D4.4 Collection of Thought Leadership working papers

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Authors	Maurits Butter (TNO), Kristina Karanikolova (TNO), Marta Palau Franco (euRobotics), Reinhard Lafrenz (euRobotics), Mayte Carracedo (FundingBox), Lucie Milcent (FundingBox), Begoña Sánchez (TECNALIA), Olivia Uguen (BLUMORPHO), Geraud Guilloud (Luxinnovation)
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Executive Summary

This deliverable aims to prove an introduction and collection of the working papers developed under the Thought Leadership approach in DIHNET. Each of the papers is shortly presented and the full papers are available in the Annexes. Not all topics initiated for discussion under the Thought Leadership Approach resulted in a paper – some discussions and collaborations in the EU ecosystem are still ongoing to allow that step. As a conclusion, we observe that initiating the discussions on strategic topics is usually appreciated (as suggested by participation in the discussions).

Table of Contents

Executive Summary 2
1 Introduction 4
1.1 Introduction to the Thought Leadership Approach 4
1.2 Introduction to and structure of the Deliverable 4
2 Thought Leadership working papers 5
2.1 DIHNET-FoSS, “Specialisation and collaboration in the European Network of DIHs: Leading the way to a European Innovation Support Infrastructure” 5
2.2 RODIN-DIHNET “Green Paper: Post-project sustainability of EU-networks: Preliminary views on elements of sustainability of EU networks” 5
2.3 DIHNET, “Future vision/strategy on the DIH Catalogue”, (confidential) 6
2.4 DIHNET, “Defining Digital Innovation Hubs as part of the European DIH network” 6
2.5 DIHNET, “Advice by the precursor EDIH network: Informal suggestions from the DIHNET precursor EDIH network on the further development of the EDIH network and Digital Transformation Accelerator” 7
2.6 “DMA food for thought – A response from the precursor network” 7
3 Conclusions 8
3.1 Results and lessons learned from the process 8
3.2 Further similar support needed in the ecosystem 8
4 Annex 1: Links to publicly available Thought Leadership Papers 10
5 Annex 2: Papers with restricted dissemination level or drafts 11

1 Introduction

1.1 Introduction to the Thought Leadership Approach

The DIHNET project aims to support a network of networks in the EU Digital Innovation Hubs (DIHs) ecosystem. One of the objectives of the project is to stimulate collaboration and discussion on key strategic topics and thereby contribute to the alignment of mind-sets and in developing a view on the future development in the ecosystem.

With the Thought Leadership approach, DIHNET aimed to develop a shared vision on strategic topics in the ecosystem by engaging with different stakeholders and leading a discussion on key selected topics. Strategic topics impacting the community and DIH networks were selected where alignment and sharing of ideas are needed in order to find new solutions in the ecosystem. Some of the selected strategic topics included sustainability, the emergence of new initiatives like the EDIHs, understanding how specialization and collaboration interact, finding continuous collaboration models, etc.

The work often involved a smaller group – often in collaboration with another network – which could lead and draft a first version of vision on the topic. In many cases, and where appropriate, a first vision was shared with the community via the DIHNET Community or a workshop to gather additional feedback and insights.

1.2 Introduction to and structure of the Deliverable

The Thought Leadership approach resulted in a number of working papers outlining the discussions on the selected strategic topics. This deliverable provides an overview of the papers developed. It should however be noted that work on some of the topics continues with some of the connected networks. For example, the work on post-project sustainability of EU networks was led by RODIN in collaboration with DIHNET and we expect that the topic will continue to be of interest.

In this deliverable, the following papers have been included:

- DIHNET-FoSS, “Specialisation and collaboration in the European Network of DIHs: Leading the way to a European Innovation Support Infrastructure” (March 2021)
- RODIN-DIHNET green paper on post-project sustainability, (December 2021)
- DIHNET, “Future vision/strategy on the DIH Catalogue”, (confidential), (September 2021)
- DIHNET, “Defining Digital Innovation Hubs as part of the European DIH network” (draft March 2020, updated to include the EDIHs in December 2021)
- DIHNET, “Advice by the precursor EDIH network: Informal suggestions from the DIHNET precursor EDIH network on the further development of the EDIH network and Digital Transformation Accelerator” (March 2021)
- DIHNET, “DMA food for thought – A response from the precursor network”, (September 2021)

In the next chapters, the deliverable will present an overview of the Thought Leadership papers with a short summary of the aim and results in the respective working paper. The papers themselves (those publicly available) are included in the Annexes.

To conclude, some lessons learned from the process and future topics on which alignment and strategic vision developed are suggested.

2 Thought Leadership working papers

The following sections provide a brief introduction to the topics and the outcomes of the Thought Leadership Papers. Links to the documents (where applicable) have been provided.

2.1 DIHNET-FoSS, "Specialisation and collaboration in the European Network of DIHs: Leading the way to a European Innovation Support Infrastructure"

Recognizing the important role of DIHs in the adoption and promotion of digital technologies in Europe, this Thought Leadership paper aimed to structure the discussion and contribute to the policy development on how sustainable collaboration can benefit from a "collaborative specialization" in the ecosystem. Advocating for effective collaboration and specialization at EU level organized via a network of EDIHs, the paper proposed that

> *"The DIH network can be a trailblazer for a truly European Innovation Support Infrastructure which wilk provide links to capacities, facilities and expertise for the twin digital and green transitions as well as supporting the shift to a more resilient EU. However, finding the right focus and complementarities requires a leadership approach on collaborative specialisation. The establishment of 'corridors' between EDIHs can be the tipping-point for more structural collaboration between European industrial ecosystems."*[1]

To support the cooperation among innovation ecosystem however, the paper argues that a shared narrative is needed among policies and programmes at different levels to provide coordinated long-term perspective of the role of support organizations like DIHs. Further, the network of (E)DIHs could benefit from establishing connections based on mapping of unique capabilities and respective complementarities among the (E)DIHs.

The paper was developed as a collaboration between the Friends of Smart Specialization and DIHNET and has benefitted from the insights from some 11 experts sharing their opinion in small brainstorming workshop in December 2020.

The paper is available in Zenodo platform, here.

2.2 RODIN-DIHNET "Green Paper: Post-project sustainability of EU-networks: Preliminary views on elements of sustainability of EU networks"[2]

In recent years the topic of post-project sustainability of EU-initiated networks has become an increasingly important topic. Many EU projects aim to initiate a network in order to connect capacities in Europe more optimally. Yet, a key question however remains on how such networks can be sustained with reduced EU-funding after the end of the of the publicly-funded project. This is not an easy question. It was therefore considered important to imitate a discussion and share ideas among such EU-network focused projects. To this end, RODIN has set up a Working Group with the 5 robotics Innovation Actions and has cooperated with DIHNET on the topic. To support the collaboration a

[1] Jan Larosse, Richard Tuffs (Friends of Smart Specialisation), Kristina Karanikolova (TNO), "Specialisation and collaboration in the European Network of DIHs: Leading the way to a European Innovation Support Infrastructure", (March 2021), available here, page 3

[2] Maurits Butter (TNO), Kristina Karanikolova (TNO), "Green Paper: Post-project sustainability of EU-networks", Confidential Draft version from 1 December 2021 (further updates expected);

joined webinar was held on 2 July 2020 and DIHNET partners participated in a session on branding as part of sustainability in one of the RODIN Summer Camps.

Based on the discussion a green paper has been drafted, outlining the main elements of post-project sustainability discussed in the RODIN-DIHNET WG. The paper aims to present a conceptual view on post-project sustainability elements, taking the business model navigator as a starting point to structure the thinking on 1) who are possible different customers, 2) what is added value is generated via the assets and services, 3) how is the value delivered, 4) what possible revenue model there are to capture this value. In addition, the organization of networks and possible business models for collaboration have been explored.

Recently, comments on the paper were received and are currently being implemented. After that the green paper will be shred with the community (the current draft will be shared with the EC as a confidential annex below).

2.3 DIHNET, "Future vision/strategy on the DIH Catalogue", (confidential) [3]

The Digital Innovation Hubs (DIHs) Catalogue was created in 2017 to collect and provide information about the DIHs across Europe. Following, the Catalogue has been translated into an online tool, managed by the JRC. The Catalogue has been a key mechanism in the DIH community not only as an important source of information about DIHs (providing yellow pages) but also to establish collaboration between the different stakeholder.

Based on the support provided from the DIHNET project and taking a future perspective, the paper offers seven recommendations that can support a future version of the Catalogue. The paper has also contributed from learnings gained in DIHNET project based on interaction with DIHs – in the community, via the Champion Challenge, working groups, the support in evaluation of entries to the Catalogue, etc. The paper has been shared with the JRC and the European Commission in a 'confidential' document from September 2021.

2.4 DIHNET, "Defining Digital Innovation Hubs as part of the European DIH network" [4]

Digital Innovation Hubs have become a core element of the EU and national strategy to support digitization of industry. But the concept has developed rapidly since 2016 and is not always not clear and harmonized with other related concepts.

To support the EU DIH community in converging towards a common understanding and shared language, the paper outlined four main characteristics of the DIH concept. The four elements put forward in the paper as clarifying the DIH concept are:

1) The **activities and services offered by DIHs to** industry and the innovation ecosystem at large;
2) The **customers** and target groups **of the DIH** and the DIH purposes towards them

[3] Begoña Sanchez (TECNALIA), DIHNET "Thought Leadership on the DIH Catalogue: Future vision/strategy on the DIH", September 2021, DIHNET Thought leadership Paper, Confidential
[4] Maurits Butter (TNO), Kristina Karanikolova (TNO), Govert Gijsbers (TNO), Geraud Guilloud (LuxInnovation), Begoña Sanchez (Tecnalia), "Defining Digital Innovation Hubs as part of the European DIH network", Draft working paper: summary, March 2020, available here

3) **Boundary characteristics** that can further define the DIH and its function in the ecosystem;
4) The **organizational features** of DIHs as a multi-actor initiatives orchestrating the ecosystem.
To further support the community in the discussion, the paper outlined several entities that resemble but are not DIHs based on the author's view.

The draft paper (March 2020) however clearly acknowledges that a **strict definition might be counterproductive** and that a balance needs to be struck between alignment and flexibility of the definition in order to take into account the differences across countries, regions and organization in Europe.

A summary of the paper was uploaded on the DIHNET community and a webinar on the topic took place on 30 March 2020 to discuss the paper with the DIHNET community.

2.5 DIHNET, "Advice by the precursor EDIH network: Informal suggestions from the DIHNET precursor EDIH network on the further development of the EDIH network and Digital Transformation Accelerator"[5]

In view of the Digital Europe Programme and upcoming European Digital Innovation Hubs (EDIHs), in October 2020 DIHNET initiated an informal open EDIH precursor network. Based on the discussions within this informal precursor EDIH network and its 4 working groups, a report was drafted with recommendations towards the European Commission for the further development of the future EDIH network and the anticipated support project (the Digital Transformation Accelerator). With a main conclusion that EU-collaboration is key in Europe (between EDIHs, in smaller thematic groups and in a general EDIH network group), the paper outline 11 suggestions on how collaboration can be supported.

The report was published in March 2021 (see here for the full document) and the suggestions outlined were presented during the Gearing Up towards EDIHs conference in January 2021 co-organized with the EC, LuxInnovation and DIHNET.

2.6 "DMA food for thought – A response from the precursor network"[6]

As part of the DIHNET informal, open precursor EDIH network initiated in October 2020, a specific working group on sandbox activities was set-up. In response to a first concept of the Digital Maturity Assessment tools presented by the EC, JRC and Tecnalia on 18/05/2021, the paper aimed to open a discussion on the tool. The response presented a consensus view by 12 EDIH candidates and DIHs. In total, eight recommendations regarding the data, the methodology and process, a well as calling for a call to keep a co-design approach have been outlined.

The report has been published available here in September 2021.

[5] Butter, Maurits (TNO), Karanikolova, Kristina (TNO), "Advice by the precursor EDIH network: " Informal suggestions from the DIHNET precursor EDIH network on the further development of the EDIH network and Digital Transformation Accelerator", paper within the framework of the DIHNET project, March 2021, available here

[6] Guilloud, Geraud; Butters, Maurits; Karanikolova, Kristina; Berger, Pierre-Damien; Bernardini, Jean-Jacques; Panjek, Paolo; Samanova, Tereza, "DMA food for thought – A response from the precursor network", document in the framework of DIHNET project, September 2021, available here

3 Conclusions

3.1 Results and lessons learned from the process

The Thought Leadership approach has been considered a key element of the DIHNET project to develop a position on strategic topics relevant for the overall EU DIH ecosystem. The Thought Leadership approach has contributed from and to the community and has acted as a way to:

- Develop a **strategic view/position on key topics** relevant for the EU DIH ecosystem, providing a forward looking vision
- Develop an **aligned understanding** among the community and **inspire** them to further explore the relevant topics and strengthen their initiative.
- **Open a discussion** among the DIH stakeholders, thereby creating an opportunity to create a shared mind-set and learn from others
- Ultimately, contribute towards better collaboration and further efficiency in the network.

Based on the experience in developing the thought leadership topics, we can bring forward the following conclusions regarding the process:

- A leading partner/person/group is needed to organize the discussions and prepare all the meetings and drafts of the documents
- The development of the vision is an iterative process – usually a combination of barnstorming with a group, drafting of preliminary ideas, discussions in wider groups and continuous discussion on some elements are needed before a clear and accepted vision is developed
- Collaboration with the community (in different modes) is key. This provides insights into the challenges faced, different approaches applied or explored, as well as inputs regarding recommendations. The collaborative approach is also key in achieving a common mind-set and convergence in the ecosystem.
- Identifying the strategic topics of interest is not always self-evident. Discussions with the community and individual stakeholders are needed to identify the challenge but also to dive into the topic to understand the underlying issue.
- There is a need for a strategic and forward looking vision on common challenges. This enables the discussion to be elevated to the ecosystem level rather than focusing on individual problems which might have different better-fitting solutions for each individual member.
- Last but not least, to lead the discussions initiative is needed but also acceptance from the community. For this, a strong brand and high standards of relevance of the selected topics and results is key.

3.2 Further similar support needed in the ecosystem

The DIHNET project is only one of the actors in the ecosystem. Within the project, with the thought leadership approach, we believe we have at least started the discussion in the ecosystem and have contributed to clarifying strategic topics. But the topics addressed above are only a start. Further topics where alignment is needed or could be anticipated are continuously emerging. How can information be collected and shared on EU level, how can we find tools to help identify the most relevant partner and initiate collaboration, how can alignment be further supported with new

initiatives with a more societal, environmental and resilient focus; etc. All these questions and many more could benefit from an open and inclusive discussion in the future.

4 Annex 1: Links to publicly available Thought Leadership Papers

Below are the links where the Thought Leadership papers already made public can be found:

- Jan Larosse, Richard Tuffs (Friends of Smart Specialisation), Kristina Karanikolova (TNO), "Specialisation and collaboration in the European Network of DIHs: Leading the way to a European Innovation Support Infrastructure", (March 2021), available HERE,
- Maurits Butter (TNO), Kristina Karanikolova (TNO), Govert Gijsbers (TNO), Geraud Guilloud (LuxInnovation), Begoña Sanchez (Tecnalia), "Defining Digital Innovation Hubs as part of the European DIH network", Draft working paper: summary, March 2020, available HERE;
- Butter, Maurits (TNO), Karanikolova, Kristina (TNO), "Advice by the precursor EDIH network: " Informal suggestions from the DIHNET precursor EDIH network on the further development of the EDIH network and Digital Transformation Accelerator", paper within the framework of the DIHNET project, March 2021, available HERE
- Guilloud, Geraud; Butters, Maurits; Karanikolova, Kristina; Berger, Pierre-Damien; Bernardini, Jean-Jacques; Panjek, Paolo; Samanova, Tereza, "DMA food for thought – A response from the precursor network", document in the framework of DIHNET project, September 2021, available HERE

5 Confidential Annex 2: - Papers with restricted dissemination level or drafts

The following paper has a restricted/confidential character and will be shared only the EC, the reviewers and the consortium:

- Begoña Sanchez (TECNALIA), DIHNET "Thought Leadership on the DIH Catalogue: Future vision/strategy on the DIH", September 2021, DIHNET Thought leadership Paper, Confidential;

The following paper is still receiving comments on the draft. Once implemented, the paper will be shared with the community:

- Maurits Butter (TNO), Kristina Karanikolova (TNO), "Green Paper: Post-project sustainability of EU-networks", Confidential Draft version from 1 December 2021 (further updates expected);

Specialisation and collaboration in the European Network of DIHs:

Leading the way to a European Innovation Support Infrastructure

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Table of Contents

0 Abstract: 3
1. Introduction 3
2. Purpose of the document 4
3. Vision 5
4. Specialisation and collaboration from the DIH perspective 6
4.1 Specialisation in the DIHs 6
4.2. Connecting Smart Specialisation Strategies and DIHs 7
4.3. Collaborative specialisation in the European DIH Network with 'mapping and matching' 8
4.4 Structural Cooperation in the EDIH network: emergence of corridors 9
5. Specialisation and collaboration from a policy perspective 11
5.1 Role of the DIH network in the development of a European Innovation System 11
5.2. The role of the EDIH in particular 12
5.3. DI Hubs and ERA Hubs: towards a new narrative for shared innovation infrastructure at EU level 12
6. Conclusions and suggested next steps 14

0 Abstract:

Digital Innovation Hubs (DIH) have emerged as a European approach for more effective diffusion of digital technologies. DIHs develop skills and offer supporting services for digital transformation, in particular in SMEs and more recently also in public administration. This approach is based on state-of-the-art innovation ecosystem policy and best practices of innovation support infrastructures.

To support sustainable collaboration in the EU ecosystem an alignment of-hubs in a European framework of specialisation and collaboration is needed. In this paper we suggest that the network of DIHs and future European DIHs can be a mechanism for the wider European Innovation Support Infrastructure needed for industrial transformation, by means of 'collaborative specialisation'.

The DIH network can be a trailblazer for a truly European Innovation Support Infrastructure which wilk provide links to capacities, facilities and expertise for the twin digital and green transitions as well as supporting the shift to a more resilient EU. However, finding the right focus and complementarities requires a leadership approach on collaborative specialisation. The establishment of 'corridors' between EDIHs can be the tipping-point for more structural collaboration between European industrial ecosystems.

1. Introduction

Digital Innovation Hubs – and similar entities such as R&I test beds, field labs, pilot lines etc. – have become an important instrument in the innovation systems in many European countries. The movement started first in the manufacturing sector and subsequently migrated to a variety of other sectors from agriculture and chemicals to health. Across Europe we find now over 400 DIHs[1]. This rapid growth in number reflects the widely acknowledged need for such hubs to support the diffusion and adoption of cutting edge innovation and technology. But, the DIH concept is dynamic and comes in many variations. As a result, after five years of developing the concept of DIHs, we now find in Europe a highly dynamic and still somewhat unstructured landscape with DIHs that serve sectoral, local and regional needs, (supra) regional coordinating hubs, national platforms and cross-border initiatives. DIHs cannot be everything to all people and cannot be expert in all fields. As they gain importance within a place-based (regional) innovation policy they will add value through specialisation and collaboration. The upcoming addition of the 'European' DIHs (EDIHs) provides another rationale for looking again at patterns of specialisation and collaboration within and across borders.

Digital Innovation Hubs were proposed as one of the five pillars in the Digitising European Industry initiative, co-developed between the European Commission (DG Connect) and the Member States in 2015. Building on previous efforts to support the technological development and innovation of companies, the DIHs combine technological expertise with business and ecosystem services to support innovative companies in their digital transformation. DIHs support industry in their digital transition by aiming to provide **one-stop shops** in every region and a strong network to ensure that every company can have **access** to these opportunities. Further discussion has emphasised the **eco-system**, and the place-based approach for these hubs, and their **connection with smart specialisation strategies** (S3). The conceptual distinction between 'competence centres', the 'DIH', the 'regional

[1] https://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-catalogue

network of DIHs' and the 'trans-European network' of services has brought further clarification[2] in line with the ecosystem and place-based approach to innovation. Smart specialisation strategies (S3) and the DIH network are arguably the key inputs to **EU-wide regional innovation policy frameworks**.

With the upcoming Digital Europe Programme (DIGITAL) and the new European Digital Innovation Hubs (EDIH), the DIH strategy aims to support the objective of uptake and deployment of digital technologies in Europe. Member States have **nominated** candidates for the selection of 'European Digital Innovation Hubs' for this Programme[3], thus engaging both the regional and national policy levels.

With the start of the new programming period dominated by the Green Deal and the post-Corona recovery plan there is a need to **anchor** the DIHs in the green and digital transformation agenda and **consolidate** the strategic approach of the DIH network that has emerged in the past few years in this context.

But in order to share the same understanding of the challenge, the DIHs and EDIHs still need to explore how to respond to basic questions on how to handle different **types of specialisation** at the level of the European innovation ecosystem: such as the geographical coverage, the distribution of services, the focus on specific domains, such as technology, sectors, applications or missions, etc.

Therefore, the key issue is how to combine specialisation and collaboration, and how to make this kind of cooperation the cornerstone of innovation support infrastructures for the twin green and digital transitions. This requires both a strong future vision and a practical methodology on how to best forge structural collaborations between DIHs.

2. Purpose of the document

This document is an input for a new learning cycle on the content and implementation of specialisation and collaboration processes in the context of DIHs and the imminent launch of the European Digital Innovation Hubs (EDIHs). The Digital Europe Programme provides a policy space for the acceleration of specialisation and collaboration for the EU-wide implementation of digital transformation across the whole population of DIHs. The 'Thought Leadership'[4] process aims at structuring this learning process in three different building blocks which explore how DIHs (in particular EDIHs) can practically collaborate, and offer suggestions for future policy development.

1) A first building block analyses **the challenges of DIH**: to be a one-stop shop for SMEs in their regions vs. the need to specialise in certain technologies, domains or sectors; to diffuse but also advance digital technologies; to focus on 'digital' and integrate this in all domains; to specialise and to collaborate.
2) In order to structure best practices and guidance, we propose in the second building block the **'collaborative specialisation'** approach (including practices for discovering smart complementarities with mapping and matching) in a leadership vision for DIH. This could contribute to exploring and developing 'corridors', structural cooperation between DIHs.

[2] DIHNET (2020), "Defining Digital Innovation Hubs as part of the European DIH network (DRAFT)"r
[3] European Digital Innovation Hubs in Digital Europe Programme Draft working document 05-05-2020
[4] Thought Leadership' is one of the tasks of the DIHNET, where transversal topics are raised to initiate discussion and support the DIHNET and general DIH community.. It was proposed in response to comments during the first DIHNET Project Review and included in the project amendment in 2020.

3) A third building block analyses the future of the DIH in the evolving **policy framework for the transition to a digital, green and resilient economy**. The leadership vision aims at anchoring the DIH in a shared narrative on the need for a European Innovation Infrastructure to support the digital transformation as a backbone of the new growth model.

3. Vision[5]

Collaboration and specialisation have been discussed in the past, but given the upcoming Digital Europe Programme and leading European strategies like the Green Deal it is important to further develop the ideas of how collaboration and specialisation can be organised both at the operational (practical) level of the (E)DIHs and at the policy level.

To this end, we propose the following policy options and recommendations to support the development of a collaborative European innovation ecosystem and a sharing of access to innovation infrastructures.

1. **Effective specialisation and collaboration at European level.**

A key challenge for the operationalisation of the DIHs and EDIHs is to integrate the seemingly differing requirements of being a regional **one-stop-shop** addressing the needs of local SMEs, and of offering added value by their **specialisation** to SMEs and other actors across borders. This can only be achieved by **place-based innovation strategies** embedded in the regional innovation ecosystems **that are interconnected at European level**. (E)DIH therefore should be linked to the regional policies such as the Smart Specialisation Strategies as a common European policy framework for cooperation for transformation. The coming selection of European DIHs (EDIH) provides a **mandate** for these selected consortia to co-develop a European network of innovation support and connect infrastructures and related services to enhance the digital transformation within regions and across borders. Specialisation and cooperation in the European network of EDIHs can be organised around **mapping** the unique competences in each region and **discovering**[6] the complementarities in the European network for supporting business opportunities in new value chains for a green, digital and resilient economy. Based on the emerging structural collaborations of strategic nature, a multiplication of such 'corridors' could be used to enhance the growth of effective cooperation networks.

2. A trailblazer of the European innovation infrastructure.

European cooperation for systemic transformation requires a shared narrative incorporating the role of different European programmes and policy levels. This policy narrative will be a crucial element to grow long-term expectations for the role of support entities like DIHs and **to align investments in complementary infrastructures.** The upcoming European Digital Innovation Hub programme is a window of opportunity for European innovation policy **to accelerate the pace towards a collaborative European Innovation System Infrastructure.** This innovation infrastructure is the backbone for co-developing new value propositions, especially in strategic areas for European growth, through the diffusion of innovation, the deployment of key

[5] Ideas contributed by Friends of Smart Specialisation

[6] The 'Entrepreneurial Discovery Process' is a governance mechanism to ensure that stakeholders that want to commit their resources for future growth opportunities of the region, are fully involved in the strategic prioritisation and implementation. https://www.researchgate.net/publication/339068135_Smart_Specialisation_at_work_The_entrepreneurial_discovery_as_a_continuous_process

technologies, access to demonstration activities, pilot actions and the testing of solutions to challenges. This is a chance to position EDIH, with their close connection to Test & Experimentation Facilities in the core of the development of the European industrial ecosystems[7]. There is also an opportunity to connect the future EDIHs with the present discussion on the new role of the European Research Area in developing a strategy for European technology infrastructures and the introduction of 'ERA Hubs'.[8]

4. Specialisation and collaboration from the DIH perspective

4.1 Specialisation in the DIHs

How can DIHs and upcoming selected EDIHs integrate the seemingly opposite requirements of being a regional **one-stop-shop** addressing the needs of local SMEs, and of offering added value by services in areas of **specialisation (** also to SMEs 'abroad')? The profile of 'first line' adviser and general support is different from 'specialised' expert for specific domains. The diffusion of the 'best available technology' (specialisations) across regions will ensure high quality services, close to the frontier. By collaborating at the EU level, DIHs can further develop their focus area while at the same time providing access to expertise and capacities of other DIHs and learn from each other.

To discuss these questions of specialisation and collaboration, it is necessary to distinguish different types of 'specialisation' seen within the DIHs and how this typology relates to 'smart specialisation'. While different types of specialisation may be distinguished for different purposes, in the experience of DIH we consider generally **four types of specialisation[9]** (could also be more or combined):

- **Technology specialisation:** DIHs often focus on a specific technology such as robotics, AI, HPC and offer services connected to these technologies to different sectors[10]. DIHs, in addition, are specialised in services for technology development at higher TRL levels, testing and prototyping and/ or on business development. With the EDIHs and DEP, the focus is on the uptake of technologies in general i.e. closer to technology deployment.
- **Sector specialisation:** many DIHs focus specifically on economic sector(s) in accordance with the strengths of the region. We find DIH addressing digitization in manufacturing, in healthcare and in agriculture for instance. But sector borders become blurred and are replaced by other categories.[11]
  We also see hubs **combining sector and technology specialisations**: e.g. hubs focusing on robotics for healthcare. The DEP puts a focus on AI, HPC, cybersecurity but also includes other technologies and recognizes the importance of sector focus. This focus should be

[7] see 'A New Industrial Strategy for Europe' https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en
[8] https://ec.europa.eu/info/news/era-communication-sets-pace-efficient-uptake-research-and-innovation-results-2020-sep-30_en
[9] This categorisation is not exhaustive. It is all about identifying 'activity domains'. We single out 'technology specialisation' and '(economic) sector specialisation' as different sub-types in this 'domain specialisation'. They have established classifications (such as IPC patent codes and NACE codes). 'Application areas' can be used as demand-side specialisation areas with although less clear classification. Preferred 'thematics' (often policy priorities) is also a way to distinguish domain specialisations.
[10] See https://consultation.onlines3.eu/2-6-specialisation-indexes. 'Specialisation' of an entity (company, region, country, …) compares the share of a technology across all technologies (in terms of expenditures or patents etc) in this entity with the share of this technology across all entities.
This relative specialisation reveals the comparative advantage of the entity.
[11] In the context of political priority setting thematic 'domains' come to the foreground, often linked to challenges (such as the policy priorities in cohesion policy). But the specification of domains is not referring to a consistent methodology for delimitation of areas (like Nace codes, patent codes, Nuts codes, …).

based on competitive strengths and addressing future needs of the local ecosystem and their integration in European value chains.[12]

- **Service specialisation:** DIHs provide four types of services: ecosystem, business, technology, skills development. These are also reflected in the four types of services expected by the new EDIHs. But DIHs will only be able to provide direct, first line support to SMEs in a limited number of technologies or sectors. For other questions that they cannot provide direct solutions, they may either provide information to SMEs or broker support from other institutions (DIHs, universities, RTOs) inside or outside the region.
- **Regional specialisation:** Many regions have adopted smart specialisation strategies that aim to integrate local supply side (resource availability / sector strengths) and demand side (specific priorities for societal needs such as ageing or climate change) issues. A DIH will be geographically focused and has a mix of services that is also specific for the area or domain it is working on. But the 'domain specialisation' will possibly be the most important characteristic for aligning efforts with other DIHs to support technology and business development in their ecosystems and value chains. Projects addressing challenges of different nature in the targeted domain will combine different supply and demand-side specialisations in EU-wide value chains. Specialisation is always connected to collaboration with matching specialisations within a domain. It is therefore important that DIHs build on and further strengthen the smart specialisation strategies of regions and their interregional collaboration.

4.2. Connecting Smart Specialisation Strategies and DIHs

'Smart specialisation' is one of the main specialisation and collaboration mechanism currently in place in Europe. Compared with the types discussed above, 'Smart specialisation' is not just a 'functional' distinction in the way ecosystems are structured. It is a policy approach for prioritising public innovation investments in activities that are identified (with the Entrepreneurial Discovery Process[13]) to be strategic for future economic (sustainable) growth within a defined territory. Business innovation support by the public (including cluster platforms and technological support infrastructures) is earmarked in smart specialisation strategies for specific domains that are of strategic importance for the region's economic development and international competitiveness. The identification of these priority domains and activities is a 'political' (stakeholder-based) preference for future focused investments in the region.

Many DIHs are connected to the Smart Specialisation strategies in their countries and a report from JRC also points that many DIHs are also participating in the consultation processes or even the drafting of the S3.[14] This link becomes ever more important in the new programming period. It is already foreseen that Member States can use structural funds (ERDF) for co-financing the set-up of EDIHs.[15]

[12] In modern industrial policies the sector approach is absorbed in a wider 'industrial ecosystem' approach that is value chain based and therefore cross-sectoral.
[13] See https://s3platform.jrc.ec.europa.eu/entrepreneurial-discovery-edp; http://www.know-hub.eu/knowledge-base/videos/entrepreneurial-discovery-process.html
[14] See for example Gabriel Rissola, Jens Sörvik (2018), Digital Innovation Hubs in Smart Specialisation Strategies: Early lessons from European regions, JRC Technical Report
[15] "A prerequisite for investments of ERDF in Digital Innovation Hubs for services under categories "Test before invest (in digital technologies)" and "(Digital) skills and training" is that these are fully supporting the regional or national smart specialisation strategy" 'European Digital Innovation Hubs in Digital Europe Programme Draft working document 22-10-2020', p14, https://ec.europa.eu/digital-single-market/en/european-digital-innovation-hubs-digital-europe-programme-0

Given that ERDF funds are connected to S3 strategies, the cross-regional collaboration of DIHs becomes intertwined with **interregional partnering for implementation of smart specialisation strategies**. The operationalisation of services across borders will always have to be fitted in other regional, national and European programmes.[16]

4.3. Collaborative specialisation in the European DIH Network with 'mapping and matching'

The digital transformation requires a quantitative and qualitative upgrade in technology diffusion efforts. How can the DIH network live-up to this task? On the basis of experiences in S3 partnerships with the model 'learn-connect-match-commercialise'[17], the 'mapping' and 'matching' have proven to be crucial steps to set-up connections between competence centres in joint projects for the testing and demonstration of new solutions. Interregional collaboration for smart specialisation can develop into 'collaborative specialisation' when the competitive specialisations in regions become aligned.[18]

This capacity to align can develop organically from the core functions of (E)DIHs. The DIHs need to make a continuous mapping at regional level of relevant infrastructures and services and of competences of their relevant partners to offer the best support to digital transformation journeys. The journey starts with a **common challenge or a mission** that urges for cooperation, because the different organisations cannot do it alone and are open to find partners with complementary specialisations. This continuous monitoring therefore also becomes the basis of collaboration with other DIHs through **exchanging and combining mappings** of their best assets in specific value domains of common interest.

The future 'Digital Transformation Accelerator'[19] – the details of which are still under discussion at the time of writing – might catalyse such discovery process of joint opportunities among EDIHs with appropriate **technical support for mapping and matching**. Starting from a challenge, the mapping exercise starts a roadmap for partnering in specific value creating actions (i.e. demonstrating and testing digital innovations with combined efforts). The mapping is therefore a method for matching the partners that are complementary for high-class services, and also to identify overlaps that might need a more focused differentiation.. Such a process of mapping and matching can be put in motion already at an early stage, starting from the experience of the thematic smart specialisation platforms[20] and the use of the Catalogue as a matching tool.

Empirical knowledge on the best practices for collaborative integrated approaches in deployment of technology for targeted use also needs to be studied. This experience is now scattered across many collaborative programmes. The present support actions (like I4MS, etc.) and umbrella organisations

[16] The challenge is to avoid a fragmentation of policy and administrative frameworks that burdens the build-up of a long-term strategy for EDIH (need to go shopping around!). Besides ERDF also EAFRD can be used for co-financing the 50ù DEP-funding. Horizon Europe support companies that work with DIH; DIH can be intermediaries to additional Invest EU financing. The most important resource might become the Recovery and Resilience Facility that labels 20% of funding for digital (including DIH). But this diversity also hinders a common DIH mission.
[17] https://www.s3vanguardinitiative.eu/pilotinitiatives
[18] www.interregeurope.eu/policylearning/news/8696/interregional-collaboration-for-smart-specialisation-methodological-tools/?no_cache=1&cHash=e4c69f7fdef08d0b9dc0b7fc91ea6c29
[19] "The organisation of this collaboration will be supported through a support facility called the "Digital Transformation Accelerator". This name signifies the importance of this action: it should animate all networking and collaboration activities and through that accelerate the digital transformation everywhere in Europe", in 'European Digital Innovation Hubs in Digital Europe Programme Draft working document 22-10-2020'. See https://ec.europa.eu/digital-single-market/en/european-digital-innovation-hubs-digital-europe-programme-0, p x
[20] Methodological Manual, S3 Platform, https://s3platform.jrc.ec.europa.eu/-/methodological-manual-developing-thematic-interregional-partnerships-for-smart-specialisation?inheritRedirect=true

for support infrastructures (like EBN, IASP, the European Cluster Collaboration Platform) and platforms for cooperation (like the S3 thematic platforms) can be partner in this empirical finding of such strategic mutual support capacity. The European Enterprise Network (EEN) is already designated to be a key partner with regard to EDIHs.[21] But a way forward to accelerate learning about collaborative specialisation, already in the 2021 preparatory period, is to task the future EDIHs to further describe their focus in a joint mapping of specialised infrastructures across regions in support of missions[22] or strategic value chains in the 14 industrial ecosystems identified for European industrial policy.[23]

4.4 Structural Cooperation in the EDIH network: emergence of corridors

The network of EDIHs can provide the steppingstones to new, more sustained forms of pan-European collaboration in the benefit of industrial transformation. At present the dominant form of European collaboration between 'hubs' of all kind that offer R&I services to industry is project-based and therefore mostly of an ad-hoc nature. Project funding is the basic funding model for European collaboration. This is a competitive and flexible form but also requires high coordination costs which limit the learning and trust-building over the longer term. While projects can often be one-off collaboration opportunities, more structured alliances (both formal and informal) partner networks play an important background role (and will continue to do so).

But to make transformation possible on the level of European ecosystems and value chains, these background collaborations have to come to the foreground. A sustained collaboration in the provision of innovation services between the network nodes needs strong channels. Such channels are 'corridors' for structural cooperation in a still fragmented and opaque European landscape of services available in regional innovation infrastructures and ecosystems.

To promote and forge the establishment of more 'corridors' for more structural collaboration between digital innovation hubs two preconditions seem to be needed: a (political) mandate and an orchestrating capacity. The one without the other is doomed to fail.[24]

All of the present structural collaborations are based on some kind of strategic alliance, such as those illustrated below, and some of which are based on current experience with existing DIHs. Often, they are facilitated by a political mandate:

- An early example of cooperative framework is ELAt: the Aachen, Leuven, Eindhoven Triangle, that is an institutional approach for cross-border cooperation based on these cities. Regional authorities are the cement for the longer-term cooperation for technology transfer between knowledge institutes.

[21] Annex - Seamless Collaboration Between Enterprise Europe Network And European Digital Innovation Hubs, in 'European Digital Innovation Hubs in Digital Europe Programme Draft working document 22-10-2020'. See https://ec.europa.eu/digital-single-market/en/european-digital-innovation-hubs-digital-europe-programme-0, P 40

[22] Missions are defined in Horizon Europe (https://ec.europa.eu/info/horizon-europe/missions-horizon-europe_en); strategic value chains are identified in European Industrial Ecosystems (https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en)

[23] https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en#transforming-our-industry

[24] Experience of smart specialisation strategies indicates that strong political leadership and good governance and capacity are required for robust and successful strategies.

- The Vanguard Initiative[25] is an alliance of more than thirty regions that was created as a political initiative to increase the role of ambitious regions in European industrial policy (Milan Declaration of 2014).[26] This gave rise to a number of 'pilots' that evolved to S3 partnerships that structure a longer-term interregional cooperation between a number of regional actors (clusters, technology centres, universities) in common priority areas for industrial transformation. These stable networks are a source of joint projects.
- Basque Country and Lombardy have recently concluded a more dedicated agreement to facilitate cooperation for innovation, based on trust building and mutual understanding of complementarities through multiple collaborations. Bilateral arrangements between regions and countries exist already for a long-time and have initiated or reinforced 'corridors' but were limited to science cooperation.
- Arrangements to use innovation infrastructure are already structured in cross-border Interreg projects (such as between Hungary and Austria) or/and in Macro-Regions programmes. Sometimes this allows to cross-border research infrastructure.[27] Cohesion policy is a major lever for 'corridors', using infrastructures and services as channels, but it has not sufficient instruments for sustained interregional cooperation.[28] The 'political will' of the regions for an outward looking innovation policy is however the basic condition.
- Sometimes the innovation actors themselves have taken the initiative to establish strategic cooperation, such as 'Silicon Europe', the alliance between the cluster organisations of the leading micro-electronic regions, that are longstanding partners in European projects. The European Cluster Collaboration Platform promotes European cluster cooperation.[29] European associations of innovation actors such as EARTO are also providing frameworks for structural cooperation between RTOs. But these bottom-up 'interest groups' need a political mandate to play a role in the architecture of structural collaboration at trans-European level.

A programme framework for promoting more project based cooperation (such as most digital innovation hub programmes up to now) is a first step. But more is needed to address the challenges of structural transformations. Collaboration can exist at different levels of engagement and ambition. The establishment of more structured and aligned corridors requires an orchestrating capacity and strategic purpose and commitment that go beyond participation in one call or even an entire programming period. The added value of structural cooperation is not only to drastically increase policy learning and technology transfer but it is a next step to develop purposeful structural synergies and targeted participation in European value chains, which is the new challenge for any region that wants to position itself (and its actors) in the twin transition. This is about building critical mass and strategic purpose and about spending R&I budgets wisely by avoiding duplication. Strategy needs to be supported by a capacity to act, to orchestrate the conditions for successful collaboration between hubs and ecosystems.

[25] https://www.s3vanguardinitiative.eu/
[26] https://www.s3vanguardinitiative.eu/sites/default/files/contact/image/final_declaration_of_milan_final_27_10.pdf
[27] The **INL** International Iberian Nanotechnology Laboratory, located in Braga (North of Portugal) was founded by the governments of Portugal and Spain under an international legal framework to perform interdisciplinary research, deploy and articulate nanotechnology for the benefit of society.
[28] A first breakthrough is the I3 'Interregional Innovation Investments', see https://www.interregeurope.eu/future/ Interregional Investment
[29] Recently the cluster cooperation is also structured according the 14 Industrial eco-systems, https://clustercollaboration.eu/in-focus/industrial-ecosystems

The orchestrating capacity can be developed in multiple forms. Some of these are:

- Bottom-up initiatives of (E)DIHs (with their lead-institutes, lead-clusters) themselves to foster solid partnerships (see above)[30]. Although this happens already, it needs to multiply and deepen by supportive network services such the Catalogue and by exploiting mapping and matching, in cooperation with the EEN and other service providers.
- Regional authorities have also created corridors with dedicated partnerships, and can structure complementarities further by using their smart specialisation strategies in an outward looking way. They can commit to S3 partnerships, that involve their (E)DIHs (and their own support instruments), with the help of facilitators such as the Vanguard Initiative, the S3 Platform and other levers such as the EIT.
- The European initiative for a Digital Transformation Accelerator – still to be designed and a call for proposals to be launched- can possibly become a more top-down orchestrating instrument for matchmaking in the EDIH network, but this can only be successful if it accepts multi-level governance to align support instruments along the whole innovation trajectory and the value chain.
- Strategic cooperation on research and technological development is already shaped by existing structures such as joint technology initiatives (JTIs) and Joint Programming Initiatives (JPIs) and public private partnerships (PPPs). But we are now witnessing the development of a new layer for technology infrastructures in the European Research and Innovation Area (ERA), with its four aims of prioritising investments and reforms in R&I to support the digital and green transition and Europe's recovery; improving access to excellent R&I for researchers across the EU; translating results into the economy to ensure market uptake of research output and Europe's competitive leadership in technology and making progress on the free circulation of knowledge, researchers and technology through stronger cooperation with EU countries.[31]

5. Specialisation and collaboration from a policy perspective

5.1 Role of the DIH network in the development of a European Innovation System

The new EDIH pillar of the DEP is a window of opportunity for innovation policy in Europe to accelerate the pace towards a more integrated European Innovation System Infrastructure, with as a core the European DIH-network and its common European mission. This innovation infrastructure should aim at developing new value propositions, in particular, in strategic areas for European growth, with the deployment of technologies, demonstration and testing of solutions to challenges.

A systematic interconnection of such facilities and services for deployment is lacking in the EU. The establishment of this European innovation infrastructure is now one of the crucial conditions to close the innovation gap thanks to revamped European innovation policies that fully engage all resources to the common challenges outlined in the Green Deal and digital transformation and needed for the recovery and resilience of our economies after the pandemic.

[30] At present several Community Support Actions and Innovation Actions build network capacity to connect DIHs, beyond their project life-time. E.g. the 'Photon Hub' seeks to develop a partnership of (7) regions that will provide an annual structural funding after the end of the project in 2024 for. I4MS and Smart Everything Everywhere (SEA) have ambitions to become a community platform, with services for DIHs.

[31] European research area (ERA) | European Commission (europa.eu)

The European Strategy Forum on Research Infrastructures (ESFRI) is already providing a roadmap coordinating cooperation and investment for European research infrastructures. This important strategic think-tank, received a mandate in the new ERA action plan to broaden its scope to all technology infrastructures.[32] But the (E)DIH network can be the start of a Europe-wide approach to deployment, go-to-market and solutions for mission-oriented research and strategic innovation. That is because the (E)DIH is a connector of the different functions that are required for supporting the digital transformation in companies and value chains. In addition, the EDIH is also a connector of the digital eco-system with policy makers at regional, national and European level. This gives them a unique position, that only can be implemented with their organisation as a well-functioning network.

5.2. The role of the EDIH in particular

This potential of a European policy framework for DIH is illustrated by the fact that more than 400 organisations are listed in the 'Catalogue of Digital Innovation Hubs'.[33] The EDIH programme wants to achieve Europe-wide coverage of support services to SMEs, but also a European added value expressed in selection criteria for networking and specialisation for European DIHs.

The coming selection of European DIHs is providing, therefore, a **mandate** to the selected consortia to co-develop a European network of technology infrastructures and related services to support the digital transformation in the regions and across borders.

EDIHs may have a role in the diffusion of state-of-the-art digital technology and innovation. Each EDIH can provide the necessary scale in each region for an integrated deployment approach by means of strong consortia of competence centres, professional innovation service providers and strong local networks for additional services and financial leverage. But the 'European added value' is in their interregional specialisation and cooperation.

A clear message should be articulated that EDIHs receive funding not only for their function to support the regional ecosystem but also to establish and sustain EU collaboration. To this end the business model for the sustained functioning of these hubs and of their network must be a central focus in this formation period. EU funding should not be just another source of project funding for these 'hubs' (as ad-hoc consortia) but contribute to a more strategic/structural approach for sustaining a European innovation infrastructure in the medium and long-term? Therefore, the European DIH network has to gain recognition as a common resource from different policy fields that share the same European strategic goals. Different instruments can contribute to a stable funding mix. The European DIH network is a trailblazer, provided it can deliver an efficient and effective mechanism to align resources for collaboration and specialisation on common challenges.

5.3. DI Hubs and ERA Hubs: towards a new narrative for shared innovation infrastructure at EU level

The success of the DIH network is a **shared ambition and responsibility** for policy leaders (supporting the network with instruments at regional, national and European level) and for entrepreneurial (E)DIHs (driving the network potential to European scale). There is a need to have an integrative policy framework for the different funding sources and tools of different policy domains and levels

[32] https://www.esfri.eu/esfri-roadmap-2021
[33] https://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-tool

In order for the EDIH initiative to play its role as trailblazer of the European innovation infrastructure and European cooperation for systemic transformation there is a need for a shared narrative about European innovation cooperation, across policies and programmes at European level. This will be a crucial element for long-term expectations that can nurture new business models for the DIHS.
The previous analysis has tried to clarify the role of (E)DIH as one-stop shops for a diffusion policy, and their internationalisation in perspective of 'collaborative specialisation' to cover complementary support actions to companies in the development of specific European value chains. The programme for the European Network of EDIHs has the potential to be a key enabler of that potential, in particular in developing 'corridors' for structural collaboration. This collaborative specialisation needs an accommodating policy framework that should be provided by a combined top-down and bottom-up approach towards the European role of innovation infrastructures. Green Deal and European Industrial Policy are giving high-level direction. Smart specialisation strategies are a bottom-up policy approach towards aligning specialisations across borders and combining assets to avoid fragmentation. The EDIHs establish a growing texture of corridors to channel collaborative specialisation.

The streamlining of the different European policy initiatives on 'hubs' is a success condition for the necessary 'top-down' policy framework that has a role in providing direction. A core feature in this long-term vision is to combine the technology diffusion approach (AI, HPC, etc) with a solution based approach, integrating different technologies for common missions and solutions for industry and society. This requires integration of policies for promoting core digital technologies with policies for other (domain specific) technologies and their infrastructures. The latter will become more and more digitised in their operation. Policy silos are a system failure.[34] The integrated European technology infrastructure is a network of flexible combination and integration of the necessary services for a tailor-made support to new value creation in promising areas for regional, national and European sustainable growth.

During the Research & Innovation Days in September 2020, Commissioner Gabriel announced the launch of **'ERA Hubs'**, as "regional organisations **similar to the EU's Digital Innovation Hubs**".[35] This is a welcome evolution, provided it avoids duplication. In the EC Communication of 30 September 2020 on 'A new ERA for Research and Innovation' this ambition is formulated as:

> "Based on a mapping of existing entities, and the analysis of potential gaps, an *ERA Hubs* initiative could be developed, building on existing capacities, such as the Digital Innovation Hubs and clusters, and linking to the Enterprise Europe Network and StartUpEurope, to provide an interconnected knowledge space. This will facilitate collaboration and exchange of best practices, with the incentive to maximise the value of knowledge production, circulation and use". [36]

[34] First signs of such integration of narratives is seen in the connection made between EDIHs and the 14 industrial ecosystems: https://www.youtube.com/watch?v=HGAex6zLWwY&feature=youtu.be
[35] See https://sciencebusiness.net/news/commission-launch-era-hubs-boost-regional-innovation
[36] "The Commission will: … Develop and test a networking framework in support of Europe's R&I ecosystems, building on existing capacities, in order to strengthen excellence and maximise the value of knowledge creation, circulation and use by 2022. " COMM(2020) 628

In addition, initiatives have been announced to 'establish **a new governance structure for Technology Infrastructures**'[37], as well as 'strategic support to regions and cities'[38] and to 'support Member States to better integrate researchers in smart specialisation strategies in cooperation with industry'.[39] These ideas are closely related to the objectives of DIHs and it will be important that these plans are connected to and further enhance already existing mechanisms such as the DIHs.

This new ERA can lay the foundation for a real 'European Research and Innovation Area' that integrates all instruments for transformative policies, not only those of the research domain. In particular the 'governance of technology infrastructures' can benefit from the input of the **DIH network as a stepping stone for the integrated European innovation infrastructure of the twin transition**. These technology infrastructures connect the domains of research, innovation, and industry with the wider systemic transformation dynamics at European scale. Many research and innovation services use the same facilities in competence centres as the diffusion services (testing and piloting). It is therefore very likely that these ERA hubs will share a lot of objectives with (E)DIHs and other EU-level initiatives for research, innovation, education and training to support ecosystems. A joint narrative has to avoid unnecessary duplication and fragmentation, in order to ensure high-quality infrastructure and services. [40]

The new governance for this European Research and Innovation Area represents a window of opportunity that should not be missed for streamlining the instruments for needed massive co-investment.[41] A new ERA can benefit from the input of the DIH network as a stepping stone for the new European innovation infrastructure supporting the twin transition.

6. Conclusions and suggested next steps

The coming Digital Europe Programme, the new Industrial Strategy and other policy initiatives such as the Communication on Europe's digital decade: 2030 digital targets, will provide a stimulating policy environment for advancing more quickly in setting up the European innovation support infrastructure (with focus on test and experimentation facilities in particular) that should become the **backbone** of European transformation policies. The European Research Area can be extended to a common area for support to innovation and technology diffusion across regional eco-systems. The new industrial policy is leveraging the Single Market (thanks to new regulation and standards) as a common transformation space for exploring and upscaling new value propositions in targeted industrial eco-systems (with industrial Alliances).

[37] "The Commission will : Support ESFRI to work towards a world-class research infrastructures ecosystem focusing on the broader range of the EU's policy priorities and improve its governance to address the broadened focus of its activity by the end of 2021, and establish a new governance structure for Technology Infrastructures. COMM(2020) 628

[38] "Strategic and coordinated support will also be offered to regions and cities building on successful initiatives such as the *Knowledge Exchange Platform*[38] (together with the Committee of the Regions) and the Science meets Regions initiative. These will be upgraded to a strategic level ensuring an effective dialogue for setting priorities and promoting synergies between R&I instruments and education and training with adequate mobilisation of cohesion policy funds." COMM(2020) 628

[39] The Commission proposes to: … Institute a dedicated work stream in the ERA Forum for Transition (i) to promote and monitor access to excellence of researchers and institutions from Widening Countries, with Cohesion Policy support, (ii) to support Member States to better integrate researchers in smart specialisation strategies in cooperation with industry, and (iii) help them design measures to support researchers in Widening Countries to improve their skills for excellence in the labour market. This should support low R&I performing countries to increase the excellence of their R&I systems. Member States lagging behind the EU average on highly cited publications should reduce the gap to the EU average by at least one third in the next 5 years. COMM(2020) 628

[40] 'Smart specialisation' was developed in DG RTD as a response to fragmentation and duplication in the field of public R&I investments for national innovation strategies (see for example Innovation Union Flagship, pp.4), but later shifted to cohesion policy only. "Member States willing to increase the performance of their R&I system towards excellence should be encouraged and supported, building on dedicated Horizon Europe measures and complementarities with smart specialisation strategies under Cohesion Policy." COMM(2020) 628

[41] See Foss policy paper 'The ERA and Smart Specialisation' (https://friendsofsmartspecialisation.eu/)

With the **Thought Leadership approach** presented in this paper the FoSS and DIHNet aim to make a contribution to the broader policy development discussion by capitalising on the experience and expectations of the DIH Community regarding internationalisation and collaboration.
Therefore, this paper can be a reference for further development and **work**, on different aspects of the vision for collaborative specialisation in a trans-European support network – e.g. in the context of the EDIHs and the future Digital Transformation Accelerator (DTA). This exploratory work can in particular focus on the implementation of the 'mapping and matching' methodology for collaborative specialisation, on analysing preconditions for more corridors of structural collaboration, and on the need of a joint narrative for the European Innovation Support Infrastructure.

The **trailblazer role** of EDIH for the European support infrastructure can be further designed with this 'thought leadership' approach. First by using the **Catalogue** of (E)DIH as a stepping stone for an interoperable mapping and matching of services in DIHs to support innovation diffusion, testing and experimentation for joint challenges. In parallel starting the stepwise reinforcement of **corridors** in the EDIH network, to demonstrate this trailblazer capacity for specific challenges. The articulation of corridors **in the 14 European industrial ecosystems** is a strategic way to couple collaborative specialisation in providing services to companies by EDIHs with the European Alliances in selected European strategic value chains.

Defining Digital Innovation Hubs as part of the European DIH network (DRAFT)

This paper is a **DIHNET working paper**, developed by DIHNET to support the DIH stakeholders in Europe in order to create a shared mindset about the foundations of the European DIH network. The objective of this paper is to create a **clear structured methodological overview and shared mindset** on the **definition/demarcation of a DIH**, so that present and new stakeholders can more efficiently talk about their experiences and strategies. We hope that this paper will inspire the community members with the further strengthening of their initiatives and finding opportunities for pan-EU collaboration.

Other (upcoming) ***DIHNET Working Papers*** address issues on the EDIH strategy, Smarter Specialisation, State Aid Rules, Finance and investments, sustainability of EU networks, etc.

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Table of Contents

1 Backgrounds to the DIH concept 3
1.1 Objective of the paper 3
1.2 Main basic building blocks of the EU DIH network 4
1.3 The EU DIH network organized in three levels 5
1.4 Evolution of the landscape 6
2 A historical perspective 7
2.1 The origin of the concept 7
2.2 An evolution of the concept 8
2.3 Evolution of the definition 8
2.4 A need for a more strict and clear definition 10
3 Defining a Digital Innovation Hub 11
3.1 Components of a definition 11
3.2 Defining a DIH through its services 11
3.3 Who are its customers 12
3.4 Boundary conditions and characteristics 14
3.5 Organisational features 15
3.6 Digitalization as demarcating characteristic 15
3.7 Key performance indicators for DIHs 16
4 Other look-alike entities (but not DIHs) 18
4.1 The Competence Centres defined by their services 18
4.2 The Regional DIH Networks (RDN) and its nodes defined by their services 18
4.3 Pan-European networks defined by their services 20
4.4 Other related entities 21
4.5 Epilogue: The upcoming European DIHs 21
5 Conclusions 22
5.1 A defining framework for the DIH concept 22
5.2 Some observations from an evolutionary perspective 23
5.3 A contextual positioning of the DIH 23
5.4 Positioning of the EDIHs 24

1 Backgrounds to the DIH concept

1.1 Objective of the paper

DIHNET started in November 2018 and aims at enhancing the EU DIH network by inspiring its stakeholders to improve their operation and connection them to the network. We aim at European, national and regional initiatives directly supporting the digital transformation and Digital Innovation Hubs (DIHs). One of our objectives is to support policymakers and other members of the EU DIH community to enhance their collaboration.

In today's economy, taking up innovative technologies is seen as crucial to improve industrial competitiveness. Especially SMEs and Mid-caps are faced with a "valley of death". Taking up these technologies are accompanied with elevated economic risks and market failures[1] that therefore legitimize governmental intervention. The origin of the DIH policy is found in this struggle of SMEs to take up digital technologies.

The Digital Innovation Hubs (DIHs) were coined in 2016 as a crucial pillar of the Digitising European Industry (DEI) initiative[2]. After 4 years, DIHs are one of the key instruments for the Commission and Member States to support the digitization of the EU industry. The "evolution" of the DIH concept was fast. From less than 100 organisations acting as DIHs in 2016, it is estimated that today there are some 1,500 organisations[3] actively participating in the European DIH network.

In the past, providing an official EC definition was seen as counter-productive. Fully demarcating and defining the DIH concept could disturb the increase of the momentum of a shared European DIH strategy, as discussions would focus more on creating a common definition and not on its aim: to boost digitalization of the European industry. However, since the launch of the concept in 2016, this momentum and support for the DIH strategy has reached a critical mass. But the concept of DIH is not clear and harmonized with other related concepts. This now can become a limiting factor to the impact that DIH like organisations can have on boosting the uptake of digital technologies.

DIHNET believes that providing a strict, more clear, definition of the concept and its contextual position can help the EU DIH community to further grow in quality and impact. This is supported by discussions with members of the network in which their desire was expressed to converge towards a more unified definition. This note aims at giving more insights to:

- Establish a **shared common conceptual framework** of a DIH and its position in the EU DIH landscape to facilitate discussions within the European DIH community.
- **Informing newcomer members** to the community what the concepts are, so they can quickly participate in the strategic discussions.
- Helping **policymakers understand the DIH** and related concepts to better develop policies for their support and facilitate aligning European and Member State policies.
- **Inspiring the community members** on further strengthening of their initiatives and finding opportunities for pan-EU collaboration.

In **this chapter**, some backgrounds are given to enable the reader to understand the evolution and reasoning of why a EU DIH community is needed. It will also provide a more conceptual overview of

[1] E.g., benefits are shared (externalities), goods that are non-excludable (public goods) and asymmetric availability of information. See http://www.mkpl.eu/results/final-results/
[2] See https://ec.europa.eu/digital-single-market/en/news/digitising-european-industry-initiative-nutshell
[3] This is an estimation of DIHNET based on the work on the catalogue and expert judgement from the partners.

the European DIH community to be able to position the different building blocks. The **second chapter** will further describe the historical backgrounds of the concept, where **chapter three** defines/demarcates the concept. **Chapter four** will put the DIH concept in its broader context and the last chapter will summarize the paper and adds some more information on the future of the DIH concept.

1.2 Main basic building blocks of the EU DIH network

DIHs support SMEs to speed up the digital transformation processes. They combine technological infrastructure and expertise with actual business creation expertise. DIHs build on the concept of open innovation: the need to jointly accelerate innovation by ensuring that that knowledge and technology flow across networks of innovation. DIHs build also on the notion of public-private partnerships for innovation, which addresses the distinctive roles of a range of public, private and civil society partners in jointly addressing complex innovation questions.

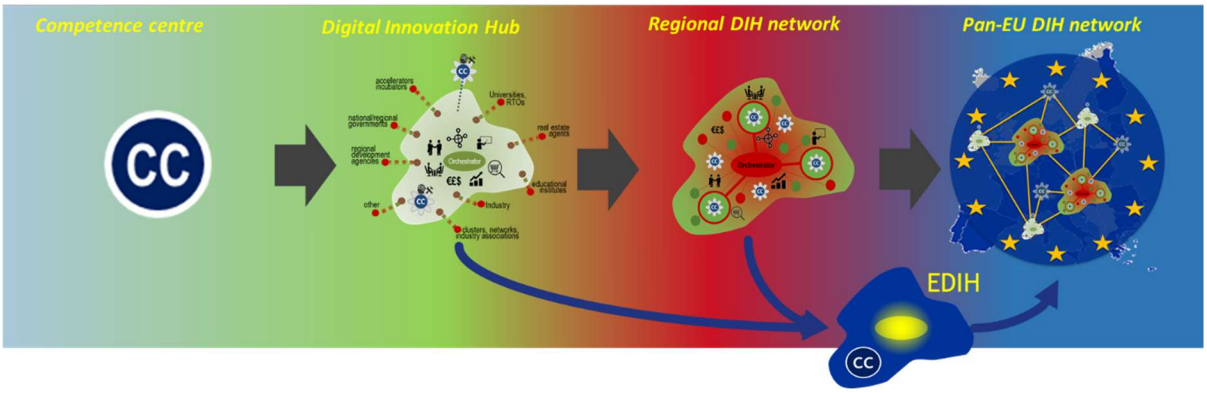


Figure 1: Main building blocks in the EU DIH network.

Today, **five different building blocks** can be distinguished that are seen as the **backbone** of the European DIH network. As they are related, a demarcation of these concepts is needed to create a common mindset:

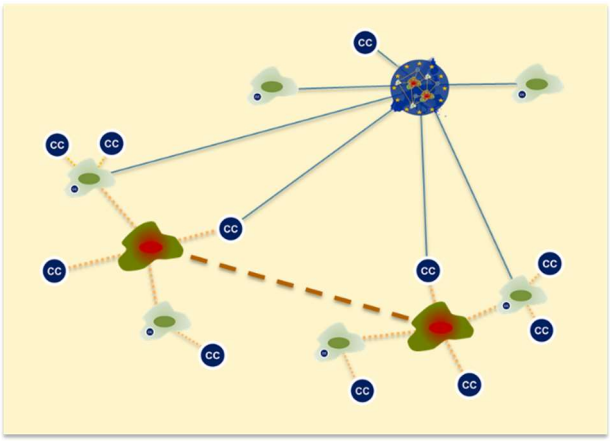


Figure 2: The relations between the different DIH building blocks in the DIH landscape.

- Core to all innovation activities are the **Competence Centres** (CCs). These organisations focus on the development of new and innovative technologies. They often have state-of-the-art technological infrastructures and accompanying technological experts. Their main focus is to help the industry translating these innovative technologies into products and accompanying manufacturing systems.
- The **Digital Innovation Hubs** (DIHs) expand the technological services of CCs to support this transformation process with more **business-oriented services**. So, a DIH complements this CC offered technological development to support SMEs to create business with a product. Also, a DIHs aims at strengthening the **regional innovation ecosystem** on a **specific**

industry/technology areas by boosting collaboration. In essence, DIHs are seen as a one-stop-shop, where companies can find an all-round support for their digital transition. In practice this support may be specialised on a certain technology (e.g. robotics hubs) or sector (e.g. agrihubs), which may lead to the emergence of more than one DIH in a region.

- When there are several DIHs and CCs in a region, it is often observed that **regional DIH networks (RDN)** organize certain services and activities at regional level, as they are common to all DIHs (e.g. IPR services). This achieves **economies of scale.** These networks are more **agnostic** to industry/technology areas than individual DIHs and focus on e.g. regional **awareness** creation and **access to finance**. But they also combine activities of the individual DIH-nodes on **pan-EU collaboration**. These networks often include the regional authorities and some representatives from regional DIHs/CCs, as well as e.g. regional development agencies and other intermediary organisations.
- The last building block are **pan European DIH networks**. To improve the EU leadership on specific innovative industry/technology areas, these networks are established to **enhance the interregional collaboration**. They connect the activities between different regions, creating access to expertise, infrastructures and available innovative products on pan-EU level.

Next to these four main building blocks, the upcoming **European DIHs** can be considered a fifth. They will play an important role in establishing the interregional collaboration. Some existing DIHs and RDNs are expected to be selected to provide a backbone of pan-European collaboration. It is clear that a relation between the different building blocks can be seen. Different missions, responsibilities and activities create different collaborative network of entities to serve SMEs.

1.3 The EU DIH network organized in three levels

DIHs are the core building blocks to the EU DIH network, providing services to the industry to adopt/develop and implement digital technologies. But the Digitising European Industry initiative also aims to boost European collaboration. This requires mechanisms to connect the different service providers (DIHs) from different regions and enable them to (jointly) connect to SMEs and MidCaps outside of their region (EU-network services).

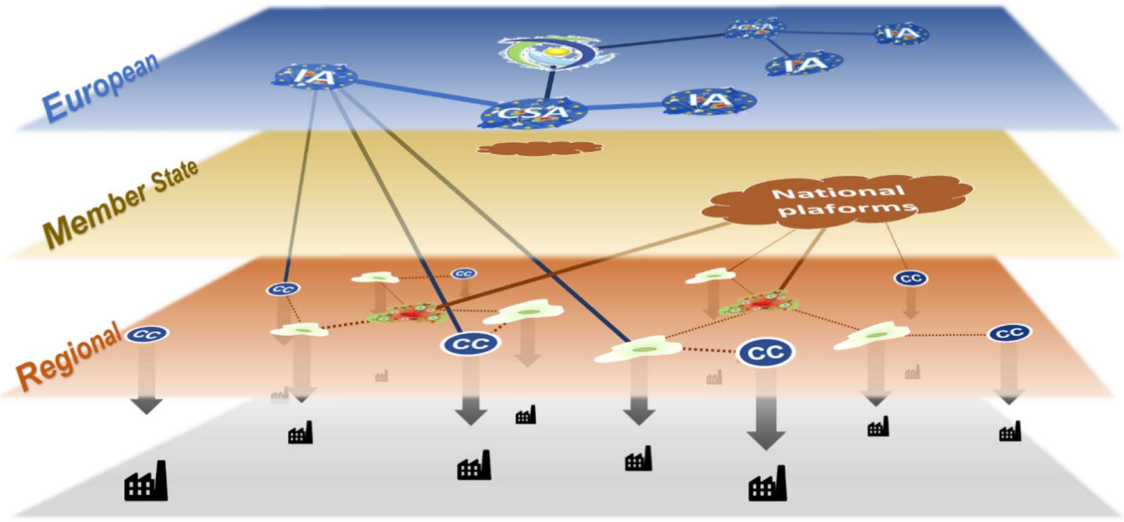


Figure 3: Simplified three level organizing approach of the EU DIH network, supporting SMEs/MidCaps and EU-collaboration.

To establish these **interregional connections**, the RDNs are pivotal. Not only do they have access their place-based capacities, but also know their regional needs. As these entities also include regional authorities, they have the political mission and accompanying capacities to increase collaborations with other regions in Europe.

Member States coordinate activities to optimize the national "fabric" of service provision using the regional strengths. Also, national cluster organisations and industry associations create networks to support their members to efficiently connect to the available capacities in the country and bundling efforts. Further, the national level also determines the policy and regulatory framework within which the DIHs operate. Depending on the centralization level of the Member State and the national division of responsibilities and regional autonomy, the overall national strategies and policies could have a significant impact on the DIH, affecting the DIH governance (e.g. is there a need for a legal entity), the policies and funding it could use (e.g. is there a national strategy and platform that organizes the regional initiatives and gives access to funds or is this the discretion of each region) and even the focus of the DIH (e.g. specific policy ambition to support specific sector or technology adoption).

Boosting **EU collaboration** is core to the European Commission. The Commission uses different instruments to stimulate collaboration, the present H2020 being one of the most important ones for the EU-DEI strategy. Within this framework programme, the Innovation Actions (IA) are, at this moment, the most important instruments for the EU DIH community. IAs are focused on specific industry areas, like robotics, I4MS, SmartAnythingEverywere and photonics. They connect the DIHs and CCs from different regions and facilitate the cross-border support to SMEs. The second H2020 instrument are the Coordinating Support Actions (CSA), which aim at coordinating and aligning activities of the different IAs within one industry area family.

1.4 Evolution of the landscape

The European landscape of DIHs is **vast and growin**g (see Figure 4). The EU DIH catalogue, today includes about **500 entities**. Although not all fully operational DIHs, it is a good indication that the EU DIH community is substantial. Also most Member States have a DIH supporting strategy, or are developing one. Next to those identified, DIHNET estimates that over **1,000 other organisations** are active in the EU DIH community. These include regional governments and agencies, industry associations, RTOs, university initiatives, national platforms, Innovation Actions, and PPPs.

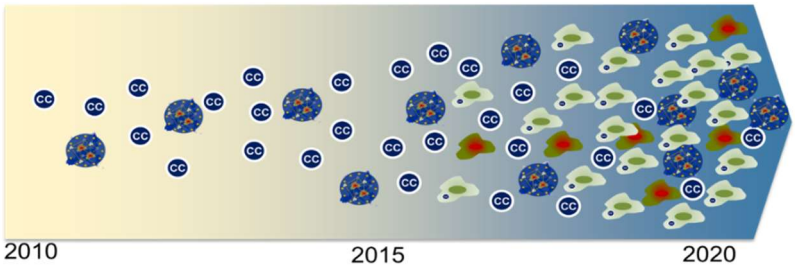


Figure 4: Evolution of the EU DIH landscape.

The community is expected to grow even more in the coming years. Not only will **Horizon Europe (HE)** support new IAs and CSAs (and underlying DIHs/CCs), also the upcoming **Digital Europe Programme (DEP)** is expected to further boost the European DIH community by supporting the initiation of European DIHs (EDIHs)[4]. It is also expected that further growth of existing and initiation of new DIHs will be supported by the new **ERDF programme** (2021-2027).

[4] For more about the proposed European DIHs: see section 4.4.

2 A historical perspective

2.1 The origin of the concept

The DIH concept can be considered a step in an **evolutionary process**. Technology centres and other entities where technological infrastructures were used as sandbox for early prototyping of new technological innovations are not new. Already in the early years of the 20th century shared research programmes were not uncommon. From the mid-20th century, Research and Technology Organisations (RTOs) more and more had a public mission to use their technology infrastructure and researchers for SMEs. Most of these entities have important common features that can be seen in a DIH, like sharing infrastructures and expertise, technology transfer activities and supporting SMEs.

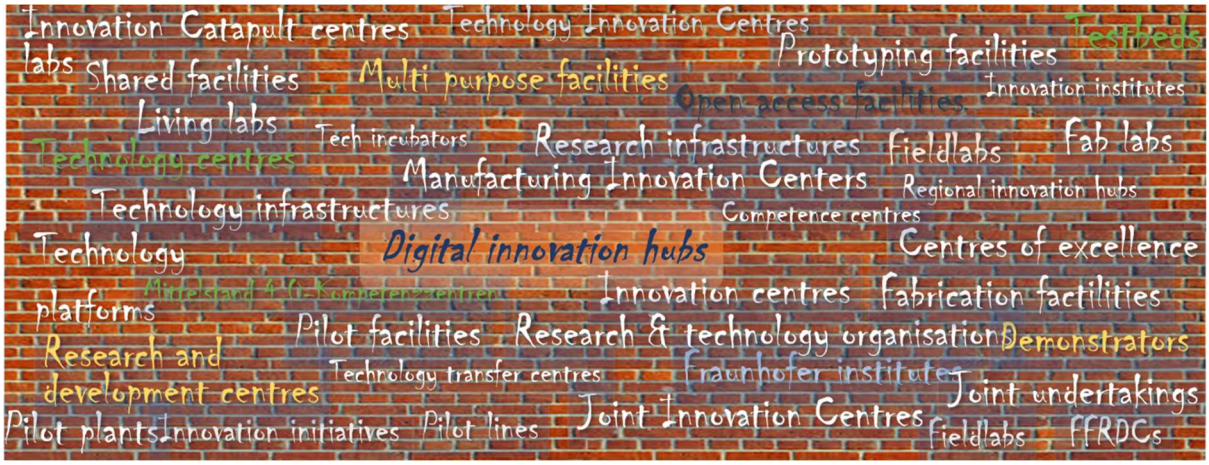


Figure 5: The wall of concepts; there are many other entities that are closely related to the DIH concept (TNO, 2019).

During the **beginning of the H2020 programme**, these technology infrastructure based entities were the common mechanism to support SMEs. In its first stage (2013-2015) the European Commission initiated the I4MS programme where six so-called Integrated Projects aimed to create networks of **"Competence Centres"** (CCs) that could support SMEs in their adaptation of digital technologies in their manufacturing process.

However, the actual new **business creation** by these technology infrastructure based networks was limited (they mostly created products and manufacturing systems). Offering technological infrastructure proved to support especially highly innovative SMEs, but "main stream" SMEs needed more help. This was confirmed by e.g. the EC-funded Multi-KETs Pilot lines project, which showed that helping SMEs to cross the " valley of death" requires an **integral approach**. It showed that the valley of death is about reducing economic risks, which was driven by two main factors: 1) Cost of innovation and 2) the uncertainty to become profitable. **Technological services** need to be complemented with more **business oriented services** to improve the translation to commercial exploitation by SMEs. Getting a technology into business needs a combination of technological development with understanding the market, finding investments, creating new business models. And ensuring that there will be **qualified personnel** to run the production.

2.2 An evolution of the concept

The concept of Digital Innovation Hubs incorporated this more integral approach to help SMEs. At the time, other similar entities were already up and running in some Member States at that time (e.g., UK Catapults, the German Kompetenzzentren and the Dutch Smart Industry Fieldlabs). However, it was believed that a common European DIH strategy could further boost digitalization of the European Industry. This lead to the inclusion of DIHs as part of the 2016 strategy to "digitize the European industry". In the accompanying Communication the Commission coined the concept of Digital Innovation Hubs [EC, 2016]. It stated:

> *"to bring the benefits of digital innovation to every industry, the Commission will invest €500 million in Digital Innovation Hubs (DIHs) so that every industry, large or small, high-tech or not, can understand the digital opportunities and get access to knowledge and testing facilities in the latest technologies."*

To make this operational, a supporting H2020 activity was developed: the I4MS Mentoring Programme. Initiated in November 2015, it was key to the development of the DIH concept. It called for proposals to develop feasibility studies and business plans for so-called "Regional Digital Manufacturing Innovation Hubs" (RDMI-hubs) – a concept which was soon renamed to "Digital Innovation Hubs". Crucial to the concept of DIH was the combination of technology services and business services.

During the period of 2016-2017, the I4MS Mentoring Programme supported in total 29 consortia to develop a business plan to become a Digital Innovation Hub. The I4MS-CSAs and I4MS-IAs operational at that time supported these consortia with technological and non-technological services to establish their DIH.

The I4MS mentoring programme can be seen as the first practical experience within a European context of what DIHs could be. Business models were explored, consortia based on detailed ecosystem assessments created and use cases conducted to bring the concept further alive.

Since then, several dedicated EC service contracts as well as CSAs/IAs funded by the H2020 programme were launched to further boost the concept of DIH. Specific attention was given to the mentoring of new DIHs in regions where there were limited structural activities to boost the use of digital technologies by SMEs (e.g., Smart Factories, DIHELP, IA DIH Network). Also, the Commission organized a series of discussions on the further development of the concept: the Digitizing European Industry (DEI) working groups. During those working groups, European Commission, national and regional policymakers, DIH partners, as well as industrial and research representatives further explored aspects of the concept. These discussions provided more "flesh on the bone" of the overall concept, by discussing the development of digital platforms, assess to financing, identification of the DIH landscape and business models. The broad participation of representatives from regional authorities and industry also ensured a practical view of the evolving DIH concept.

2.3 Evolution of the definition

From the start of the concept in 2016, defining a DIH was complex. The Multi-KETs Pilot lines project[5] in 2014 also came to the conclusion that defining them was seen as difficult, even perhaps irrelevant.

[5] The Multi-KETs pilot lines, assigned by DG-Grow, focused on the assessment of how governments can support SMEs to cross "the valley of death" (http://www.mkpl.eu/). Core conclusion was that governments should facilitate so-called "Shared facilities for pilot production".

"Defining Shared facilities for pilot production should be done by focusing on its activities/functions". For the DIHs it was clear that some Member States (MS) had implemented policies supporting the digitization of industry and were supporting DIH-like initiatives. But these MS often use a slightly different approach to their national and regional requirements regarding DIHs (e.g. the Italian more sectoral and Spanish DIHs more regionally coordinated). Therefore, a flexible approach providing minimal criteria was adopted[6].

This approach could already be seen in the I4MS Mentoring Programme (2015-2016), where in the open calls for interest a comprehensive definition of RDMI-hubs was deliberately not included. However, some important criteria were identified for the selection. First, an RDMI should have an open innovation approach and should combine technological infrastructure with business and ecosystem services. Also, it should be orchestrated by one organisation, but seek partnerships with several other organisations (multi-actor approach).

During the following years, the development of a common definition was explored. During the Digital Assembly in Bratislava (2016) the following broad definition was provided by the Commission:

> *"A Digital Innovation Hub is a virtual and/or physical '**one-stop-shop**' for any business to access support in understanding **digital technologies** and support on how to **finance**/nurture the necessary investments for a digital transformation. The **core** of a Digital Innovation Hub is a **competence centre**. The specific Hub-function is a **connector** function. The competence centre is most of the times a **'hard'** technical infrastructure, while the hub is a **'soft'** infrastructure for business services."*

After this first definition, other definitions were proposed and discussed during the DEI working groups, but none formally adopted. Even today in the different parts of the EU DIH community there are different views on what a DIH should be. In practice, nowadays, one can observe that the definition of a DIH is tweaked depending on the regional situation, needs and capacities. This has led to different characteristics existing simultaneously.

Figure 6: Description of the DIH concept (EC, 2018).

Today, the Commission does provide some guidance in what a DIH is. Already initiated in 2016 by the I4MS Mentoring programme, a "definition by activities" approach was followed. At the moment, the Commission uses the approach shown in Figure 6.

But the concept of DIHs is still evolving. The new upcoming DEP envisions that European and national funding support will be provided to European DIHs (EDIH). The question emerges as to how these EDIHs are positioned to the DIHs and other building blocks, and they will collaborate?

[6] The JRC Catalogue, today lists 4 criteria that entities need to fulfil before having access to the Catalogue; for more see here: https://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-catalogue

The experience of the last years is that because of different political context, national and regional authorities adjust the DIH concept to facilitate the local situation. This is also confirmed by discussions with individual hubs and regional authorities, showing a large variety of governance structures (yes/no memberships), legal entities (MoU based/single legal entity), partner structure (small/large consortia) and funding mechanisms (private/public). And although the services provided have commonalities, also significant differences in approaches are found: from DIHs with a stronger technology focus to more networking focused DIHs that build on traditional cluster functions. Therefore, creating a shared common European definition presents a challenge.

2.4 A need for a more strict and clear definition

However, this open approach on defining a DIH has some pitfalls and many stakeholders consider it as increasingly problematic. For example it is mentioned that any organisations can call themselves DIHs. This dilutes the value of being a DIH and for example its marketing added value. Especially consortia that systematically cover the different services and address the different aspects of the innovation chain feel that they can benefit from a more leading approach from the Commission. It would distinguish them from the many other initiatives. And a more strict definition has therefor the potential to strengthen the potential impact of the concept to the European industry. A guided, quality-label-oriented approach would drive the service quality of the DIHs and actual impact:

- Creating a clear definition on the DIH concept will help and stimulate consortia to **improve their operation**.
- A definition on DIHs can be used to provide a **benchmarking mechanism**, used by entities to identify weaknesses and issues to address.
- A strict definition will act as a quality mark, so entities are stimulated to become part of a selected group because of **branding mechanisms**.
- The marketing value of individual DIHs will be higher, but then also the **EU DIH strategy will gain importance**.
- A strict definition is also useful to delimitate the DIH concept and gain more concrete factual understanding which self-reported initiatives in the DIH catalogue. The catalogue would then have **more added value** (see chapter 4).
- A clear and accepted definition will limit the discussions on what a DIH is, therefore leaving **more time for the future** steps to make it operational.

But to develop such a common definition is **complex**. It must **balance** focus to create a **high quality** persuasive, desirable objective and leave enough **flexibility** to allow the “real life” regional characteristics to be integrated. This definition also needs to enable **measurable characteristics** that organisations can strive for, boosting collaboration and growth.

3 Defining a Digital Innovation Hub

3.1 Components of a definition

Today, DIHs are at the core of the digitalization strategy of the European Commission, many Member States and of many other non-EU countries. Governments see innovation-oriented public private partnerships as key to link their public research to creating innovative business. Sharing innovative infrastructures and expertise, combined with boosting collaboration between all innovation partners is seen as crucial to create a strong regional innovation ecosystem. ***And a DIH is seen as the core mechanism to create a strong, collaborative regional innovation ecosystem where all innovation partners are working together to support SMEs in a specific digital technology[7].***

But defining a DIH on European level requires a fine balance between convergence and flexibility. This fine balance is key to create added value and to ensure that the DIH concept is recognizable and distinguishable across different stakeholders while also flexible enough to fit the different situations across Europe. Therefore, the definition cannot be black and white. The **concept is an instrument** to improve a structural collaboration between the innovation partners in order to boost the uptake of innovative digital technologies.

So, a more operational description of different aspects based on experience will better suit the purpose to understand what a DIH is and create a shared mindset between the EU DIH network stakeholders. With this in mind, four basic elements can be identified:

1) The activities and services deployed to customers and the innovation ecosystem at large;
2) The customers of the DIH, their involvement and the DIH objective towards these customers;
3) Boundary characteristics to further demarcate the DIH;
4) The organizational structure of DIHs as a multi-actor initiatives.

After a description of these elements, the chapter also provides information on the DIH concept with regard to the DIH as a policy instrument, the "digital" aspect and Key Performance Indicators.

3.2 Defining a DIH through its services

The **objective of a DIH is to support SMEs** with the uptake of digital technologies, so the DIH can be defined by the services they provide to these SMEs. The first set of services are the **technological services**, supporting the development of new innovations based on technological infrastructure and expertise. This is often referred to as "test before invest" function but could include everything from testing to support in R&D collaborative projects.

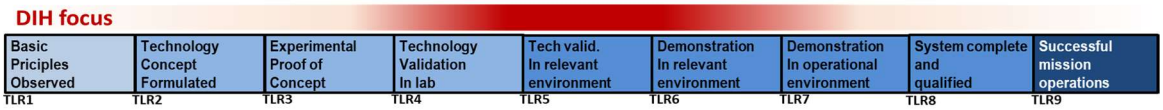


Figure 7:The focus of a DIH is on TRL4-7, not excluding connection to other TRL levels.

[7] Although a Digital Innovation Hub is focused on organizing the regional innovation ecosystem on a specific digital technology, the DIH concept is also applicable for other technologies. An example are the Dutch Fieldlabs, which are not limited to digital technologies; the Dutch fieldlab DOC provides innovative optical solutions to SMEs, following the DIH approach.

Infineon[5] experienced problems with cost efficiency of a new manufacturing system to produce wafers for their next generation energy chips at TRL6. Fundamental research was conducted, resulting in a new substrate. This shows that high TRL position innovations still can require low TRL research.

Often discussions on the definition of a DIH are about what **TRL levels** it supports. As one of its core objectives is to facilitate the translation from research into business, a DIH emphasis is clearly on TRL 4-7. However, the TRL approach is single technology oriented and innovations are often **multiple technologies**[8]. Also it is a **misconception** that there is no research to be done in the higher TRL levels. The core mission of a DIH is to ensure that the "innovation relay game" is organized, **orchestrating** the connection between different **product** and **manufacturing** related technology developments.

Next to the technology services, the uptake of technologies also requires **business services**. These will help an SME to adjust its organization and actions to the market and the changes brought by digitization (including supporting **access to finance**).

The DIH is also a connector (spider in the web) in the region and offers **ecosystem services**, to boost regional innovation ecosystem. Focused on a specific technology, it brings together the different stakeholders in the innovation relay game to ensure a collaborative network of partners to enhance the quality of the collaboration in the region.

Because one of the biggest problems today is finding qualified personnel, DIHs also offers **skills training and education.** This ensures that their customers have the capacities to implement the new technologies. Skills and training are horizontal, covering skills in technology, business and ecosystem related topics.

A more detailed overview of these four type of services can be seen in Figure 8.

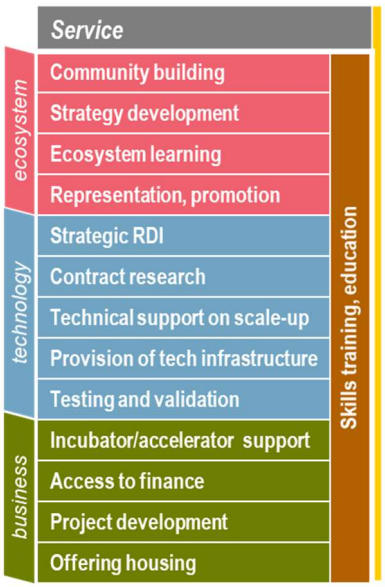


Figure 8: Services offered by DIHs, defining and demarcating the concept.

It is crucial that a DIH provides a portfolio of services, including technological, ecosystem and business support functions. Only by providing this mixed portfolio DIHs can address the different needs of companies in their digital transformation. An important principle that should be observed in the process of developing a service portfolio for the DIH is that it should not compete with or replace services already provided by existing parties. Rather, the DIH should integrate the services of market providers – while developing itself only those services that the market does not provide (market failure).

3.3 Who are its customers

The second element that defines a DIH is the customers that they deploy those services to. Looking at its main objectives, it can be said that SMEs are the main customers. There are several "market

[8] Next to the Technology Readiness Level scale that focuses on the product, also the Manufacturing Readiness Level (MRL) scale is relevant, focusing on the manufacturability of a product. A DIH addresses both.

failures" is strong with this type of companies[9]. However, there is no one SME and therefore a more in depth assessment is needed.

Based on the "Rogers" diffusion of innovations curve, five different types of adopters can be distinguished[10]: innovators, early adopters, early majority, late majority and laggards. It can be stated that the primary customer type of the DIHs are early adopters. However, also the innovators and early majority are important customer groups[11]:

- The **innovators** are important, as they are the first to explore the potential benefits from innovative technologies. This customer type is therefore an important innovation partner to a DIH. The services for these customers are more technology oriented, as they typically are knowledgeable on how to creating business with their innovation. Their focus is on lower TRL levels (TRL3-5).
- However, a special sub-set of these innovators are the **start-ups**. Although they are often focused on innovative new products (with related low-TRL services), they need the more business support.

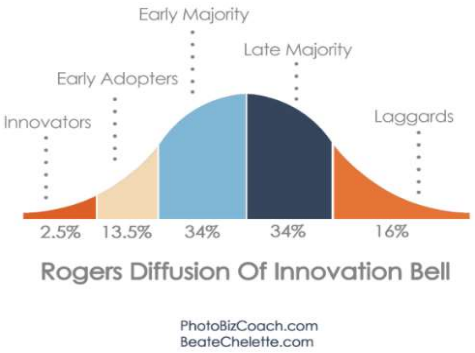


Figure 9: "Rogers" innovation adoption curve (source: Communicatie KC).

- Core to the DIH customer group are the **early adopters**. They focus on the adoption of state of the art existing technologies. However, often the integration/adoption of these technologies require fundamental tweaking. The activities therefore are mid-TRL (4-7) and include both prototyping and demonstrator activities. They also include the business support services.
- The **early majority** is about companies that need showcases to implement innovative solutions, without extensive tweaking (TRL6-9). This customer type would not be the primary customer of the DIH, but e.g, awareness creation and demonstration can be deployed.

An important characteristic of an SME is that contrary to large firms, the scope of their innovation activities mostly are resource-wise focused (one new product type). Large companies usually have a multiple product type focus, allowing a portfolio approach. This leads to a more structural, long-term approach for capacity/capability building.

Next to the SMEs, in the last years the Commission included **Mid-caps** to the core customers. These can be defined as somewhat larger companies that still don't have a fully functioning innovation capacity and small innovation portfolio. Therefore market failures are still seen and sharing is an important mechanism to cross the valley of death.

But **large firms** are still an important customer group. Although they are not in the core mission of a DIH, they are instrumental to the sustainability and overall functioning of the DIH. Involving them will increase the critical mass of activities and allow the DIH to improve its capacities (expertise and infra) to service SMEs. Part of this group are also **industrial service providers** (usually larger companies).

[9] The presence of market failures are a requirement for governmental intervention.
[10] Rogers, Everett M. (1962). Diffusion of innovations (1st ed.). New York: Free Press of Glencoe. OCLC 254636.
[11] The late-majority and laggards are not customers for the DIHs.

They offer consultancy services to SMEs, and/or provide innovative state of the art technological infrastructure (equipment/products/software).

The different sectors as well as the general regional awareness of (digital) innovative solutions are also likely to influence the customers, the service offering and the governance of the DIH. For example SMEs in advanced manufacturing are likely to find digitization more relevant than SMEs in traditional industries. Similarly, start-ups are more likely to seek innovation than incumbents.

A last more indirect customer type are "**governments"** or public administration. Although the EU-wide mapping and local varieties makes the analysis complex, the first subtype are the **regional/local governments** that are looking to enhance the quality of their regional innovation ecosystem. DIHs can address their needs. The services offered are especially focused on network support to the regional innovation ecosystem, but they would also co-fund more business and technological services for individual regional SMEs. **National governments** is a customer type when the technological/sectoral focus of the DIH has a national scope. The Commission is a customer type if the technological/sectoral focus still has an emerging character, or the need for interregional, trans-EU collaboration is strong.

3.4 Boundary conditions and characteristics

Although these services and customer types are already highly demarcating the DIH concept, some additional characteristics can also be seen as important:

- The **open innovation** character of the entity is considered an important requirement. This means that partners, as well as new customers can come and go to the DIH.
- DIHs should focus on **supporting the (regional) ecosystem**, taking a spider in the web approach.
- DIHs support SMEs/MidCaps in crossing the valley of death, **connecting research with actual business**.
- DIHs are **industry driven, but not industry/company owned,** to ensure that the benefits of the DIH will not be flowing towards specific companies.
- The **mission** of the DIH is mostly **society driven**. As a consequence, DIHs do not pursuit profit, but are focused on boosting the regional ecosystem.
- Because of the society driven and "not-for-profit" character, DIHs are often **public/private partnerships**. The initial public influence and funding will reduce after time as the industry driven will translate in increase of private funds. However, it is expected that some public funding will be needed because of its customers being SMEs and societal mission.
- DIHs provide a mix of commercial and public services and are financed from a variety of public and private sources (financial engineering). To ensure the DIH long-term financial sustainability requires a financing plan that includes both revenues from commercial services (fees) and investments in the DIH that cannot easily be recovered through service provision (e.g. promotion, awareness creation dissemination, pre-competitive R&D, etc.)
- DIHs act as a **one-stop-shop** for SMEs/MidCaps to support them take up innovative digital technologies. This leads naturally to the fact that DIHs are often multi-actor organizations. Although DIHs do not need to have all services available in their organization, they should have direct access to these services through active partnerships.

3.5 Organisational features

The last element to the definition of a DIH is its organizational characteristics. As already said, DIHs are usually a **multi-actor organization**, allowing full support of the innovation chain, making use of existing competences in the region. This is needed to ensure that the different services an SME needs are provided in a systemic and efficient way. These organisations include not only departments of RTOs and universities that can provide the technology infrastructure and accompanying expertise, but also organisations like incubators, accelerators, and/or cluster/network organisations to provide the ecosystem and business services. To ensure access to finance, often formal participation of regional development agencies is seen.

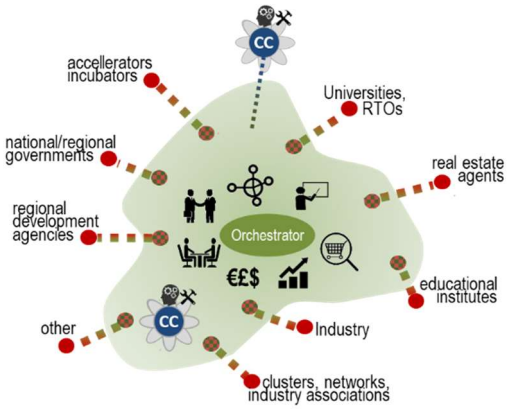


Figure 10: Graphical depiction of a DIH.

Last but not least, the DIH is driven by an "orchestrating" organization that coordinates the different activities. Most often, this is a partner organization (often an RTO), but there are also examples of private consultancy companies or public authorities. For example of the Digital Hub Logistics in Dortmund aims to fill the gap between pre-competitive research and the market and relies on the existing ecosystem in the region and its network consisting of the Fraunhofer Institute for Material Flow and Logistics IML and the Fraunhofer Institute for Software and Systems Engineering ISST, EffizienzCluster Management GmbH, and Duis Port, Technical University of Dortmund, Economic Development Agency Dortmund.[12]

3.6 Digitalization as demarcating characteristic

The previous characteristics, services and other indicators are applicable for all innovation hubs, even those not focusing on digitization. For example, the testbeds represented in the EPPN database and focusing on different technologies (e.g. materials innovations) can also be conceptually seen as DIHs and CCs with a different industry/technology area. Also, the pan-EU networks have a flexible focus and the RDNs are by definition agnostic to industry/technology areas.

However, this paper describes the ***Digital*** Innovations Hubs. Therefore, digitization further demarcates the DIH concept.

The European policies[13] underlines 3 key strategic technologies with the Digital European Programme: High Performance Computing, Artificial Intelligence and Cybersecurity. Alongside these three, the proposed regulation add "Advanced Digital skills" to reinforce EU capacities. It is worth noting that also the key strategic technologies are shaped under pillars, bridges and interactions between the four are foreseen and a more detailed observation can map a wide range of technologies. Quantum

[12] https://digitalhublogistics.com/

[13] Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing the Digital Europe programme for the period 2021-2027 (COM(2018) 434)

technologies is probably the best example of that, where Quantum Communication Infrastructure has been added during the negotiations under the cybersecurity pillars.

When it comes to the role of the DIH within the legal text, it is worth mentioning the 2 following points:

1. The document used the terms "Digital and related technologies" when it comes to the provision of digital transformation services
2. The document allow DIH to specialise in specific thematic services and are not required to cover all thematic.

This is actually the heart philosophy of the European policy shaping the DIH concept: each DIH can work on the digital technologies it decides to focus on. The Digitalisation is therefore becoming a strategic decision that shall be taken by the DIH governance.

Obviously, the DIH concept is to give and support competitive advantages to the support ecosystem, the European ecosystem at large under the Digital Europe Programme, the local ecosystem under the local DIH. A focus on the current advanced digital technologies is therefore a natural conclusion: use of High Performance Computing, deployment of Artificial Intelligence, application in Quantum, Cybersecurity in communication, Blockchain takes-up… and so on.

But it becomes then the decision of the local governance and the local authorities to decide the difference of focus according the need of the local ecosystem. In relation to what was said in the section 3.3 of this paper, a regional government can decide:

- to support the lagers to catch up their delays (for example to use digital cloud computing for billing or customers relations);
- to support the innovators to build world-wide leaders in the advanced digital technologies (for example the scale up of the start-up in 5G through technological deployment within the region);
- to focus on a sector (for example by digitalising a sectorial value chain with blockchain);
- to make a mix of the 3 previous ones and even more…

What are the targeted digital technologies will be the strategic decision of the governance of the DIH that will set the course of its work. This is where the close collaboration with public authorities, being European, national, regional or local is key.

On top of that, it is worth noting that the DEP is set within a 7 years framework. And if 3 technological pillars are identified as from today, the advanced digital technologies are most likely to evolve within the lifetime of the DEP and along the lifetime of the DIHs that are supposed to outlive the DEP. A good source of what new digital technologies might emerges would be the outcomes of the Horizon Europe programme, where synergies will be crucial and where DIH will most likely be invited to participate to disseminate the future new advanced digital technologies.

3.7 Key performance indicators for DIHs

Assessment of the performance of a DIH is considered an important aspect of the definition of a DIH. This is also connected to the maturity of the DIH, as these KPIs improve during its lifetime. The KPIs can be used by the DIH-management with regard to operational success, but also to assess quality and possible improvements through benchmarking. Next to this, the KPIs have a third function to inform receiving public co-funding.

With regard to these KPIs, the following clusters of indicators can be distinguished between:

- Overall operational quality indicators, including number of employees, turnover, number of customers and overall public funding.
- Ecosystem coordination and awareness indicators, including information about awareness creation events, social media participation, matchmaking activities.
- Service provision indicators, information about number of individual services provided, additional investments created, customer satisfaction, trainings, projects.
- Interregional collaboration indicators, information about its alignment with RIS3, number of interregional collaborations (and turnover), participation in international events, international partners.

These KPIs must be seen as a flavour of the outcomes and operational characteristics of a DIH. It can be incorporated in its business plan. A full description of these KPIs can be found in the DIHNET paper "Key performance Indicators for European DIH network building blocks".

4 Other look-alike entities (but not DIHs)

To better understand what a DIH is, a description and demarcation of entities that are connected to the core concept is provided in this chapter. As stated above, there are three other core concepts that are directly linked to the DIH concept, but also some other entities can be mentioned.

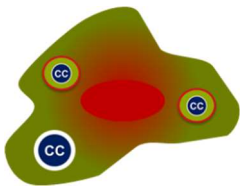
4.1 The Competence Centres defined by their services

The first connected concept to be described is the Competence Centre (CC). These entities formally had a key role in the early phase one of the H2020 programme (notably in I4MS phase 1). Examples of CCs include (departments of) RTOs such as TNO, CEA, Fraunhofer institutes or universities such as Technical University of Munich[14]. However, they overlap with the RTO or university based research/technology centres.

The CCs were the core instrument to support digitisation, facilitating the use of research infrastructures by SMEs. They are highly focused on specific technologies, made operational through e.g., demonstrators, expertise and testing equipment. The business expertise available is usually offered by engineers and is more technical in nature (e.g., what are the technical implications of specific user demands), leading to limited support on e.g., market assessments, finding funding and development of business plans. The CCs focuses on providing state of the art technological infrastructure and direct (mostly technological) expertise, researching/developing new technologies for SMEs and large companies. Activities conducted are e.g., RDI, prototyping supporting scale-up, testing and validation.

Figure 11: The focus of a CC is on the technological services.

4.2 The Regional DIH Networks (RDN) and its nodes defined by their services



The success of the DIH strategy in several regions led to multiple DIHs on different industry/technology domains. In several cases, regional authorities decided to coordinate these scattered entities to better support the regional SMEs. For example, the Dutch SMITZH[15] provides a joint offer of 8 field labs as well as practical and financial support to companies and the Basque BDIH[16] has organized its expertise along six nodes related to specific technologies like cybersecurity of advanced materials.

These regional DIH networks optimise the operation of the their DIHs/CCs. A crucial element to this coordination is that it is more agnostic to specific industry/technology domains. RDN focus on creating a one-stop-shop to regional SMEs, even sometimes beyond the specialised services offered by DIHs/CCs or other suppliers in their region. The Italian IP4FVG for instance operates in a Hub & Spoke model, where the hub coordinates access to the services and expertise present and makes use of territorial access points: the nodes[17].

[14] See for example the HORSE project competence centers here: http://www.horse-project.eu/Competence-Centres
[15] https://www.smitzh.nl/en/
[16] https://basqueindustry.spri.eus/en/basque-digital-innovation-hub/
[17] http://www.ip4fvg.it/metodologia/

If a regional innovation hub network is established, an important consequence is that some of the responsibilities of DIHs on business and ecosystem support are organized on the regional level rather than in each individual DIH. When done properly, this transforms the function of the DIH into an **RDN-node.** This entity still offers a more comprehensive support with regard to a CC, (also supporting more business services), but it uses the collective RDNs expertise to support the ecosystem on e.g. community building and access to finance. The regional innovation hub network does also tend to support the regional network of innovation initiatives by aligning the services and creating an efficient operation. Often the DIHs/CCs in a region are not well connected, as they have no responsibility, or capability, to enhance the innovation ecosystem in general beyond their domain remit.

The differences among CC, DIHs and RDNs is best exemplified by contrasting their services and functions in the ecosystem. These differences and the shift of responsibilities when a RDN emerges are shown in the figure below.[18]

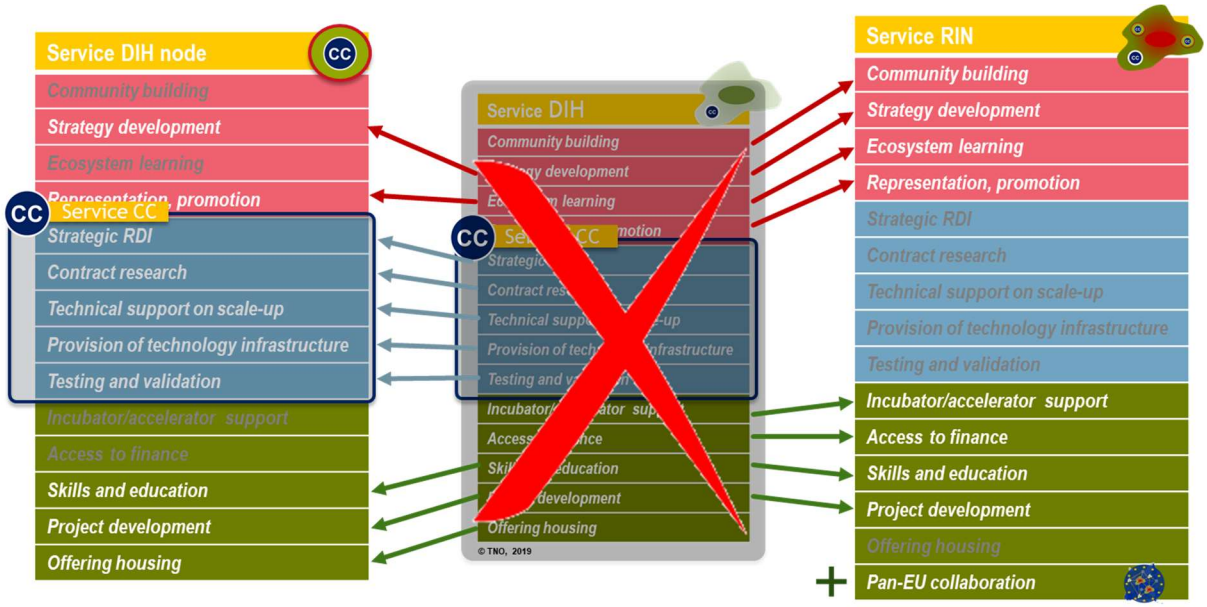


Figure 12 Distinguishing among DIH-node, DIH, and regional innovation hub network services (source TNO 2019)

With regard to its characteristics, a RDN-node has no essential characteristics changed compared with a DIH. However, with a DIH the ecosystem support has a more general character, where the DIH-node will have a more industry/technology area focus. The organisational characteristics will change as the full coordinating "spider in the web" structure will be organised by the RDN in close collaboration with the RDN-node.

[18] If a RDN is established, it is likely that the one-stop-shop function would be shifted from the individual DIH-node to the RDN which can support a company in finding the right competence.

4.3 Pan-European networks defined by their services

The last complementary building block relates to pan-EU DIH networks. As boosting the EU collaboration is the core mission of the European Commission, these pan-EU networks are almost always supported by the EC. Currently, this support is often provided via Horizon 2020 and the respective Innovation Actions and CSAs (e.g. RODIN is the CSA for five IAs, each establishing a network of robotics DIHs in different sectors; SmartAgriHubs includes a network of more than 140 hubs in agriculture).

Innovation Actions are focused on specific industry/technology areas, like robotics, manufacturing, photonics. Nowadays, many IAs connect DIHs and CCs from different regions and provide a network that offers cross-border support. The Coordinating Support Actions (CSA) offer complementary support by coordinating and aligning activities of the different IAs within one industry/technology area family. These pan-EU networks also support ecosystem/technology/business/skills services, but all within the perspective of pan-EU collaboration. An overview with possible services for pan-EU networks is provided in Figure 13.

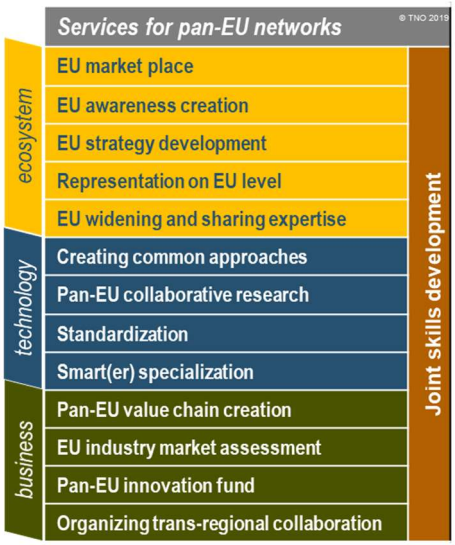


Figure 13 Possible services provided by pan-EU networks (source TNO 2019)

Looking at the possible services/functions of pan-EU networks, one can conclude that they have a connected but fundamentally different role than the other entities in the DIH community. The main mission of pan-EU networks is to support the DIHs/CCs with their pan-EU collaboration and actively make connection between the different actors in a specific industry/technology area. The relations between the DIHs/CCs and the pan-EU networks is shown in Figure 14.

The pan-EU network and collaboration is often funded by the Commission, not only to enable networking activities but also to create a fund to support companies to take up the digital technologies (e.g. FSTP funding for experiments). Also, these funds are used to financially support the DIHs/CCs to provide the services. The EU-network is responsible for the initiation of the EU collaboration and coordinating the EU DIH community on a specific industry/technology area. Next to this, the RDNs are connected to support the actual interregional collaboration.

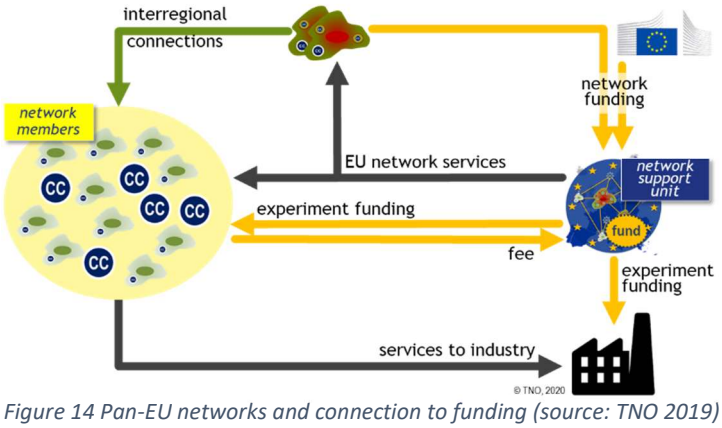


Figure 14 Pan-EU networks and connection to funding (source: TNO 2019)

4.4 Other related entities

Next to these three directly connected building blocks, there are many other organisations that are member of the EU DIH community. Some of them are often **mistaken as being a DIH** and therefore are to be discussed to further demarcate the DIH concept.

Research and Technology Organisation (RTO) are often mentioned as DIHs. In many DIHs the RTOs *are* one of the **critical partners**, but they usually do not have the capacity to offer all the needed services to SMEs. Even though many RTOs also have network/business service capacities, their main function/mission is related to technology development (CC). Also, they are mostly networks, with departments that have a specific industry/technology orientation with related technological infrastructures/expertise. So, it can be said that an RTO is a key partner and can support many DIHs, acting as the CCs within the DIH organization. RTOs are often an initiator of a DIH.

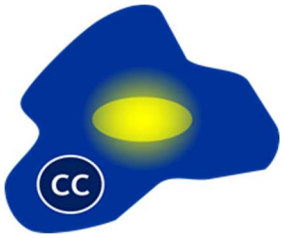
Entities such as **testbeds** could also perform similar functions especially to a CC, providing a experimentation and testing environments. However, there are EU initiatives currently developing networks of testbeds as well as developing the innovation ecosystem in which they operate, thus expanding the concept with further functions.

Cluster/network organisations are often suggested as DIHs. As the mission of these organisations is to create (industrial) innovation networks it is not a surprise that they are highly related to the DIHs. In many cases, these types of organisation act as the orchestrator of a DIH, as they have high quality capacities to organise the innovation ecosystem community. However, typically these clusters/networks do not have the technological infrastructure, as well as (some of the) business service expertise. Therefore, they need to partner with Competence Centres (RTOs, Universities, etc) and in some cases other stakeholder to provide a mixed portfolio of services. This cooperation in a multi-partner entity often forms the DIH concept.

As skills increasingly are seen as a critical service, **universities (of applied science) and vocational education institutes** are seen relevant. Although they can provide this service (as well as access to technological infrastructure), their position in the innovation ecosystem is often too limited to act as a full DIH. As with clusters/networks, these can operate as an orchestrator or critical partner to a DIH.

4.5 Epilogue: The upcoming European DIHs

The Commission has announced the **Digital Europe Programme (DEP)** as a new strategic programme to boost the further uptake of digitalization in the European industry. Although its strategy and even acceptance is not yet formalized, it is more than likely that it will become adopted by the Member States. DIHs are seen as key pillar to the DEP, key in facilitating the uptake of digital technologies. But DEP also introduces the concept of European DIH (EDIH). The DEP aims at establishing a EDIH in every EU region, boosting digitization in their ecosystem. But how is a EDIH related to a DIH?



EDIHs can be seen as DIHs (or RDNs) with an additional function: strengthen the EU DIH community. They are focused on creating pan-EU collaboration, facilitating the use of expertise of place based regional expertise on a pan-EU level. These EDIHs can be seen as selected DIHs/RDNs, structurally incorporating its responsibility to establish EU collaboration in the EDIH mission. A DIHNET paper is under construction to describe the EDIH in its context.

5 Conclusions

5.1 A defining framework for the DIH concept

Concluding from the past descriptions on the DIH concept and its contextual position, the DIH can be defined in four parts. The first part focuses on the services it delivers, the second part of some core characteristics, the third on the customers of the DIH, and the fourth the organisational structure.

The services provided should fully support the tweaking and uptake digital technologies by SMEs and MidCaps, as well as orchestrating their regional innovation ecosystem. In Figure 15, an overview is provided of the services that can to be addressed by a DIH. Although some services might not be fully covered by the DIH (grey), a mixed portfolio of business, ecosystem and technology, as well as skills services is seen as crucial. The TRL focus is on TRL4-7, but also services on higher and lower TRL levels are common.

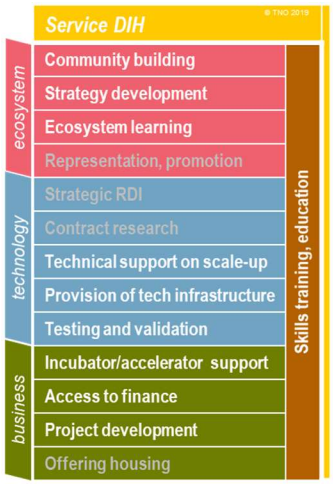


Figure 15 Services offered by DIHs

DIHs often target SMEs and MidCaps in order to address a market failure. Looking at the innovation level of companies, DIHs usually focus on early adopters as their the primary customer group. However, also the innovators and early majority are important customer groups[19]. Large firms are often customers to the DIH, either to create a sustainable critical mass of commercial service delivery or connected vendors for state of the art technological infrastructure capacity.

Next to these service provision activities, some core characteristics are to be met:

- DIHs support SMEs/MidCaps in crossing the valley of death, **connecting research with actual business**.
- A DIH **supports the (regional) innovation ecosystem** collaboration on a specific industry/technology area.
- The **mission** of the DIH is **society driven**. There is no pursuit of profit.
- It has an **Open Innovation** character**:** The DIH should be open to new partners and customers.
- A DIH is **industry driven, but not industry owned**.

A DIHs is a **one-stop-shop** for SMEs/MidCaps to support them with the take-up of innovative digital technologies. However, this does not imply that all services and capacities are available within the DIH. This can also be organized by **collaborations with other service providers in the region** (or even outside). However, this collaboration should have a structural character, based on actual shared activities and going beyond the mere "telephone book" connections. A **key building block** of the DIH is a CC that offers the technological services, but it is accompanied formal partners that offer the ecosystem and business services. The DIH is **coordinated by an orchestrator** that is responsible for its consortium collaboration, based on its innovation management capacities.

[19] The late-majority and laggards are not customers for the DIHs.

Services	Characteristics	Organisation
Core: Support the uptake of technologies	Connecting research/business	One-stop-shop
Providing technological services	Supporting regional ecosystem	Structural collaboration with partners
Providing business services	Society driven, no pursuit of profit	CC as key building block
Providing ecosystem services	Open innovation character	It has an central orchestrator
Providing education/training services	Industry driven, not owned	Acts as spider in the web
	Supporting SMEs/Midcaps, focusing on early adopters, innovators and early majority	

Figure 16: Overview of defining characteristics of a DIH.

5.2 Some observations from an evolutionary perspective

Chapter four creates a structural view on what a DIH is. However, this must be seen as an "beckoning perspective" that can be used to further develop the DIH. In practice, most of the DIHs will not address all the described characteristics. An evolutionary approach is needed, especially as a DIH often will be based on an existing CC. Therefore, the following observations can be made:

- Often a DIH will have been engaged in most of the services described and also projects with other regional innovation partners conducted. However, the services and partnerships must be structural. Within the organisation of the DIH, most of the capacities for the services must be available, not through an ad-hoc organisation, but through a structural organisation. This is also the case for partnerships, where these must be based on past shared activities and not just by a "phonebook" connection.
- A DIH is not created out of the blue. It is often based on an existing Competence Centre, or a cluster organisation. Therefore, the evolution towards a full grown DIH can be expected to take some years. However, this does not mean that they are not a DIH; they are in an early stage of development.
- The evolution from a CC often leads to a focus on the technological services in the beginning of the DIH. However, the other services must developed from the beginning on. Especially the networking activities are crucial to ensure that the DIH will have a self-sustaining critical mass of activities. Also, the business services are critical to ensure that actual impact can be made.

5.3 A contextual positioning of the DIH

Looking at different closely connected actors and their functions, the following summary of basic characteristics can be made (see figure below).

If a RDN is set up in a region to coordinate and support multiple DIHs, the DIHs will shift some of their support services to the regional level and will transform into a RDN-node. In this case, the DIH function will be distributed among the RDN and RDN-nodes. The consequence is that the DIH must be seen as an integral part of the regional ecosystem, but with a distributed and multi-DIH organisation. So its mission of supporting the uptake of specific industry/technology focused innovations by SMEs/MidCaps is made operational through a regional structure.

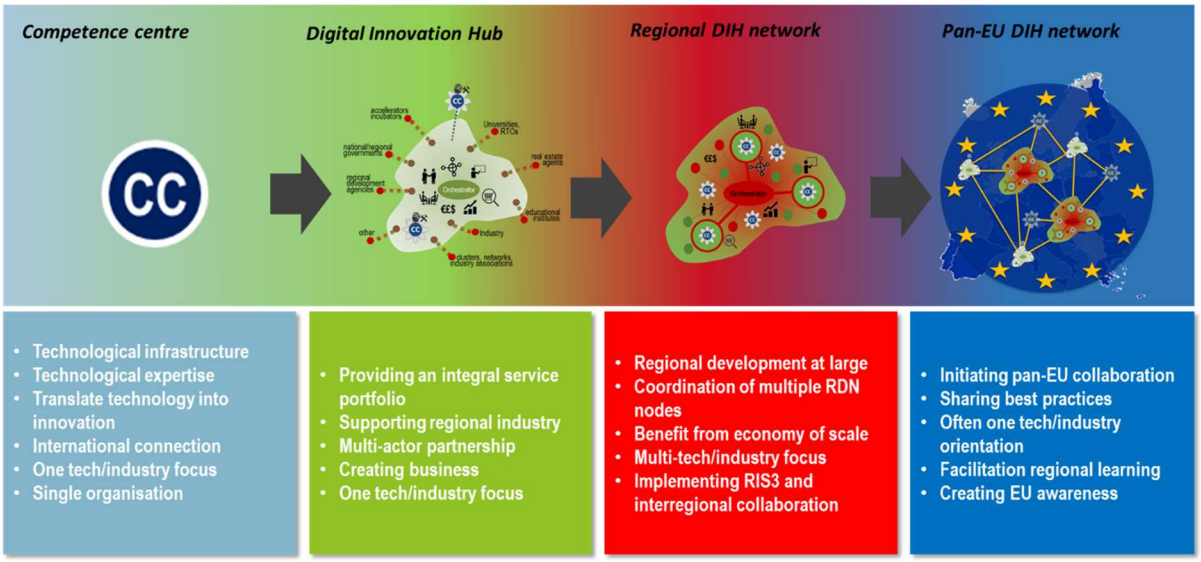


Figure 17: Overview of distinguishing characteristics between the basic EU DIH building blocks.

Although the services provided and additional characteristics will stay the same, the organisation changes. The RDN can be seen as a "super-DIH", coordinating for several more industry/technology area oriented RDN-nodes. The RDNs become the one-stop-shop in the region, facilitating the connection for the nodes to the services they do not provide. The CCs are not the key building blocks anymore, the RDN-nodes are. In some cases, these RDN-nodes will closely resemble a CC. They will still have a central orchestrator, but this will be on the meta-level and the nodes will also have a central orchestrator. The spider in the web function is shifted to the RDN.

The DIHs are primarily focused on supporting their regional ecosystem. The pan-EU networks will support them to increase their network to the pan-EU level. But these networks are fundamentally different then the DIHs. Although very often DIHs are part of the EU-network consortia, they must more be seen as members of an association.

Looking at the definition of the DIHs, the pan-EU networks have no overlap. They provide networking services to help the DIHs to offer their services on a pan-EU level.

5.4 Positioning of the EDIHs

The upcoming EDIHs can be seen as DIHs or RDNs with an additional mission related to support of EU community. Therefore, they need to incorporate this mission as a structural function of their organization with the related expertise and resources. EDIHs do not need to be new entities and can build on already existing initiatives in the region.

Advice by the precursor EDIH network

Informal suggestions from the DIHNET precursor EDIH network on the further development of the EDIH network and Digital Transformation Accelerator

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www.dihnet.eu

Table of Contents

0 Executive summary on the advice 3
1 Introduction 4
1.1 The precursor network to informally explore the EDIH network 4
1.2 Interregional collaboration key to the competitiveness of Europe 4
1.3 The EDIHs: pivotal to connect all regions 5
1.4 Our view on the EDIH network 6
2 Our view on the EDIH network 7
2.1 The of the network is to connect and align the regions 7
2.2 Specialisation to ensure attraction 8
2.3 210 EDIHs; one European network 8
2.4 The DTA: Making sure the network works 9
2.5 Build on existing networks in the European DIH community 11
3 Making the EDIH network operational 12
3.1 Challenges ahead 12
3.2 Business models to ensure sustainable collaboration 12
3.3 The organisation and governance 13
3.4 Financial considerations 14
3.5 Member States also as key stakeholders 14
4 Conclusions and suggestions for next steps 15
4.1 Overall conclusions 15
4.2 Focus of the DTA should be on initiation 16
4.3 Create European value, but leave room for regional implementation 16
4.4 Create an active brokerage functionality to forge collaborations 17
4.5 Create a detailed map of supply and demand and to find complementarities 17
4.6 Be all inclusive for DIHs, but prioritize EDIHs 18
4.7 Ensure institutionally that the DTA is driven by the needs of the EDIHs 19
4.8 Organize the network in subnetworks 19
4.9 Ensuring quality of the network and EDIH quality label 20
4.10 Clarify the use of funding instruments by EDIHs 20
4.11 Develop formalized approaches to facilitate collaboration 20
4.12 Utilize the EDIHs as a tool to implement strategic agendas 21

0 Executive summary on the advice

The report is developed within the framework of the DIHNET project but in strong collaboration by the informal and open DIHNET precursor EDIH network initiated in October 2020. The report provides suggestions towards the European Commission for the further development of the EDIH network.

The overall conclusion from the activities of the precursor network is that EU-collaboration is crucial and there is a strong willingness from the community to actively participate and make it a success. The precursor network suggests that the collaboration can be organized in three layers of organization:

1. Actual EDIH-EDIH collaborations, based on corridors
2. Goal oriented subnetworks, using existing EU-networks as foundation
3. The overall initiation and forging of collaborations by the DTA

The three levels are accompanied by different business models. In these three levels, the actual creation of value and the way the value is capitalized is fundamentally different.

The report outlines 11 main suggestions, which could further develop the EDIH strategy and support collaboration. Many of the suggestions relate to the coordination and organization of the EDIH network and the supporting activities of the Digital Technology Accelerators. Therefore, these could support the Commission services in further planning the connection between the EDIHs and the DTA as well as the future DTA in evaluating the needs of the candidate EDIHs. The 11 suggestions are:

1. Focus the activities of the DTA on setting the boundary conditions and initiating collaborations;
2. The approach to the EDIH network is to create European value, but ensure room for regional implementation;
3. A (database) marketplace has limited added value. Instead an active brokerage functionality is needed, where access to information is connected to active brokerage support;
4. A detailed map of supply and demand is needed to find complementarities, using a distributed collection mechanism with all EDIHs.
5. The EDIH network should be all inclusive for DIHs, but prioritize on supporting the EDIHs.
6. The DTA should be driven by the needs of the EDIHs and this should be institutionally embedded.
7. Organize the EDIH network in subnetworks, making use of existing other EU-networks.
8. Ensure the quality of the network, using a EDIH quality label. But make sure that this a pro-active constructive approach that allows a positive commitment of the EDIHs.
9. Clarify the use of funding instruments by EDIHs, focusing on how to deal with the EDIH network, the DTA activities and the interregional EDIH collaborations.
10. Develop formalized approaches to facilitate collaboration to make the operations more concrete, practical and efficient through economies of scale.
11. Utilize the EDIHs as a tool to implement strategic agendas, as they will be a pivotal structure in the regions for research, development, innovation and deployment.

1 Introduction

1.1 The precursor network to informally explore the EDIH network

The precursor EDIH network was initiated by DIHNET in October 2020. It is an informal, open, voluntary network and includes over 60 potential EDIHs and other relevant organisations. Around 90 representatives and experts participated and contributed to the precursor meetings and discussions. Four working groups explored topics related to activities, business models, governance and organization and sand-box activities related to the EDIH.

This report is an **advice** from the informal **precursor EDIH network** to the European Commission for the further development of the EDIH strategy.

The precursor network was initiated within the context of the coming Digital Europe Programme, announcing the financial support of up to **210 European Digital Innovation Hubs** (EDIHs) in Europe. Included in this strategy is also the support of this **network** of EDIHs by a **coordinator** that forges/boost their collaboration: The Digital Transformation Accelerator (DTA).

The report has been developed within the framework of the **DIHNET project**, in close collaboration with a limited number of representatives of organisations that are developing a proposal to become an EDIHs. DIHNET includes a work package for post-project sustainability. In consultation with the Commission, DIHNET adjusted its activities to explore the creation of such a network and its coordinator. This was taken up by setting up an informal precursor network, in which organisations were invited to discuss this collaborative EDIH network and the DTA with regard to business models and organisation.

1.2 Interregional collaboration key to the competitiveness of Europe

The EDIHs are seen as an important instrument to boost regional capacities and support European collaboration. Where the **individual EDIHs** have a **local** function, the overall aim of the **EDIH network** is to enhance the European collaboration (the **EU function**). The following points are important arguments for the European collaboration:

- **Easy access to leading edge technologies and skills/expertise at European level**
  The interregional collaboration makes available competences from individual regions to other regions, complementing their shortage (import/export). It also includes the interregional use of available capital intensive “state-of-the-art” infrastructures developed
- **Support and initiate new business opportunities**
  To broaden and reinforce innovative markets by supporting access industry and research in other European regions. Allowing/supporting access to each other’s markets will enhance the competitiveness of the regional industries and new business creation, also facilitating the creation of pan-EU value chains.
- **Increasing the global excellence of European specialisms**
  Joint/complementary development of specific advanced digital technologies will boost Europe global leadership. Access to a network will allow the individual members to deliver and deploy technologies in variety of sectors. Interoperability and combined regional markets will improve economy of scale and use of capacities and capabilities.
- **Using regional experiences to build pan-EU EDIH capabilities**
  Best practices developed in one region can be used in others, mirroring successful setups and

use of new knowledge developed through participation in DEP activities. Also, less mature hubs can learn from more mature hubs (widening).

- **Increase the impact of public and private capital investments**
  Collaboration and aligning regional, national and European investments in innovation, avoids duplication and reduces overhead. Available infrastructures will be better used/aligned, as well as interregional of the public support system.

- **The European Single Digital Market to grow champions**
  Supporting further access to private funding at Pan-European level through collaborations between European regions will also further contribute to reaching the European Single Digital Market objectives and will facilitate the growth of European champions in the European green and digital transformation. European champions are key to generate fertile ecosystems across Europe for the benefits of all European start-ups and SMEs

To actually benefit from these opportunities, a network is needed that facilitates these collaborations.

1.3 The EDIHs: pivotal to connect all regions

Being "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",[1] EDIHs are seen as a key tool to provide access to technology testing and support of digital transformation in their region.

The objective of the Digital Europe Programme is to have approximately 210 EDIHs across Europe,[2] which will be able to address the digital transformation challenges faced by many regions and SMEs in Europe. Through the EDIHs, SMEs across Europe are expected to be supported with the deployment of advanced digital technologies. While the DEP highlights HPC, AI and cybersecurity as priority technologies, the EDIHs are expected to support the industry at large with the twin transitions – green and digital. They will provide providing industry and public sector with support on broader range of technologies. The EDIHs therefore are positioned as a key mechanism to reach industry and the public sector, offering support in their digital transformation.

The EDIHs will have an important function to **support the regional ecosystem**, strengthening the overall regional capacities and developing further specialization. But the EDIHs will also have an important function to **connect to European strengths and support EU-collaboration**. In this way, the capacities across Europe can be utilized and this will contribute to the overall European added value. This European function is especially crucial to the EDIH network and the DTA.

[1] European Commission (2021), "European Digital Innovation Hubs in Digital Europe Programme: Draft working document 25 01 2021", page 7.
[2] The foreseen distribution of funding of Digital Europe Programme for EDIHs in all MS is between 107 (min hubs) and 211 max. number of hubs (recommended) but is subject to adaptation once a final decision on the budgets have been taken. For more information, see European Commission (2021), "European Digital Innovation Hubs in Digital Europe Programme: Draft working document 25 01 2021", page 30.

1.4 Our view on the EDIH network

It is clear that the EDIHs will not act in a vacuum, but need to be embedded in the regional ecosystem and collaborate to ensure that the European added value can be achieved. To optimally organise this European network, we see three main elements of this network:

- **The individual EDIHs**, which will be selected and will provide services to SMEs and public sector in their local ecosystem. The EDIHs can also be seen as a stronghold and connection to the **local** innovation capacities, competence centres, etc.
- The **Network of EDIHs.** The connected individual EDIHs will provide opportunities to each other regions, learn from peers and access capacities and expertise in other regions.
- **The coordinating DTA:** The Digital Technology Accelerator will support the network, by providing tools, facilitating the collaborations, initiating joint activities.

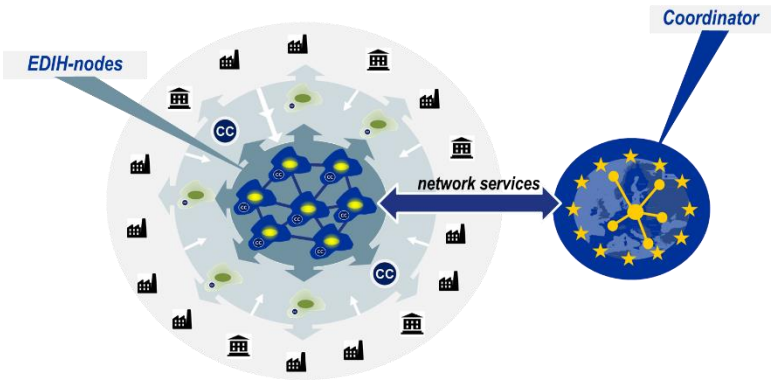


Figure 1: View on the EDIH network

Our view on these three elements is provided in the following chapters.

2 Our view on the EDIH network

2.1 The of the network is to connect and align the regions

The **vision** for the **individual EDIHs** is that the support of digital transformation is mostly done in the regions. A close proximity and active participation in regional ecosystems is crucial to ensure an efficient and effective support of the industry in order to uptake the advanced digital technologies. The place-based characteristics of the region and the existing partnerships and regional networks will be key to this support. Also, the regional characteristic will shape the way this support is organised.

However, the overall **vision** for the EDIHs is that to optimally benefits from advanced digital technologies, a strong **European collaboration** is needed to use the regional/national public investments and place-based capacities/capabilities. This collaboration will lead to a more competitive European industry, keeping regional specialisms, but making these regional capacities and specialisms available on European level and generating new European added value. This mechanism that regional specialisms can strengthen the European industry at large, is not only crucial for competitiveness, but also for other "grand challenges", because of the enabling character of advanced digital technologies.

So, the **mission** of the **European EDIH network and member EDIHs** is to ensure that the benefits of interregional, European collaboration on digital transformation is cashed in. The EDIH network then ensures that available capacities/capabilities within regions are made available for other regions, as well as that their regional needs can be fulfilled by capacities/capabilities from other regions. The underlying EDIHs then are the gateway from/to other regions. Also, it is the mission of the collective EDIHs and its network to improve the interoperability of European public services, industrial digital solutions and digital skills.

We see the following **objectives and added value** as key to the **EDIH network**:

- A joined/aligned communication on European activities, leading to a **better awareness** on the benefits of advanced digital technologies and added value of European collaboration;
- Creating more impact by enabling the **pan-European use of state-of-the-art** European and regional infrastructures and expertise.
- Enhance the **quality of the European innovation ecosystem**, allowing (initiation of) EU-collaboration to be easier.
- **Initiating/enhancing the number of** actual interregional research/industry/government **collaborations** through pro-active brokerage.
- **Enhancing the regional quality of the support** of digital transformation by peer-to-peer learning and sharing best practices between the individual EDIHs.
- **Increased availability of skills in Europe** through increased access to regional available skills and joined development of skills and expertise;
- **Better access to finance** for interregional collaborations on digital transformation by increased (public and/or private) financial support.
- Support to creating **sustainable corridors** of collaboration between different regions and reducing the barriers for interregional and EU collaboration.

2.2 Specialisation to ensure attraction

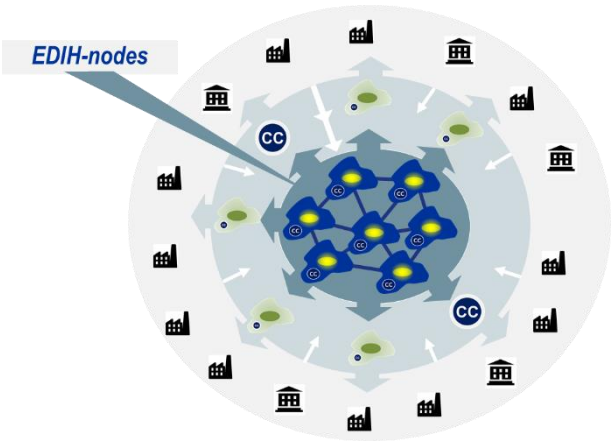
The EDIHs all have their specialism. These specialisms are based on their regional strengths, their place-based (regional) research and industry capabilities as well as their own regional innovation ecosystem. Although the primary function of the EDIHs is local, the EDIHs improve their specialisms to both strengthen their region, as well as increase their added value to other regions. Using the specialisms as a USP, they stimulate the European smart specialisation. And attract collaboration!

Looking at the precursor network partners, most look at the specialisms as a combination between specific advanced digital technologies and a market demand (sectoral). Sometimes specific industrial/societal challenge is used to further demarcate the specialism. This is often based on the industrial characteristics of the region and existing research infrastructures/expertise.

An assessment of the precursor network partners (via a survey) specialism shows that this specialism is not easy to formulate and made operational. Many take a broad approach to formulate the specialisms, leading to a more inclusive approach. Focal areas are digitization in manufacturing, but also health and data management as well as connection to the twin digital and green transitions[3].

Next to these specialisms, the focus of the activities of the EDIHs are on deployment. The DEP instrument is built around the need to get advanced digital technologies to business and this focus is highly appreciated. However, deployment needs to be founded in research and innovation. And therefore, most of the precursor network partners are based on existing research and innovation oriented DIHs (e.g. as the "orchestrator"), expanded with other regional partners that are complementary with e.g. the focus on deployment.

2.3 210 EDIHs; one European network



The dual function of the EDIH strategy on one side reinforces the region and on the other side strengthens European collaboration. So, the **network** aims at the actual collaborations between the individual EDIHs. The precursor network members see the following **key values created** by this collaboration:

- Access to expertise/infrastructures/markets;
- Access to funding for EU-collaborations;
- Creation of pan-EU value chains;
- Good/best practices of advanced digital technology deployment, as well as common standards, approaches, templates and background information;
- Access to available personnel/experts in other regions (workforce);
- Learning from each other with regard to approaches, infrastructures, best practices;
- Increasing impact through aligning investments.

[3] These findings are subjective, as they are based on the limited number of members of the precursor network. Also, each EDIH is supposed to develop their own specialization based on regional capacities and needs and would therefore vary per market and technology.

An identification of the **contributions** that the EDIHs would be willing to provide, led to the following:

- Co-development joint approaches, sharing good practices and knowledge from own ecosystem;
- The collection of information about the strengths of the regions, including expertise and infrastructures;
- Financing EU-collaborations through a joint innovation voucher strategy to facilitate cross-border collaboration involving the regions;
- Active participation in periodic European EDIH networking events;
- Participate in brokering to boost interregional collaborations b/n regional industries and RO.

The selected EDIHs are also expected to develop their own focus – on a technology, application, market, or a combination. One way to promote the collaboration is to **create sub-networks** which connect EDIH with similar specializations and interest (in a technology or sector) to help exchange ideas and markets. Preferably, the connections should be non-competitive. Such organization in sub-networks will make interactions and collaboration more efficient and effective, while also supporting cross fertilisation. EDIHs will gain both on specific interactions at a sub-network level addressing their core activity, but they will gain also in meeting and interacting with other sub-networks to know better about challenges and expectations faced by other groups. Such dual approach could lead to new European Value proposition.

However, the existing DIHs that will not be selected as EDIHs are still an important part of the community and should be offered access to the EDIH network. They will also be interested to make use of the value of the network and are willing to contribute.

2.4 The DTA: Making sure the network works

The precursor network members stress that to transform the 210 individual EDIHs to a EDIH network requires a coordinating organization. The DTA is seen as a crucial organisation to facilitate between the EDIHs and potential sub-networks to increase economy of scale and initiate the collaborations. Also, overarching, more general activities are to be conducted that increase the efficiency. However, they acknowledge that active participation from the EDIHs is needed and indication on the scale of such participation could support the candidate EDIHs in their application.

An important aspect of the DTA is that it should in general focus on setting the boundary conditions to EU-collaboration, but after a first initiation it should be serving the EDIHs and let the EDIHs take charge of the actual making operational of the collaborations.

An overview of the expectations of the potential EDIHs towards the DTA was provided via a survey.

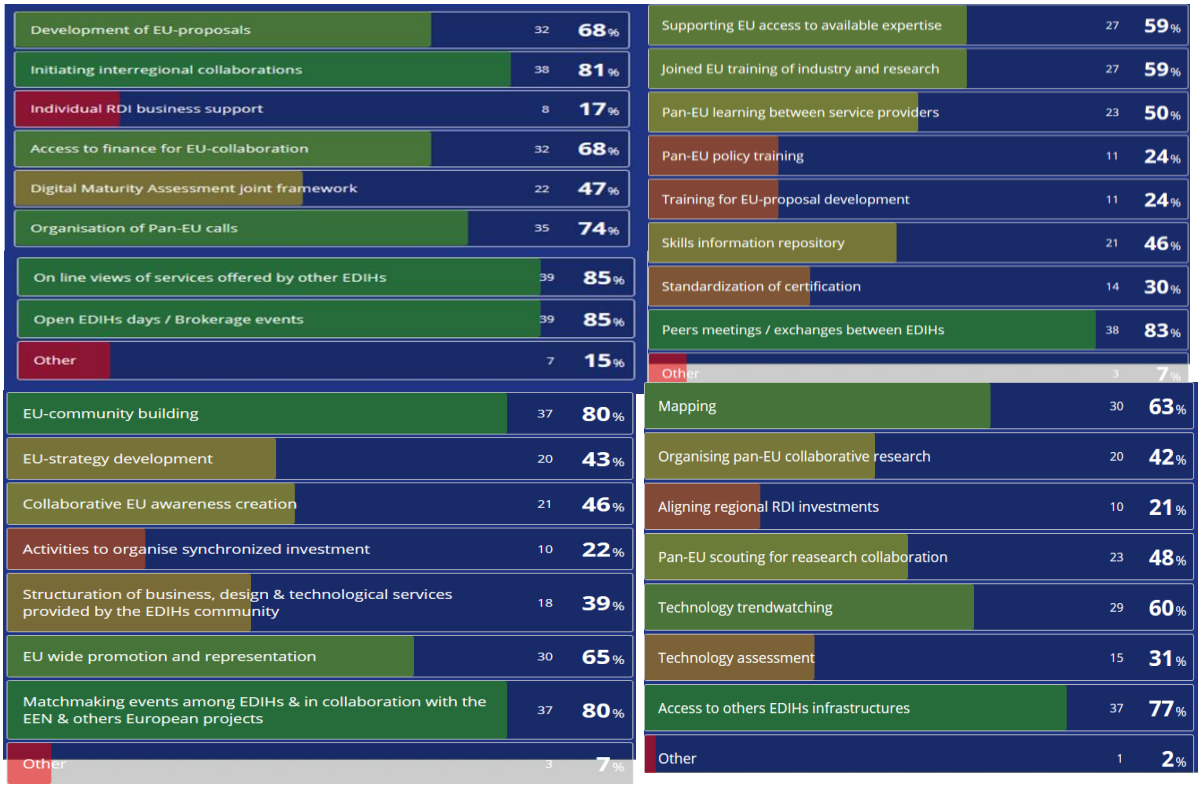


Figure 2: Results from the precursor network survey (N=50) on the future activities of the DTA.

Assessment within the precursor network of the needs that EDIHs have with regard to this coordinator, identified the following needs:

- A common, joined information base that should have a good overview of the members to enable quick connections among EDIHs;
- Common, co-created approaches among the EDIHs and support to liaise with sub-networks in the EDIH network;
- Facilitate/provide boundary conditions and tools to enable the members to seek each other, thereby also facilitating the connection among various sub-groups in the network;
- Initiate connections between EDIHs in the initial stages of collaboration, including exploring the organization of the EDIH network and the possibility to establish sub-networks.
- Support for the EDIHs with access to knowledge on specific technologies (via centres of excellence in HPC, AI, cyber for instance);
- Support of the activities of EDIHs to connect to European infrastructures, for example by exploring sharing of data to develop artificial intelligence enabled products and services;
- Support, tools and mechanisms to facilitate further engagement of funding in their network including private funding. Possible connection with support to DIHs could also be explored if the EDIH network deems this as useful.

- Active networking, including 1) organizing EDIH brokerage events and matchmaking, 2) community building 3) enabling viewing the services of the EDIHs,
- Explore joint activities to support the collaboration and the end users – e.g. activities to organize pan-EU collaborative research or organizing pan-EU call (see below for more examples)

It was considered important that DTA needs to be independent (not industry owned, non-for-profit, not prejudiced on technology/country, etc), but also that the EDIHs need to have a direct influence on the activities of the DTA.

2.5 Build on existing networks in the European DIH community

The network of EDIHs and the DTA will co-exist in a community where DIHs, regional, national and pan-EU networks already exist. Therefore, discussions with the precursor network indicate that the EDIH network should be inclusive, finding ways to also connect to the existing DIHs. In this the, EDIHs could be a connection point to the remaining DIHs in the region (a role that still needs to be explored with the remaining DIHs). Further, a connection with existing networks (e.g. on AI, on agriculture, robotics, etc.) and their role in the collaboration needs to be explored.

Also, it should be highlighted that setting collaborations and establishing trust are time consuming and challenging. Therefore the EDIH network should leverage as much as possible and build on existing collaborations, networks, alliances, associations. The DTA should support the connection of the EDIHs to the other relevant EU initiatives on digital transition, such as EU and international alliances, associations and the partnerships developed under previously by the DIHs, H2020, and the upcoming Horizon Europe programme (EUROHPC, and other of the Digital Industry & space Cluster of HE). Especially the existing and upcoming Innovation Actions and Coordination Support Actions should also be connected to the EDIHs through the DTA.

3 Making the EDIH network operational

3.1 Challenges ahead

One of the main challenges ahead of the EDIH network is to connect and synchronise activities in the DIH and EDIH ecosystem. There are already many DIHs operating and participating in regional, national and EU networks. The EDIHs can be seen as additional entities (even though many of the candidate EDIHs are likely to be built around existing DIHs) in this ecosystem. They can act as a stronghold, representing the regional capacities and at the same time providing regional ecosystem with access to the EDIH network partners, but this requires recognition of such function on all levels.

The following challenges are seen to make an efficient and effective network operational:

- Connect to existing networks, tools and other actors in the EDIH network to ensure that existing activities are optimally used;
- A clear distinction between the roles and responsibilities between the different actors in the EDIH network.
- Create clear focus on what topics the Europe has added value can be beneficial and actual collaboration can be established (connecting local-Europe).
- Find sustainable business models to ensure that European collaboration creates value, but also that value is capitalized and funded.
- Establishing the mechanisms and common approaches among the EDIHs and creating a sense of trust and cooperation among the EDIHs.
- Making sure that the EDIH related activities create an impact, rather then a set of tools and approaches that are not fully accepted and used by the EDIHs.
- How to initiate the participation of the Member States in the EDIH network and DTA.

3.2 Business models to ensure sustainable collaboration

The collaboration between EDIHs are focused on creating added value and the network are committed to creating these collaborations. However, to have a sustainable collaboration requires a business oriented approach, with a balance between providing value and capitalizing the value. Although it was concluded that some public funding always will be needed, a more commercial approach needs to be incorporated. These business models will however be different for the network of EDIHs and for the individual EDIH-EDIH collaboration (possibly supported by the DTA). Even though the two are connected, the value proposition, revenue streams and even needs of the target audience are expected to vary. Further it should be explored whether sub-networks in the EDIH network should be explored and how they will be connected to the network and the EDIHs.

So, three levels of collaboration can be distinguished between:

1. Business models in which the individual EDIHs collaborate to provide direct services through interregional collaboration (paid by companies, public sector (as a direct customer) and regional authorities);
2. Associations of EDIHs (subnetworks) that exploit synergies (scale, efficiency) between its EDIH members and even other existing networks that create platform business (supported by EDIHs, companies and the EC);
3. Network coordination, facilitation (the DTA), mainly focused on the member EDIHs (paid by EC);

Business models accompanied with agreed upon revenue models (could also be tit-for-tat or in-kind) will be needed to provide some structure to the collaborations. In the precursor network it was discussed that the local EDIHs will most probably need to remain the contact point of the companies in order to preserve their position in the local ecosystem and provide service in close proximity.

It is important to notice that the bi and multi-lateral collaborations between the "210 EDIHs", mainly aim to provide services to the peer EDIHs and their customers (SMEs, public sector) or (local) partners. The added value of such collaboration can be multi-faceted but mainly revolves around learning from good practices of other EDIHs, import/export of infrastructures, expertise and innovations. Possible revenue models include tit-for-tat, performance fees, commercial fees, etc. However, alternative transaction methods could be utilized (tokens, points, services). For instance, the DIH HERO project is currently exploring exchange of digital currencies and in Germany, an exchange of tokens with equivalent service/price is explored. When it comes to brokerage fees, SMEs may be willing to pay for brokerage (to local EDIH or even the DTA) provided that there is strong enough need.

It is likely that for the EDIH-EDIH node collaboration, the DTA will be able to provide support, moderate and enable the tools and rules of engagement for the collaboration – a good brokerage platform is essential, trust, confidence in the expertise. Yet, a big challenge remains on how to deal with liabilities among the different services providers (EDIHS, CC, companies) cross-border. Also, ensuring good quality of the services offered by the partner EDIHs and addressing biases towards only partnering with certain partners are challenges for the future network that need to be considered. One option to address this are period assessments of the EDIHs (based on objective criteria) as well as incentives to redress lack of collaboration (e.g. more benefits/support/visibility if EDIH cooperate with # of other EDIHs).

Moreover, a major condition for the sustainability of the EDIHs collaboration is to generate economic value both at EDIH level and especially at European level. DTA can initiate and coordinate EDIHs network to become operational and will have to be part of the discussion on value generation and relevant business models as previously listed previously (tit-for-tat and performance fees). DTA will need to support and provide relevant tools and mechanisms to enable value generation within EDIH network; possible activities could relate to defining relevant KPIs and monitoring the generated value and exploring and encouraging further funding options.

3.3 The organisation and governance

The organization and governance of the EDIH network and establishing a connection with existing initiatives would require a usable and practical approach in order to support the EDIHs and enable the stakeholders to detect opportunities for collaboration. With this in mind, the following elements should be taken into account:

- Inclusiveness The EDIH network should explore how to establish a coherent and effective interaction with other DIHs and existing networks in order to enable the DIH and EDIH community to support and cater for the vast number of SMEs and public authorities in Europe.
- Need to explore how the other existing networks and the DTA and EDIHs will collaborate, including exploring possible subnetworks in the EDIH network.

- Organization of the network in thematic sub-networks based on technology, sector, market specializations, then connected to the actual DTA. Several present Innovation Actions can be seen as candidates to organised these sub-networks.
- For the precursor network which can provide suggestions to the future DTA: involve also DIHs and other networks and start with a light structure.

3.4 Financial considerations

The financial aspect of both the EDIHs and the EDIH node interregional collaborations are an issue to consider. Some of the participants in the precursor network pointed that clarity and case studies on how EDIHs can offer services funded by other programmes (e.g. the DIH is also part of EEN, EIT or Interreg programme) without duplicating efforts but also properly report will be useful. Also, clarification of what the EU grants to EDIHs will be with regard to commercial services are needed.

An important other financial aspect to consider is the funding of interregional collaborations. It is unclear at this moment how these collaborations can be funded. The DTA should be facilitating the further development of a structured approach in which this can be made operational. This issue is also connected to the not-for-profit rule set out in the EDIH guidance and FAQ is as follows. Unless the DEP Model Grant Agreement differs substantially from H2020/HEU MGA, all EDIHs that are constituted as a consortium will, per definition, be unable to provide services on a commercial basis since any income generated will be deducted from the grant. The mixing of public and private money within the hubs will inevitably lead to substantial challenges vis-à-vis the legal framework and financial rules governing European grants. Basic contractual agreements between EDIHs constituted as consortia are not legally enforceable, given that the EDIH is not a legal entity.

3.5 Member States also as key stakeholders

As mentioned, the EDIHs will perform dual function: 1. The first is to **enhance the capacity/capability of the regions** to support digital transformation in their region and 2.The second is to **enhance the EU-collaboration**. For these, the EDIHs are expected to receive funding from both the Member States (or regions) and the EU (through DEP). The EDIHs therefore have two important stakeholders: the Member States which are interested in promoting the national and regional competitiveness and the EC, which is focused on creating scale and efficiency in order to support industry competitiveness. The EDIHs need to balance these interests well while also directly providing practical support to the SMEs. As balance does not come easily, it could be a recommendation to assign the cross-border networking to purpose-built topics and sub-groups.

4 Conclusions and suggestions for next steps

4.1 Overall conclusions

The overall conclusion of our work is that a strong willingness can be expected among the EDIHs to commit and to be actively involved in European collaboration, supported by the DTA. This is driven by a strong acknowledgment that European collaboration is key to the survival of Europe's digital industry, as well as that it must be a joint venture among all EDIHs. We suggest to have a three-layered structure of the EDIH network:

1) The actual interregional collaboration that are initiated between individual EDIHs;
2) Goal-oriented (thematic: technology or application) sub-networks between EDIHs to exploit scale and synergy and how to create further value;
3) The overall initiating and forging of collaborations in a network by the DTA.

These three layers have their own business models and structure, but are intertwined in their operation. The layers should also ensure that the connectivity and operation run smoothly.

Our vision is that the DTA plays a crucial role in setting the boundary conditions for the EDIHs and other stakeholders to benefit from each other's capacities, capabilities, knowledge and experiences. The DTA could also recommend tools and process to the stakeholders to ease the communication and collaboration and operations of the EDIHs. But the regional sovereignty needs to be secured, allowing the EDIHs to benefit optimally and adapt to the local needs and stakeholder requirements. Reducing barriers for collaboration, economy of scale for joined activities, providing information about the strengths of Europe are all seen as added value from the network. One of the pre-requisites of the collaboration is to enable better understanding of each other's expertise, capabilities, capacities, services and focus areas.

So, the actual value for Europe is created by the individual EDIHs at large and therefore it is crucial to ensure that they have an active role in the DTA. Also, the collaboration with other EU-networks need to be ensured to make use of existing values. Even the link or involvement of non-EDIH stakeholders should be ensured, creating an all-inclusive network. But European added value requires that the network evolves towards a structure in which the value created is recognised and awarded by the regional ecosystems.

It is clear that in the early years of the EDIH network, governmental support is crucial and may be needed throughout the lifetime of the EDIHs and the network. Creating these collaborations is difficult and requires exploration towards standardized, efficient approaches. Also establishing trust, active networks, a position in the European innovation ecosystem takes time. However, after its initiation the EU-collaborations need to also have enough value to be capitalized in non-public ways, possibly still with support from public funding. We also believe that in the end, even if limited, public funding support will be needed to ensure that the overall ecosystem is supported (societal mission) and ensure an efficient and effective EU-collaboration so Europe can benefit from our regional strengths. Such next step toward sustainability will have to be designed from the launch of the EDIHs network activities with the support of the DTA.

4.2 Focus of the DTA should be on initiation

It is suggested that the **DTA should focus on supporting and initiating EU-collaboration, leveraging on the EDIH support.** For this, specific activities from the DTA will need to be organized but also the support of the EDIHs will be needed. It is suggested that clarification on the resources that the EDIHs are expected to dedicate as well as the connection among the EDIHs and the DTA are clarified to help the candidate EDIHs in their preparation for the restricted call.

The DTA will especially address collaboration between EDIHs, but the active engagement and initiation of the EDIHs will be needed to form the EDIH-EDIH collaboration. While the DTA and the network itself will need to develop and provide many services, in the short to medium term, it is suggested to focus on:

- Organize the enablers for EDIHs to find each other. This should connect to the previously discussed brokerage, mapping & positioning of the EDIHs, including an agreed taxonomy/ontology and possibly information on how the national EDIH/DIH environment is organized in the different MS.
- Stimulate and enable the EDIH-EDIH interaction, but organizing opportunities to share ideas and good practices on possible cooperation. Also continuous exploration of new approaches for cooperation should be organized.
- Develop and provide opportunities to discuss and co-develop with the EDIHs strategic and long-term vision and plans for the DIH/EDIHs policy in general and to support the EC digital and green strategy.
- Encourage cross fertilization between EDIHs sub-groups to generate new value proposition for exploitation of technologies and to address applications challenges.
- Provide information and connection with experts on particular tech/pillars of DEP
- Link to existing and upcoming networks and DIHs and identify a good governance (see below)
- Support the establishment of rules of collaboration (standard contracts, pricing/tokens/time exchange, etc).
- The DTA could support EDIHs in defining and implementing relevant tools and mechanisms for EDIHs to further engage public funding and private investment.
- DTA could support EDIHs to share good practices and implement recommendations from EIB on access to finance for (E)DIHs in: exploring dedicated debt instrument for digitalisation and exploring dedicated instruments (equity and/or debt for growth capital) for transformative technologies.

4.3 Create European value, but leave room for regional implementation

The EDIHs have a double function: 1) Increasing regional capacities and 2) Gateway to Europe. While coordination on EU level is seen as beneficial, the actual support to the industry and the public sector will mostly happen on the regional level. Therefore, we think it is crucial to **balance European coordination and making it operational on regional level**. The DTA and other European coordinating activities should be setting boundary conditions and more general structures for interregional collaboration, exchange and interoperability, but allowing the actual last step towards the customer to be tweaked for the regional customers. This is needed to adjust to the regional needs, but also to ensure that the EDIHs can create their individual brand that is crucial for their long-term sustainability.

4.4 Create an active brokerage functionality to forge collaborations

To enable EU collaboration among the EDIHs, it is crucial for the EDIHs to be able to find each other and the particular competences and specializations on the other EDIHs. Although there is often discussions about creating only a marketplace (passive), we think its actual benefits would be limited. Instead, the members of the precursor network believe that the creation of an active brokerage functionality would be more beneficial and critical.

To make this operational, it should include two elements. The first is a brokerage platform, in which the EDIHs can showcase demand and supply, underpinned by a systemic and well-organized mapping of the EDIHs and their competencies. The generic platform can be provided and maintained by the DTA but the EDIHs and the subnetworks should be engaged in developing, maintaining and providing the information in agreed taxonomies/ontologies. But the second is that a brokerage service is provided by the DTA in collaboration with the subnetworks that actively support the EDIHs to initiate the collaboration using the strategic information provided. Based on the discussions in the precursor network the following elements were identified as important:

- **focus on usability to find other EDIHs**: while simplicity is desired, the platform should also provide exhaustive enough information on the DIHs to help them identify partners
- **organize detailed mapping:** well-structured but detailed mapping of key aspects for the EDIHs is needed to allow to easily find partners. A balance should be found between making the mapping general enough to be easily used and extensive enough to cover all the aspects of the EDIHs.
- **link to existing domain/technology market places**: there are already a number of market places where DIHs are required to add information. Interoperability needs to be organised or alternatively a 1-time import of data from the present platforms to the new one could be explored.
- explore **linking to existing platforms**, including a systematic discovery of relevant platforms such as the EEN platform which offers a way to post requests towards service providers across Europe.
- **human communication and support** will be needed to complement the brokerage platform: establishing trust among the partners takes time and there will likely be a need for further support in events or one-on-one by the DTA to activate the connections.
- **ensuring connections and active collaborations:** many platforms and marketplace already exist. The DTA and its partners will have to identify and stimulate drivers for collaborations facilitating the use of the different tools set-up. Such drivers and triggers will contribute to the value generation process at local and pan European level.
- **Explore ways to improve the interoperability of European public services** and cross-learning from available solutions for the public administrations

Setting such a brokerage place is a project on itself with significant management and data protection (sensitivity) challenges. Yet, it can be seen as a long-lasting tool needed for the collaboration.

4.5 Create a detailed map of supply and demand and to find complementarities

Highly connected to 4.4 is the creation of a structured approach (taxonomy) to map the EDIHs. This is required to enable cooperation, a good overview of the capabilities of the different EDIHs is needed. It allows creation of a detailed positioning of the EDIHs and map of the supply and demand.

This requires **agreement on taxonomies/ontologies** that would allow finding the right partners. Some of the suggestions in the precursor networks discussion included: information on technologies,

sectors, markets, position in the value chain, end-market, vs technology orientation, infrastructures, information on the national DIH-EDIH landscape. Again, aligned with other existing mapping activities.

To maintain such information up to date, rethinking **the management of the mapping/information** is needed. One option is to have distributed management responsibilities to ensure up-to-date information and easy communication. There is also a need to implement processes to ensure that the information on this mapping of the EDIHs is up to date, trustable and accurate. A balance needs to be found between easy to update system and a process to ensure good quality of the data. The EDIHs and the suggested subnetworks can play a role in both requirements.

Yet, during the discussions, it was noted that next to the mapping of the EDIHs, further measures to stimulate the collaboration and networking, including ensuring that collaboration with different partners to prevent searching for partnership only with west EU for instance, is needed.

The previously mentioned development of the mapping of EDIHs **could be connected to the existing JRC Catalogue**. However, to enable EDIH brokering and inter-regional collaboration, the information collected is at this moment suboptimal. Therefore, it should be explored whether the extra functionalities to enable collaboration could be organized via the Catalogue. Also, possibilities for a restricted access section which allows monitoring of KPIs of the EDIHs could be explored.

Next to this, the collection of information and population of the catalogue should be changed towards a distributed mechanism in which the EDIHs play a crucial role in the data collection. The DTA then should coordinate and organise the validation of the data collected, including e.g. through delegation to the subnetworks.

4.6 Be all inclusive for DIHs, but prioritize EDIHs

The EDIHs are expected to be at the core of the EDIH network, cooperating in order to improve information exchange and collaboration among them. However, there is a need to also **include other DIHs in this collaboration**. This is essential in order to also define the different responsibilities of the core EDIH members and other stakeholders of the European DIH community.

Based on the discussions in the precursor network WGs, it is **recommended that the network should in general be inclusive**, in particular towards **(existing) DIHs**. DIHs are already existing and will continue to serve the local needs. Therefore, alignment and cooperation with them is important. EDIHs could serve as a regional connection to other DIHs but not in all cases as not all DIHs will accept such 'authority' over them. Further, **connection with existing networks** (CSAs, AI DIH network, robotics, etc) and finding synergies with them should be established. This is crucial not only to optimally benefit from existing structures and approaches to create added value for the regions, but also to make use of existing valuable capacities/capability. It will also contribute to share lessons learnt and best practices between activities having different roles but sharing common objectives for the digitization of the European industry. Next to this, both the DEP and Horizon Europe will also support existing and new networks.

To enable such inclusive network, there is a need for:

- Mapping of relationships, synergies and differences between EDIHs and other similar hubs and entities; For this common taxonomy will be needed

- Define a clear structured approach for the collaboration, looking at the roles and responsibilities of these networks and initiatives.
- Coordination from the DTA. This will be important as it could provide a platform to enable the collaboration as well as identify the responsibilities among the various members.
- Low threshold for participation could stimulate the inclusiveness, allowing existing initiatives to hold onto their brand and developed strategies.

4.7 Ensure institutionally that the DTA is driven by the needs of the EDIHs

The DTA is currently envisioned as a separate support mechanism which will help the EDIHs to network and learn from each other, including activities on train-the-trainer and the connection with the specific objectives of the DEP. In this respect, the DTA can support a strategic long-term vision and news ways to collaborate among the EDIHs. The DTA should also support the links with other (financial) programmes and networks in Europe.

However, to ensure that the DTA is actually EDIH driven and responds to the needs of the EDIHS, it is suggested to explore how the EDIHs can be included institutionally in the management of the DTA in the future. This can have the benefits of improved alignment to the needs but also create a sense of ownership (and participation!) from the EDIHs as well as a generating a common European vision. Many options are possible, EDIHs could provide input to the DTA via advisory boards, via inclusion in the management team, election mechanisms for boards in the DTA, possible secondments, etc. This needs to be coordinated with the future EDIHs, EC and the national governments.

As there are many EDIHs, some kind of a rotation to share ideas and provide direction to the DTA can be explored. Continuity of the activities of the DTA can be ensured via the DTA core team (at the start set by the service contract). The EDIHs should also be expected to contribute (with time, ideas) in the development of common approaches, strategies, exchanges, etc. However a way to ensure that all contribute is crucial.

The discussions that took place in the Working Group 3 about the governance of the Precursor Network led to the conclusion that the network should include different types of members:

- EDIHs as core members;
- DIHs as associated partners;
- Existing networks such as SmartAgriHub, EUhubs4data, EUrid... as associated partners

The Precursor Network can be seen as a start, exploring how the connections with such networks can be established. The Precursor networks has started contact with other existing networks that would like to collaborate with this approach, such as SmartAgriHubs, Rodin, I4MS or EUH4D (BigData).

4.8 Organize the network in subnetworks

The future EDIH network is expected to have about 210 EDIHs. Subnetworks with specific focus are a useful concept in between EDIHs and DTA to give as much priority to EU collaboration as to the regional competitiveness. To ease the communication and increase the chances of collaborations, discussions in the precursor network indicated that:

- **forming thematic EDIH sub-networks** should be explored in order to ease the connection among (E)DIHs with similar specialisms. EDIH-EDIH collaboration is expected to be sector/application or technology driven, therefore such networks can provide a common ground among the EDIHs.
- The organization in sub-networks should be **coordinated by a specific organization/projec**t which then interacts with the DTA to align messages and exchange information.
- The **DTA can then orchestrate the sub-networks as well as the more general topics** on collaboration as well as facilitate the organizational and administrative side of organizing such sub-networks

4.9 Ensuring quality of the network and EDIH quality label

The EDIHs will undergo a selection process in order to be granted the EDIH label. It is however crucial to explore how to **establish an EDIH quality level**, potentially indicating different levels. To establish a collaboration, there should be some kind of quality assurance of the services offered also by the other partners in the EDIH network. This quality will initially be provided by the selection process.

During the precursor network discussions, it was suggested that **periodic checks based on previously agreed and very objective criteria** could be a solution. This evaluation can potentially be organized by the DTA (as a neutral body) but clarity of the criteria, objectivity of the results and ease of collection of the information should be ensured. It should however be mentioned that not all precursor members agree with this approach as it might lead to more complexity. Whether additional actions are required should be further explored by the future DTA.

The added value of this evaluation is not only to ensure a quality mechanism, but also drives the further development of the EDIHs. It will structure the development of training programmes, as well as initiate the participation of EDIHs in training programmes.

4.10 Clarify the use of funding instruments by EDIHs

The EDIHs are expected to be funded via the DEP programme and the national/regional funds. However, it should be clarified on EU level, what funds could be used for what activities and how the funds will be distributed (following the EIT approach?). Discussions in the precursor network also indicated that clarification is needed on how the reporting will be organized (single reporting mechanisms of the EDIHs in DEP vs reporting for the different co-funding sources). Further it will be worth clarifying how the EDIHs can use their funding and complementary programmes such as ERDF HE, Invest EU, to directly provide services to the local SMEs.

Special attention is requested for the funding of the interregional collaborations. As the funding of the EDIHs primarily are allocated to the financing of the regional partners, the combined, interregional funding is to be addressed (e.g. funding of joined interregional projects).

4.11 Develop formalized approaches to facilitate collaboration

To enable EDIHs to easily and quickly exchange services among each other, it is suggested that a **standardised contractual arrangement is explored by the future EDIH network**. As suggested in the precursor network discussions, the future DTA could explore a system of services and value for the different services (exchanged between the EDIH-EDIH collaboration). Templates could be provided.

This could lead to a comparatively easier exchange of service/type of payment between EDIHs, avoid individual contracting.

The exchange of services does not necessarily need to follow money exchange. Exchange of tokens, points, time could be explored. This should relate to the services between the two EDIHs. For the service directly provided to an SME, the SME could pay (if payment for these services is needed and not provided for free by local DIH).

4.12 Utilize the EDIHs as a tool to implement strategic agendas

The EDIHs are expected to have close connection to the regional needs and stakeholders as well as support the European added value via collaboration. As such, they are well positioned to support industry and the regional ecosystem in the implementation of strategic priorities (new technologies, more sustainable, green economy, etc) and help companies understand and adopt these.

Annex: Overview of the participating organisations in the open precursor network (as of 8 March 2021)

No	Proposed (E)DIH and other participating organizations	Region	Country
1	IP4FVG	Friuli Venezia Giulia	Italy
2	BDIH	Basque country	Spain
3	EDIH SMITZH	The Rotterdam-The Hague Area	Netherlands
4	NND	Northern Holland region	Netherlands
5	EDIH SNL	Noord-Braband, Zeeland	Netherlands
6	Crobohub	Croatia	Croatia
7	Smart Attica EDIH	Attica Region	Greece
8	Transilvania DIH	Transilvania	Romainia
9	Latvian IT cluster	Latvia	Latvia
10	EDIH4IAE.LT	Central and Western Lithuania	Lithuania
11	Minasmart	Auvergne Rhône Alpes	France
12	DIH Tourism 4.0 CZ		Czech Republic
13	L-hub	Luxemburg	Luxemburg
14	DigIT Hub	Skåne-SW	Sweden
15	Flanders Make	Flanders	Belgium
16	EDIH Robosence	Eastern Netherlands	Netherlands
17	EDIH Saxony	Saxony	Germany
18	Extremadura digital Innovation Hub Tech4E	Extremadura	Spain
19	AIR4S DIH	Madrid	Spain
20	Flanders' Healthtech Hub	Flanders	Belgium
21	AI DIH network	EU	European Union
22	Cybersecurity Innovation Hub	Brno/Jihovýchod	Czech Republic
23	DIHGIGAL	Galicia	Spain
24	DIH Región de Murcia	Murcia	Spain
25	Grand E-nov	Grande Est	France
26	Czech Southwest DIH	Jihozápad/Severozápad	Czech Republic

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27	Digital Hub Logistics Dortmund	Regierungsbezirk Arnsberg, Northrhine-Westfalia	Germany
28	i4CAM HUB	Castilla-La Mancha	Spain
28	i4CAM HUB	Castilla-La Mancha	Spain
29	HPC4Poland EDIH	Wielkopolska	Poland
30	IRIS DIH	Navarra	Spain
31	Inndromeda DIH	Valencia	Spain
32	MADE	Lomerdia/national	Italy
33	Aragon DIH	Aragón	Spain
34	DIHNAMIC	Nouvelle-Aquitaine	France
35	CSEM		Switserland
36	IMEC	Flanders	Belgium
37	DigiTech	Sofia	Bulgaria
38	DIHBIO	Madrid	Spain
39	EDIH AURORA		Norway
40	Zealand Hub		Denmark
41	Balearic Islands DIH	Palma de Mallorca	Spain
42	DIVA -Digital Innovation Value Accelerator	Pays de la Loire	France
43	DIH Marche	Ancona	Italy
44	DIH Silesia Smart Systems	Katowice	Poland
45	DIH5G		Poland
46	iMan Norte Hub		Portugal
47	Irish Manufacturing Research DIH		Ireland
48	ASTER DIH	Emilia-Romagna Region	Italy
49	SUMITY EDIH	Paris	France
50	DIH Confindustria Emilia-Romagna Ricerca	Emilia-Romagna Ricerca	Italy
51	Lithuanian Robotics DIH		Lithuania
52	Agrobofood		European
53	Institute of Entrepreneurship Development (iED)	Larissa	Greece
54	AddedValue DIH	Budapest	Hungary

55	am Lab		Hungary
56	BlueDIH		Croatia
57	DIH-HERO (IA)		European
58	EDIH Vilnius/Sunrise Valley DIH	Vilnius	Lithuania
59	DATAlife	Galicia	Spain
60	Digihall	Ile-de-France (Paris region)	France
61	Dutch Societal Innovation Hub	NL	Netherlands
62	NEDIH, ORION, MOSAIC		Norway
63	TICE	Portugal	Portugal
64	AsDIH (Asturias DIH)	Llanera	Spain
65	University of Belgrade - School of Electrical Engineering (ETF)/Belgrade robotics DIH		Serbia
66	Czech Institute of Robotics, Informatics, and Cybernetics/ Czech Technical University	Prague	Czech Republic

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DMA food for thought – A response from the precursor network

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Authors	Geraud Guilloud Maurits Butters Kristina Karanikolova Pierre-Damien Berger Jean-Jacques Bernardini Paolo Panjek Tereza Samanova
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Table of Contents

1 Reasoning 3
1.1 Introduction to the paper 3
1.2 Reminder of the proposed approach 3
2 Response 4
3 Recommendations: 5

1 Reasoning

1.1 Introduction to the paper

On the 18/05/2021, the European Commission, jointly with JRC and Tecnalia, introduced the first concept of the Digital Maturity Assessment tools and the process approach they are proposing for the future funding EDIH. The purpose of this approach is to enable the Commission and the future Digital Transformation Accelerator to measure at macro level the impact of the EDIH on their respective local economies.

This document is a "droit de réponse" to the proposed approach by the Working Group 4 of the precursor network. This document gathers a consensus view from 12 EDIH candidates and DIH involved in the Working Group 4 to initiate a dialogue and an open discussion.

This document aims at initiating a collaborative co-design to be able EU-wide cooperation and interactions with DMAs.

1.2 Reminder of the proposed approach

The points below summarised the proposed approach presented during the webinar on the 18/05/2021.

- The Commission, with the future EDIH grants, is setting an obligation to report on the advancement of the work and on the impact made by each EDIH
- Among the KPI wished by the EC, there is the measurement of the increase on digital maturity of organisation that have used the services of the EDIH and therefore the data collected with the Digital Maturity Assessments.
- The Commission has presented what it called **"common DMA"** and this wording will be used in the rest of the document.
- **The mandatory report is built on 4 modules (M1, M2, M3 and M4) and to be repeated 3 times (T0, T1 and T2) in the lifetime of the use of the EDIH services by an organisation**
- **The 4 modules are:**
    - **M1: customer data**
    - **M2 Digital maturity assessment**
    - **M3: EDIH support/collaboration**
    - **M4: innovation radar**
- **There are 3 time foreseen:**
    - **T0: before the EDIH services**
    - **T1: 1 year after the use of the EDIH services**
    - **T2: 2 years after T1**
- The Commission is pushing for a common DMA while leaving the possibility for each EDIH to use its own tool.
- The future DTA will play a central role in offering the common DMA, the API for "local" DMA and measuring the impact
- The common DMA is presented as questionnaires for the organisation (more on this below)
- The common DMA is currently in English but they are considering translation

It is worth noting the parallel of this approaches and more specifically on the 4 modules with the EEN approach, especially on the innovation radar and follow-up processes.

2 Response

The precursor network WG4 welcomes the work done by the European Commission and the JRC on proposing a common approach for the DMA.

We acknowledge that, as co-funder, the European Commission has a right of review on the activities performed under the future EDIH grants.

We also acknowledge that the DMA questionnaire presented on the 18/05/2021 correspond only for the T0 process. The DMA questionnaire for T1 and T2 are unknown at the writing of this report.

It is the strong belief of this group that:

1. The approaches of the DMA is very diverse in Europe with some organisations participating to candidate EDIH performing DMA for more than 20 years, while others might just starting. For DMA-experienced organisations, the data collected from the DMA spanning several years is a goldmine of information and the exercise is well established. The EU approach must not put at risk the historic know-how and knowledge collected. A common DMA used identically EU-wide is not welcome. The difference in the local economies, the industrial sectors, and considering the interests of the local funding authorities, do not make this option preferable. We encourage the creation of a common Digital Maturity Scale (like for the TRL scale) which would allow each DMA methodologies to provide a comparable results.

2. The exchange of data between the future EDIH and the future DTA must respect the local confidentiality mindsets that might already exist, the legally-binding agreements local EDIHs might have (such as the EEN consortium agreement) and GDPR, especially regarding customer data. The technical structure proposed during the webinar are actually gathering general information from the EDIH's customers. For the vast majority, these information are already collected during the DMA. We consider the one proposed on the 18/05/2021 as light enough and workable to be shared with the DTA. However, the EDIH must have the freedom to retain some information in the module M1.1 General data such as the contact person or name of the company. Indeed by the competitive nature of the digital transformation, the EDIH must have the possibility to leave anonymous some fields to insure the confidentiality level requested by the endeavouring customer. A list of ad-minimum criteria must be established in a co-design approach.

3. The share of data must be made as automatic as possible to avoid reporting burdens to the local EDIH and non-added-value red tapes. It is in the best interest that the requested data presented in the T0 DMA questionnaire does not become more complex or does not expand

further but can be shared via API without too much effort. Special consideration must be given to automatic translation, respecting the use of local languages.

4. Only an extensive DMA, requiring on-site visit, and long and thorough interactions, provides insights to define the Digital Transformation journey of a company. To provide added-value insights, the DMA must reflect the sector of application and the local economies. It must be acknowledged that the sample of data requested are not forming a thorough DMA. A 2-steps approach “light DMA”, “full DMA” can be envisioned with adequate funding support.
5. We are inviting the Commission to clarify the extent of EDIH services that would trigger a DMA roll out and a compulsory exchange of DMA data.
6. The establishment of the corridors or cross-border EDIHs are the best situation for testing and experimenting common DMA tools.
7. Corridors/cross-border EDIH cooperation are possible only if EDIH trust DMAs performed by other EDIH. A double DMA performed by 2 EDIHs for the same customer is not preferrable. Therefore a non-binding certification process must be insured that would labelled the DMA methodology of each EDIH raising trust and confidence and insuring a EU-wide level-playing field. The DTA shall also encourage exchanges of information and benchmark activities on the DMA.
8. If the EDIHs communicate part of their data to the DTA and/or the European commission, it is only natural that a reciprocity exists in accessing the data from and for all the EDIHs with the same level of confidentiality. The reciprocity of access to data must be insured between the DTA, the European Commission and the individual EDIHs.

We also take note that the webinar presented only the T0 DMA questionnaire. We are looking forward analysing the proposed T1 and T2 DMA questionnaires.

3 Recommendations

1. **The data to be collected and transferred to the DTA must be as light as possible.**
2. **The data to be collected must be anonymised (or pseudo-anonymised). EDIH must have the possibility to leave out some information.**
3. **The data required must not be too complex and must allow easy API for automatic transfer of the information. The list of data exchanges must embrace the principle of “as short as possible, as long as necessary”**
4. **Since the industrial sectors and the local economies are too different in Europe for an EU-wide common DMA, the collaboration among the EDIH network would benefit a common DMA scale (like the TRL scale).**

5. **The Commission is invited to provide a clear list of EDIH services which trigger a DMA roll out and a compulsory exchange of DMA data.**
6. **In order to insure the cross-border/corridors collaboration between the DMA landscape, the DTA should investigate a non-binding certification process of the DMA methodologies in a co-design approach with the EDIHs. We invite the future DTA to perform DMAs benchmarks with results publicly available and to set a DMA methodology repository.**
7. **Keep co-design approach of the reporting report with the future EDIH and reciprocity in accessing the data collected.**
8. **In order to move forward, we are inviting the Commission to present furthermore T1 and T2 questionnaires for SME illustrated with samples of results and all the three versions T0, T1 and T2 of the questionnaires for the Public Administrations.**

DIH/EDIH candidates signatories:

- Aragon DIH (ES)
- Confindustria Emilia-Romagna Ricerca | Digital Innovation Hub Emilia-Romagna (IT)
- DIH Tourism 4.0 (CZ)
- ER2digit (IT)
- EDIH Grand Est (FR)
- Hub for Digital Innovations (H4DI) (CZ)
- IP4FVG - Industry Platform for Friuli Venezia Giulia (IT)
- IRIS DIH – Navarra Digital Innovation Hub (ES)
- Loire Valley Data Hub (FR)
- Luxembourg Digital Innovation Hub (LU)
- Manufacturing Innovation Valley DIH (LT)
- MINASMART (FR)