Interreg Atlantic Area European Regional Development Fund
EUROPEAN UNION
IN 4.0

IN 4.0

ADAPTATION OF INDUSTRY 4.0 MODEL TO THE NAVAL SECTOR

WP5.2. TRAINING SYLLABUS

1 Context: the IN 4.0 Project

The IN 4.0 Project aims at improving competitiveness of companies in the naval sector through their adaptation to the productive model represented by industry 4.0, guaranteeing the continuity of the sector in an increasingly demanding market, where innovation is a key factor in strategic positioning. To this end the transnational training program described in the current training syllabus is included in action 5 of the project work plan: “IN WORK AND IN TRAINING”.

This action includes two main activities:

- The production of joint diagnosis of the current situation of the implementation of industry 4.0 in the naval sector in the Atlantic Area, pursuing a new approach for the redefinition of job positions (full report: Joint diagnosis of the current situation of the implementation of industry 4.0 in the naval sector in the Atlantic area)
- And following the above-mentioned diagnosis, the design of a training program that aims at providing workers, graduates and students in their grade final year with the necessary skills and knowledge to adapt to the new technological scenario.

This training syllabus includes a transnational approach of the training course, which is intended to be implemented on the five participating countries in the IN 4.0 Project: Ireland, United Kingdom, France, Portugal and Spain, therefore the official language is English.

On the other hand, the current training syllabus must be adapted to the particularities of each country, especially when it comes to internships and work placements granted both to graduates and undergraduates.

Moreover, the aspiration of the IN 4.0 training course, beyond the IN 4.0 Project, is to become a resource that maritime companies can adapt and use at any time in the future.

2 Industry 4.0

The fourth industrial revolution has brought Industry 4.0, a new model for the organization and control of the value chain, based on information technologies.

As in previous industry revolutions, this new model is characterized by the application of new technologies to industrial processes. Whereas in the past steam engines, diesel engines and electricity were introduced, today we are facing the integration of information and communication technologies (ICT) in factories. A fact that necessarily involves establishing a dialogue on the redefinition of processes, products and services and even of business models themselves.

Industries such as the automotive, energy, steel and aeronautics, act as the nuclear axis of our industrial production. Not only in terms of quality, but also of quantity. For our industrial companies to benefit from this impact and the value generated, it is necessary to know and implement a range of enabling technologies.

The technologies of mass data analysis (Big Data), Internet of Things (IoT) (objects of daily life connected to the Internet), collaborative and connected robotics, virtual and augmented reality, additive manufacturing, cyberphysical systems and Artificial Intelligence (AI), are areas of great importance, and as consequence a great demand of qualified manpower is needed due to the enormous opportunities it offers.

A world of possibilities is opened thanks to this new paradigm of Industry 4.0, which has yet to be defined and delimited, industry can be strengthened. It is necessary to understand these intelligent factories as an opportunity to take advantage of the knowledge acquired in production processes.

The introduction of the single digital market and the digital transformation of industry, within the European Union itself, are priorities set for the period 2014-2019. Industry 4.0 training Program is framed in this context of opportunities, aiming at providing knowledge on the concept of "intelligent and connected factories: digital transformation of industrial companies, their processes, products and markets".

The Industry 4.0 training program, which focuses on the naval sector, intends to approach the new paradigm from three dimensions of study:

- **Technology:** enabling technologies, the body of knowledge that makes this new era possible.
- **Business:** the impact on the process, product and business model that has been brought to the industry by the digitization of factories.

- **Applications:** successful experiences in companies and associated industries in the maritime sector, that combining Technology and Business have been able to participate in Industry 4.0 projects and make them profitable.

Companies in the industrial sector, product engineering, consulting firms and integrators of technological solutions must prepare their human resources for the challenge of digital transformation and the design of connected products. In fact, the lack of training, as well as the weak promotion of technology-based talent represent a major risk for the viability of companies in the Atlantic Area.

Training such generalist experts seems to be an important part of the roadmap towards digital transformation.

3 Title of the training program

INNOVATION MANAGEMENT: INDUSTRY 4.0 IN THE SHIPBUILDING AND SHIP REPAIR INDUSTRIES

4 Objectives of the training program

4.1 General Objective

Providing knowledge on the available industry 4.0 technologies, by determining the possibilities they offer and how they can be implemented to an industrial environment in order to make it more competitive.

4.2 Specific Objectives

- Performing a technical analysis of appropriate industry 4.0 solutions and technologies in the enterprise.
- Diagnosing the starting point for the digitalisation of a company.
- Identifying the main key enabling technologies of the connected industry.
- Understanding the fundamentals of the connected industry in the main industrial sectors.
- Channelling strategic thinking, the right leadership style and cultural profile of companies to ensure the success of the digital transformation.
- Performing a technical analysis of appropriate industry 4.0 solutions and technologies in the enterprise.

5 Structure of the training course

The "***Innovation management: industry 4.0 in the shipbuilding and ship repair industries***" training program is structured in two parts:

- **Online training (through the e-learning platform)**, which is common to all the targeted profiles of trainees. They will have access to the same modules, units and contents through the same e-learning platform.
- **Presential training** (internships/work placements in maritime companies) **aimed only at a selection of recent graduates or students in their final year** (depending on the country) who fulfil the requirements to be placed in companies. The IN 4.0 project includes the following minimum indicators per country in terms of number of trainees engaged through an internship/ work placement contract in companies:

Country	Partner	Indicator (n. of trainees on an internship/work placement in companies)
Spain & Portugal	DEPO	10
Ireland	CIT	5
France	BPN	5
UK	University of Strathclyde	5

As a conclusion, the training program does not guarantee a job, fees or internships to all trainees taking the online part of the program. Only the selected recent graduates or final year students will be granted an internship, according to the distribution per country indicated in the table above.

The Covid-19 pandemic has changed the scenario and face to face actions are now at risk, however, the IN 4.0 partnership has decided to maintain internships/work placements in maritime companies, when possible, as training highly qualified graduates and undergraduates is a key factor for the modernisation of the shipbuilding and ship repair industry.

6 Teaching Methodology

Learning methods are the training processes that encompass and structure a complete training action. The most common, and most traditional, method is the expository, which consists of a linear presentation of contents, introducing practical activities, debates and tests that guarantee the acquisition of knowledge and skills. However, there are other methods designed to increase learners' interest and promote their commitment to the learning process, such as project learning or the case method.

Two main methods will be implemented in the current training program: **exposure and case**. These methods will be carried out in a virtual environment through an e-learning platform and videoconferencing systems, as well as through work placements/internships in companies. Work placements/internships are aimed only at selected recent graduates or final year students in each participating country.

Regarding the main characteristics and relevance of each of the methods, the objectives of the **exposure method** are the transmission of knowledge based on a critical approach to the subject, allowing students to reflect and discover the connection between different concepts. The exposure method seeks to generate critical awareness that will help to find solutions to the different problems.

These are some of the skills promoted through the exposure method:

1. Knowledge
    a. Academics linked to a subject: Acquisition, understanding and systematization of specific knowledge of a subject
    b. Linked to the professional world: application and use of knowledge for professional problem solving
2. Skills and abilities
    a. Intellectuals: acquisition of strategies for reflection, synthesis and evaluation
    b. Communication: communication of ideas and drawing of conclusions; relationship with the teacher
    c. Interpersonal: discussing with others the ideas raised
    d. Organization/personal management: acquisition of planning strategies, organization and management of time and resources for learning
3. Attitudes and values
    a. Professional development: developing skills related to lifelong learning
    b. Of personal commitment: development of motivation, effort for learning and development of autonomy

The exposure method implies in this case virtual implementation through the e-learning platform and through webinars on the course contents.

On the other hand, the **case method** consists in the study of certain cases, real or fictitious situations, in which participants must make autonomous decisions. These are some of the main characteristics of the case method:

1. Encouraging active student participation
2. Simulating the conditions that support learning by doing
3. Developing problem-solving and decision-making skills
4. Personalising learning
5. Strengthening student's ability to deal with complex situations

This is a method that will benefit selected recent graduates and final year students doing their work placements in maritime companies, however students who are not selected for work placements will also have the opportunity to experience real cases through different exercises and deliverables included in each module of the course.

As a conclusion, the **case method** will be provided through the e-learning platform and webinars, as well as through the immersive experience of internships (only) for selected students.

On the other hand, e-learning implies a series of advantages, such as:

- Absence time and space barriers (ubiquity).
- Individualised learning process.
- Promotion of self-learning.
- Interactivity between mentors and students

In addition, e-learning involves three key pillars:

- **The e-learning platform**. It is a virtual classroom where the student will have access to all the materials and communication systems with the tutor and the rest of the students in the group.

- **E-learning content**. Available through the e-learning platform, it is the basis for learning the course, the material on which the student will study to later acquire the skills with the practice associated with the study of these contents.

- **Mentors**. Understood as a guide to learning. The tutor will provide all the support to achieve the objectives by resolving doubts, energizing the course and providing feedback on the results.

6.1 E-LEARNING COURSE STRUCTURE

Training platforms normally have a modular structure, listing all the modules included in the training syllabus.

For each training action of the project there will be a previously configured and tested course. The platform structure will be as follows:

- **General**
    - Announcement
    - Presentation of the course
    - User manual
    - Chat
    - Didactic guide
- **Common Module structure (from 1 to 6)**
    - Module 1. Forum. In which a thread of conversation will be specified on the part of the mentor to promote the participation of students.
    - Module 1. SCORM of contents.
    - Module 1. Evaluation test (questionnaire)
    - **Video training pills**
        - 3 mins videos in which an expert explains practical cases or features of relevant 4.0 technologies
    - **Webinars**
        - A complementary webinar per module will be delivered by the e-learning mentor. These webinars will complete or consolidate the contents learnt and will substitute any presential training actions (excluding work placements/internships) to adjust to social distance requirements after the COVID-19 health crisis.
- **Self-assessment per module**
    - A knowledge acquisition assessment test.

- **Final Grading**

- **Certificate**
  - The course certificate will be activated automatically in the platform for those students whose final grade is equal to, or higher than, 50%.

6.2 GRADING CRITERIA

For a student to successfully pass the course, a number of requirements must be met:

- Each student **must have accessed at least 80% of the contents in the platform** (depending on the modules in which they are enrolled)
- Each student must have passed the final assessment tests with a grade of at least 5 (over 10)
- In the case of **recent graduates** or **final year students** placed in maritime companies (interns), the in-company mentor must issue a report assessing both their aptitude and their attitude

6.3 TRAINING PILLS – EXPERT GUIDELINES

Pre-Production of Training Pills

Before recording, the purpose of the video must be clear, remembering that it is a training video, 3 minutes long, in which it is important to catch the attention of users at the other side of the smartphone, computer or tablet screen. The video should preferably be recorded in English. In case it is recorded in another language, it should be subtitled in English.

First of all, it is recommended that the expert recording the video writes a script about what he/she wants to communicate in the video, including a description of everything that will happen in the video. Therefore, it will contain the video's dialogue, images and visual resources that we will use to convey a message.

All the scripts should have the following structure so that they are unified:

1. Presentation of the expert. It is important to choose a person who adds value to the content based on their professional experience.
   For example: Hello! My name is ... and I am responsible for ... in the company ...

2. The importance of the module on which the module is doing.
3. Professional experience or knowledge that provides value to users.
4. Farewell.

Once the script is clear, it is necessary to choose the video setting. It must be a place withouth echo or background noise, since audio is one of the most important elements of a video.

If the chosen setting is an office or in an enclosed space, the color of the walls must be solid, preferably white. Wallpapers or background pictures should be avoided, as well as appropriate clothing that does not have polka dots, stripes or pictures.

Try to record in natural light, as it is essential when making a good video.

In case you decide to make it with artificial light, three points of light are needed: two in front of the speaker and a third one behind, which will act as a backlight.

There is no image without light, so lighting is as important as the quality of the audio.

Production of training pills

Once the script is prepared, the location and the best light are chosen, we are ready to record the video.

For this, we can use a professional camera or a smartphone.

It is important to place it in front of us, we recommend using a tripod and if this is not possible, place it at eye and nose level.

If we choose to use a mobile device, the recording will be done horizontally.

Contents

The video training pills' topics and contents must be related to the course modules.

6.4 WEBINARS METHODOLOGY

A Webinar is a type of conference, workshop or seminar that is broadcast over the Internet. The main feature is the interactivity that occurs between the participants and the speaker. As in any face-to-face event, the speaker is speaking live to the audience and attendees can ask questions, comment and listen to what other participants have to say.

Webinars are delivered in real time, with a specific date and time. It is possible to participate from any computer connected to the Internet and in which specific software has or has not been loaded and/or a password has been entered to connect to the speaker's application.

On the other hand, these events are also useful for "networking", that is, the connection between people with similar interests who can continue communicating and collaborating after the Webinar is over.

Therefore, in order to develop each one of them, both the mentor and the students will be provided with a software platform that allows the realization of webinars such as Zoom, Skype or similar.

A minimum of one webinar per module must be produced, ideally delivered by the course mentor in each country. Webinars will last approximately **45 minutes** during which the mentor will go deeper into the contents of the training module and will be able to interactively resolve queries from the participants of the same.

On the e-learning platform and by e-mail, participants will be given the passwords to enter the webinar at least one week in advance.

The mentor must have at least the following equipment:

1. Computer with internet connection
2. Speakers
3. Microphone

The minimum requirements for participating students will be the same except for the microphone, as they will also be able to interact through the chat of the webinar itself.

The sessions may be recorded to be able to use them both on the platform itself and on social networks of the IN4.0 Project.

As a conclusion, these webinars are group sessions and constitute and opportunity for debate, live interaction and networking between students and mentors. Following the COVID-19 crisis' consequences, these Webinars substitute any group face-to-face sessions.

Contents

As previously explained, the topic and contents of each Webinar will be related to the module where the Webinar is framed, seeking to provide a deeper insight into such contents, as well as to offer the opportunity for group interaction

7 Profiles of stakeholders taking part in the training program

7.1 Mentors' *profile*

Mentors should have extensive professional experience in the implementation of Industry 4.0 technologies or have experience in the shipbuilding and repair sector. Ideally, a mentor with experience in the implementation of 4.0 technologies should also have experience in the field of ship construction and repair.

Mentors will add value to the course by transferring their experience through videoconferences or real cases that allow students to successfully grow, both personally and professionally.

Recommended mentors' minimum requirements

-Training and education:

- Degree in computer engineering, telecommunications, industrial (or similar).
- Demonstrable medium-high level of English.

-Required knowledge:

- Knowledge in IT technological innovations such as Robot Process Automation (RPA), Big Data, Machine Learning, IoT, improvement of internal processes with technological tools (ERP, CRM), among others.
- In addition, mentors will have the capacity to evaluate the real and profitable application of 4.0 technologies.

Mentors' tasks and responsibilities

Mentors will guide and support the different profiles of students enrolled in the online training course.

Depending on each students' profile, mentors are responsible for guiding them through the course, supervising their progress and supporting them when required:

- Answering students' queries through the platform (direct communication channel with students)
- Promoting debate on certain topics (forums, etc.)

- Monitoring students' progress (compliance with deadlines, etc.)
- Obtaining reports through the platform (per course, per student, etc.)
- Organising and delivering one webinar per module (such as described in the previous sections, these webinars are group sessions and constitute and opportunity for debate and live interaction. Webinars substitute any group face-to-face sessions)
- Grading students

Resources provided for mentors

- A configurated e-learning platform with full contents
- Enrolled students with a configurated profile according to the modules they are doing
- An embedded communication messaging system in the e-learning platform
- A manual on the use of the platform
- Technical support by the platform administrator (direct communication channel)

Recommended mentors' dedication (in hours)

36 hours	Preparation and delivery of 6 webinars (one per module)
24 hours	Group and individual mentoring, grading, etc.
60 total hours	Support for students throughout the 9-week e-learning course

Number of mentors per country

Each country must appoint at least one mentor. One mentor could teach all modules, or one mentor could be appointed per module (or several modules).

Mentors could be external experts, or they could be appointed from among the regular staff experts per partner.

7.2 Trainees' profiles

Before listing and explaining the different profiles of trainees targeted in this training course, it is necessary to remark that the IN 4.0 training program is split in 2 parts:

- **Online training (through the e-learning platform)**, which is common to all trainee profiles
- **Presential part** (internships/work placements in maritime companies) **aimed only at selected final year students or recent graduates**, depending on the country, who fulfil the requirements to be placed in companies

Table of minimum qualifications for students to participate in the IN 4.0 internship program according to national labour law per country

Spain & Portugal	Graduates (after 2016, included)
France	Undergraduates (final year)
United Kingdom	Undergraduates (final year)
Ireland	Undergraduates (final year)

Trainees' profile 1. Graduates who will be granted an internship (work placement) in maritime companies

University graduates (**level 6 EQF**) with advanced knowledge in a field of work and study that requires a critical understanding of theories and principles will be selected in Spain.

Special emphasis is placed on **science and engineering professionals** who conduct research; improve or develop concepts, theories and operational methods; or apply scientific knowledge related to fields such as physics, astronomy, meteorology, chemistry, geophysics, geology, biology, ecology, pharmacology, medicine, mathematics, statistics, architecture, engineering, design and technology **(ESCO-08 code: 21).**

And within this classification, **engineers** are the priority, as they design, plan and organize the testing, construction, installation and maintenance of structures, machines and their components, and production systems and plants; plan production schedules and work procedures to ensure that engineering projects are carried out safely, efficiently and cost-effectively. **(ESCO-08 code: 214).**

And those **engineers** not classified under other headings who research, design, advise, plan and manage the construction and function of electronic, electrical and telecommunications systems, components, motors and devices; who organize and establish control systems to monitor the performance and safety of electrical and electronic assemblies and systems **(ESCO code 08: 215).**

Access to such training would also be possible for those specialists in **public administration and business** who perform analytical, conceptual and practical tasks to provide services in financial affairs, human resource development, public relations, marketing and sales in technical, medical and information technologies and communications spheres; and to conduct reviews of the organization's structures, methods and systems, as well as quantitative analyses of information affecting investment programs **(ESCO code 08: 24).**

Criteria for selection and evaluation of interns

Different selection criteria will apply, depending on each country's local particularities, however, coordinating partners should take into account the following requirements:

Requirements	Description	Points
University qualifications (compulsory)	Trainees must prove to hold a university qualification, obtained after 2016 (included), or to be enrolled in a university course framed in the above mentioned ESCO profiles: - ESCO-08 code: 21 - ESCO-08 code: 214 - ESCO code 08: 215 - ESCO code 08: 24	To be fixed
Proficiency in English (if applicable)	Level of English: B1, or below, according to the Common European Framework of Reference (CEFR)	To be fixed
	Level of English: Above B1, according to the Common European Framework of Reference (CEFR)	To be fixed
Personal interview (recommended)	Candidates will be called on a personal interview (face-to-face or virtually) with the chosen selection board	To be fixed
Other criteria (as many as needed)	To be fixed per country according to particular needs	To be fixed
	TOTAL MAX. POINTS	To be fixed

Terms of the internship/work placement agreement for awarded interns

Each country is free to adapt the terms of the internships, according to the local legal particularities and hosting companies. However, some recommended terms to take into account are:

- Duration of the internship (to be fixed per country)
- Internship agreement terms (to be fixed per country)
- The intern **will report to the appointed in-company mentor** who will lead and supervise the intern's tasks and innovation proposal
- At the end of the internship period, students must deliver an **innovation proposal (compulsory)** to the company that hosted them. This innovation proposal, adapted to

the needs and reality of the hosting company, will be produced with the support of the in-company mentor.

Trainees' profile 2. Active workers from maritime companies

Active workers will only engage in the online training part of the program (through the e-learning platform) and will only take the recommended modules according to their profile and experience, as specified in the following section (Recommended modules per job profile/responsibilities). Workers will only take part in the online training and will obtain a certificate for participating in the course.

Trainees' profile 3. Unemployed workers with experience in the maritime sector (optional)

Following the COVID-19 crisis, the project partnership decided to open the training to unemployed workers. Unemployed workers will only engage in the online training part of the program (through the e-learning platform) and will only take the recommended modules according to their profile and experience, as specified in the following section (Recommended modules per job profile/responsibilities). Unemployed workers will only take part in the online training and will obtain a certificate for participating in the course.

Number of trainees per profile and country

Trainee profile	Mandatory (acc. to PAF)	Recommended
Trainees' profile 1. Graduates/undergraduates who will be granted an internship (work placement) in maritime companies	10 Spain & Portugal 5 France 5 UK 5 Ireland	
Trainees' profile 2. Active workers from maritime companies	Not specified	Between 10 and 20 per country
Trainees' profile 3. Unemployed workers with experience in the maritime sector (optional)		

7.3 Hosting companies and in-company mentors for interns

Interns will be allocated to the hosting companies appointed by each partner. A company could host more than one intern.

An agreement between the hosting company, intern/interns and coordinating partner should be drawn.

The companies hosting interns must appoint a in-company mentor who will coordinate and supervise their work. Interns will report to the assigned in-company mentor.

In-company mentors **must support selected interns in delivering an innovation proposal to their host companies**. Mentors must be able to lead, promote and coordinate selected interns to produce the technological innovation proposal to be delivered at the end of their internship through the **innovation proposal (based on one of the technologies included in the training course)** to be handed over to the hosting companies. To this end, mentors must oversee the analysis of market opportunities and work closely with the heads of the functional areas of the organizations hosting the interns.

8 Course delivery dates per country

The training course delivery dates per country **will be determined by local particularities, always taking into account that any actions related to this training course must be completed and fully paid by August 2021.**

Country	Potential start date of the online platform (e-learning part)	Potential start date of the internships
Spain	*To be fixed*	*To be fixed*
France	*To be fixed*	*To be fixed*
Portugal	*To be fixed*	*To be fixed*
Ireland	*To be fixed*	*To be fixed*
UK	*To be fixed*	*To be fixed*

9 Recommended modules per job profile/responsibilities

It is recommended that all interns take all the modules, however, depending on the professional profiles of employed and unemployed workers, it is recommended that they take some specific modules.

JOB DESCRIPTION (ROBOTICS)
Position: Robotics Engineer
Description: RPA or real-time application developers with extensive IT knowledge and experience in process automation projects.
Recommendations for the study of modules: MODULE 2 | KEY ENABLING TECHNOLOGIES IN MANUFACTURING MODULE 3 | KEY ENABLING TECHNOLOGIES IN MANUFACTURING MODULE 4 | DIGITAL FACTORY. MANUFACTURING INTELLIGENCE MODULE 5 | MACHINE LEARNING FOR PRODUCTION ENGINEERING

JOB DESCRIPTION (MACHINE LEARNING)
Position: NLP Engineer and Deep Learning Engineer
Description: mainly to predict failures in technological equipment and to forecast productivity factors for the following year.
Recommendations for the study of modules: MODULE 4 | DIGITAL FACTORY. MANUFACTURING INTELLIGENCE MODULE 5 | MACHINE LEARNING FOR PRODUCTION ENGINEERING

JOB DESCRIPTION (IOT)
Position: telecommunications specialist M2M or IoT solution architech.
Description: necessary for traffic monitoring, in measurements, etc. Engineers in charge of all technologies related to automation and intelligent factory sensors.
Recommendations for the study of modules:

MODULE 3 | KEY ENABLING TECHNOLOGIES IN MANUFACTURING MODULE 4 | DIGITAL FACTORY. MANUFACTURING INTELLIGENCE MODULE 5 | MACHINE LEARNING FOR PRODUCTION ENGINEERING

JOB DESCRIPTION (ESB)
Position: Engineer in Big Data, Open Source and Middleware.
Description: required to integrate all enterprise systems.
Recommendations for the study of modules: MODULE 3 | KEY ENABLING TECHNOLOGIES IN MANUFACTURING MODULE 4 | DIGITAL FACTORY. MANUFACTURING INTELLIGENCE MODULE 5 | MACHINE LEARNING FOR PRODUCTION ENGINEERING

JOB DESCRIPTION (RA)
Position: Artificial intelligence engineer, industrial engineer, graphic designer and architect of intensive solutions.
Description: design digital sketches and solve complex business problems.
Recommendations for the study of modules: MODULE 3 | KEY ENABLING TECHNOLOGIES IN MANUFACTURING MODULE 4 | DIGITAL FACTORY. MANUFACTURING INTELLIGENCE MODULE 5 | MACHINE LEARNING FOR PRODUCTION ENGINEERING

JOB DESCRIPTION (MOBILITY SOLUTIONS)
Position: DevOps engineer or software engineer.
Description: innovate and adopt new technologies and unify software development.
Recommendations for the study of modules: MODULE 4 | DIGITAL FACTORY. MANUFACTURING INTELLIGENCE MODULE 5 | MACHINE LEARNING FOR PRODUCTION ENGINEERING

JOB DESCRIPTION (CLOUD)
Position: cloud architect and virtualization specialist. Devops engineer or software engineer.
Description: have the objective of managing important company processes through the network.
Recommendations for the study of modules: MODULE 3 | KEY ENABLING TECHNOLOGIES IN MANUFACTURING

MODULE 4 | DIGITAL FACTORY. MANUFACTURING INTELLIGENCE MODULE 5 | MACHINE LEARNING FOR PRODUCTION ENGINEERING

JOB DESCRIPTION (CIBERSECURITY)
Position: security auditors for normative approach, GDPR, processes and procedures and hacking consultants for the ethics with approach to security and vulnerability analysis.
Description: Cybersecurity has become one of the biggest challenges for organizations to avoid mismanagement that negatively affects both the economic and reputational level.
Recommendations for the study of modules: MODULE 3 | KEY ENABLING TECHNOLOGIES IN MANUFACTURING MODULE 4 | DIGITAL FACTORY. MANUFACTURING INTELLIGENCE MODULE 5 | MACHINE LEARNING FOR PRODUCTION ENGINEERING

10 Course duration (hours)

MODULE 1. IMMERSION 4.0
MODULE 2. KEY ENABLING TECHNOLOGIES IN MANUFACTURING
MODULE 3. KEY ENABLING TECHNOLOGIES IN MANUFACTURING
MODULE 4. DIGITAL FACTORY. MANUFACTURING INTELLIGENCE
MODULE 5. MACHINE LEARNING FOR PRODUCTION ENGINEERING
MODULE 6. CONTROL MANAGEMENT AND CHANGE MANAGEMENT

On the other hand, trainees are recommended to have an estimated dedication of 3 hours/day **(**15 hours per week) in a **period of 9 weeks**.

Trainees will **be part of a group with common concerns, experiences and interests** so that, with participation in different forums, chats and other tools, learning will be much more enriching.

In addition, there will be the help of an expert mentor in the subject so that the student can make the most of the tools available and help in resolving queries, **adjusting the course to the specific needs per student** through the recommendation of further contents and

articles, proposal of related filmography, suggestions of other training actions, explanation of real cases, and so on.

The training is structured in 6 modules:

MODULE 1. IMMERSION 4.0
MODULE 2. KEY ENABLING TECHNOLOGIES IN MANUFACTURING
MODULE 3. KEY ENABLING TECHNOLOGIES IN MANUFACTURING
MODULE 4. DIGITAL FACTORY. MANUFACTURING INTELLIGENCE
MODULE 5. MACHINE LEARNING FOR PRODUCTION ENGINEERING
MODULE 6. CONTROL MANAGEMENT AND CHANGE MANAGEMENT

Each of these modules is composed of didactic units organized in a sequential and logical way so that the student can progress gradually, acquiring the necessary skills to **achieve the capabilities and units of competence.**

The following proposed chronogram **includes an estimation of the required dedication per task**: reading and study of the contents and the activities to be carried out, to be adapted to the learning rhythm of each student.

For this reason, it is necessary to set some **recommended study dates** that will allow an adequate organization to successfully achieve the objectives of this course.

Activities	**Responsable**	**Study dates in weeks**								
		1	2	3	4	5	6	7	8	9
MODULE 1. INMERSIÓN 4.0	Mentor & Platform dynamizer									
MODULE 2. KEY ENABLING TECHNOLOGIES IN MANUFACTURING (	Mentor & Platform dynamizer									
MODULE 3. KEY ENABLING TECHNOLOGIES IN MANUFACTURING	Mentor & Platform dynamizer									
MODULE 4 DIGITAL FACTORY. MANUFACTURING INTELLIGENCE	Mentor & Platform dynamizer									
MODULE 5. MACHINE LEARNING FOR PRODUCTION ENGINEERING	Mentor & Platform dynamizer									
MODULE 6. CONTROL MANAGEMENT AND CHANGE MANAGEMENT	Mentor & Platform dynamizer									

11 The e-learning platform

11.1 E-learning platform

The e-learning platform, provided by DEPO, is hosted in this link:

- Spanish: https://training-in40.depo.gal/login/index.php
- English: https://training-in40.depo.gal/login/index.php

The e-learning platform includes the following technical requirements:

- Compatibility with SCORM and IMS standards.
- Performance, understood as the number of participants that support the platform, the speed of response from the server to users and the time to load web pages or download files, which allows:
    - Support a number of participants equivalent to the total number of participants in the training actions given by the training center or entity, guaranteeing a minimum lodging equal to the total number of participants in these actions, considering a number of concurrent users of 40% of that number of participants.
    - Have the necessary transfer capacity so that there is no effect of delay in the audiovisual communication in real time. The server in which the platform is hosted must have a minimum bandwidth of 100 Mbps, sufficient to download and upload.
    - **Operation 24 hours a day, 7 days a week**. Technological compatibility and integration possibilities with any computer infrastructure or operating system, database, Internet browser between the most common servers or web. It is possible to use the functions of the platform with compatible complements and viewers.

If additional installation of any support for advanced functionality is required, the platform must provide free access.

Integration of tools and resources needed to manage, administer, organize, design, deliver and evaluate training actions over the Internet, specifically by having the following:

Tools that facilitate collaboration and communication among all participants, both asynchronous (forums, whiteboards, mail, lists, etc.) and synchronous (messaging system, chat, videoconference, etc.).

- Content development, management and integration tools.
- Tools to monitor training, participants' progress and learning assessment.
- Tools for the administration and management of participants and training activities.

The server of the online platform must comply with the requirements established in Organic Law 15/1999, of 13 December, on personal data protection, so that the person responsible for the platform must identify the physical location of the server and compliance with the provisions on international data transfers in Articles 33 and 34 of the Organic Law and Title VI of the implementing Regulation, approved by Royal Decree 1720/2007, of 21 December. Availability of a user service that provides technical support and maintains the technological infrastructure and, in a structured and centralized manner, attends to and resolves participants' technical questions and incidents. The service, which must be available to participants from the beginning to the end of the training action, must have an operating schedule of morning and afternoon, must be accessible by telephone and electronic messages and may not exceed a response time of more than 2 working days.

11.2 E-learning platform administrator

An e-learning platform administrator will be appointed to carry out the following tasks:

- Providing and configurating the e-learning lay-out and necessary plug-ins for the e-learning platform
- **Creating and configurating users for the different profiles of stakeholders taking part in the course**:
    - Mentors from all countries (they should receive technical guidance on the use of the platform). The administrator will also provide technological support to mentors
    - Students
    - Reader profiles (if necessary)
- **Enrolling students from all countries** (students should be provided with a course guide explaining the objectives of the course, as well as the technical requirements, taking into account that four different profiles of students and that they will be taking different course modules.
- **Cloning the online course** to adapt to the needs of each participating country and/or group of students (a minimum of 9 courses)
- **Configurating the Moodle platform to**:
    - Adapt it to the corporate image of the IN 4.0 Project
    - **Automating the e-learning platform so that:**

- each student knows their degree of progress and remaining time/contents in order to reach their personalized objectives, taking into account that there are several students taking different modules
- grading students according to the criteria mentioned in the section of "Grading criteria"
- issuing personalized certificates to each student who has passed the course
- managing the training course assessment questionnaires which will result in a report on user satisfaction (a minimum of surveys will have to be established)
- coordination of transversal activities (coordinating the transnational webinars, uploading information pills videos, informing about new contents uploaded to the platform, etc.)

- The e-learning administrator must prove a minimum commandment of English in order to be able to communicate with the mentors from the different countries and provide the support they require
- The e-learning administrator should be available for the duration of the online training course, considering that it will be implemented at different periods:

Total estimated students (5 countries in total): **125 (est.)**
Total weeks: **36 non-consecutive weeks (est.) until August 2021**, taking into account that the course will be implemented in 5 different countries in different periods, and that each course will last for a maximum of 9 weeks

12 Course contents (modules and units)

MODULE 1. IMMERSION 4.0 (15 HOURS + 45 mins consolidation webminar)
Attendees will be introduced to the context of disruptive change that technological evolution is causing in organizations.

UNIT 1: A Brief History: From the First Industrial Revolution to Industry 4.0

1. Previous context
2. First Industrial Revolution
3. Second Industrial Revolution
4. Third Industrial Revolution
5. Fourth Industrial Revolution

6. Industry 4.0
   6.1. Objectives and benefits
   6.2. Challenges and opportunities
   6.3. Social and economic risks
7. Horizon 2020

UNIT 2: Evolution from Lean Manufacturing models to advanced manufacturing

1. Evolution from lean manufacturing models to advanced manufacturing
1.1. Continuous improvement
   1. 1.1.2. PDCA Cycle
   2. 1.1.3. The seven tools of quality
1.2. Lean manufacturing
1.2.1. What is value?
1.2.2. What is productivity?
1.2.3. What is lean manufacturing?
1.3. Principles of lean manufacturing
1.4. Goals of lean manufacturing
1.5. Lean manufacturing tools
2. Advanced manufacturing
2.1. Traditional manufacturing system
2.2. Current manufacturing system
2.3. Advanced manufacturing system
2.3.1. Traditional production vs. advanced manufacturing
2.3.2. Pillars of advanced manufacturing
2.4. Evolution

UNIT 3: Technologies included in industry 4.0

1. Key enabling technologies
   1.1. Manufacturing related technologies
   1.2. Technologies related to digital components

UNIT 4: People in the environment 4.0

1. People in the environment 4.0

UNIT 5: Necessary basis for the implementation of model 4.0

1. Necessary Basis for the Implementation of Model 4.0
2. Intelligent factories
2.1. Characteristics of an intelligent Factory

UNIT 6: Dynamic analysis of the starting point and current situation of the Sector in Europe

1. The digital transformation in the European Union
1.1. Europe 2020 targets and proposal

1. Objectives, lines of action and strategic lines Horizon 2020
1.2. Excellent science
1.3. Industrial leadership
1.4. Social challenges
2. Current state of digitisation of European industry
2.2. Initiatives of the European Maritime Technology Institute
2.3. Success stories: Horizon 2020 and the shipbuilding sector
2.3.1. Simplification of the manufacture of metal parts
2.3.2. Twin Marine Lifter (TML), offshore elevator
2.3.3. Maintenance and repair in hard-to-reach environments

UNIT 7: Management strategy / support for initiatives 4.0

1. Strategies and support of the Administration to the initiatives 4.0
   1.1. LeaderSHIP 2015: objectives
   1.2. LeaderSHIP 2015: results
   1.3. LeaderSHIP 2020
      1.3.1. Employment and skills
      1.3.2. Market access and market freedom
      1.3.3. Access to finance
      1.3.4. Research, development and innovation
2. Horizon Europe (2021-2027)
   2.1. Focus on research and innovation

CONSOLIDATION WEBINAR (COMPULSORY IN ALL MODULES)

MODULE 2. KEY ENABLING TECHNOLOGIES IN MANUFACTURING (20 HOURS + 45 mins consolidation webminar))

It will show how to integrate traditional processes with new manufacturing technologies and leverage new capabilities for the evolution of the industry.

UNIT 1 Additive manufacturing

1. Additive manufacturing
   1.1. History of additive manufacturing
2. Conventional manufacturing
3. Phases of the additive manufacturing process
4. Manufacturing technologies
   4.1. Additive technologies in polymeric materials
      4.1.1. Applications and success stories

4.2. Additive technologies in metallic materials
4.2.1. Applications and success stories
4.3. Additive technologies: other materials
5. Choice of additive technology
5.1. Key factors in the choice of an additive technology
6. Advantages and disadvantages of additive manufacturing
7. Conclusions and future of additive technology

UNIT 2 Robotics

1. Robotics. Manufacturers and technologies
2. Robot: concept and types
2.1. Types of robots
2.2. Industrial robot
2.2.1. Evolution of the industrial robot
2.2.2. Structure of an industrial robot
2.2.3. Objectives for the use of industrial robots
3. Collaborative Robotics
3.1. Bases of Collaborative Robotics
3.2. Worker-Cobot Alliance
3.3. Objectives of the use of cobots
3.4. Cobot solutions
3.5. Cobot versus traditional robot
3.6. Applications of Robotics and Collaborative Robotics
4. Use of AGV´S in Logistics. Independent Procurement
4.1. Independent sourcing

MODULE 3. KEY ENABLING TECHNOLOGIES IN MANUFACTURING (25 H + 45 mins consolidation webminar))

The second section dedicated to KETs will focus on those technologies with a digital component that represents a more disruptive change with respect to the current context.

UNIT 1: Cloud Environments

1. What is Cloud Computing?
2. Actors in the Cloud Computing model
3. Types of Cloud Computing

3.1. According to data protection regulations
3.2. Depending on the type of service
4. Legislation
4.1. Localization of Cloud Computing
4.2. Transparency

UNIT 2: Big Data

1. Concept of Big Data
1.1. The 3 V's
1.2. The 7 V
2. Origin of the data
3. Use of data
4. Hadoop tool
5. Examples of use of Big Data
5.1. Walmart

UNIT 3: Beyond Analytics

1. Beyond Analytics
1.1. Analytics Applications in Industry
1.2. Steps to follow to incorporate Analytics into the Company

UNIT 4: Internet of Things

1. Definition of IoT
2. Sectors in which IoT is used
2.1. Industry and IoT
2.2. Health and IoT
2.3. The home and IoT
2.4. Consumers and IoT
3. What makes IoT possible?
4. Future of IoT
5. What do we mean by things?
6. A global nervous system
7. The three key layers of IoT
7.1. Hardware
7.1.1. Smartphones
7.2. Infrastructure of connections
7.3. Applications and services
8. Location: the new consumer requirement
9. Evolution of business
10. Obstacles to IoT

UNIT 5: Cyberphysical Systems

1. Context
2. Cyberphysical systems
   2.1. Composition of cyberphysical systems
   2.2. Function and characteristics of cyberphysical systems
   2.3. Benefits of cyberphysical systems
3. Present and future of cyberphysical systems
   3.1. Current events
   3.2. People in the Intelligent City
   3.3. Data management
   3.4. Safety in the environment 4.0
4. Usefulness of cyberphysical systems

UNIT 6: Augmented reality

1. Context
2. Augmented reality
   2.1. Augmented reality operation
   2.2. Elements of augmented reality
3. Types of augmented reality technology
   3.1. Monitoring technologies
      3.1.1. Sensor-based tracking technologies
      3.1.2. Digital device vision-based tracking technologies
      3.1.3. Hybrid tracking technologies
   3.2. Visualisation technologies
      3.2.1. Hand display
      3.2.2. Spatial display
      3.2.3. Head Mounted Display (HMD)
   3.3. Industrial applications of augmented reality
   3.4. Future challenges of augmented reality

UNIT 7: Sensorial Advances

1. Sensors
2. Characteristics of a sensor
   2.1. Design
   2.2. Benefits
      2.2.1. Static performances
      2.2.2. Dynamic performances
      2.2.3. Environmental performances
   2.3. Reliability
3. Types

UNIT 8: Cybersecurity

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MODULE 4. DIGITAL FACTORY. MANUFACTURING INTELLIGENCE (25 HOURS + 45 mins consolidation webminar))

Specific ICT tools and solutions for the Factory of the Future will be analysed, opening up a range of opportunities to drive decision-making and achieve operational excellence.

UNIT 1: MES (Manufacturing Execution System)

1. Manufacturing execution system (MES)
1.1. Functions
1.2. Characteristics of the MES
1.3. Other considerations
2. Enterprise resource planning (ERP)
3. Integration of MES-ERP
3.1. Benefits
3.2. Results
3.3. Conclusions

UNIT 2: New generation CMMS (Computerized Maintenance Management System)

1. Types of maintenance.
1.1. Corrective maintenance
1.2. Preventive maintenance
1.3. Predictive maintenance
2. Maintenance systems
2.1. Total Productive Maintenance (TPM)
2.1.1. Advantages of HPT
2.1.2. Process of implementation of the TPM
2.2. Computer Maintenance Management System (CMMS)
2.2.1. Functions
2.2.2. Objectives
2.2.3. Benefits
2.2.4. Implementation process
2.2.5. Implications
2.2.6. Implementation Failures
2.2.7. Evaluation
2.2.8 Documentation and security

UNIT 3: EAKM (Enterprise Asset Knowledge Management) for Advanced Maintenance

1.Enterprise Asset Management (EAM)
1.1 Functions

1.2 Activities

UNIT4: Systems with proactive approach, management by exception

1. Reliability Centered Maintenance (RCM)
   1.1. Functions of the RCM
   1.2. Benefits of RCM
   1.3. Elements needed for a CMR analysis.
   1.4. Phases of implementation of CMR
   1.5. The success of the RCM
2. Data evaluation criteria
3. Administration by exception (MBE)
   3.1 Objectives of administration by exception
   3.2. Functioning of the administration by derogation

UNIT 5: SCADA OF SCADAS

1. Scada of Scadas
   1.1. Functions of the SCADA
   1.2. Benefits
   1.3. Requirements
2. Modules of a SCADA
   2.1. Configuration
   2.2. Interface
   2.3. Process module
   2.4. Data management and archiving
   2.5. Communications
3. Hardware Components

UNIT 6: Mobility Solutions

1. Mobile technologies
   1.1. Guidelines for mobility solutions
2. Purpose of mobility
3. Phases of mobility implementation
   3.1. Effects of the introduction of mobility
4. Management of guests

UNIT 7: Solutions applied to energy efficiency

1. General regulation of energy efficiency
   1.1. Energy efficiency
   1.2. Energy Efficiency Certificate
2. Solutions for small buildings
3. Solutions for medium and large buildings

4. Solutions for industries and infrastructures

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MODULE 5. MACHINE LEARNING FOR PRODUCTION ENGINEERING (20 HOURS + 45 mins consolidation webminar)

Advanced process optimization systems and the application of advanced models to "virtualize" the factory and understand and predict the behavior of processes and assets will be presented.

UNIT 1: Virtual Factory and Process Models

1. Virtual factory and process models
   1.1. Classification of models

UNIT 2: Optimization of processes and assets through simulation tools

1. Optimization of processes and assets through simulation tools
   1.1 Simulation: trends, advantages and limitations
   1.2 Simulation tools

UNIT 3: Identification of deviations in real time

1. Identification of deviations in real time

UNIT 4: Advanced process monitoring models

1. Advanced process monitoring models

UNIT 5: Prediction of failure modes with simulation tools

1. Prediction of failure modes with simulation tools
   1.1. Factors giving rise to faults
   1.2. Effects of unreliability

MODULE 6. CONTROL MANAGEMENT AND CHANGE MANAGEMENT (20 HOURS + 45 mins consolidation webminar)

Evolution of a system of continuous improvement towards a model based on integrated cycles of radical improvement aimed at acquiring in-depth knowledge of the processes.

UNIT 1: World-class management system for continuous improvement

1. World-class management system for continuous improvement
   1.1. Process improvement
   1.2. Requirements for process improvement

UNIT 2: The importance of the flow of knowledge and its structuring

1. The importance of the flow of knowledge and its structuring

UNIT 3: The paradigm shift

1. The paradigm shift
   1.1. The World Class Manufacturing (WCM) system
   1.2. The business model
   1.3. Paradigm shift of Industry 4.0 applied to Naval

UNIT 4: Drawing of the profile of the leader 4.0

1. Drawing of the profile of the leader 4.0
   1.1. Qualities of a leader 4.0
   1.2. Leadership styles

UNIT 5: The Idea Factory: Structured Knowledge Generation

1. The Idea Factory: Structured Knowledge Generation

UNIT 6: Strategic deployment and stimulation of talent. The channeling of knowledge

1. Strategic deployment and stimulation of talent. The channeling of knowledge
   1.1. Strategy and Talent 4.0
   1.2. The channeling of knowledge

UNIT 7: The industrialization of knowledge: the factory of ideas

1. The industrialization of knowledge: the factory of ideas

UNIT 8: Project Management 4.0

1. Project management 4.0
   1.1. How to approach a project
   1.2. Project Management

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