
- Application Layer: the courses, the student's registration, the quality assessment...
- Resource Layer: LMS, MOOC, Social media platform, Payment platform...
- Data Layer: Database, external cloud data, learning analytic data...

The description of the Learning Center architecture is detailed in the deliverable D2.5

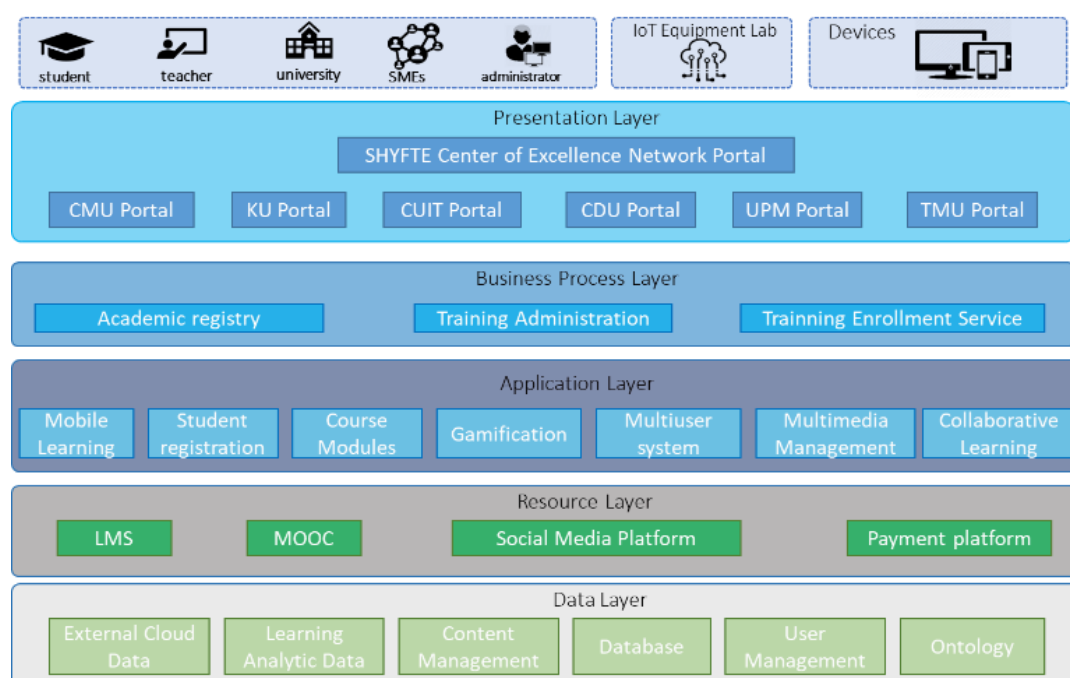


Figure 2. Learning Center Architecture

Each Pilot is responsible for the platform at his or her level, maintaining its identity aligned with country regulations country, thanks to the federation quality of the architecture. The databases are distributed at different locations. This means that there are local databases and databases at the top level of the architecture that should be synchronized.

Each Pilot is responsible for the platform at his or her level, maintaining its identity aligned with country regulations country, thanks to the federation quality of the architecture. The databases are distributed at different locations. This means that there are local databases and databases at the top level of the architecture that should be synchronized.

*The description of the Learning Center is detailed in the **Deliverable D2.6***



Figure 3. Learning Center Main Page

### 3.4.1 Students Individualized Training

The first option (Students Individualized Training) will let the users create a training program for themselves depending on what the users want to upskill. The first step is to choose a domain.

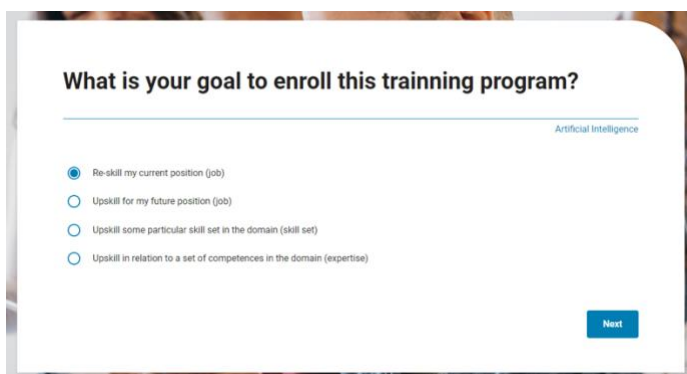
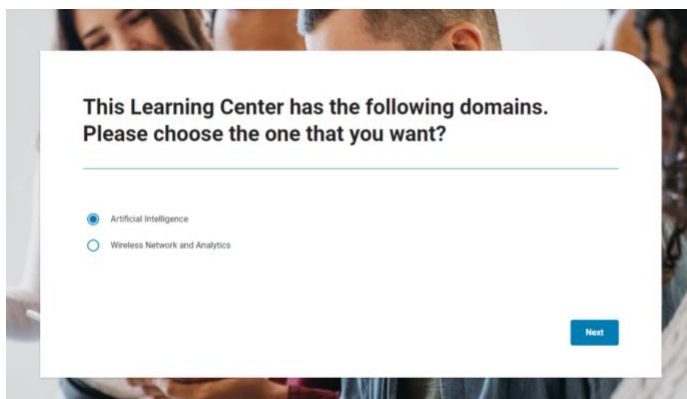
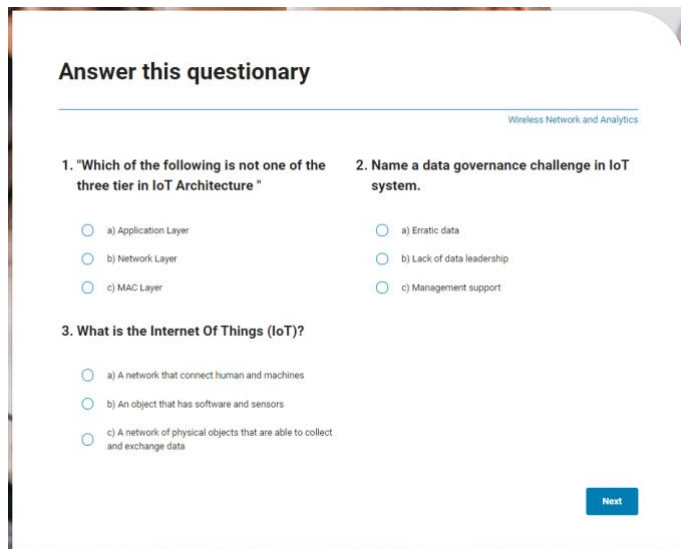


Figure 4. Learning Center Domain Selection

After choosing a domain the users have to choose their goal and there are four options, re-skill or up-skill a job position, up-skill a particular skill set or up-skill a particular competence.

The users must prove that they know the hard skills selected and for that the website will present a quiz with questions regarding those hard skills. If a user didn't know any of the presented skills this part will be skipped.



**Answer this questionnaire**

Wireless Network and Analytics

1. "Which of the following is not one of the three tier in IoT Architecture "

- ☐ a) Application Layer
- ☐ b) Network Layer
- ☐ c) MAC Layer

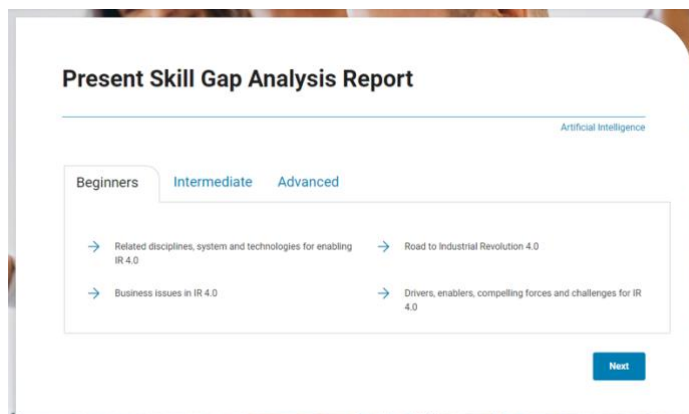
2. Name a data governance challenge in IoT system.

- ☐ a) Erratic data
- ☐ b) Lack of data leadership
- ☐ c) Management support

3. What is the Internet Of Things (IoT)?

- ☐ a) A network that connect human and machines
- ☐ b) An object that has software and sensors
- ☐ c) A network of physical objects that are able to collect and exchange data

Next



**Present Skill Gap Analysis Report**

Artificial Intelligence

Beginners Intermediate Advanced

→ Related disciplines, system and technologies for enabling IR 4.0

→ Road to Industrial Revolution 4.0

→ Business issues in IR 4.0

→ Drivers, enablers, compelling forces and challenges for IR 4.0

Next

Figure 5. Learning Center Skill Gap Analysis

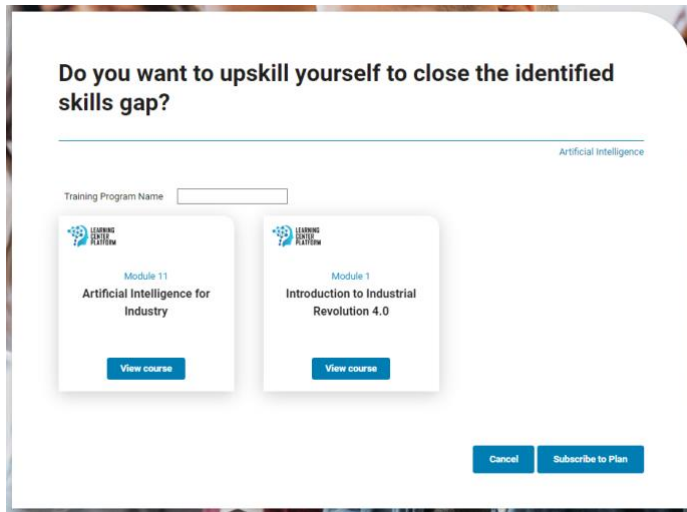


Figure 6. Learning Center Domain Selection (2)

This way the website creates the skill gap needed and generates a training program proposal. Now the user can subscribe or cancel the plan. If the users want to subscribe, they must fill the training program name input.

### 3.4.2 Enterprises Individualized Training

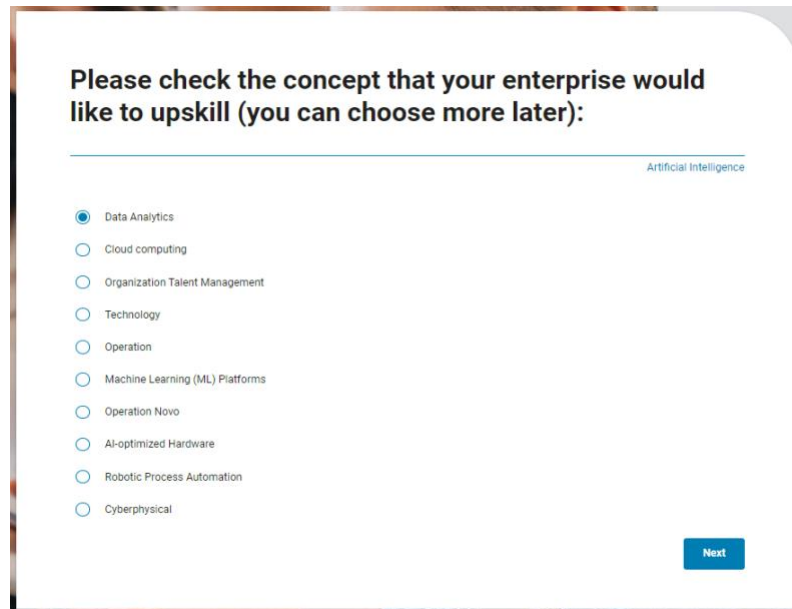
Now going through the process of creating a program for an organization (Enterprises Individualized Training) a user can choose a gap to up-skill or create a custom training program. Reminding that a user can only use this option if the account was created as an organization.



Figure 7. Learning Center Enterprise Interface



After choosing a domain the website will show a list of concepts in which the users can up-skill the organization.



Please check the concept that your enterprise would like to upskill (you can choose more later):

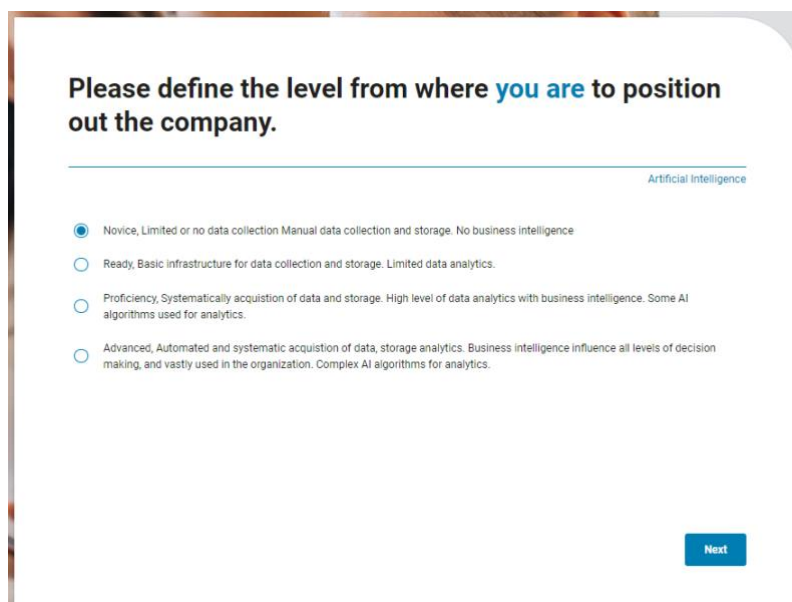
Artificial Intelligence

- ☒ Data Analytics
- ☐ Cloud computing
- ☐ Organization Talent Management
- ☐ Technology
- ☐ Operation
- ☐ Machine Learning (ML) Platforms
- ☐ Operation Novo
- ☐ AI-optimized Hardware
- ☐ Robotic Process Automation
- ☐ Cyberphysical

Next

Figure 8. Learning Center Enterprise Concepts Selection

The next step is to define the skill gap by selecting the current level and the desired one by the organization in relation to the chosen concept.



Please define the level from where **you are** to position out the company.

Artificial Intelligence

- ☒ Novice, Limited or no data collection Manual data collection and storage. No business intelligence
- ☐ Ready, Basic infrastructure for data collection and storage. Limited data analytics.
- ☐ Proficiency, Systematically acquisition of data and storage. High level of data analytics with business intelligence. Some AI algorithms used for analytics.
- ☐ Advanced, Automated and systematic acquisition of data, storage analytics. Business intelligence influence all levels of decision making, and vastly used in the organization. Complex AI algorithms for analytics.

Next

Figure 9. Learning Center Enterprise Level Definition



**Please define the target level from where **you** want to position out the company**

Artificial Intelligence

- ☐ Novice, Limited or no data collection Manual data collection and storage. No business intelligence
- ☐ Ready, Basic infrastructure for data collection and storage. Limited data analytics.
- ☒ Proficiency, Systematically acquisition of data and storage. High level of data analytics with business intelligence. Some AI algorithms used for analytics.
- ☐ Advanced, Automated and systematic acquisition of data, storage analytics. Business intelligence influence all levels of decision making, and vastly used in the organization. Complex AI algorithms for analytics.


[Next](#)

Figure 10. Learning Center Enterprise Level Definition (2)

With the skill gap the website will generate a training program for the organization.


**Training Program**

Artificial Intelligence




Module 3  
Neural Network Computing

[View course](#)




Module 9  
Convolutional Neural Networks

[View course](#)




Module 2  
Fundamental of Artificial Intelligence

[View course](#)




Module 5  
Supervised and Unsupervised Learning

[View course](#)




Module 4  
Reinforcement Learning

[View course](#)



Module 1  
Introduction to Industrial Revolution 4.0

[View course](#)



Module 6  
Introduction to Artificial Intelligence Application

[View course](#)

[Next](#)

Figure 11. Learning Center Enterprise Training Program

### 3.5 Continuous improvement and sustainability

To perpetuate the use of the Learning Centers we defined, with all the partners of the project HEIs and SMEs, a sustainability assurance plan for their quality certification.

The objective is to obtain ISO 9001 quality certification in the medium term. To achieve this, the Learning Centers have been designed based on a process approach to be compatible with ISO certification.

Procedures have been defined for the main steps of the main processes:

- registration of trainees,
- evaluation of their maturity level,
- training programs proposal,
- evaluation of training programs
- ...

Based on this, a sustainability plan is designed towards the designated HEIs of the Partners Countries to ensure the continuation of this key activity beyond the end of the project.

The plan to perpetuate the use of the Learning Centers has been defined by each partner in order to sustain their use. These sustainability actions have been described in deliverables D2.1 to D2.4 (which describe the 4 pilots developed within the project).

The key issues to ensure the sustainability of the Learning Centers are:

- The assessment of the Learning Centers' services and learning materials
- The quality certification of the LC (ISO9001 processes QMS)
- The definition of a Business/Economic model
- The first level of sustainability is **to reuse the learning materials developed in each of the pilots** (courses, hands-on, use of equipment...). For this, depending on the partners, these modules will be integrated, partially or totally, into existing programs. For others, the modules will be proposed as optional modules that can be validated (credits) in existing programs. Finally, some modules will be integrated into the Long-life education platforms of the partner universities.
- The second level of sustainability concerns the Learning Centers. **The principle is that the learning centers will last after the end of the project**, and that the partner universities will rely on them to increase their collaboration with companies and other universities in their

country. For this, the learning centers have been designed to allow a follow-up of the interactions (LC observatory). The partner universities will therefore continue to communicate and disseminate information to ensure that these Learning Centers become a real center of expertise. To guarantee the sustainability of the learning centers, the quality procedures put in place and the training of quality managers in internal audits will make it possible to consider quality certification (ISO 9001) for the Learning Centers within two years. This delay is necessary because to be certified, a learning center must have been used for a period.

- From an **economic point of view**, the partner universities are committed to continuing to invest in order to ensure the sustainability of the Learning Centers. They have clearly understood the value of these centers of excellence for the development of their students' skills and for promoting continuing education among companies. To this end, rates have been defined and will be integrated into the Learning Centers.

In addition to this global sustainable assurance plan some local actions were defined in each partner university.

In addition to this global sustainable assurance plan some local actions were defined in each partner country university.

*The Shyfte Sustainability Assurance Plan is described in the **Deliverable D3.3***

### 3.6 Industry 4.0 Observatory

Companies will use the Learning Center to train and improve the skills of their employees. One of the objectives of the Learning Center Industrial Observatory is to enable the partner universities to analyze the needs of companies in terms of skills and the evolution of the labor market.

We integrated in Learning Centers portal a solution able to act as an observatory of the innovations creation combining industry 4.0 related technologies. It also comprises a service to support such creations from the trainees.

- Each Learning Center, in each country will be an Observatory of the Industry 4.0 involvement in its country.
- We defined in each Learning Center a dashboard with different KPIs:
  - Number of enterprises registered in the Learning Center

- Number of salaries trained
- Number of students trained
- Number of modules concerned
- ....

To this end, certain services are provided by each Learning Center to enable interactions with company representatives.

The main process developed in the Learning Center has considerable differences when comparing with the student's process. The user is a representative of a company and knows the current state of the company in some concepts in Industry 4.0 domain. That user also knows what is the target level that the company aims to achieve.

So, in the first step, the user will choose the Domain where the company fits in, secondly will choose the desired concepts of domain and the target level. Therefore, the system will present the enterprise's gap analysis and a custom training program. That training program consists of the identified modules to close the gap and could be assigned by the SME representative to one or more employees or even to himself.

The user can leave their feedback about a module when it is finished, then all the feedbacks can be seen in the dashboard page. The dashboard has information for all the main domains of the CEO, for trainees, training, and trainers.

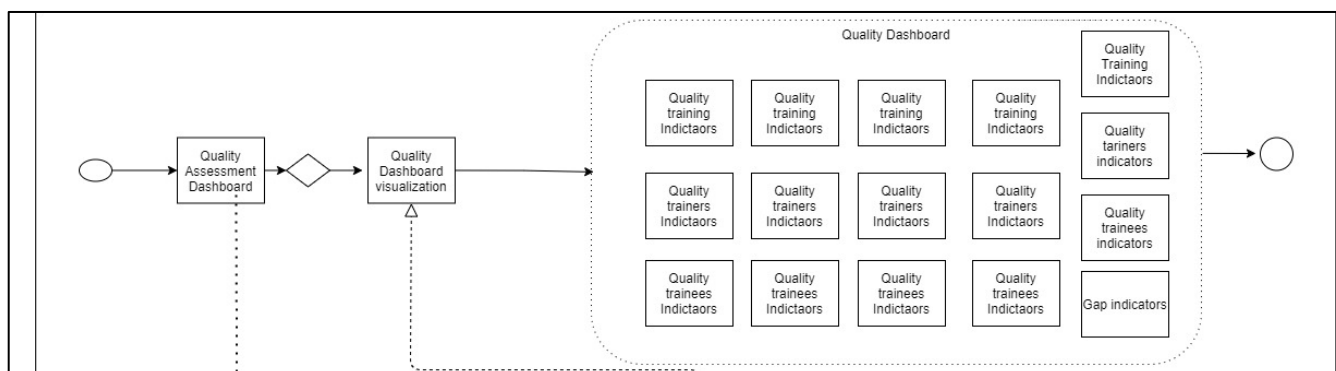


Figure 12. Quality Assessment Process Dashboard

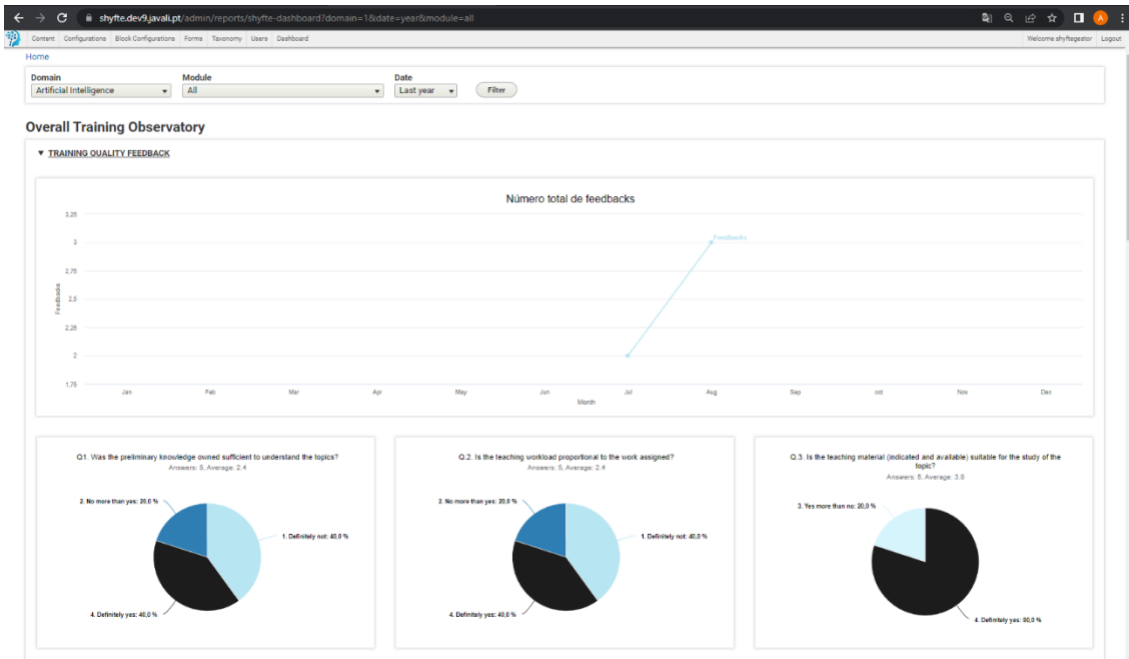


Figure 13. Overall training observatory

Based on these results, key performance indicators and feedback, the partner universities will be able to better understand the behavior, requirements and needs of companies.

A periodic analysis of these feedbacks, and the interactions with the users, will allow for the evolution of learning materials content and the development of new materials for learning center users. It will also provide a better understanding of the labor market related to the evolution of Industry 4.0.

*The Shyfte Learning Center Industrial Observatory is described in the **Deliverable D3.3***

### 3.7 Technology Transfer (IP, patent, spin-offs...)

Regarding technology transfer and innovation, the Learning Center proposed a menu for the companies with a more innovative view about support and exists to help user's innovation that reflects the knowledge given by the learning center. This means that if the users have any problem with some project, either a prototype or just an idea, they can ask for extra help to all available trainers/researcher.

This way is possible to analyze information about know creators and innovation regarding the learning center.

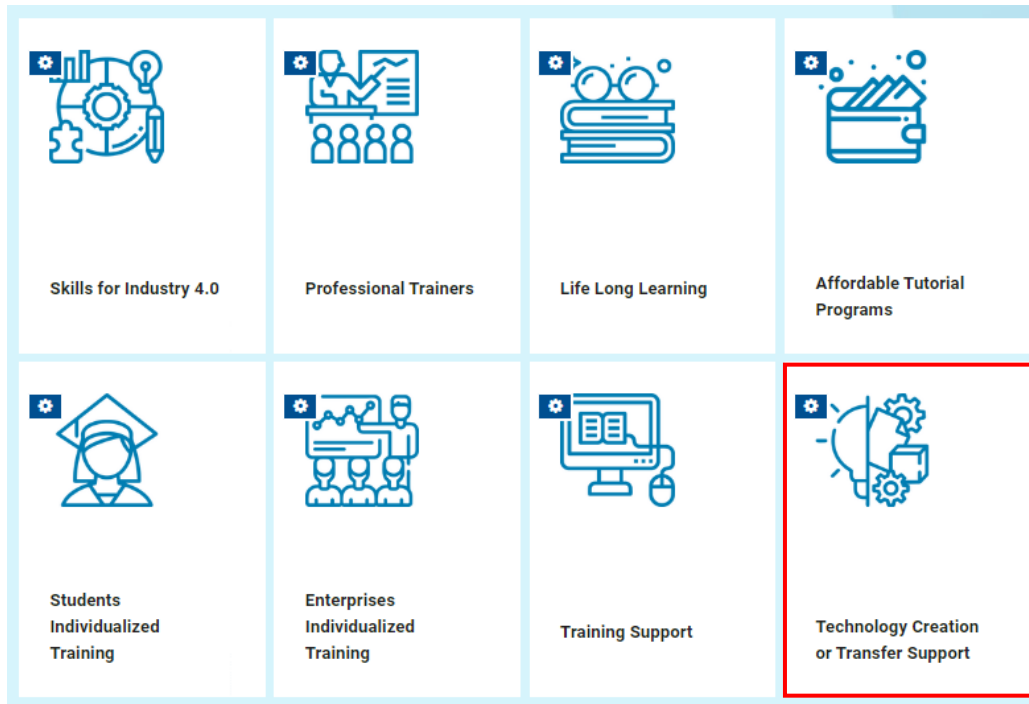


Figure 14 – Technology creation or transfer support.

### Technology Creation or Transfer Support

We have experts that can assist you in preparing your innovations, in terms of design, testing and exploitation. If you have any technical question you may consult us.

#### Contact us

Subject \*

- Select -

Text \*

Write your message

Submit

Figure 15 – Technology creation or transfer support.

The principle is to make the link between the Learning Centers, the Industrial observatory (the registered companies in the Learning Center, the evaluation questionnaires...), and the Technology Transfer (innovation, creation...) to sustain the use of the Learning Centers.

*Details of Technology Transfert & Innovation are presented in **Deliverables D2.6 & D3.3***

### 3.8 Shyfte 4.0 main dissemination results

To summarize the main results in terms of dissemination, we can analyse different dimensions: scientific dissemination, industrial and academics dissemination, and general dissemination:

#### 3.8.1 Scientific dissemination: publications in conferences and journals

Dissemination activities at international conferences disseminate the results and impacts of the Shyfte project. These activities, which have been scheduled and organized by the partner institutions, other academic and related associations in Europe and beyond, including participation in special sessions, keynote speakers and papers, have been carried out throughout the duration of the Shyfte project.

Conference papers are good opportunities to disseminate scientific work and present those results to academic community. During the project, **20 publications** in International Conferences were presented. We also organized **1 special session** in the international conference “IEEE – 15th China-Europe International Symposium on Software Engineering Education” which was held in 2019 in Lisbon-Caparica, Portugal. This session focused on “Skills for Industry 4.0”, 5 papers were presented. SHYFTE papers participation and contributions in international conferences, which have been carefully planned.

All the partners participated to the publication plan, the scientific results can be summarized as following, **27 publications**:

- **1** Keynote Speaker in an international conference
- **1** Special session in an international conference
- **20** papers presented in international conferences (most of them are indexed conferences IEEE)
- **7** publications in international journals:

All the journals are indexed (Web of Science and/or Scopus) and related to Industry 4.0: *Frontiers in Computational Neuroscience; Int. Journal of Manufacturing Technology and Management; Int. Journal of Advanced Manufacturing Technology; Journal of Physics: Conference Series; Production & Manufacturing Research; Int. Journal of Product Development*

*Details of scientific dissemination are presented in **Deliverable D4.4***



### 3.8.2 Industrial & academic dissemination: industrial workshops, meetings, seminars and dissemination events

Workshops and seminars are opportunities to discuss relevant topics and validate project methodologies, tools and results. These types of initiatives have been developed throughout the project both to promote useful discussion for project development and to disseminate the results of the Shyfte project.

The containment period related to Covid-19 did not allow the multiplication of this type of event, as companies and universities were not available for it, but we still managed to adapt and to organize and maintain remote events.

Shyfte workshops and seminars are simultaneously a valuable opportunity to expand and enlarge the network with other stakeholders.

The main KPI's are as follows:

- Industrial workshops (face-to-face & virtual): **10** industrial & academics workshops
- Visits to companies: **4** visits (in Chengdu, Chiang Mai, Kuala Lumpur)
- Seminars (face-to-face & virtual): **5** dissemination seminars
- Formal meetings (face-to-face): **10** Plenary and/or PMB meeting
- Informal meetings (virtual): **44** Plenary and/or PMB meeting

*Details of academic and industrial dissemination are presented in **Deliverable D4.4***

### 3.8.3 General dissemination: Shyfte project in the medias (websites, social networks, youtube...)

Through Shyfte's publicity channels, it was possible to disseminate the project to the target groups in the different partner countries in Asia and Europe. Publicity for the Shyfte project followed a specific dissemination strategy, including media outreach, website extension, promotional materials and launch ceremonies (during plenary meetings). The main Shyfte communication channels available are: Shyfte website ([www.shyfte.eu](http://www.shyfte.eu)), Shyfte facebook (<https://www.facebook.com/shyfteproject/>), the Youtube channels ([https://www.youtube.com/playlist?list=PLTKeiSPWAMd\\_o\\_t8Flgg2GlezQh9gEF6](https://www.youtube.com/playlist?list=PLTKeiSPWAMd_o_t8Flgg2GlezQh9gEF6)), others videos. Promotional materials (e.g. kakemono, flyers...) have been created to promote the project and its results to target audiences.

In the same way as for the industrial & academic diffusion, the period of confinement linked to Covid-19 did not allow the multiplication of communication events, but we used all the communication channels to continue to communicate about the project.

The main KPI's are as follows:

- **13** publications on Shyfte in institutional websites
- **9** articles in medias (journal online and magazines, research exposition, news portals...)
- **5** promotional videos (youtube)
- **19** participations in seminars, workshops, exhibitions, fairs... (online or face-to-face)

*Details of general dissemination are presented in **deliverable D4.3** and on the Shyfte website:*

<http://shyfte.eu/wp-admin/post.php?post=1733&action=edit>

## 4. Shyfte 4.0 Gap and deviation analysis

Within the framework of the project, we faced an unexpected event, which concerned all the partner countries, and which was the health crisis linked to Covid-19.

This international pandemic did not allow us to continue in the same way the work initiated during the first part of the project (from November 2018 to January 2020). Physical meetings were no longer possible, which impacted and modified the way of managing the project (WP5), the organization of training sessions (WP2), the organization of dissemination events (WP4) ...

The main issues concerned the management of the project, training sessions for trainers and for students, and events related to the dissemination of the project:

- For the **management of the project**, the main issue concerned the PMB physical meetings, we reorganized our work, switching to regular plenary and PMB virtual meetings. It was a bit difficult to mobilize all the partners, because of the containment and the closure of the universities, but finally, we found a way to work all together and to continue the work on the WPs and the different tasks.
- For the **training sessions**, we quickly set up a first phase of distance learning sessions, which went very well, but we were behind the initial planning, and we were not able to make the best use of the equipment acquired in this first phase. The objective was to wait until the end of the pandemic to restart face-to-face training sessions.

Based on the initial travel plan, we organized 10 travels and cancelled 7 others. Because of the delay in the development of the training sessions (trainers and students), we were not able to manage the travels for EU experts (20 days) to participate to training of the students. The training of the students took place in the last months of the project. The EU partners participated remotely to most of the events and training sessions.

- For the **dissemination**, it was complicated to continue the dynamics of company visits, organization of workshops and seminars and participation in conferences. We adapted, and we organized remote events, but the overall quality was not always the same. On the other hand, we made more use of the website (main one, and that of the partner universities) and social networks (mainly Facebook), to keep informing about the progress of the project.
- Another issue concerns the collaboration between the partners. The partner Cognitus contributed to all the WPs and tasks assigned to it. The collaboration was fruitful because of Cognitus' expertise in computer technologies, and in particular, artificial intelligence, deep learning, machine learning, big data...

Cognitus was the co-leader of the WP1, it has actively participated in the analysis of the gaps between the needs of companies in terms of knowledge and the contents of the training courses proposed by the universities. Cognitus participated in the elaboration of questionnaires for companies and in the analysis of the answers obtained. They accompanied and validated the knowledge models defined to respond to the observed gaps.

Cognitus worked also with all the partners in the elaboration of the strategic quality plan, the dissemination strategy, the global management of the project.

This was a bit more difficult during the containment period related to the Covid-19 crisis. Cognitus continued to work and collaborate with the project members. But the company was

affected by the health crisis and was forced to stop its activity in the project in July 2021 and could not continue to collaborate during the 10-month extension period of the project.

We informed our PO about the situation, and we explained that the absence of this partner during the end of the project would not have an impact on the efficiency of the project.

*The detail of the Gap and deviation analysis for the four Pilots is described in **Deliverables D2.1 to D2.4***

## 5. Conclusion

The objective of this deliverable is to propose a final report that includes a publishable final synthesis report with a description of the main results, potential impact and main dissemination activities.

In order to summarize 4 years of work, as well as the main results of the project, we decided to first present the measurement of the main key performance indicators:

- Short- and long-term Impact indicators
- Logical Framework Matrix indicators
- The Quality Assurance Matrix and Indicators

Then, we summarized some of the most important results:

- Learning Materials development
- Training of the Trainers Sessions
- Training of Students Sessions
- Learning Centers implementation, with their main processes:
  - Students Individualized Training
  - Enterprises Individualized Training
  - Continuous improvement and sustainability
  - Industry 4.0 Observatory
  - Technology Transfer (IP, patent, spin-offs...)
- Shyfte 4.0 main dissemination results
  - Scientific dissemination: publications in conferences and journals
  - Industrial & academic dissemination: industrial workshops, meetings, seminars and dissemination events
  - General dissemination: Shyfte project in the medias (websites, social networks, youtube...)

Finally, we summarized the Shyfte 4.0 gap and deviation analysis.



<http://www.shyfte.eu/>