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D1.6. The administrative organisation of the DIH

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Executive summary

This document draws the path to create Digital Innovation Hubs in Tunisia and Morocco. It starts by presenting the process adopted to create, organise, and evaluate DIHs in Europe. Then, it presents some examples of DIHs created in Africa under the H2020 ICT58 call.
This deliverable provides guidelines to create Competence Centres and then DIHs in Morocco and Tunisia. It also provides some insights about the administrative management of these targeted DIHs.

Table of contents

Table of Figures

Table of Tables

1. Introduction

This document is developed as part of the ENHANCE project.

1.1. Purpose of the document

This document explains the concept of Digital Innovation Hub, its evolution from the previous European Programme (H2020) through the "Digital Europe" programme between 2021 and 2027. The document proposes methodologies to create Competence Centres and Digital Innovation Hubs in Africa.

1.2. Reference documents

The definition of the assigned skills in the table 1 are released in the deliverable D1.2: Gap analysis between HEIs and industry 4.0 skills related to MPQ4.0

1.3. Applicability

This document will be used by Moroccan and Tunisian partners to initiate their strategy for creating Competence Centres and Digital Innovation Hubs. The document is Confidential.

1.4. Definitions

Competence Centre: are institutions offering expertise in key enabling technologies.

Digital Innovation Hub: one-stop-shops organisations proposing digitalisation services to industry.

European Digital Innovation Hub: transformation of existing DIHs with financial support from the European Commission and National Agencies in different European countries.

1.5. Structure of the document

This document is organized in 9 sections:

- Section 1: introduction
- Section 2: ENHANCE project overview
- Section 3: Digital Innovation Hubs development strategy in Europe
- Section 4: Digital Innovation Hubs development in Africa
- Section 5: Competence centres development strategy in Morocco and Tunisia
- Section 6: Digital Innovation Hubs development strategy in Morocco and Tunisia
- Section 7: The administrative organisation of the DIHs in Morocco and Tunisia
- Section 8: Annexes
- Section 9: References

1.6. List of acronyms

- **CC**: Competence Centre
- **DE**: Digital Europe programme (2021-2027)
- **DIH**: Digital Innovation Hub
- **EDIH**: European Digital Innovation Hub
- **ENHANCE**: strENgtHening skills and training expertise for TunisiAN and MorocCan transition to industry 4.0 Era
- **KET**: Key Enabling Technologies
- **MPQ:** Maintenance, Production and Quality

- **RTO:** Research and Transfer Organization
- **SME:** Small and Medium Enterprises

2. ENHANCE project overview

ENHANCE – strENgtHening skills and training expertise for TunisiAN and MorocCan transition to industry 4.0 Era – is an Erasmus Plus project founded under the KA2 Cooperation for innovation and the exchange of good practices (Capacity Building in the field of Higher Education) programme by the European Commission under Grant Agreement N° 619130, to be conducted in the period January 2021 until January 2024. It engages 7 partners from 5 countries with a total budget of 779k€. Further information can be found at http://eplus-enhance.eu/. Figure 1 gives an overview of the ENHANCE project organization.

The emergence of industry 4.0 concepts and applications brings new paradigms impacting all the industrial business domains when they need to conduct successful digital transformations or increase workshops connectivity. The evolution of Maintenance, Production and Quality Engineering (MPQ 4.0) represents the main application domains where Industry 4.0 produces effective beneficial results.

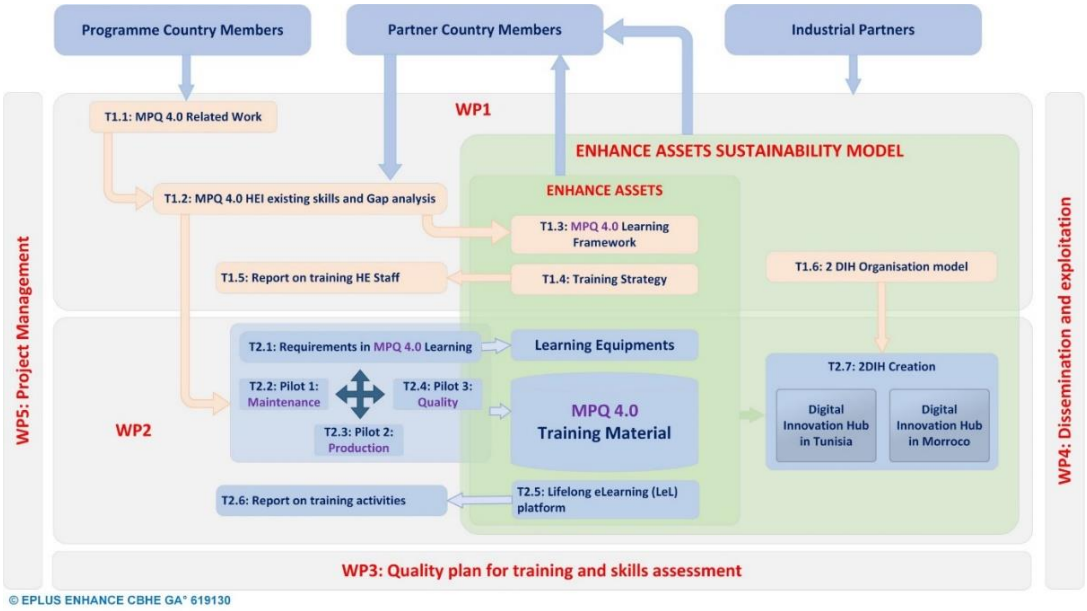

Figure 1. ENHANCE project organization.

The ENHANCE project focuses on building new MPQ training capacities at Higher Education Institutions (HEI) in Tunisia and Morocco to establish interactions between the following stakeholders:

- European universities and research institutions (from France, Germany and Portugal) confirmed MPQ 4.0 competencies, training materials, collaborative research projects, full operational Digital Innovation Hubs (DIH), technology transfer experiences, etc.
- Partner country universities (from Tunisia and Morocco) with teaching and training activities in MPQ and existing connections with their local industrial partners.

The ENHANCE project will create several outputs and two primary tangible outcomes:

- New MPQ 4.0 equipment and training materials developed in connection with the existing training programmes and consolidated through three industrial pilots. The new material will be used to train the trainers and the students in the different partner country universities.
- Two DIHs, one in Tunisia and one in Morocco to sustain the project outcomes through their reuse for training in industry.

ENHANCE aims to become the reference model for creating effective and sustainable training material for MPQ 4.0 in both partner countries with content approved by academia and industry.

3. Digital Innovation Hubs development strategy in Europe

The European Commission launched on 19 April 2016 the first industry-related initiative of the Digital Single Market package. Building on and complementing the various national initiatives for digitising industry, the European Commission acts to trigger further investments in the digitisation of industry and support the creation of better framework conditions for the digital industrial revolution. One of the more important pillars of the Digitise European Industry effort is the activity to develop a network of Digital Innovation Hubs (DIH).

Digital Innovation Hubs (DIHs) are based upon technology infrastructure (Competence Centre - CC). As proximity is considered crucial, they act as a first regional point of contact, a doorway, and strengthen the innovation ecosystem. See deliverable D3.1, section 5 (Quality Strategy for DIH Establishment), for more details on DIHs and corresponding missions.

The rationale behind this initiative is to help European Industry, small or large, high-tech or not, to grasp the digital opportunities. The European Commission will focus 500M€ over the next 5 years from Horizon 2020 budget to support the development of DIHs. It is the European Commission's ambition that all companies should have a DIH within their region, through which they should be able to access competences in order to digitise their organisations and their products and services. Furthermore, the services provision by existing Hubs can be strengthened by the establishment of a pan-European network of DIHs.

The Digital Innovation Hubs (DIH) catalogue (http://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-tool) was set up to provide a comprehensive picture of DIHs in the EU across varying competences, structures and service offerings.

3.1. Contribution to regional development

One clear role of DIHs in many regions is to make available support easier to find by making the system more transparent and communicating it more clearly to its potential beneficiaries, for example offering one-stop shops where a DIH help and guide SMEs through the innovation support system. While some DIHs assist start-ups who are based on digital technologies, others support the development of new products and services by more mature companies that are not fully exploiting the digital opportunities yet.

3.2. The organisation of a DIH

DIHs are diverse in terms of organisation – from regional bodies to clusters or research centres. They differ also in their geographical coverage – regional or beyond. The competences that are available in-house vary from business development skills, start-up support or technical skills to communication and engagement competences; however, these can be easily expanded through their networks since DIHs draw upon many external partner skills – either located in the region or further away. To engage successfully with new customers, DIHs need to provide services that are relevant to local SMEs and industry needs and build trustful relations. Figure 2 Illustrates examples of services provided by DIH Wallonia (taken from DIH & S3 workshop presentation).

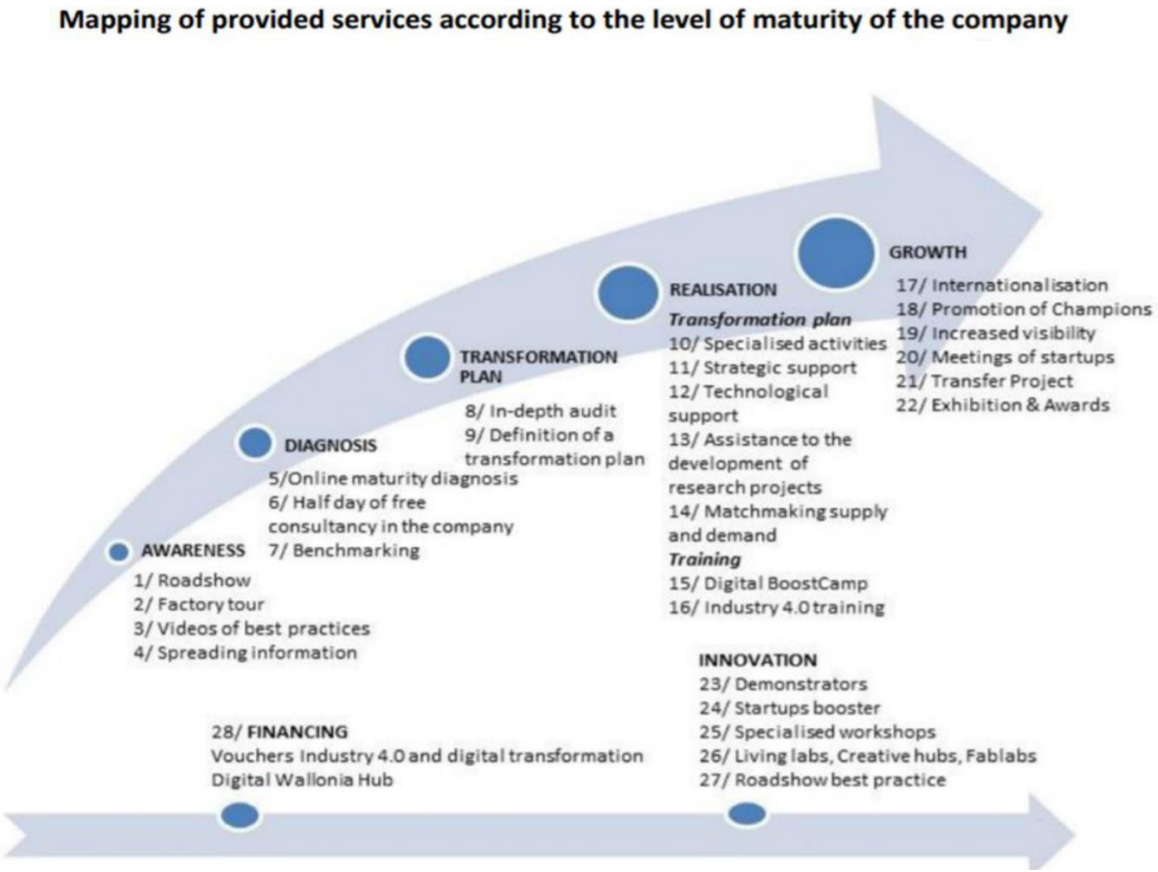

Figure 2: Services provided by DIH Wallonia (source: DIH & S3 workshop presentation) [1]

3.3. Digital Innovation Hubs development process

Digital Innovation Hubs hold significant potential to support and assist SMEs and start-ups and could become key actors in bringing digitisation within the reach of all industry sectors. Figure 3 illustrates the developments steps to define Digital Innovation Hubs supporting businesses, and especially SMEs and non-technology intensive industry, in seizing the opportunities of digital transformation.

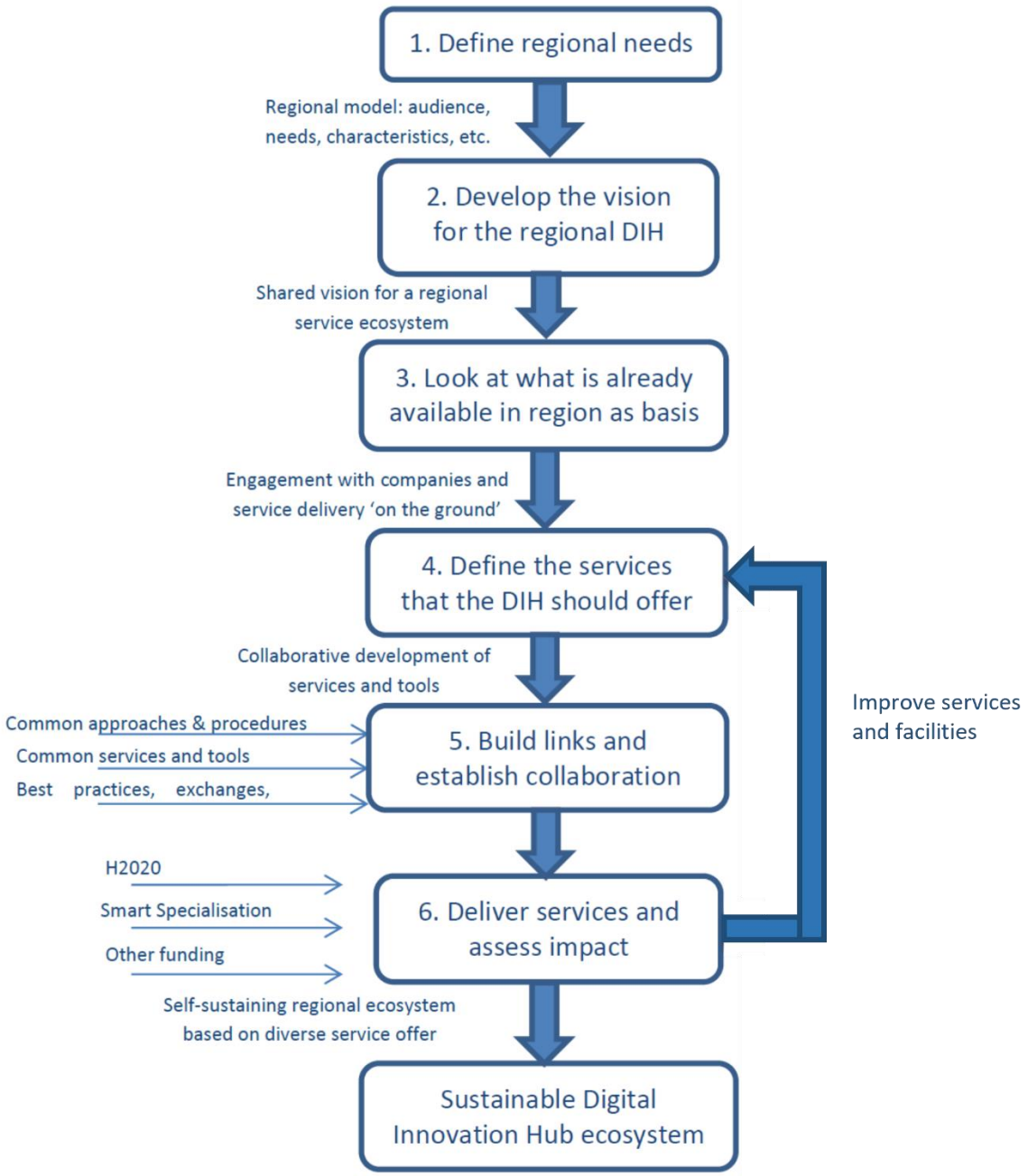

Figure 3: A Guide for a Digital Innovation Hub [3]

3.4. European Digital Innovation Hubs development strategy

The European Commission continues to support Digital Innovation Hubs under the new programme 2021-2027 "Digital Europe". This programme supports the deployment and the best use of digital capacity and interoperability concepts.

To build key digital capabilities, the programme will boost investments in five interrelated specific objectives (SOs), as foreseen in the Regulation:

- SO1: High Performance Computing (approximately €2 227 million Euro)
- SO2: Artificial intelligence, data and cloud (approximately €2 062 million Euro)
- SO3: Cybersecurity and trust (approximately 1 650 million Euro)
- SO4: Advanced digital skills (approximately 577 million Euro)

- SO5: Deployment, best use of digital capacity and interoperability (approximately 1 072 million Euro)

The first four SOs are focused on building capacities in the key technological areas of high-performance computing, artificial intelligence, cloud and data and cybersecurity, as well as the advanced digital skills required to deploy those technologies.
SO5 will be about deploying and using those digital capacities, promoting the Digital Single Market and advancing the digital transformation in a wide range of areas, such as the modernisation of public administrations, health, judiciary, transport, mobility, energy and the environment, education, culture and media.
A European Digital Innovation Hub (EDIH), as transformation of existing DIHs, (see Figure 4) is a single organisation or a coordinated group of organisations with complementary expertise, with a not-for-profit objective that support companies – especially SMEs and mid-caps – and/or the public sector in their digital transformation. EDIH will act as DIH, covering the same main four missions (Test before invest, Skills and training, Support to find investments, Innovation ecosystem and networking), but with networking capabilities at the EU level.
Supported by the Digital Europe (DE) Programme as an investment programme in digital capacities, DE wants to make an impactful contribution to the capacity of European Digital Innovation Hubs. The European Commission therefore proposes to invest between 0.5 and 1M€ per year in each hub. Together with the contribution of the Member States, this would add up to a significant investment between 1 and 2 M€ per year per EDIH. With the current budget proposal for Digital Europe, it is foreseen to support between 100 – 200 hubs in the EU, with at least one hub per Member State. European Digital Innovation Hubs (EDIH) will collaborate with the existing DIHs and offer to them new networking capabilities. New DIHs in Africa should be connected to the EDIH initiative in the future.

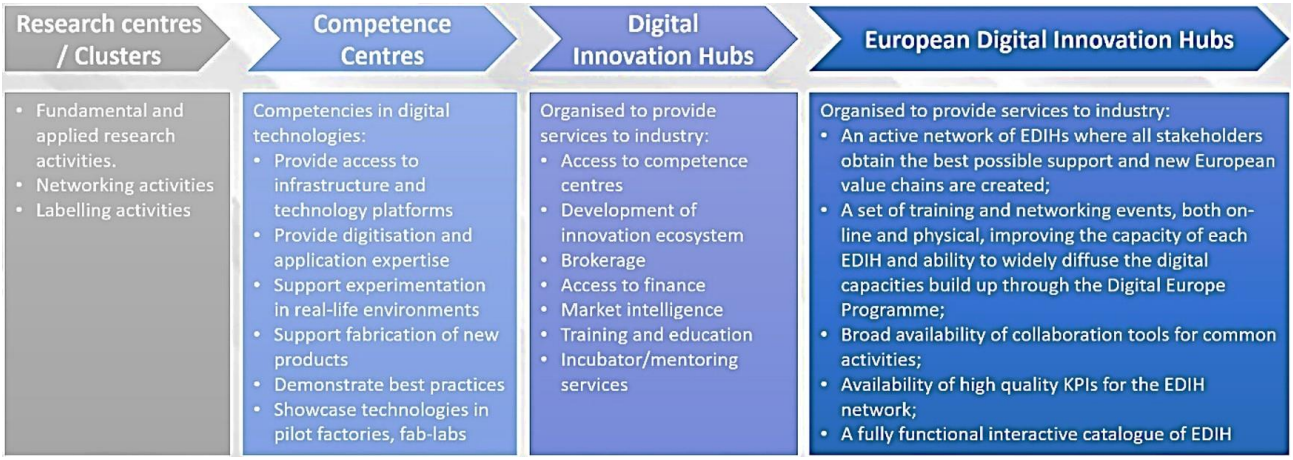

Figure 4: The EDIH building path

3.5. Digital Maturity Assessment for EDIH Customers

The Joint Research Centre of the European Commission has developed a Digital Maturity Assessment (see Figure 5) which should be used by all EDIHs to measure the progress of Digital Maturity of the organisations (enterprises) which they supported. Connected DIHs to the EDIH initiative will be impacted by this maturity assessment process.

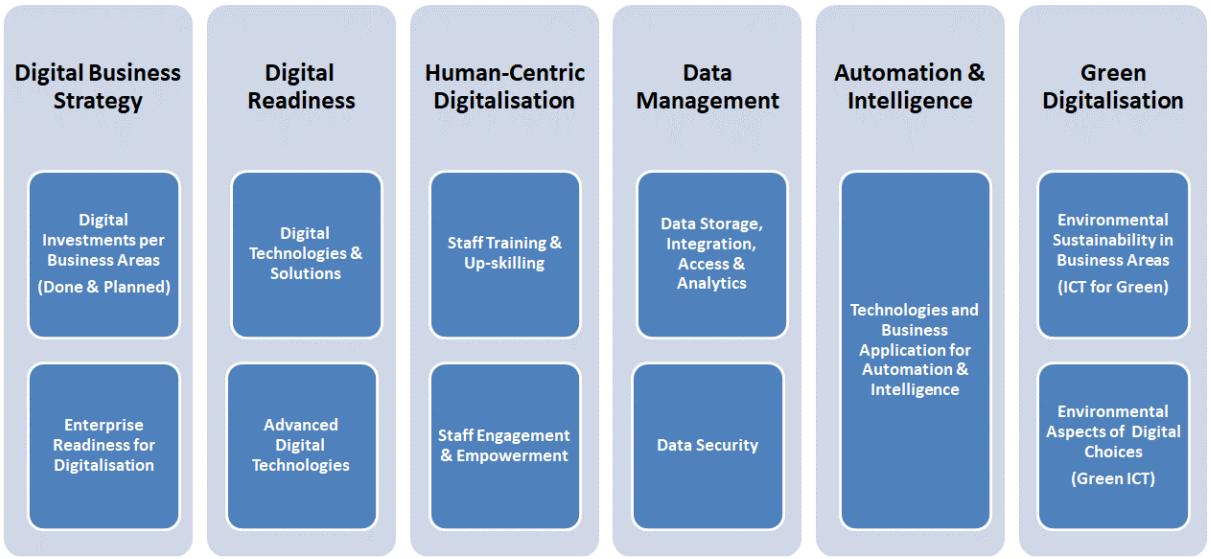

Figure 5: Digital Maturity assessment criteria [5]

3.6. Competence Centres

Competence centres are institutions offering expertise in key enabling technologies. The Digitising European Industry programme recommends upgrading Competence Centres to Digital Innovation Hubs. The holistic view of digitisation as a company-wide transformation process enables companies not just to identify technical solutions but to finance and nurture the innovations to a level that they may actually be implemented within the business and contribute to improved competitiveness. Figure 6 shows how competence centres can collaborate with other innovation actors in a digital innovation hub to provide a holistic set of digital transformation services to industry.

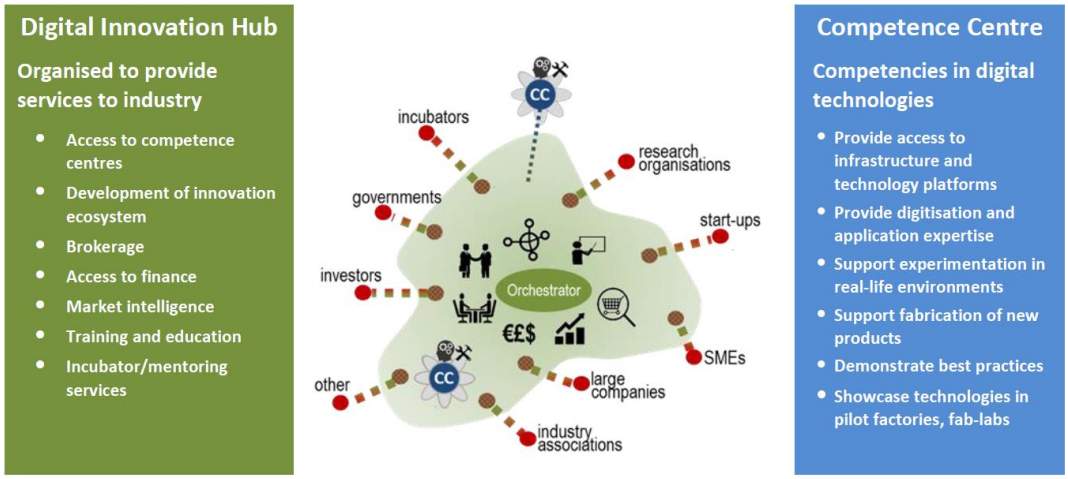

Figure 6: Competence Centres as an Element of Digital Innovation Hubs [3]

4. Digital Innovation Hubs development in Africa

The European Commission supported a specific call under the H2020-2018-2020 work programme related to the development of the Digital Innovation Hubs in Africa. The ICT-58-2020 Call "International partnership building between European and African innovation hubs Specific Challenge" was proposed to reinforce cooperation and strategic partnership with "low and middle income countries" in Africa to support the strengthening of existing digital innovation hubs (DIHs) in Africa and to facilitate the

collaboration between EU and African DIHs in order to strengthen a common EU Africa innovation and start-up ecosystem. Five projects[1] were founded by the EU under this programme.

IDEA D4D HUB (Grant agreement ID: 101017015) - Innovation Dialogues Europe-Africa" D4D Hub (1 December 2021 - 30 September 2023)

Project objective

IDEA D4D Hub is boosting inter-African and African-European multi-stakeholder dialogue and collaboration in the digital society by supporting and strengthening the role of ICT/digitalisation stakeholders, precisely civil society and academia, to engage and contribute actively to multi-stakeholder dialogues for human-centred digital transformation and by supporting the development of joint digital innovations as a response to societal challenges that hinder an inclusive digital society. The activities of the project are based on the recommendations of the EU-AU task force on the digital economy, in particular in the area of research and innovation and will support the implementation of the EU's Digital4Development strategy, Common Research, Development and Innovation priorities, African Union Agenda 2063, Africa Connect and Africa-Europe Alliance for Sustainable Investment and Jobs.

AfriConEU (Grant agreement ID: 101016687) - The first Trans-continental Networking Academy for African and European Digital Innovation Hubs (1 February 2021 - 31 January 2024)

Project objective

The AfriConEu project envisions to essentially strengthen and reinforce the digital innovation ecosystems in Africa by targeting existing Digital Innovation Hubs (DIHs) and supporting them through capacity building and networking activities. African DIHs are playing a central role in the development of digital entrepreneurship and by raising their capacities to tackle the challenges they face they will be more effective in driving digital innovation forward. To achieve its mission, the AfriConEu project will connect DIHs from Nigeria, Uganda and Tanzania with DIHs from Europe with the aim to (i) facilitate knowledge and experience sharing, (ii) drive the development of mutually beneficial partnerships and (iii) support the creation of collective projects for boosting digital economy, empowering youth and fostering innovation and growth. To realize its mission the project will develop, test and validate the "AfriConEu Networking Academy" an innovative mechanism for connecting and sharing best practices, experiences and resources between DIHs in Africa and between DIHs in Africa and EU, in a comprehensive, replicable and self-sustaining way. Through two flagships programmes, the AfriConEu Networking Academy will empower and enable African DIHs to best serve their local industry, boost their start-up ecosystem and empower the youth population with the necessary skills to thrive in a digitalized world.

HUBiquitous (Grant agreement ID: 101016895) - Paving the Foundation for Disruptive Technologies in Tomorrow's Digital Innovation Hubs (1 January 2021 - 31 December 2023)

Project objective

HUBiquitous is an Innovation Action aiming at creating a joint Africa-Europe Startup & Innovation Ecosystem for long-term collaborations and partnerships. The project has the ambition to increase the technology level and capacity building of 30 local DIHs/TechHubs in 5 African countries. The project proposes highly innovative concepts called Innovation Enablers (i.e. Solution Lab, Application Business Box, and MeetHub online platform). The purpose of these enablers is to provide technical (e.g. IoT, AI, and BigData disruptive technologies) as well as entrepreneurial development skills to DIHs and startups/entrepreneurs. Thanks to these Innovation Enablers, the project will further demonstrate and build the local innovation and ecosystem capacity through 3 programs: (i) Talent program, building digital skills for local talents, (ii) Accelerator program, creating innovative applications and products

[1] https://cordis.europa.eu/search?q=contenttype%3D%27project%27%20AND%20programme%2Fcode%3D%27ICT-58-2020%27&p=1&num=10&srt=/project/contentUpdateDate:decreasing

and (iii) Community program, developing the Africa-Europe start-up and innovation communities. HUBiquitous Innovation Enablers and Programs will, therefore, support and empower the startup and entrepreneurship ecosystems from both continents with the development of a rich and sustainable collaboration between African and European DIHs. HUBiquitous consortium is composed of a partnership of Ten (10) entities, five European and five African, coming from nine different countries. It builds on the existing cooperation and partnership stemming from two previous H2020 ICT International Collaborations with Africa projects (WAZIUP and WAZIHUB). The ultimate target of HUBiquitous is to pave the way for long-term and sustainable innovation for the African DIHs.

DIGILOGIC (Grant agreement ID: 101016583) - Facilitating and stimulating the unleashing of innovation potential through the first Pan EU-Africa sustainable network of Digital Innovation Hubs (DIHs) focussing on smart logistic. (1 January 2021 - 31 December 2023)

Project objective

The vision of DIGILOGIC is to boost the cooperation and strategic partnership between European and African Digital Innovation Hubs (DIHs) paving the way for startups, SMEs and innovators to jointly develop smart logistic solutions, in close cooperation with industries and ventures, securing sustainability and success. The motivation that drives the EU-Africa DIGILOGIC project is to facilitate and stimulate the unleashing of the innovation potential within Africa's young engineers and entrepreneurs. It achieves this through the creation of the first Pan EU-Africa sustainable network of DIHs, focussing on the topic of smart logistics. DIGILOGIC sees the horizontally connecting logistics industry at the converging point of interest for digital innovation for social and business development, a crucial node for Europe's and Africa's sustainable prosperity. DIGILOGIC is centered on five DIHs: three DIHs in Europe (DE, FI, IT) and two DIHs in Africa, reaching nine countries (GH, NG, ZM, ZA, KE, MW, ZW, NA, MZ).

Furthermore, DIGILOGIC is unique in that it includes both an online eLearning and collaboration platform for smart logistics and the first practical demonstration of the success of this new federation of smart logistic EU-Africa DIHs, by incorporating four, so-called, "Challenges" that will involve both European and African innovators (startups, ICT professionals, Micro SMEs) in real projects in the logistic sector, to solve existing issues that require new technological solutions. These Challenges (both in EU and AU) will not only demonstrate the benefits of using trained and skilled persons from low-/middle- income African countries (thereby contributing to youth employment), but will set the stage for tighter collaboration between EU-AU Digital Innovation Hubs and contribute to reinforce the international dimension strategic partnership and outreach of the Horizon 2020 ICT Programme 2018-2020 and contributing to the upcoming Horizon Europe.

AEDIB|NET (Grant agreement ID: 101017105) - African-European Digital Innovation Bridge Network (1 February 2021 - 31 January 2024)

Project objective

In the scope of the ICT-58 call, AEDIB|NET has the objective to strengthen a common African European digital innovation ecosystem by supporting local digital innovation and start-up ecosystems in Africa and facilitating the collaboration between European and African DIHs. AEDIB|NET aims to build on the experience of European DIHs, and adapt the approach to the African context in order to facilitate synergies and collaboration potential. This includes developing and strengthening key infrastructure such as a Pan-African network of DIHs, as well as building strategic cooperation mechanisms and facilitating bridging activities on technical capacity building and technology transfer between African and European innovators and start-ups, SMEs, private sector actors, academia, local governments and investors. In addition, AEDIB|NET will foster the development of an enabling environment that is reinforced by conducive local policies. The African consortium partners are the cornerstones of the

African digital innovation ecosystem and have the strength of bringing together relevant policymakers (i4policy), supporting innovators and start-ups in Innovation Hubs (AfriLabs, Digital Africa) and investors (ABAN, VC4A). Their expertise is core to successfully building networks on the continent and beyond. The European consortium partners contribute experience in fostering innovation, entrepreneurship and investment, as well as the establishment of and networking between DIHs (FundingBox, Steinbeis, EBN, EBAN, Civitta). Thereby, in the scope of AEDIB|NET, these partners ensure full access to the European innovation ecosystem, DIHs and experience of the efforts made by the EU in the past.

From the analysis of the previous projects' scopes, objectives, and consortium, we can assume the following:

- North African countries are less represented in the founded projects. Only Egypt is represented in one project (HUBiquitous).
- All the five projects share a common methodology for technical capacity building based on the transfer of EU partners' knowledge and expertise.
- African partners will act to create local synergies with relevant actors and policymakers to develop start-ups and innovation channels.

The four ENHANCE partners in Tunisia and Morocco share the same strategy for capacity building to improve their training programmes. They aim to ingest first the most advanced EU partners knowledge and expertise related to Industry 4.0. These new capacities will motivate new graduated students to create their start-ups and scale more their innovative ideas. Then, they seek to create new collaboration channels with industrial players to support them in workers training and skills upgrading. Finally, they plan to collaborate with industry in co-developing new innovative projects.
The next section will draw the first step in this strategy.

5. Competence centres development strategy in Morocco and Tunisia

As released in deliverable D1.5, the ENHANCE project proposes the following final list of courses and use cases organised into topics and training activities as presented in Table 1.

Table 1: ENHANCE courses and use cases activities.

Domain	Course / use case	Skills	Code	Training Activities
Maintenance 4.0	Course 1: Advanced Maintenance strategies	skill 1.1 skill 1.2 skill 6.1	Act 1.1	Use cases of eXtended Reality (XR) in Smart Maintenance 4.0 contexts
		skill 3.1 skill 3.2 skill 3.3	Act 1.2	Sensor Network Design in Smart Maintenance 4.0 contexts
		skill 6.1 skill 6.2	Act 1.3	Failure Modes, Effects & Criticality Analysis (FMECA) in Smart Maintenance 4.0 contexts
		skill 4.1 skill 4.4 skill 6.5	Act 1.4	Contributions of Smart Maintenance 4.0 to Energy Management & Energy Efficiency of Industry 4.0 Assets
		skill 4.4 skill 6.5	Act 1.5	Sustainability Driven Smart Maintenance 4.0
	Course 2: Integrated maintenance planning	skill 5.1 skill 5.2 skill 5.3 skill 5.4	Act 2.1	Data-Driven Reliability for Smart Maintenance 4.0
		skill 5.3 skill 6.1	Act 2.2	Maintenance planning and scheduling in Industry 4.0 contexts
		skill 6.1 skill 6.2 skill 6.4	Act 2.3	Contributions of Industry 4.0 technologies to Total Productive Maintenance
		skill 5.3 skill 6.2 skill 6.3	Act 2.4	Downtime forecast and optimal maintenance planning
		skill 1.1 skill 1.3 skill 5.1 skill 5.2	Act 2.5	Industry 4.0 Asset & Maintenance Management Systems
	Use Case 1	skill 3.1 skill 3.2 skill 3.3	Act U.1.1	Real time communication
		skill 1.2 skill 5.1 skill 5.2 skill 5.3 skill 5.4	Act U.1.2	Data acquisition and storage in industry 4.0
		skill 6.1 skill 6.2 skill 6.3	Act U.1.3	ML and application for maintenance
		skill 2.2 skill 2.3 skill 6.2	Act U.1.4	KPI, Dashboarding and data visualisation
Production 4.0	Course 3: Production, planning, scheduling and control in industry 4.0	skill 1.1 skill 1.2 skill 1.3 skill 4.1	Act 3.1	Design and development of smart Production Planning/Scheduling systems
		skill 5.1 skill 5.3	Act 3.2	Planning and scheduling techniques and approaches in industry 4.0

		skill 6.1 skill 6.2		
		skill 4.1 skill 4.3 skill 6.1 skill 6.4	Act 3.3	Methods and frameworks for control systems in agile manufacturing
		skill 5.1 skill 5.2 skill 5.3 skill 5.4	Act 3.4	Data-driven planning/scheduling models and algorithms
		skill 5.2 skill 5.3 skill 6.1 skill 6.2	Act 3.5	Big data and predictive inventory analytics
	Course 4: Factory 4.0 : Concepts, techniques, and application	skill 1.1 skill 1.2 skill 5.1 skill 5.2	Act 4.1	PLM and Digital Factory
		skill 1.2 skill 6.1 skill 6.4	Act 4.2	VSM for production 4.0
		skill 1.1 skill 1.2 skill 1.3 skill 2.1 skill 6.1	Act 4.3	Virtual Reality for simulation
		skill 1.1 skill 2.2 skill 2.3 skill 3.3 skill 6.2	Act 4.4	KPI, Dashboarding and data visualisation
	Use Case 2	skill 5.1 skill 6.1 skill 6.2 skill 6.3	Act U.2.1	Emerging technologies for production planning and scheduling
		skill 1.3 skill 6.1 skill 6.4	Act U.2.2	Horizontal and vertical integration & Workflow management
		skill 1.1 skill 1.2 skill 3.1 skill 3.2 skill 3.3 skill 4.3	Act U.2.3	CPS design and development
		skill 5.2 skill 5.3 skill 6.1 skill 6.2	Act U.2.4	Data driven inventory management
		skill 1.2 skill 3.3 skill 4.3 skill 4.4 skill 6.5	Act U.2.5	Digital control systems (DCSs)
Quality 4.0	Course 5: Advanced PSS Quality Design	Skill 1.1 Skill 1.2 Skill 1.3 Skill 5.1 Skill 5.4	Act 5.1	Integrated thinking system modelling and development
		Skill 6.1 Skill 6.2	Act 5.2	Non-Conformities RCA and Quality gates design

		Skill 6.4		
		Skill 3.1 Skill 4.1 Skill 4.3	Act 5.3	QC model design
		Skill 1.1 Skill 4.1 Skill 4.4 Skill 5.1 Skill 6.5	Act 5.4	Design for X applied for Quality
		Skill 1.1 Skill 6.1 Skill 6.4	Act 5.5	IoT and BPM for Integrated VSM
	Course 6: QC analytics for Zero defect manufacturing	Skill 1.2 Skill 4.3 Skill 6.4 Skill 6.5	Act 6.1	Integrated process improvement
		Skill 1.2 Skill 4.3 Skill 6.1 Skill 6.4	Act 6.2	Quality Process maturity self-assessment and lifecycle management
		Skill 3.2 Skill 5.1 Skill 5.3 Skill 6.5	Act 6.3	Inspection Methods, sampling, Inspection Plan
		Skill 6.2 Skill 6.3	Act 6.4	Prescriptive and adaptive decision for Quality Control
		Skill 5.3 Skill 6.2 Skill 6.4	Act 6.5	Quality Planning, Control and Management functions
	Use Case 3	Skill 3.1 Skill 5.2 Skill 6.1	Act U.3.1	Sensors' sensitivity analysis and selection
		Skill 6.1 Skill 6.2 Skill 6.4	Act U.3.2	Non-Conformities RCA and Quality gates design
		Skill 1.1 Skill 6.1 Skill 6.4	Act U.3.3	IoT and BPM for Integrated VSM
		Skill 1.2 Skill 4.3 Skill 6.1 Skill 6.4	Act U.3.4	Quality Process maturity self-assessment and lifecycle management
		Skill 6.2 Skill 6.3	Act U.3.5	Prescriptive and adaptive decision for Quality Control

The Key Enabling Technologies (KETs) provided by the ENHANCE project are already listed on deliverable D1.1. Table 2 proposes a first organisation of these KETs according to the proposed activities. The final list will be released after the development of the activities content on WP2.

Table 2: ENHANCE Key Enabling Technologies

Domain	Training Activities	Key Enabling Technologies
Maintenance 4.0	Use cases of eXtended Reality (XR) in Smart Maintenance 4.0 contexts	Augmented Reality Virtual Reality Mixed Reality
	Sensor Network Design in Smart Maintenance 4.0 contexts	Cyber physical System IIoT

	Failure Modes, Effects & Criticality Analysis (FMECA) in Smart Maintenance 4.0 contexts	Cyber physical System
	Contributions of Smart Maintenance 4.0 to Energy Management & Energy Efficiency of Industry 4.0 Assets	Cyber physical System
	Sustainability Driven Smart Maintenance 4.0	
	Data-Driven Reliability for Smart Maintenance 4.0	Cyber physical System IIoT Machine Learning Big Data Analytics
	Maintenance planning and scheduling in Industry 4.0 contexts	Cyber physical System Machine Learning
	Contributions of Industry 4.0 technologies to Total Productive Maintenance	Cyber physical System IIoT
	Downtime forecast and optimal maintenance planning	Machine Learning Big Data analytics
	Industry 4.0 Asset & Maintenance Management Systems	Cyber physical System IIoT
	Real time communication	Cyber physical System IIoT
	Data acquisition and storage in industry 4.0	Cyber physical System IIoT
	ML and application for maintenance	Machine Learning Big Data analytics
	Dashboarding, Reporting and data visualisation	Cyber physical System IIoT Big Data analytics
Production 4.0	Design and development of smart Production Planning/Scheduling systems	Cyber physical System IIoT Machine Learning Big Data analytics Cloud/Edge/ Fog Computing
	Planning and scheduling techniques and approaches in industry 4.0	Cyber physical System IIoT Machine Learning Big Data analytics Cloud/Edge/ Fog Computing
	Methods and framworks for control systems in agile manufacturing	Cyber physical System IIoT
	Data-driven planning/scheduling models and algorithms	Cyber physical System IIoT Machine Learning Big Data analytics
	Big data and predictive inventory analytics	Machine Learning Big Data analytics
	PLM and Digital Factory	Cyber physical System IIoT Simulation/Emulation
	VSM for production 4.0	Cyber physical System IIoT
	Virtual Reality for simulation	Augmented Reality Virtual Reality Mixed Reality
	Dashboarding, Reporting and data visualisation	BI, Big Data analytics
	Emerging technologies for production planning and scheduling	Cyber physical System IIoT

		BI, Big Data analytics
	Horizontal and vertical integration & Workflow management	
	CPS design and development	Cyber physical System
	Data driven inventory management	BI, Big Data analytics Machine Learning
	Digital control systems (DCSs)	Cyber physical System IIoT
Quality 4.0	Integrated thinking system modelling and development	
	Non-Conformities RCA and Quality gates design	Cyber physical System
	QC model design	Cyber physical System
	Design for X applied for Quality	Cyber physical System
	IoT and BPM for Integrated VSM	Cyber physical System IIoT
	Integrated process improvement	
	Quality Process maturity self-assessment and lifecycle management	
	Inspection Methods, sampling, Inspection Plan	Machine Learning Big Data analytics
	Prescriptive and adaptive decision for Quality Control	Machine Learning Big Data analytics
	Quality Planning, Control and Managament functions	
	Sensors sensitivity analysis and selection	
	Non-Conformities RCA and Quality gates design	
	IoT and BPM for Integrated VSM	Cyber physical System IIoT
	Quality Process maturity self-assessment and lifecycle management	
	Prescriptive and adaptive decision for Quality Control	Cyber physical System IIoT Machine Learning

One of the main outcomes of the ENHANCE project consists of the creation of four Competence Centres supported by the four partners in Tunisia and Morocco. From the list of proposed KETs, each one of these partners will constitute its KETs portfolio and define the expertise perimeter of its Competence Centre. The following template in Figure 7 will help to structure the organisation of the targeted CCs. In fact, each competence centre should propose a business plan aligned with the regional needs and priorities. In addition, the targeted CC must be able to engage collaborations with industrial companies and propose a clear portfolio of services supporting digital transformation initiatives.

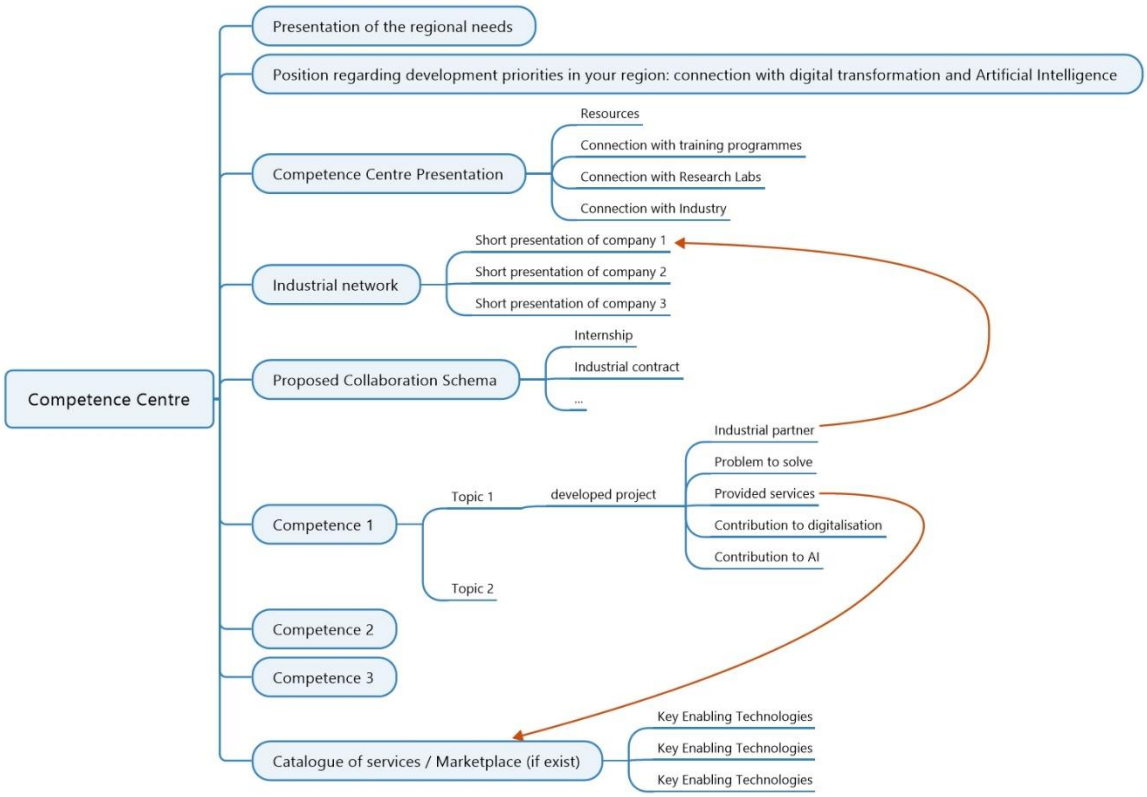

Figure 7: ENHANCE Competence Centre organisation template

6. Digital Innovation Hubs development strategy in Morocco and Tunisia

After the definition of the four competence centres, and during the task T2.7, the evaluation of the four competence centres will be based on the following capabilities:

- Provide access to infrastructure and technology platforms
- Provide digitisation and application expertise
- Support experimentation in real-life environments
- Support fabrication of new products
- Demonstrate best practices
- Showcase technologies in pilot factories, fab-labs

The transformation of Competence Centres into Digital Innovation Hubs will be done during T2.7 and will be based on the results of the previous evaluation. The ENHANCE project was designed to support such initiative as the predefined project objectives are closely aligned with the missions of DIHs.

Table 2: ENHANCE objectives vav DIH missions

ENHANCE Objectives	DIH missions
Analyse the gap between acquired skills in HEIs and the required MPQ4.0 skills by industry of the future.	Innovation ecosystem & networking
Develop a learning framework addressing MPQ4.0 skills (denoted LF-MPQ4.0).	Test before invest

Building partner HE staffs according to the LF-MPQ4.0 and using Train the Trainer Approach.	Skills and training
Develop innovative teaching materials using learner-centred learning methodology. These materials will include 5 courses and 3 case studies that will be produced for the three bachelor programs in industrial engineering of partner universities. Materials will be in English and French.	Skills and training
Create a Lifelong e-learning (LeL) platform for practitioners.	Skills and training (and update training programmes basing on collaboration experiences and feedbacks)

The ENHANCE project, represented by the three DIHs coordinated by the European partners will support the labelling of the selected African DIHs. This process will be submitted to the EC Unite "Digital Transformation of Industrial Ecosystems (CNECT.A.4)" for coordination, validation, and refinement.

7. The administrative organisation of the DIHs in Morocco and Tunisia

Each institution in both partners countries represents a legal entity able to support the creation and the sustainability of a Digital Innovation Hub. The process of the administrative organisation of the DIHs in Morocco and Tunisia will follow the process represented in Figure 8. The evaluation process of the CCs and the DIHs will be done by all partners representatives in addition to representatives from the Advisory board (industrial partners). The validation results will be validated by the Project Management Board.

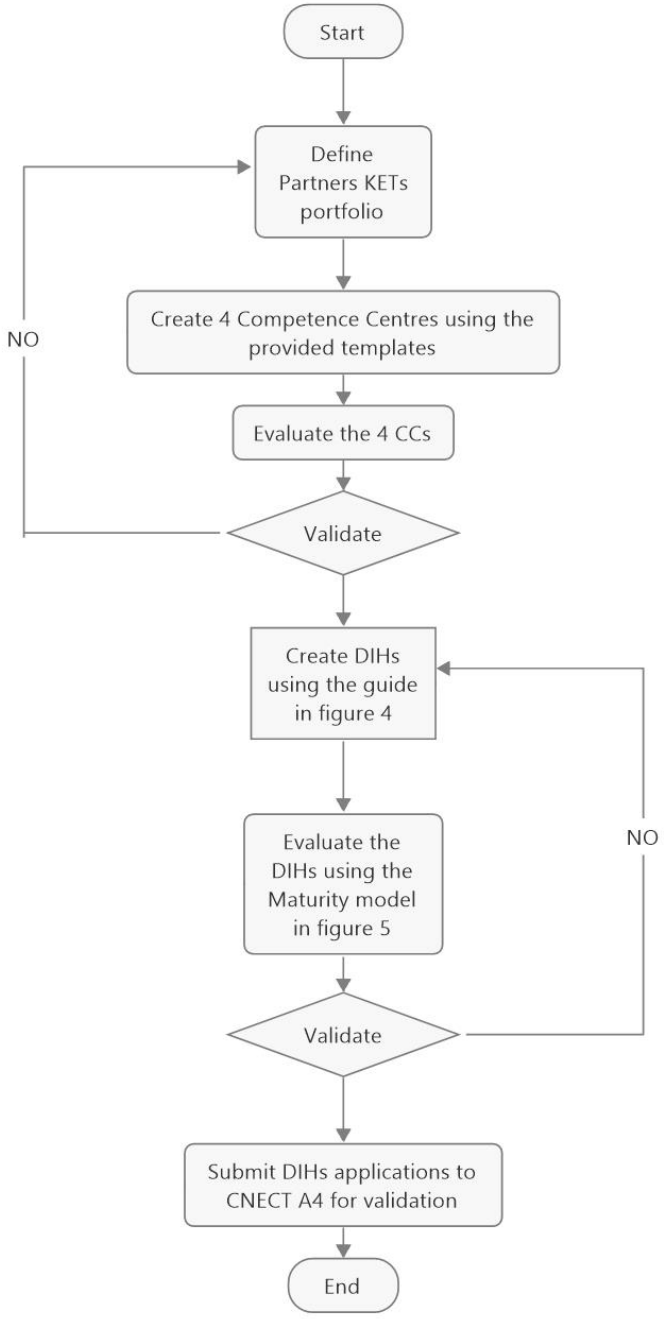

Figure 8: DIH administrative organisation in Morocco and Tunisia

The implementation of the process presented in Figure 8 will be developed in the deliverable D2.7 between M17 and M35.

8. Annexes

8.1. National Strategy for Digital Transformation in Tunisia[2]

The Tunisian strategy for digital transformation proposed for the period 2021-2025 and announced during the last Tunisia Digital Summit (June 2021) is organised on 6 axes:

- Develop the digital and financial inclusion using new technologies. To improve the connectivity and reduce the digital divide problem, the public institutions will develop the connectivity of their network and increase access to financial services, mobile payment, and other facilities.
- Promote Tunisia as a digitalised area. Given the impact of digitalisation on social inclusion, the development of digitalisation at the regional level will help to attract investors and develop an entrepreneurial dynamic of innovation.
- Increase the digitalisation of the public administration (e-administration) to enable a citizen-oriented administration through the digitalisation of its business processes. The digitalisation will upgrade the overhaul of government systems and supports structural reforms of the administration.
- Make use of advanced technologies to strengthening Tunisia's positioning in terms of the use of new technologies (5G, Artificial Intelligence, Internet of Things, blockchain, cybersecurity, quantum Computing, etc.)
- Adapt training and employment policies to the requirements of the new information and communication technologies sectors by developing the digital workforce; revitalizing the virtuous circle of growth and employment quality; reskilling employees to get the new advanced knowledge related to the recent advances of their business domain; upskilling workers using digital learning platforms to improve their knowledge; or cross-skilling to allow workers the acquisition of additional competences through webinars, moocs, serious games, etc.
- Strengthening digital sovereignty through the massive implementation of cyber-security concepts and solutions in public administration to ensure the security of user data.

8.2. National Strategy for Digital Transformation in Morocco

In April 2021, The Moroccan Special Commission on the Development Model (Commission Spéciale sur le Modèle de Développement , CSMD) has published a general report on the new development model of the country by 2035. Among the levers of change, the report specifies the transformative projects of initiation of the new development model, including digital development.

Five main challenges must be taken up to ensure full mobilization of the potential of digital technologies in the country's development projects:

- Adopt a high-level digital transformation strategy. A mission team in the form of an interministerial delegation, results-oriented and endowed with expert human resources could be set up to have the technical and institutional legitimacy essential to the conduct of this transversal transformation project. It would coordinate with all the administrations and structures concerned and would rely on the Digital Development Agency (Agence de Développement du Digital, ADD) for implementation.
- Upgrade fixed and mobile, high-speed, and very high-speed, digital infrastructures, and their extension to the entire territory, ensuring a right of access to all citizens. It is necessary and

[2] https://www.youtube.com/watch?v=sqtorLO38q8

urgent to launch a broadband coverage operation for the entire territory, including in white areas, to reduce the digital divide revealed by the Covid-19 crisis, and provide access, everywhere in the country, to a quality connection and sufficient speed for uses that have become essential, such as distance education. The connection of all public facilities throughout the territory, such as hospitals and schools, must be ensured and functional, including in rural areas. To reduce the cost of digital investments for the community, and accelerate their deployment, it is also recommended to promote the pooling of infrastructure between operators, including fiber optic networks owned by public companies. Finally, it is also recommended to strengthen the level of competition on the fixed and mobile broadband market, under the effective control of the National Telecommunications Regulatory Agency, (Agence Nationale de Réglementation des Télécommunications, ANRT), potentially through the entry of new players, infrastructure operators or Internet service providers. Such catching up in connection infrastructure should be supported by the Universal Telecommunications Service Development Fund (Fonds de développement du service universel des télécommunications, FDSUT).

- Develop digital platforms for all services to citizens and businesses, as well as participation platforms at central and regional levels. There is an urgent need to accelerate the digitization of administration through a single digital platform, allowing everyone to access all the administrative services necessary for their daily life. The digitization of State and administrative services has seen progress recently, with the adoption of laws for administrative simplification. Well underway, the digitization of the administration must be accelerated, with the adoption and immediate implementation of laws on digital administration, administrative simplification and cybersecurity, without forgetting the digitization of the administration of justice and its services to citizens.
- Train skills to support and implement this digital transformation. These skills are now being trained in clearly insufficient numbers, both for the needs of the private sector and for the needs of the administration. It is important to strengthen the workforce trained in digital technology, across all qualification levels, from technicians to doctoral students. Massive training of young people in digital skills would also promote their inclusion and access to employment in the post-Covid-19 economic context.
- Complete the legal framework aimed at ensuring the digital confidence of users and the digital sovereignty of the Kingdom. This mainly involves speeding up the production of laws and implementing decrees on cybersecurity, intellectual property, and personal data management and putting in place the institutional framework allowing full legal recognition of digital interactions and legal value of digital documents, through the electronic signature and the unique digital citizen identifier, in compliance with the guarantees on the protection of personal data.

9. References

[1] Gabriel Rissola, Jens Sörvik, Digital Innovation Hubs in Smart Specialisation Strategies, Joint Research Centre (JRC),2018, 50 pages.
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[4] European Digital Innovation Hubs in Digital Europe Programme, Draft working document, 25 01 2021, 52 pages
[5] Digital Maturity Assessment for EDIH Customers, Target group: Enterprises, Stage: T0 (prior to EDIH support start), 2021, 8 pages.