

DIGITAL INNOVATION HUBS CATALOGUE

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Final Report
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TNO innovation
for life

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TNO Report

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Digital Innovation Hubs Catalogue Final Report

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Executive Summary

In April 2016 the European Commission has published its communication on “**Digitising European Industry – Reaping the full benefits of a Digital Single Market**”. With this strategy, based on the collective effort of public and private stakeholders across Europe at regional, national and EU level the Commission aims to ensure that any industry in Europe can fully benefit from digital innovations to upgrade its products, improve processes and adapt its business models to the digital change. The investment of € 500 million in a **pan-European network of digital innovation hubs** (DIHs) where business and obtain advice and test digital innovations is a pivotal part of this strategy.

To contribute to the digital transformation of the European industry a consortium led by TNO was awarded to develop a **catalogue of the present existing DIHs in the EU** with the aim to provide:

- **Comprehensive information to any SME or industry** to find infrastructure and expertise the need and contact to potential partners;
- A **platform** to DIHs to **advertise** their **expertise** to potential customers and showcase their activities;
- Policymakers with information about the **state of play of EU DIHs**;
- Identification of **networks** in the field of digitalisation in the industry.

The project had two objectives:

- 1) **Database with over 100 DIHs in EU28.** A database covering all EU 28 digital innovation hubs including comprehensive information on each hub that could afterwards be used to build a portal making this information available to all interested parties, fostering the use of the hubs and fostering their development and networking.
- 2) **Recommendations to maintain and further extend the database.** The quality and value of the database highly depends on the way it is updated. “Old” information will lower the value and use of the database and an updating strategy is required.

In line with the description of DIHs formulated by the DEI working group 1 the following **three minimum conditions** have been formulated that DIHs should meet to be included in the Catalogue:

- 1) **Initiated under on a regional, national or European policy initiative** to digitize the industry;
- 2) Receive **governmental funding** (private funded initiatives are excluded);
- 3) **3 examples of services provided** to clients (technology services, business development and ecosystem development).

The consortium partners have collected comprehensive information on DIHs with the **top-down approach**. Often in close collaboration with national and regional authorities the partners have identified 345 DIHs in all EU 28 Member States,

including Member States without having a national policy initiative in place. Next to the top-down approach also **bottom-up** (with the online survey) DIHs have been identified. In total 186 DIHs profiles have been collected with the bottom-up approach. **Both approaches appeared to be complementary and contributed to a database with comprehensive information on in total 531 DIHs in the EU28 Member States**, including some initiatives from outside the EU 28.

The current database provides **valuable snapshots on the EU DIH landscape**, a landscape that is **dynamic and in development**. Many DIHs are in preparation as well as candidates in all EU28 Member States and new initiatives pop-up on a weekly basis. Based on the data included in the database first analyses show that:

- 60% of the DIHs have been established in the last three years;
- DIHs have a broad technology focus: on average they focus on eight digital technologies;
- DIHs have a broad market scope: markets “Education”, “Transport” and “Manufacturing of machinery and equipment” are the most addressed markets;
- DIHs offer a broad range of services: services related to “Ecosystem building, scouting, brokerage, networking”, “Education and skills development” and “Collaborative research” are offered to customers by almost 70% of the DIHs;
- DIHs are funded with a mix of funding sources: 40% of the DIHs receive funding from national specific innovation funding instruments, regional funding instruments, partner resources and Horizon 2020;
- DIHs deliver services to different types of customers: SMEs are the main target customer;
- Type of funding source seems not to have impact on the type customers DIHs target, probably due to the mix of funding sources.

The information collected already proved to be useful for policymakers to get insights on the **state of play of DIHs on regional, national and European level**. For the further development of the Catalogue in terms of process, content and use for policy development, networking the following overall recommendations can be given:

- The approach of a **combined bottom-up and top-down procedure is required to create a high quality repository on DIHs** and initiated a critical mass of information that activated the community. There is a risk that the motivation to contribute will reduce, with consequences for the quality of information and the actual use of the information. **Coordinated effort** is needed not only to improve the system of data collection and its quality, but also to increase the usability and actual use of the information.
- It is crucial that the **system to collect the information is shifted to a web based system**, but the analysis of the information for policymakers is expected to be done in standalone versions. Therefore, **export to open source data formats** is crucial. The actual data collection requires be a combination of top-down and bottom-up and therefore a **high quality evaluation/validation procedure**. The project team believes that a social media approach can be integrated, but overall moderation is essential.

- **The DIH Catalogue portal requires timeliness of data**, hence a **permanent up-date is recommended**. Maintenance of a database of this kind, however, is very demanding since the digitalization landscape is currently modifying almost every day. Hence the DIH catalogue can only be **a snapshot of a specific period of time**, and not claiming to be complete!
- With regard to the data collected the overall conclusion is that **for policymakers and networking between initiatives the data is sufficient**, although some improvements can be made. However, **for SMEs the data collected is insufficient and should be further enhanced with other functionalities**. Also a more dispersed approach is recommended, facilitating existing channels to SMEs to offer the information.

1 Introduction

1.1 The European Industrial Digitisation Strategy



Led by Commissioner Oettinger, in April 2016 the European Commission has published its **communication on “Digitising European Industry – Reaping the full benefits of a Digital Single Market”**¹. The overall objective of this European strategy for digitising industry is to:

ensure that any industry in Europe, big or small, wherever situated and in any sector can fully benefit from digital innovations to upgrade its products, improve its processes and adapt its business models to the digital change.

This requires not only a dynamic digital sector in Europe but also the full integration of digital innovations across all sectors of the economy. This DEI strategy is based on an ambitious collective effort involving public and private stakeholders across Europe at regional, national and EU level.

With the implementation of the digitization agenda, the Commission aims at:

- The investment €500 million in a pan-EU network of digital innovation hubs (centres of excellence in technology) where businesses can obtain advice and test digital innovations.
- The mobilisation over €50 billion of public and private investments
- Helping coordinate national and regional initiatives on digitising industry by maintaining a continuous EU-wide dialogue with all actors involved. A governance framework will be set up with Member States and industry.
- Focusing investments in EU's public-private partnerships and strongly encourage the use of the opportunities offered by the EU Investment Plan and European Structural and Investment Funds.
- To set up large-scale pilot projects to strengthen internet of things, advanced manufacturing and technologies in smart cities and homes, connected cars or mobile health services.
- To adopt future-proof legislation that will support the free flow of data and clarify ownership of data generated by sensors and smart devices. The Commission will also review rules on safety and liability of autonomous systems.
- Present an EU skills agenda that will help give people the skills needed for jobs in the digital age.

As the DIHs are a pivotal part of the Strategy, developing a catalogue of the present existing DIHs in the EU will contribute to this digitization of the European industry.

¹ <https://ec.europa.eu/digital-single-market/en/news/communication-digitising-european-industry-reaping-full-benefits-digital-single-market>

1.2 Objectives of the project

The main **aim** of the project was to provide the **European industry access to knowledge** of the digital opportunities and testing facilities to masters its digital transformation. To achieve this aim the catalogue needed to contain as comprehensive as possible information on the digital innovation hubs in Europe to give to any SME or industry access to the exact competence fitting its needs in order to digitize its products and services and give access to potential actors to join a given DIH in offering their competences and services.

Next to providing the European industry with information where to find support with their digital transformation, the catalogue's aim was to give the European DIHs a **platform to communicate their expertise** to their potential customers by being able to showcase their services on an European level. Furthermore, the availability of information on "who-is-who" should create opportunities to find possible cooperation's between the DIHs and stimulate a **pan-European** network of DIHs.

Next to these aims to improve the innovation network, also policymakers should be able to assess the existing DIHs based on the information collected to allow them to **improve their policy** on DIHs, based on evidence.

More concrete core **objectives** of the project are as followed:

- 1) **Database with over 100 DIHs in EU28.** A database covering all EU 28 digital innovation hubs including comprehensive information on each hub that could afterwards be used to build a portal making this information available to all interested parties, fostering the use of the hubs and fostering their development and networking.
- 2) **Recommendations to maintain and further extend the database.** The quality and value of the database highly depends on the way it is updated. "Old" information will lower the value and use of the database and an updating strategy is required.

1.3 What are Digital Innovation Hubs

The concept of digital innovation hubs was formally launched during the EC Communication on "Digitising European Industry – Reaping the full benefits of the Digital Single Market" in April 2016.² However, this concept is far from final due to the early stage of development. With roundtables and series of phone conferences the DEI Working Group 1 discussed key issues, such as the characteristics of a Digital Innovation Hub, how to develop a network of DIHs in Europe and which investments are necessary to build the network of DIHs. In the first report "Digital Innovation Hubs: Mainstreaming Digital Innovation Across All Sectors"³ published in

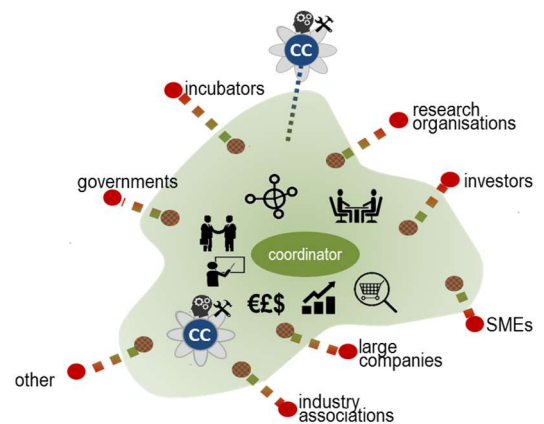
² <https://ec.europa.eu/digital-single-market/en/news/communication-digitising-european-industry-reaping-full-benefits-digital-single-market>

³ <https://ec.europa.eu/futurium/en/content/report-wg1-digital-innovation-hubs-mainstreaming-digital-innovation-across-all-sectors-final>

December 2016 on the work of the working group the following description of a DIH is presented:

“A Digital Innovation Hub (DIH) is a support facility that helps companies to become more competitive by improving their business/production processes as well as products and services by means of digital technology. DIHs act as a one-stop-shop, serving companies within their local region and beyond to digitalise their business. They help customers address their challenges in a business-focused way and with a common service model, offering services that would not be readily accessible elsewhere. The services

available through a DIH enable any business to access the latest knowledge, expertise and technology for testing and experimenting with digital innovations relevant to its products, processes or business models. DIHs also provide connections with investors, facilitate access to financing for digital transformations, and help connect users and suppliers of digital innovations across the value chain.... Apart from a focus on technologies, a DIH may focus as well on certain sectors, for instance on agriculture, textile, construction, etc.. Proximity between DIHs and companies is an important factor and the first point of contact for companies will often be a DIH in the same region. As an innovation ecosystem that provides access to the services, facilities and expertise of a wide range of partners, Digital Innovation Hubs ensure that different customer segments get the services they need; that DIHs co-operate effectively with each other; and that the supporting competence centres create solutions that are easy to scale.”⁴



For the development of the catalogue digital innovation hubs have been defined as followed:

“Digital Innovation Hubs are one-stop-shops that help companies to become more competitive with regard to their business/production processes, products or services using digital technologies. They are based upon technology infrastructure (competence centre) and provide access to the latest knowledge, expertise and technology to support their customers with piloting, testing and experimenting with digital innovations. DIHs also provide business and financing support to implement these innovations, if needed across the value chain. As proximity is considered crucial, they act as a first regional point of contact, a doorway, and strengthen the innovation ecosystem. A DIH is a regional multi-partner cooperation (including organizations like RTOs, universities, industry associations, chambers of commerce, incubator/accelerators, regional

⁴ <https://ec.europa.eu/futurium/en/content/report-wg1-digital-innovation-hubs-mainstreaming-digital-innovation-across-all-sectors-final>

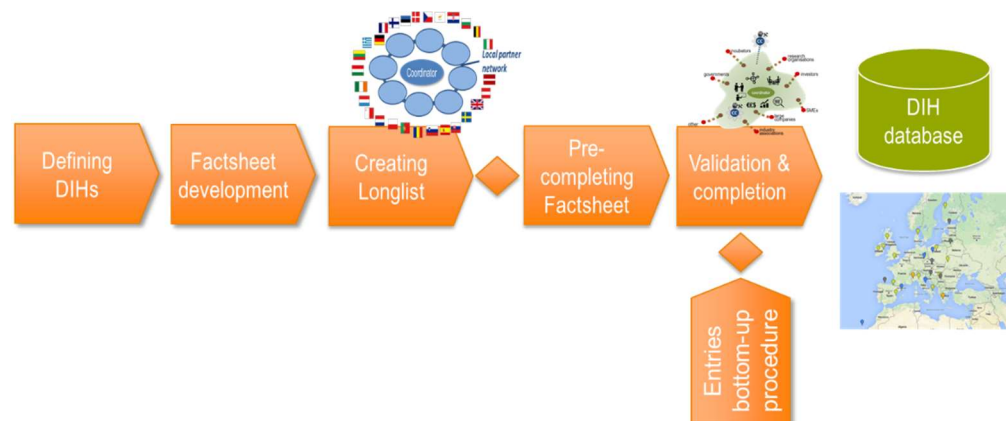
development agencies and even governments) and can also have strong linkages with service providers outside of their region supporting companies with access to their services.”

To be included in the catalogue the following three minimum conditions were formulated that must be met:

- 4) Initiated under on a regional, national or European policy initiative to digitize the industry;
- 5) Receive governmental funding (private funded initiatives are excluded);
- 6) 3 examples of services provided to clients (technology services, business development and ecosystem development).

1.4 The approach

Figure 1 Approach DIH Catalogue project



The project consisted of three core elements:

1. The first was to identify digital innovation hubs in all EU 28 MS to provide a landscape of the digital innovation hubs in Europe.
2. The second element was to profile digital innovation hubs that match the three minimum conditions.
3. The third element was to create a catalogue with digital innovation hubs using a database structure that allows integration into a portal, as well as updates and further expansion (e.g. new functionalities).

The following elements were included in the project:

- The first issue was to address the identification of the digital innovation hubs in all EU 28 MS. For this a top-down approach was complemented with a bottom-up approach. For the top-down approach a pilot study has been carried out in The Netherlands to test the feasibility of the during the Inception meeting formulated three minimum conditions.
- Second step of the top-down approach was to identify digital innovation hubs initiated under national and regional digitisation policy initiatives. In case in Member States no policy initiatives were in place the vast

experience and local networks of the correspondents were used to identify digital innovation hubs and to ensure that also less well developed or advertised DIHs were identified.

- The second issue was to create comprehensive profiles (in the local language and English) of the hubs in such a way that SMEs and any industry will be able to find exact competence fitting its needs in order to digitise its products and processes. For this a template has been pre-completed for each DIH by the correspondents. This pre-completed template, accompanied by a Recommendation letter of the Commission, has been sent to the DIH for validation, including the request to complete the profile. With this approach the efforts for the DIHs were limited and thereby the chance of complete and high quality profiles has been increased.
- Completed profiles were uploaded to a database to create a catalogue containing comprehensive information on all EU DIHs. The structure of database allowed integration into the portal developed by JRC Sevilla, as well as updates and further expansion (e.g. new functionalities).
- For the bottom-up approach an online survey has been published for spontaneous applications to collect all required information to create complete profiles. The applications received via this approach have been evaluated and if the minimum conditions were fulfilled these DIHs have been added to the catalogue.
- Based on feedback and additional inputs from the NCPs and the Commission on preliminary overviews with identified DIHs missing initiatives have been added to the database, including DIHs initiated under EU policy initiatives.

1.5 Deliverables and milestones

- √ **Milestone 1: Approved project approach, deliverables and planning: M2**
 - Deliverable: D1 Inception report
- √ **Milestone 2: Presentation of the project at the European Stakeholder Forum in Essen (31 January/1 February 2017): M2**
- √ **Milestone 3: Presentation interim findings at the 1st interim meeting: M4**
 - Deliverable D6: 1st Interim progress report
- √ **Milestone 4: Presentation interim findings at the 2nd interim meeting: M6**
 - Deliverable D7: 2nd Interim progress report
 - Presentation of the project at a roundtable meeting with the MS (27 June 2017)
- √ **Milestone 5: Approved Digital Innovation Hubs Catalogue: M12**
 - Deliverable D2: 1st Interim database & map: M4
 - Deliverable D3: 2nd Interim database & map: M5
 - Deliverable D4: 3rd Interim database & map: M8
 - Deliverable D5: 4th Interim database & map: M11
 - Deliverable D8: Final report: M12

2 Digital Innovation Hubs Catalogue

2.1 The DIH Catalogue database

531 Digital Innovation Hubs identified

In total 531 Digital Innovation Hubs have been identified in the EU 28 Member States, as well as in some neighbouring countries.⁵ The identified DIHs have been assessed according to the three minimum conditions and classified to their evolutionary development phase (see Table 1 and Table 2).

Table 1 Overview identified DIHs the according to their development phase

Overview	Total numbers
Identified DIHs	531
In preparation DIHs	113
Candidate DIHs	234*
Operational DIHs	184
DIHs entered in the database	531

*in case the DIH is operational, but did not provide three good examples of services they provide the DIH has been classified as candidate.

Table 2 Number of DIHs per country

Country	DIH in preparation	DIH candidate	DIH in operation	Total DIHs
Albania	-	-	3	3
Austria	-	43	2	45
Belgium	3	4	17	24
Bosnia-Herzegovina	-	1	2	3
Bulgaria	-	1	1	2
Croatia	3	-	-	3
Cyprus	1	2	-	3
Czech Republic	-	2	1	3
Denmark	1	3	5	9
Estonia	3	1	5	9
Finland	6	2	6	14
France	16	27	17	60
Germany	6	49	24	79
Greece	2	4	1	7
Hungary	-	2	2	4
Ireland	1	5	4	10
Italy	16	9	4	29

⁵ DIHs from outside the EU28 applied to be included in the catalogue via the online survey.

Kosovo	-	1	3	4
Latvia	-	-	2	2
Lithuania	2	2	1	5
Luxembourg	-	-	6	6
Macedonia	1	1	1	3
Malta	-	1	1	2
Montenegro	-	1	1	2
Netherlands	17	32	18	67
Norway	1	-	-	1
Poland	7	8	3	18
Portugal	-	-	2	2
Romania	1	2	-	3
Serbia	6	1	4	11
Slovak Republic	-	2	-	2
Slovenia	1	-	3	4
Spain	8	15	33	56
Sweden	6	2	5	13
Ukraine	1	11	-	1
United Kingdom	4	11	7	22

Combined top-down and bottom-up approach worked well

With the top-down approach the consortium partners have, often in close collaboration with national and regional authorities, identified hubs in all EU 28 Member States, including Member States without having a national policy initiative in place. In total 345 DIH initiatives have been identified with the top-down approach.

Next to the top-down approach also bottom-up (with the online survey) DIHs have been identified. In total 186 DIHs have been collected with the bottom-up approach. After reviewing the provided profiles the applications that met the minimum conditions have been included in the catalogue. In Table 3 the overview of the division between the top-down and bottom-up collected DIHs given.

Table 3 Identified DIHs with top-down and bottom-up approach

Approach	Top-down identified DIHs	Bottom-up identified DIHs
Number of DIHs	345	186**
Origin of the applications	35 countries*	30 countries

*The number of top-down identified DIHs includes DIHs included on request by the Commission, such as DIHs initiated under the I4MS mentoring program and DIHs initiated under other EU policy initiatives (e.g. ECHORD++, ROBOT-NET, etc.).

**The online survey proved to be an easy way to collect profile information and therefore has been used to collect information on DIHs identified with the top-down approach as well as.

FP7 and Horizon 2020 projects and DIHs initiated under EU policy initiatives

Based on data provided by the Commission 10 FP7 and Horizon 2020 calls related to digitisation of the industry have been entered into the database, including the 30 projects funded under these calls, as well as all participating partners. The projects have been labelled as “EU Projects”. In addition the 29 candidate DIHs of the I4MS Mentoring program have been added as DIH, as well as a number of DIHs provided by the Commission (e.g. Robotics Innovation Facilities of ECHORD++, Open Labs of ROBOT-NET, Co-Location Centres of EIT Digital, etc.).

Other initiatives

The online survey was open for any spontaneous application. Based on the submitted information all applications have been assessed on the three minimum conditions and the description of a DIH. 32 initiatives of the applications do not fit with the description of a DIH, because they are either a technology or science park, accelerator, or incubator. These initiatives could be(come) part of a DIH, but based on the provided information do not seem to fulfil the criteria at this moment. For this reason these initiatives haven been entered into the database, but with the classification ‘Other’.

Appr. 60% of the profiles is complete

According to the evolutionary development stage approximately 60% of the profiles of the DIHs included in the database are complete. Providing sensitive information (strategic partners, turnover...) was often mentioned by the DIHs as topic of concern.

2.2 Snapshots of the European DIH landscape

In this section some key findings on the content of the database will be presented to provide some snapshots of the DIH landscape in EU28 Member States.

Dynamic DIH landscape in the EU28

Over the past years DIHs have been established in all the EU28 Member States. Figure 2 shows the locations of the DIHs, as well as their evolutionary development stage. Three different stages have been defined:

- 1) In preparation (a consortium exists, but has not yet been formalized);
- 2) Candidate (formalized, but not yet served customers);
- 3) In operation (history of service offered to several customers).

The map clearly shows the dynamics of the DIH landscape in Europe with many DIHs in preparation as well as candidates in all EU28 Member States.

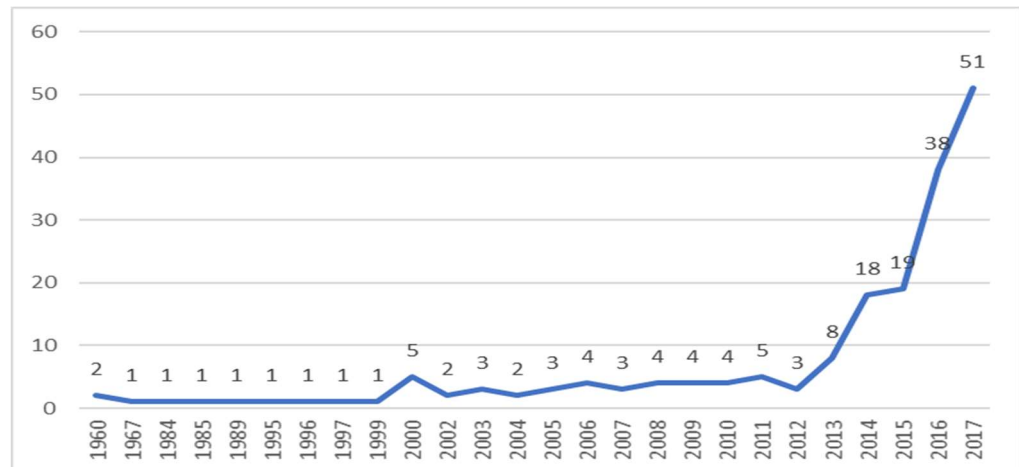
Figure 2 Geographical map of the European DIH landscape



60% of the DIHs have been established in the last three years

Based on the data provided by 185 DIHs on their year of establishment Figure 3 shows on the one hand that some DIHs are based upon already existing initiatives, e.g. competence centres. However, 60% of the DIHs do not have a long history and have been established in last three years.

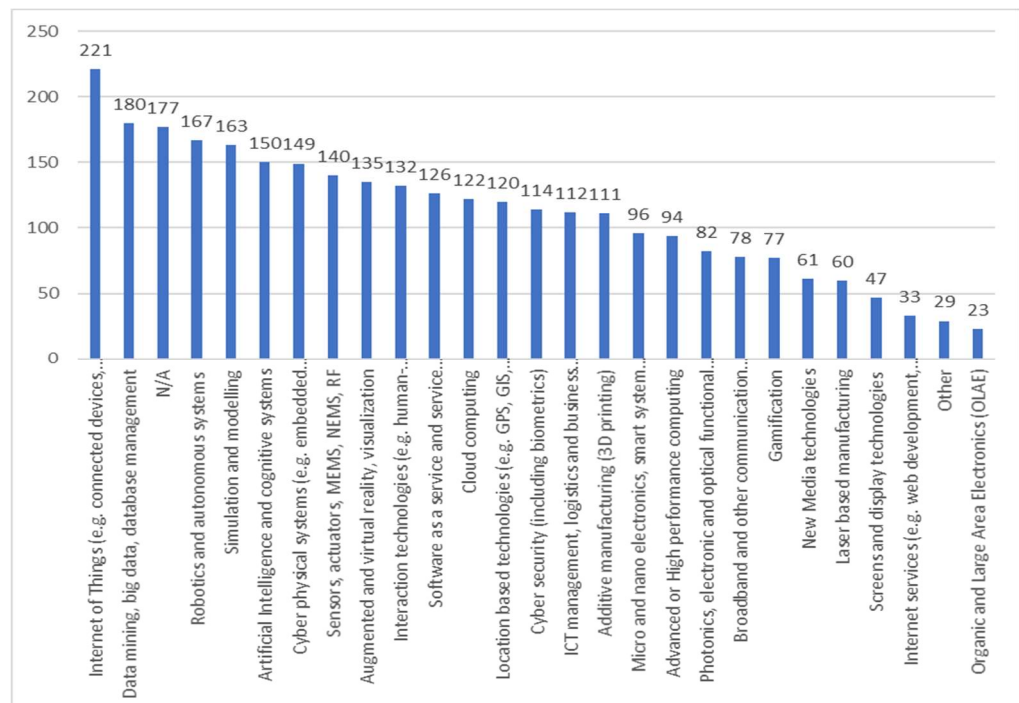
Figure 3 Year of establishment DIHs (n=185)



DIHs have a broad technology focus: on average they focus on eight digital technologies

Based on the data provided by 362 DIHs on their digital technology focus cover a broad range of digital technologies: on average they focus on eight technologies out of the 26 listed. Technologies that are most addressed are shown in Figure 4: more than half of the DIHs address IoT, followed by digital technologies focused on datamining and big data, robotics and autonomous systems and simulation and modelling.

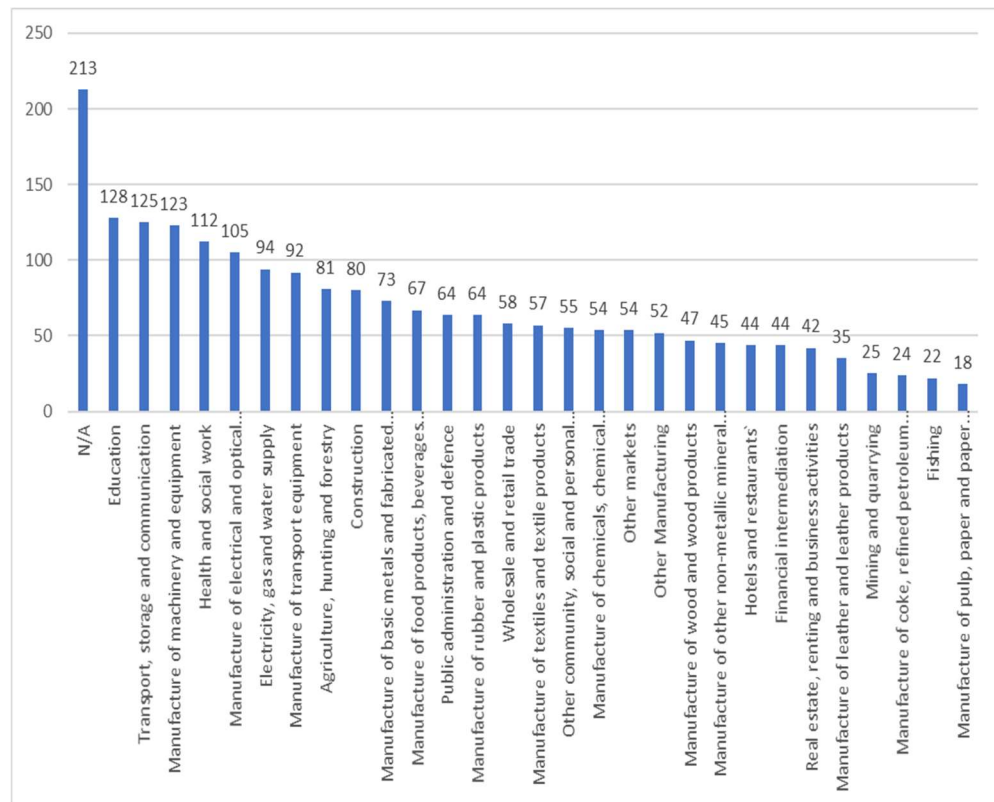
Figure 4 Distribution of DIH technology focus (n=362)



DIHs have a broad market scope: markets “Education”, “Transport” and “Manufacturing of machinery and equipment” are among the most addressed markets

Based on the data provided by 326 DIHs on the markets they address it shows that DIHs have a broad market scope: on average DIHs address six markets out of the 29 markets listed. Figure 5 shows that the markets “Education”, “Transport” and “Manufacturing of machinery and equipment” are the most addressed.

Figure 5 Distribution of market sectors addressed (n=326)

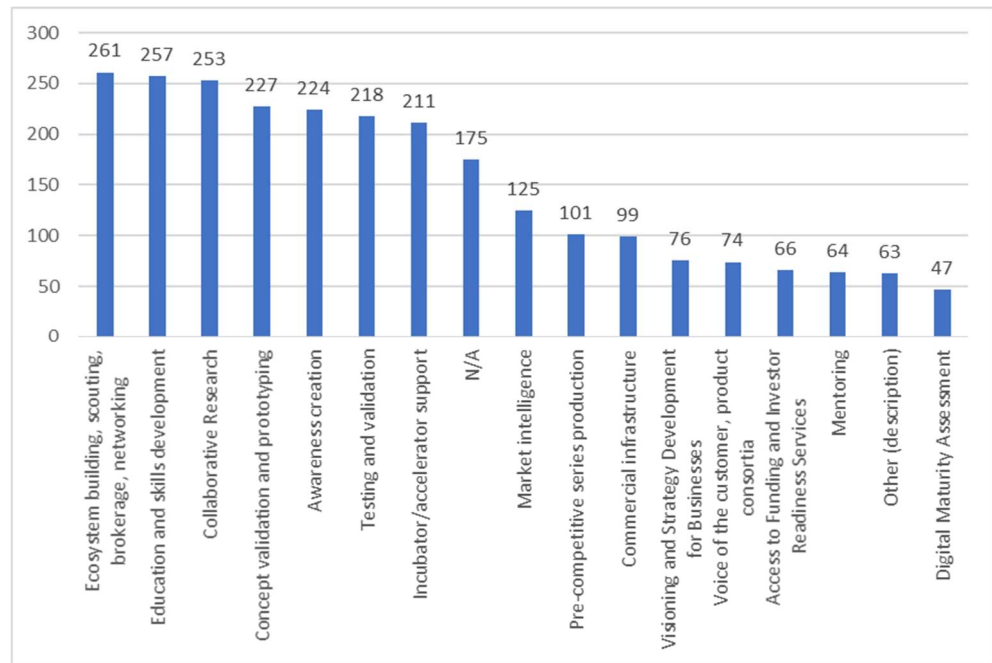


DIHs offer a broad range of services

Based on the data provided by 364 DIHs on the services they offer to their clients it shows that DIHs offer a mix of services. The average number of services offered is seven out of the 16 services listed.

Figure 6 shows that services related to “Ecosystem building, scouting, brokerage, networking”, “Education and skills development” and “Collaborative research” are offered by almost 70% of the DIHs.

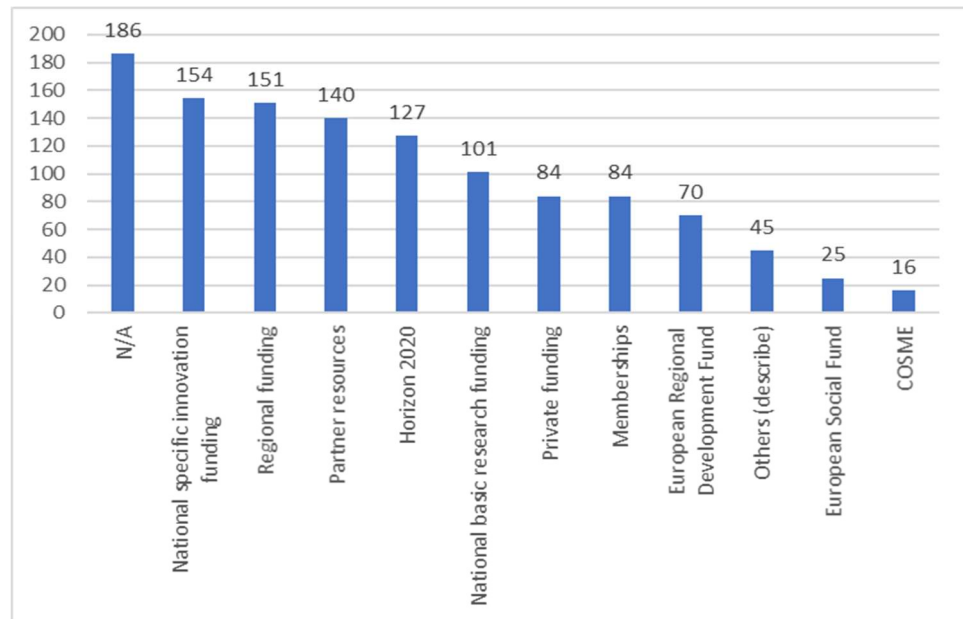
Figure 6 Distribution of hub services offered (n=364)



DIHs funded with a mix of funding sources: 40% of the DIHs receive funding from national specific innovation funding instruments, regional funding instruments, partner resources and Horizon 2020

Based on the data provided by 353 DIHs on their funding sources it shows that funding for the DIHs comes from different sources. Figure 7 shows that around 40% of the DIHs receives funding from national specific innovation funding instruments, regional funding instruments, partner resources and Horizon 2020.

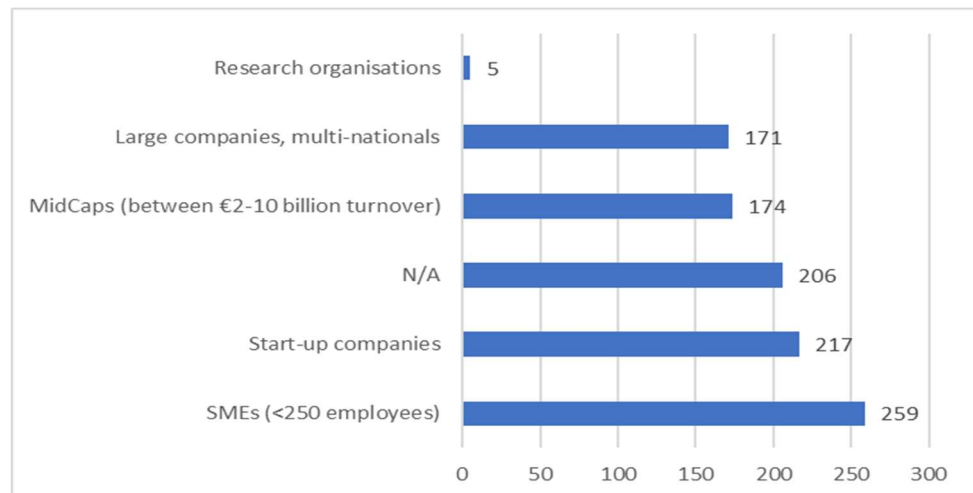
Figure 7 Distribution of funding sources of DIHs (n=353)



DIHs deliver services to different types of customers: SMEs are the main target customer

Based on the data provided by 333 DIHs on the type of customers that are repeatedly supported by the DIH it shows that DIHs deliver services to all types of customers. Figure 8 shows that SMEs are the main target customer for DIHs: 77% of the DIHs deliver services to SMEs, followed by start-ups (65%), Midcap (52%) and large companies (51%).

Figure 8 Distribution of type of customers (n=333)



Type of funding sources seems not to have impact on the type customers DIHs target

To analyse the impact funding sources might have on the type of customers DIHs target the correlation between these two characteristics has been analysed (see Table 4). In the first column the funding sources are listed and in the rows the number of DIHs that target the different type of customers are given. As described above (see Figure 7) DIHs use a mix of funding sources and target in general several type of customers (see Figure 8), therefore the numbers of DIHs given in the rows per funding source and per type of customer are not exclusive. For instance the 12 DIHs that receive funding via COSME and target large companies are DIHs that receive funding from other funding sources as well and target also other type of customers. For this reason the table indicates that the funding source seems have no significant impact on the type of customers the DIH targets: they use a mix of different funding sources and therefore seem not to be influenced on the type of customer they focus on.

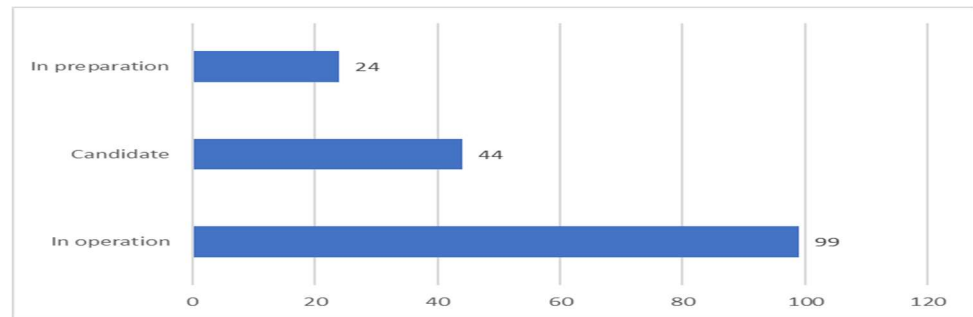
Table 4 Cross correlations DIH funding sources and type of customers

Customer type/ Funding sources	Large compan y	MidCa p	Re- search org.	SME	Start- up
COSME	12	11	2	14	12
European Regional Development Fund	39	42	1	61	50
European Social Fund	18	16	1	20	17
Horizon 2020	86	89	3	112	83
Memberships	52	52	1	79	63
National basic research funding	75	75	3	91	71
National specific innovation funding	102	110	1	139	116
Others (describe)	19	19	-	35	31
Partner resources	95	92	1	122	109
Private funding	58	62	1	74	64
Regional funding	96	108	3	137	112

167 DIHs have a technology focus on Robotics and autonomous systems

Of the 531 in the database included DIHs 167 have a technology focus on Robotics and autonomous systems. According to their evolutionary development stage 60% of the DIHs are operational (see Figure 9).

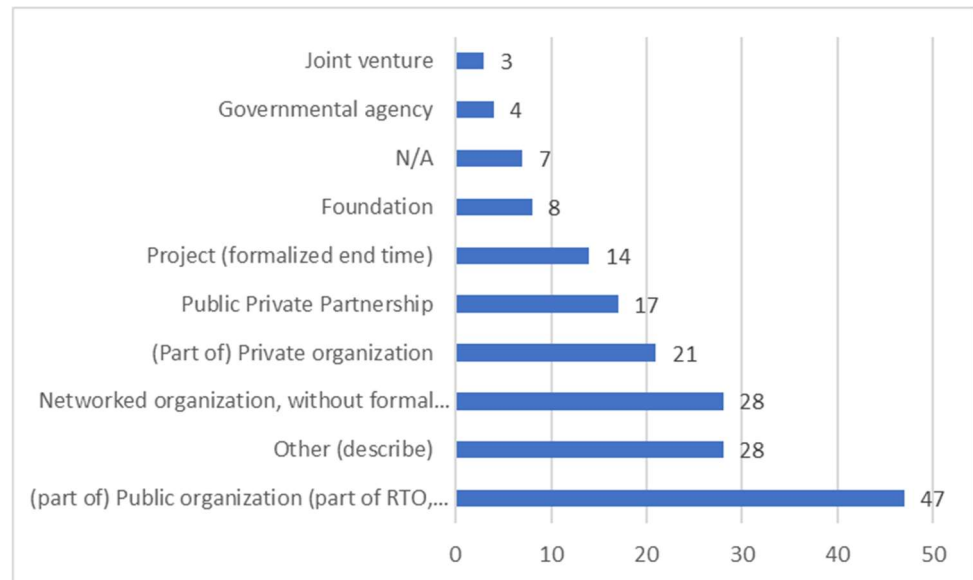
Figure 9 DIHs focused on robotics according to their evolutionary development stage



DIHs focused on Robotics vary in their organizational form

With regard to the organisational form the DIHs focused on Robotics vary: around 25% of the DIHs are (part of) public organisation (part of RTO, or university), followed by the forms of a networked organisation, a form not listed (other) or (part of) private organisation (see Figure 10).

Figure 10 Organisational form of DIHs focused on robotics (n=177)



3 Conclusions and Recommendations

3.1 The process of data collection

This section focuses on the experiences gained with the data collection and will provide some recommendations for the further improvement of the catalogue with regard to efficiency, effectiveness and quality:

- The followed approach was a combination of top-down and bottom-up collection of data. This combination has proven to be crucial, as the top-down stimulated organisations to actively provide information and the bottom-up procedure increased the efficiency of the process as well as the completeness of the profile information requested.
- The collection of information requires strong efforts, even for the bottom-up procedure. Although using the bottom-up procedure will take less effort to collect the information, the processing/validation as well as activation of the bottom-up collection will take considerable time.
- The validation of the collected information requires participation of the organisations themselves, as the information to be collected is too specific to be found on the internet.
- Following a suboptimal procedure will lead to suboptimal quality of the information (garbage in, garbage out). This can quickly lead to a quality level of information, where its added value will be too limited that it is not useable anymore.
- The social pressure to be a “Digital Innovation Hub” has now reached a level that the dataset is self-sustaining and activates new DIHs to enter their initiative. This is a combination of the requirement of being a DIH to get funding in different countries and the EC, as well as competitors being included in the dataset already.
- The communication on the Catalogue during different events had significant impact on the active participation of potential DIHs.
- The validation of the entries is crucial, but very difficult.
- The added value of being part of the catalogue is not clear and may become a risk in the future data collection. Today, the incentive is that H2020 funding is connected to being a DIH, but this will weaken for the future.
- As many organisations provide the information on their own initiative, the information provided may be positively biased. An example is that DIHs often state that their coverage of services is extensive, although some services are hardly provided.

Considering the previous conclusions, the following recommendations can be given with regard to the collection and validation process:

Combine bottom-up and top-down in data collection

It is recommended that the maintenance of the catalogue should be based on the preliminary work of our team. Hence: an "experience treasure" already exists. We

suggest that the organisation of the data collection should follow a combined bottom-up and top-down approach. In close cooperation with the National Contact Points and European Commission, a networked consortium of EU28 experts should organise the collection of data in individual countries to ensure the quality and consistency of the collection. This will create strongholds on country level to activate the DIHs and other stakeholders to enter their information into a website/database.

Use a two-step approach for bottom-up entry of information

Although the bottom-up process of collecting information is crucial, an open way of data collection through the RIS3 website can easily compromise the data quality. A three step approach is advised:

1. External input is delivered through a sandbox (both new entries and adjustment in existing entries).
2. The data is evaluated on quality by the internal team, also supporting the request for additional information. This can be supported by the website.
3. New entries are to be validated by a validation team and made active on the website after this OK.

Use a systematic approach in validation of information

As the quality of the data is crucial for the actual added value of the catalogue, the validation is crucial to its success. The assessment of new entries by an individual project team member should not be followed. A transparent, objective procedure is required for the final validation.

The validation “team” can be advised by National Contact Points from the Member States. However, the validation team members must have no interests on the validation. The validation procedure can take place periodically and also supported by the website.

3.2 The data collection systems

During the project, different systems were used to collect the data. An MS Access database was used to collect top down data, next to Word templates. The bottom-up collection was organized through a standardized survey. Also overviews of possible project entries were provided in Excel format. The data was integrated using MS-Access and then migrated to a website that is managed by the JRC.

Some conclusions can be drawn on these different systems:

- The database uses a relational database model, with many one-to-many tables. This is required to collect and use the information optimally.
- The relational database structure creates an issue with using Excel as input for the database, as Excel does not support relational data structures with one-to-many tables.
- The data collection highly depends on the expertise, willingness of the experts and their network to use the different formats. More advanced experts used the

MS Access, but even this took time to get used to. For small datasets it was inefficient.

- Using individual contacts of DIHs as providers of information required a bottom-up approach through a website. However, the alignment of the collected data with the MS Access database was critical and some elements cannot be automated.
- The integration of the information collected in these different systems is time consuming as the different formats are not fully compatible. To transform the different data sources to the final website system sometimes takes days of work.
- Using existing sources of information is complex, due to the different field definitions. The EC data sources are not aligned with the needs for the catalogue. Also the database from DG Grow on Technology Centers is partially incompatible and requires high efforts to incorporate the data.
- The migration of the MS Access database with the JRC website database technically was possible without significant problems. However, the complexity of the data structure required efforts for alignment.
- Although the original proposal also aimed at providing information to support SMEs, during the kick-off meeting with the Steering committee decided that at this moment this would not be implemented. Also the RIS3 website offered by the JRC mainly aims at supporting policy and networking between DIHs (the two other objectives of the study). At this moment, it is the opinion of the project team that the information collected is suboptimal for SME support.

Regarding the data collection systems, the following recommendations can be given:

Use a system that allows relational structures

The use of a relational database is crucial for the assessment of data. An example is that in this way, the funding sources used can be linked to the different services provided. For this, codified classifications are to be used to characterize the DIHs. These classifications will include one-to-one types, as well as one-to-many. A web-based relational data system is preferred for data collection, but MS Access would allow standalone in-depth data analysis for policy purposes.

Use a simple web-based data collection system

The data collection will include top-down and bottom-up approaches. One system is needed to collect this data and this needs to be accessible through the internet. However, the collection system needs to facilitate secure access, sandbox entry of data, evaluation and communication functionalities and a validation system. Also a functionality that will allow the public to provide ratings on the DIHs entered is required, but this also needs to be moderated by an objective team of experts.

Offer the data collected to other organisations (open data)

The collected data is now accessible through the JRC RIS3 website. However, many potential users will not access the information because it is not offered in a

way usable for them. The multi-used profiles require a more distributed way of communication, so other organisations can develop tailor made GUIs. This requires a full open data approach to the information collected. Also other ways of using the data can then be followed.

Incorporate the information collection in an overall SME support dashboard

Offering information for SMEs will be crucial to enhance the impact of the catalogue and more important the digital transformation of the European industry. It is recommended that the catalogue should be further incorporated into a dashboard that offers more information on digitization at large for SMEs. Examples can be a Digitization self-assessment tool, brokerage between SMEs on digitization products/services, best practices and an active Q&A function.

3.3 The content

Our partnership of 12 organisations has collected much information on Digital Innovation Hubs. Also the information provided by the European Commission and representatives from governments and actual DIHs (in the making) contributed to this repository. The basic goal is on the one hand to serve all interested parties with structured information on the DIH landscape and (new) activities and, on the other hand, to position the EC as a strategic think-tank for FP 9 in issues such as 5G, IT systems and infrastructure, robotics, skills and education,...

During this interactive process of data collection and its analysis, we can draw the following conclusions about the content of the catalogue:

- With an interactive (European) geographic search facility the EC Digital Hubs Catalogue should always provide quickly and precisely up-to-date information on the present state-of-the-art of DIHs in Europe.
- During the project, some core criteria were used to validate if a new entry could be considered a DIH. We have had extensive feedback that this approach to a definition is not constructive.
 - The three services are required to get an entry to be fully operational. Not only the difficulties of confidentiality are considered as a barrier, also the assessment takes much effort from specific experts and is therefore not easy to achieve.
 - The definition of a DIH is not clear and left to the individual Member States to be judged. This leads to problems with processing new bottom-up entries and subjective validation.
- The criteria to become a DIH (3 services, part of a regional, national or European policy initiative, governmental funded) is seen by many external stakeholders as unsatisfactory (NCPs, as well as contacts for potential DIHs). The three criteria are seen as providing arbitrary results, jeopardizing the quality and use of the catalogue.
- With regard to the definition of a DIH, the following conclusions can be drawn of aspects that can be considered crucial:

- The multi-business model approach is well an approach followed by many of the collected hubs.
- The assessment on funding of DIHs leads to the conclusion that the regional aspect of a DIH is in many cases crucial. Also funding a DIH is not solely the responsibility of a (national) digitization policy initiative, but also draws from more general funding opportunities. The private funding for DIHs can be considered a limited source and is not often seen.
- As the assessment shows, some initiatives are not directly linked to a regional or national digitization policy initiative. This is the result of many initiatives using alternative funding sources. However, many of them can be considered DIHs.
- Many of the initiatives are now characterized as “candidates”, because they do not meet the three criteria. Especially the three services are blocking the “fully operational” stage. But the assessment and feedback shows that they are from a practical point of view often “fully operational”.
- Some characteristics are more useful for policy development then others:
 - Useful characteristics are among others: Funding type, type of customers, market sectors, evolutionary stage, hubs services, technology focus.
 - Characteristics that are less useful are: Funding objectives, geographical scope, number of customers, number of employees, organisational form.
 - Some characteristics are missing: Detailed info on funding, longitudinal information.
 - Some classifications need to be improved, like funding type, types of initiative and services.

Regarding the content the following recommendations can be given:

Create a balanced approach for the definition of DIHs

It is recommended that a pan-European approach to DIHs is developed. This will not only create a balanced dataset, but also more added value to the catalogue. It is advised to allow the catalogue to include initiatives that formally are not DIHs, but related, such as Competence Centres and Testbeds. This will create a more balanced and useful repository. The approach to the definition should include the following elements:

- Allow related types of initiatives, like Competence centres, Technology Centres, Living Labs and Testbeds. Some initiatives can even be regarded as more than one type.
- We recommend that the definition of a DIH includes two elements:
 - General characteristics of the initiative: Addressing digitization issues, openness to new customers, focus on crossing the valley of death, active cooperation between research/industry/government/education, focus on SMEs and MidCaps as customers, industry driven/but not owned.
 - The DIH offers services to support crossing the valley of death. These services include technological services, business development services as well as ecosystem building services.

- By using this approach to the definition initiatives can be classified as other types of initiatives. Therefore the approach should include the definition of these other types as well.
- Including the evolutionary stage of the initiative will allow upcoming initiatives to be entered into the database. This will facilitate networking/cooperation, but also further development with other types of services. This evolution characterisation can be linked to the definition.
- An initiative often originates from existing organisations that combine their capacities. Although the definition suggested requires the offering of specific services, special attention is required to make sure that these services are directly offered by the DIH and not the “mother” organisations at large.

Enhance the data collection with some additional characteristics

The collected characteristics proved to provide detailed information on the DIHs. Some additional aspects could be further expanded:

- The funding of DIHs should include more qualitative information and an expanded classification.
- Longitudinal information is crucial for policy evaluation and development and therefore we recommend that the data collection system records the changes made in the dataset.
- Although part of the RIS3 website, the catalogue not yet is fully aligned with the RIS3 classifications. A further alignment and synchronization is needed.

Create a multi-level approach to funding of DIHs

The assessment of funding sources used shows that funding a DIH is patchwork, combining different funding opportunities. The Framework programme does contribute significantly to the included DIHs, but regional funding opportunities appear to be even more crucial. Also national and in-kind contributions are crucial for the sustainability of the DIH. Therefore, it is recommended that a pan-European strategy on multi-level funding of DIHs is to be developed to secure the long-term sustainability of the initiatives.

Align the different EC repositories on initiatives

At this moment, at least three different repositories are already present that include information on innovation hub kind of initiatives. The DIH catalogue, the I4MS catalogue, and the DG Grow Technology Centers catalogue. A fourth is now developed within the scope of RTD Pilot lines/testbeds. It is recommended that these activities are strongly aligned, with a tagging system to cover the different functionalities. Not only will this be more efficient, also the outcomes will be more useable for policymakers, the initiatives and the customers of the initiatives. This does not mean that there will be one portal for the information, because different user groups can have different requirements. However, aligning will enable further improvement of the data quality. Furthermore the connection to national and regional initiatives should be made.

3.4 Overall conclusions and recommendations

The overall conclusion of the project is that the approach of a combined bottom-up and top-down procedure is required to create a high quality repository on DIHs. Looking at other initiatives, this approach initiated a critical mass of information that is needed to activate the community. However, there is a risk that the motivation to contribute will reduce, with consequences for the quality of information and the actual use of the information. Coordinated effort is therefore needed not only to improve the system of data collection and its quality, but also to increase the usability and actual use of the information.

It is crucial that the system to collect the information is shifted to a web based system, but the analysis of the information for policymakers is expected to be done in standalone versions. Therefore, export to open source data formats is crucial. The actual data collection requires be a combination of top-down and bottom-up and therefore a high quality evaluation/validation procedure. The project team believes that a social media approach can be integrated, but overall moderation is essential.

The DIH portal requires timeliness of data, hence a permanent up-date is recommended. Maintenance of a database of this kind, however, is very demanding since the digitalization landscape is currently modifying almost every day. Hence the DIH catalogue can only be a snapshot of a specific period of time, and not claiming to be complete! With regard to the data collected, the overall conclusion is that for policymakers and networking between initiatives the data is sufficient, although some improvements can be made. However, for SMEs the data collected is insufficient and should be further enhanced with other functionalities. Also a more dispersed approach is recommended, facilitating existing channels to SMEs to offer the information.

ANNEX I: Geographical map

The map below shows the locations of the identified and profiled DIHs. Next to the location of the DIHs the evolutionary stage of the DIHs is visualised with the different colours.



The map can be fully customised with the link below:

https://drive.google.com/open?id=1NcRnG0H38PIOyuj-oPZ_BjiJLcQ&usp=sharing

ANNEX II: Country observations

Austria

- *Approach and data collection:* The identification of the Austrian DIH initiatives is quite a challenge. The process started with the analysis of sources provided by the national I 4.0 Plattform. Due to the current discussion in Austria about which institutions would be suitable for Digital Innovation Hubs depends on the definition of the DIH concept. Following several calls and discussions with stakeholders (Austrian Federal Ministry of Transport, Innovation and Technology, I 4.0 Plattform) it has become clear that no decision has been made on ministerial level.
- *DIH landscape:* It is expected that a large number of initiatives would potentially meet the minimum conditions. The current list of potential DIHs includes Austrian institutions with research activities in the field of production / digitization. However, due to the current political debate in Austria it is not possible to make a decision on which initiatives should be included in the catalogue, and which not. The current list can therefore only be used as an orientation.
- *Other:* The suggestion from the EC to focus on the “Comet Centers” has been followed-up, however IFT and Joanneum Research have not replied yet.

Belgium

- *Approach and data collection:* The current policy initiatives (Made different and Marshall 4.0) do not include the DIHs, or are still in the development phase. Therefore other policy initiatives have been taken into account to identify potential DIHs. Based on national and regional digital strategies, networks and personal contacts potential hubs have been identified and verified by regional authorities. The identified and according to the minimum conditions assessed potential DIHs have been contacted directly to collect profile information.
- *DIH landscape:* To date 3 fully operational DIHs have been initiated and around additional 1-2 candidate DIHs are expected to provide their profile information..

Croatia

- *Approach and data collection:* The Croatian national policy initiative Digitizing Impulse 2020 is under preparation and at the moment there are no established hubs. The current initiatives that potentially could evolve into DIHs are based upon collaborations between technology parks, science centres and IT incubators. The identified potential DIHs have been contacted via the national contact persons.
- *DIH landscape:* To date 3 DIH initiatives have been identified, both are in preparation.

Cyprus & Greece

- *Approach and data collection:* Nor Greece or Cyprus have a national/regional policy initiative implemented, however links could be made to EU initiatives. The

DIHs have been identified based on country knowledge and with the support of EC that advised on the already existing initiatives. After assessment on the minimum conditions the hubs have been contacted directly with the request to provide information. The collaboration with the hubs to provide the profile factsheets ranged from very proactive to more challenging. The formal support of the Commission facilitated the data collection processes.

- *DIH landscape*: To date 7 out of the 9 identified hubs have provided profile information.
- *Other*: Further information on the value added of the project for the DIHs is expected to ease the data collection process.

Czech Republic & Slovakia

- *Approach and data collection*: The Czech Industry 4.0 initiative is in place, but without action or executive plan. Therefore the initiative is more or less in hands of well-established competence centers at research institutions and/or universities. For this reason potential DIHs have been identified with web search, personal contacts and networks. Potential hubs, as well as their formal and informal links to companies and other organisations and associations have been mapped and the outcomes have been discussed with representatives of the organisations. In particular useful were the contacts with the IT4Innovations DIH. The catalogue has been received well, in particular by those that already knew about DIHs. Several other potential DIHs have been informed about the possibility to provide profile information with the online survey.
- *DIH landscape*: The landscape is in development and therefore most of the identified DIHs are considered as candidate DIH. Many of the initiatives have been taken by Competence Centres and universities. These organisations however do not have the competence to support business development (mentoring, mediation of access to finance, etc.).
- *Other*: The project increased awareness among policy makers and DIHs. Furthermore it is expected that the project will significantly contribute to the further development of the required policies, the corresponding action plan at national level.

Denmark , Finland & Sweden

- *Approach and data collection*: The DIHs in the three countries have been identified based on a top down policy approach, contacting the ministries in charge. For Finland the source of the listed Hubs was TEM, the Ministry of Economic Affairs and Employment, in Denmark the Danish Ministry of Industry, Business and Financial Affairs provided the Danish Digital Innovation Hub list and for Sweden the list of DIHs was delivered by Division for business of the Ministry of Enterprise and Innovation and VINNOVA. The hubs have either been requested to provide information by the ministries, or directly, mostly using the online survey. In the three countries the current policy is in development and there is no overall national consensus on who is a DIH and who is not one.

- *DIH landscape*: In collaboration with the local ministries robust lists of current existing DIHs has been collected. However, due to the current policy changes it is expected that the current landscape might look different in half a year.
- *Minimum conditions*: The requested examples of services are by some of the DIHs seen as sensitive information that is often not shared.
- *Other*: In general people are confused about the new hype word (D)His and are unsure if it is worth to embark on yet another European funding adventure.

Estonia, Hungary, Latvia, Lithuania, Poland & Romania

- *Approach and data collection*: Since most CEE countries have not yet implemented a national/regional digitalisation initiative, it was not possible to make a link. Even for countries that are in the process of establishment, no formalised or even informal link to DIH has been made in most cases (Poland as exception). Identification and data collection via personal contacts, IT and Industry Associations, Technology Parks, Ministry of Economy, Ministry of Science and Education, etc. Public Policy makers were not helpful because the concept of Digitalisation is only emerging, while DIH as a concept is not very well understood and sometimes not recognised yet. Main challenge was to identify DIHs that operate as a DIH without being aware or using the term themselves. Unintended result of the catalogue exercise is awareness raising among policy makers and among stakeholders (parks, associations, accelerators, etc.) about DIHs
- *DIH landscape*: All DIHs that identify themselves as DIH have been mapped. However for organisations providing similar services (and typically broader) that don't recognise themselves as DIH, we cannot be complete as it is 'arbitrary' which organisation to identify and which not. It can be argued that many types of organisations provide (some) DIH services: associations, clusters, business support agencies, tech parks, incubators, accelerators, Maker Spaces, Fab Labs, Valleys, co-working spaces. Typically, these organisations provide different services and are not recognised as DIH, however in some cases it was recognised that organisations like these provide many or even most services a DIH provides. That means that there might be many still unidentified organisations that could possibly be a DIH that remain unmapped.
- *Minimum conditions*: Minimum conditions are quite high for a fully operational hub, meaning limited number of hubs are identified in CEE. Collecting information and validating them is difficult, since the meaning and concept of hubs is not well known. Some potential hubs are not interested in providing the information and remain therefore unidentified. Mainly in Estonia several organisations which are suspected to be a Hub see no added value in providing this information.
- *Other*: Methodological, we need a one-size-fit-all approach to be consistent in comparing results from different countries, however the meaning of what is a HUB has very different profile comparing West and East. Shared facilities, which seem to be a crucial element for many DIHs are totally absent in CEE. Only universities have some facilities which they try to make 'open access': this is not linked to DIH initiatives and in general seemed to be of little added value.

Possible reasons are: 1) limited number (regional density) of high-tech companies with critical mass (people + funding) for doing R&D using the shared facilities and with willingness and capacity to pay for access to shared facilities. (MTC membership fee of 200 k EUR per year, might translate to membership fee of 1 k EUR in Lithuania for DIH providing soft services) 2) Limited quality of services universities can provide: they are not 'competence centres', but just infrastructure provider.

France

- *Approach and data collection:* Data collection in collaboration with the French national authorities (French Ministry of Higher Education and Research as well as the Ministry of Economy & Finance). A meeting was organized on the 31st of March and led to the alignment of the French data collection process and the DIH Catalogue project to avoid double work. The ministry has direct contacts with a certain number of hubs (under the framework of national policy initiatives). To complement these contacts regional authorities were invited to participate/cooperate. In some regions the identification of DIHs and data collection appeared to be a challenge, because of the absence of hubs under the national framework. Also some regions have reservations with the national initiative (for example due to historical distrust about national/central policies favouring major companies as well as the strong industrial focus of the initiative, i.e nanotechnologies, advanced materials/manufacturing, etc. which is not relevant for every territory)
- *DIH landscape:* Around 50 DIHs are expected, however it is possible that this number is not exhaustive. In particular not operational DIHs, or not under national/regional policy initiated hubs are less visible. In some cases, the distinction between competence center / hub / cluster has to be clarified because of the number of labels & structures sometimes gathering the same stakeholders but under different initiatives.
- *Minimum conditions:* Data collection process by the French national authorities is still ongoing, the actual number of initiatives that meet the minimum conditions is therefore uncertain.
- *Other:* Project positive received, however providing sensitive information (strategic partnerships, turnover...) is a topic of concern.

Germany

- *Approach and data collection:* Identification of the DIHs based on sources provided by the national Industrie 4.0 Plattform. The support from this national initiative was very helpful. Although the national platform initiative is very interested in the EC DIH catalogue project, the narrow time schedule made it impossible to assist us (with the meaning of giving strong support to the DIH identification and collection of Information) within the last weeks: any action by the Plattform I.4.0 has to be approved by various national Ministries and stakeholders. Hence, for the future (next months) support of the catalogue by the Plattform I.4.0 can be hoped for. In addition to the national initiative regional DIHs initiated under the Digital Hub Initiative have been contacted, also these

contacts were helpful in providing information. The collaboration with the DIHs is quite good with intensive discussions with some of them on how to fill in the questionnaire.

- *DIH landscape*: Completeness of coverage cannot be guaranteed, since digitalization processes are an iterative, active and alive process. Much engagement is evolving and many initiatives are about to be born or developed right now. Therefore an open online entry that allows further hubs to be registered is recommended.
- *Other*: DIHs are interested in receiving further information on how their data will be treated by the EC and about the progress of the catalogue. Very often the question was raised: What is the exact definition of a DIH? Who will decide on the content of the map? When will it be online? When is the decision for a hub taken and when does the platform have to be fully "functional"? Do we get an extra notice?

Ireland & United Kingdom

- *Approach and data collection*: The UK and Irish potential DIH initiatives have been identified using networks, online search and contacts with national policy authorities. Based on available public information profiles have been pre-completed and set out for completion and validation by the DIHs.
- *DIH landscape*: In the UK the landscape includes many of the Catapults. Most of these are fully operational. The concept of DIHs in Ireland is relatively new and therefore the Irish landscape is still in development.
- *Other*: Providing information on partners, clients, examples and turnover is considered as sensitive information.

Italy

- *Approach and data collection*: The identification of the Italian Digital Innovation Hubs was executed with the collaboration of Confindustria, the Italian entity responsible for the creation and coordination of the Italian DIHs under the Industria 4.0 initiative, and Fabbrica Intelligente Cluster, developed under the "Notice for the Development and Enhancement of National Technology Clusters". The identification process started with a web search to list the possible Italian catalogue candidates according to the three minimum conditions. The list was then validated by Confindustria and Fabbrica Intelligente according to the clarification that we provided on the DIHs catalogue admission criteria. Several workshops were organised with the hubs representatives both physically and by conference call to introduce the project and the DIHs concept, and to clarify the questionnaire. Given that the hubs raised under the Fabbrica Intelligente initiative were already fully operative, it was possible to gather already some information from the web and then the collected data were validated by the related representatives. On the Industria 4.0 National initiative hubs, instead, poor information was available on the web thus the factsheets were built up directly together with the hubs coordinators. Anyway, a complete collaboration from the coordinators of the National

initiatives as well as the hub representatives allowed the collection process of the hubs profiles.

- *DIH landscape*: The Calenda Plan, that include also the Industria 4.0 initiative, has been recently launched and the possible DIHs are raising their hands to receive the national funding. A map was created for the geolocalisation of the potential hubs. This map lists 21 possible DIHs but in most cases these are at the very beginning of the organisation and quite far to start providing services. The most advanced candidates are the ones reported in the Italian section of the database. Due to the only recent Italian digitisation campaign, the hubs initiated under the Industria 4.0 National initiative are mostly in the development stage. Hubs initiated under the Fabbrica Intelligente initiative, instead, are fully operational.
- *Minimum conditions*: In some cases the example of the services provided are not specifically related to a utility supplied for a fee but they, for sure, represent the efforts of the hub to support the industries that ask for their expertise with the innovation and digitization process.
- *Other*: A hub started under Trento autonomous province initiative is expected to apply via the online survey, as well as one of the Industria 4.0 candidate hubs (Piemonte) in two-three months.

Luxembourg

- *Approach and data collection*: The DIHs have been identified and assessed in close collaboration with Luxinnovation.
- *DIH landscape*: All existing DIHs have been identified. Due to the dynamics, with new initiatives appearing quickly a continuous approach is recommended, including regular updates of the catalogue.
- *Other*: Public organisations are not included as potential clients of the DIHs. Because of the growth of private-public partnerships at the European level focused on digitalisation these type of clients could be added.

Malta

- *Approach and data collection*: The national authorities running the hubs have been very helpful to identify the DIHs. Other sources used were websites, personal contacts, phone calls and face-to-face meetings to collect and assess the profile factsheets.
- *DIH landscape*: The DIHs have often very specific roles which have developed as a result of the local context and the perceived needs of the ecosystem. Being a small country this is bound to vary from the large countries being mapped.

Netherlands

- *Approach and data collection*: Starting point of the identification process were the fieldlabs initiated under the national Smart Industry strategy, as well as related regional strategies. In close collaboration with the Smart Industry board the initiatives identified have been assessed according to the minimum conditions and mapped to their evolutionary stage. Completion and validation of

profiles by the DIHs is quite a challenge, due to the large number of requests these initiatives receive to provide information for other studies.

- *DIH landscape*: Besides the 60 aspirants, candidates and operational fieldlabs initiated under national and regional policy initiatives also many other initiatives seem to qualify as a DIH. Examples are Big Data Hubs initiated under the national Digital Agenda, or competence centres transforming into potential DIHs, like Holst, Soliance and Qutech.
- *Other*: Providing sensitive information (strategic partners, turnover...) is a topic of concern for many of the DIHs and therefore not all profiles are complete.

Portugal

- *Approach and data collection*: To identify potential DIHs in Portugal national and regional strategies have been analysed. Discussion with key institutions, such as Competence Centres and existing DIHs have been carried out in order to assess them and map these DIHs.
- *DIH landscape*: potential DIHs initiated under national and regional policy initiatives, as well as EU policy initiatives haven been identified and assessed.
- *Other*: DIHs in Portugal were clearly localised.

Slovenia

- *Approach and data collection*: DIHs are not planned to be developed on national basis or in scope of the national strategy. National authority has been contacted, however DIHs are not planned to be developed on national basis or in scope of the national strategy therefore the received information was limited. Identification of DIHs with online research. Identified DIHs were contacted directly. DIHs were all keen of creating such a DIH catalogue and support the initiative
- *DIH landscape*: None of the DIHs was identified under the national policy initiative. DIHs offer a broad range of services to their clients and were not very keen on narrowing it down or presenting their clients in detail.
- *Other*: Collecting the profile information was not completely easy. Most of potential DIHs, were surprised about the amount and type of information requested.

Spain

- *Approach and data collection*: To identify potential DIHs in Spain national and regional strategies (4.0, RIS3, I4MS, EU policy initiatives, etc.) have been analysed. Workshops have been organised in close collaboration with the Spanish national and regional authorities. A Workshop was organised by the Spanish Ministry in Madrid with the participation of the EC on 25th May entitled *DIHs in Spain*. The Workshop was a very good means to aware and learn about DIHs. More than 80 participants took part on it. Regional and national institutions have been also contacted directly. Furthermore, dissemination activities to inform DIHs on the catalogue project have been carried out, for instance by CDTI, the Spanish Ministry and other organisations.

- *DIH landscape*: existing potential DIHs initiated under national and regional policy initiatives, as well as EU policy initiatives have been identified and assessed. This has resulted in the identification of many more initiatives than initially expected (almost 50).
- *Other*: The presentations at the workshop organised in Madrid on 25th May by the Spanish Ministry have been very useful and supportive. A high number of DIHs have been identified in Spain. Completion and validation of profiles for all DIHs identified has been challenging as the number of DIHs has resulted much higher than expected.

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