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# Characteristics and regional coverage of the European Digital Innovation Hubs network

De Nigris, S., Kalpaka, A., Nepelski, D.

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# Contents

## Abstract

The European Digital Innovation Hubs (EDIHs), established under the Digital Europe Programme, play a pivotal role in bolstering digitalisation across European businesses. There are 227 hubs, of which 151 are funded directly by the Digital Europe Programme. The EDIHs are widely distributed across 85% of European regions, covering almost 90% of the EU's working population. The EDIHs are formed of a diverse array of organisations, including private companies, research organisations, universities, and public sector entities. The services provided by EDIHs to SMEs and public sector organisations encompass a broad spectrum of technologies and sectors showcasing diversity in strategies and designs. The hubs demonstrate strong competencies in key technologies like Artificial Intelligence, Cybersecurity, and High-Performance Computing.

## Executive summary

Increased digitalisation is a key tool for addressing some of the major challenges that European businesses face. To this end, a **network of European Digital Innovation Hubs (EDIHs)** has been established under the Digital Europe Programme. Its objective is to provide tailor-made digitalisation support to small and medium-sized enterprises (SMEs) and public sector organisations in all regions and sectors of the EU.[1]

As of 2023, the EDIHs network comprehends **227 hubs**. 151 EDIHs are funded by the Digital Europe Programme and 76 Seal of Excellence EDIHs receive national funding.[2]

The EDIHs are **regional multi-partner consortia** of public and private actors, including such organisations as research and technology organisations, universities, industry associations, regional development agencies and private sector companies. **85% of the European regions host** organisations forming the EDIH network and **EDIHs services are available in nearly 90% of the European regions** representing equally large share of the EU working population.[3] In total, **2355 unique organisations** participate in the EDIHs initative.[4] The average **EDIH has 11 participants** and is located in three regions.

The EDIHs network has **very strong research and innovation underpinnings**. Majority of the participants are universities and research organisations strengthened by the representatives of the private sector. 80% of EDIHs have at least one private company among their participants. Universities and research organisations are not only the majority of EDIHs participants, they also receive the largest share of EU budget.

Private companies forming EDIHs operate mainly in the **Information and Communication Technologies (ICT)** and **Professional, scientific and technical activities sectors**. Participants belonging to the *Other* category are predominantly Associations and membership organisations.

The services offered to SMEs and public sector organisations to foster their digitalisation cover a large palette of technologies and sectors. For the former, the EDIHs target technologies encompassing both software and hardware as well as more specialised technologies, such as Additive Manufacturing. Similarly, for sectors, the EDIHs offer spans the European industrial landscape. **The portfolio of an average EDIH encompasses 9 technologies, 7 sectors, and 8 services**. EDIHs can have a more generalist profile from a technological and sectorial standpoint or a more specialised one, suggesting a strong diversity of EDIHs strategies and designs in order to deliver services in their environment.

EDIHs' competencies in the key technologies supported by the Digital Europe Programme are available in the majority of the European regions. For example, **EDIHs offer support for Artificial Intelligence in 91% of the European regions**. Their regional coverage of Cybersecurity and High Performance Computing is 73% and 61% respectively.

Among the most common sectors supported by the EDIHs are **Manufacturing**, targeted by 64% of EDIHs, **Health Care** and **Public Sector**.

The EDIHs exhibit properties of a pan-European network and have **a strong rooting in the ICT R&I Framework Programme**. 89% of EDIHs have participants originating from such projects and almost a third of EDIHs participants took part in such projects. This indicates that most EDIHs are a blend of more experienced participants who already have a track record in the European research and innovation landscape, and new actors with a variety of backgrounds, thus enabling EDIHs to possibly act as a bridge between the two.

[1] https://digital-strategy.ec.europa.eu/en/activities/edihs
[2] https://european-digital-innovation-hubs.ec.europa.eu/home
[3] Regions refer to units at Level 2 of the Nomenclature of territorial units for statistics (NUTS): https://ec.europa.eu/eurostat/web/nuts/background
[4] 2814 in total as some organisations participate in more than one EDIH.

| Key facts about the EDIHs network | |
|---|---|
| Number of EDIHs | 227 |
| Number of EDIHs funded by the Digital Europe Programme | 151 |
| Number of Seal of Excellence EDIHs | 76 |
| Total number of unique EDIHs participants | 2355 |
| **Portrait of the average EDIH** | |
| Average size of EDIH by number of participants | 11 |
| % of private organisations among EDIHs participants | 30% |
| % of universities and research organisations among EDIHs participants | 33% |
| % of public sector organisations in EDIHs participants | 11% |
| **Location and geographical coverage of EDIHs** | |
| % of European regions with EDIHs participants | 85% |
| % of European regions covered by EDIHs services | 90% |
| Average number of EDIHs partners in a region | 3 |
| **Technological offering and sectorial focus of EDIHs** | |
| Average number of target sectors | 7 |
| Average number of target technologies | 9 |
| Average number of services provided | 8 |
| **Key technologies offered by EDIHs, % of EDIHs** | |
| Artificial Intelligence | 91% |
| Cybersecurity | 70% |
| Internet of Things | 64% |
| **Key sectors covered by EDIHs, % of EDIHs** | |
| Manufacturing | 64% |
| Health care | 47% |
| Public Sector | 44% |
| **Networking patterns of EDIHs** | |
| % of EDIHs participants involved in ICT R&I Framework Programme projects | 27% |
| % of EDIHs with participants involved in ICT R&I Framework Programme projects | 89% |

# 1. Introduction

## 1.1. Policy context of the EDIHs

Until recently, digital technologies were considered as an innovative means to increase business efficiency and to expand to new markets. The 2020 crisis showed, however, that they are critical for the very existence of businesses irrespective of their size and location. Only 20% of European SMEs are highly digitised and the global lockdown exposed their weaknesses, forcing many of them into bankruptcy. Thus, digital transformation of European firms is not only a matter of achieving productivity gains and keeping up with global competition, but it is essential for the resilience of the European economy against external shocks.

Against this background, *A Europe fit for the digital age*[5] is among the key priorities of the current EC, promoting digitalisation of businesses as a way of increasing the competitiveness of the European economy. As a result, one of the cardinal points of the **Digital Compass**[6] for the EU's digital decade policy programme proposes that, by 2030, more than 90% of SMEs reach at least a basic level of digital intensity.[7] One of the main tools facilitating the digital transition is the **Digital Europe Programme.**[8] It provides funding and supports projects increasing the adoption of key digital technologies, including the creation of a network of **European Digital Innovation Hubs** (EDIHs), and the Recovery and Resilience Plans that allocated 20% of the total funds to digital priorities. It is also notable that the New Industrial Strategy[9] sees the digitalisation of the European SMEs playing a key role in the twin transitions.

Back in April 2016 the European Commission launched the first industry-related initiative of the Digital Single Market package. Building on and complementing the various national initiatives for digitising industry, the Commission took action to trigger further investments in the digitisation of industry and support the creation of better framework conditions for the digital industrial revolution. One of the more important pillars of the Digitise European Industry effort was to develop a network of **Digital Innovation Hubs** (DIHs)[10]. A DIH is a regional multi-partner cooperation, including such organisations as research and technology organisations, universities, industry associations, chambers of commerce, incubators/accelerators, regional development agencies and vocational training institutes.[11] The idea is that each DIH acts as the epicentre of a regional or national digital innovation ecosystem able to provide access to services, facilities and expertise of a wide range of partners. The aim is to ensure that the SMEs or the public sector get the services they need; that the target regional market segments get access to innovative, scalable solutions and that DIHs cooperate with each other at regional, national and European level.

In this context, DIHs funded by the new **Digital Europe Programme** for the period 2021-2027 are the **European Digital Innovation Hubs**. The creation of the EDIHs is an attempt to facilitate collaboration and technology flow between suppliers and users of digital technologies and services in all European regions and sectors. The EDIHs will accelerate the digital transformation primarily by increasing the heterogeneity of ties

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[5] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age_en

[6] https://futurium.ec.europa.eu/en/digital-compass

[7] Digital intensity of firms in Europe is assessed by the Digital Intensity Index (DII). A basic level of digital intensity entails the use of at least four of the twelve selected variables, which means it includes enterprises with a low, high and very high level of the DII, excluding the very low level.

[8] https://digital-strategy.ec.europa.eu/en/activities/digital-programme

[9] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en

[10] Can be seen under the category "Funded by other initiatives" https://european-digital-innovation-hubs.ec.europa.eu/edih-catalogue?f%5B0%5D=edih_soe%3Aedih&f%5B1%5D=edih_soe%3Asoe

[11] https://s3platform.jrc.ec.europa.eu/w/digital-innovation-hubs-as-policy-instruments-to-boost-digitalisation-of-smes

among the suppliers and users of digital technologies and their ability to exploit the potential of digital innovation in diverse regional and economic environments.

## 1.2. **Context of the present study**

Since 2017, the Joint Research Centre (JRC) and Directorate-General for Communications Networks, Content and Technology (DG CNECT) have collaborated in a research programme on the digitalisation of SMEs and public sector organisations in Europe. Within the context of this collaboration JRC is currently providing support in the implementation phase of the EDIHs network in areas such as the development of the Digital Maturity Assessment (DMA) Frameworks for SMEs and public sector organisations as well as quantitative and qualitative analysis of EDIHs.

Among the objectives of the EDIHs is to accelerate digital transformation throughout Europe and to drive the uptake of such advanced digital technologies as Cloud, Artificial Intelligence and Big Data. They are expected to play a central role in the Digital Europe Programme[12] as one-stop shops that help companies become more competitive regarding their business/production processes, products or services using digital technologies. The EDIHs support is multi-faceted: it ranges from providing access to technical expertise and experimentation, so that companies can "test before invest", to providing innovation services, such as financing advice, training and skills development that are needed for a successful digital transformation. The EDIHs will also support companies and public sector organisations in the use of digital technology to improve the sustainability of their processes and products, in particular regarding energy consumption and reduction of carbon emissions.

As of today, 151 EDIHs[13] have been selected to receive funding for their operations from the EU Digital Europe Programme and the Member States. In addition, there are another 76 that received the Seal of Excellence certification with which they may secure funding under different funding instruments such as the Cohesion Funds[14], the Recovery and Resilience Fund[15] of NextGenerationEU[16] mechanism, and others. The network started being operational gradually since September 2022.

The EDIHs, which have a strong regional rooting, closely mirror the diversity of Europe's regions. This report presents the results of an early quantitative analysis of the EDIHs features, with the aim of sketching their "profile" in this starting phase of the initiative. Considering the heterogeneity of the context the EDIHs operate in, there is no "one-size-fits-all" approach to foster the digital transformation of their environment and, therefore, every EDIH has a particular design, in terms of actors, target technologies and sectors as well as geographical outreach. Nevertheless, the EDIHs network shares strong commonalities and, in what follows, the analysis is articulated along three main axes. First, the EDIHs setup, composition and geographical spread (Sections 2, 3). Second, the EDIHs technological and sectorial offer (Section 4). Third, we adopt a network perspective in Section 5 by delving in the pre-existing connections between different actors that will, possibly, sustain the development of the EDIHs network. The analysis stems from a blend of data from the EDIHs themselves, fused with data on their regional context and data characterising the organisations participating in the EDIHs, issued from proprietary databases (see Annex B).

[12] https://digital-strategy.ec.europa.eu/en/activities/digital-programme

[13] https://european-digital-innovation-hubs.ec.europa.eu/edih-catalogue

[14] https://ec.europa.eu/regional_policy/home_en

[15] https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/recovery-and-resilience-facility_en

[16] https://next-generation-eu.europa.eu/index_en

# 2. Portrait of the average EDIH

The EDIHs are regional multi-partner consortia of public and private actors, including organisations such as research and technology organisations, universities, industry associations, regional development agencies and private sector companies. This section aims at giving a first outlook of the structure of the EDIHs and which entities are the constituents of the EDIHs. It starts with the analysis of the size of the EDIHs and their composition, before moving on to the characteristics of the EDIHs participants, looking at their sector of activity and size. Box 1 provides key features of the average EDIH.

**Box 1: Portrait of the average EDIH**

- The average EDIH has 11 participants.
- The majority of participants are private companies, universities, and research organisations.
- Universities and research organisations receive the largest share of the EDIHs budget.
- 80% of the EDIHs contain private companies.
- Private companies operate mainly in the *ICT* and *Professional, scientific and technical activities sectors.* Participants belonging to the category "Other" are predominantly *Associations and membership organisations.*

## 2.1. Size and composition of the EDIHs

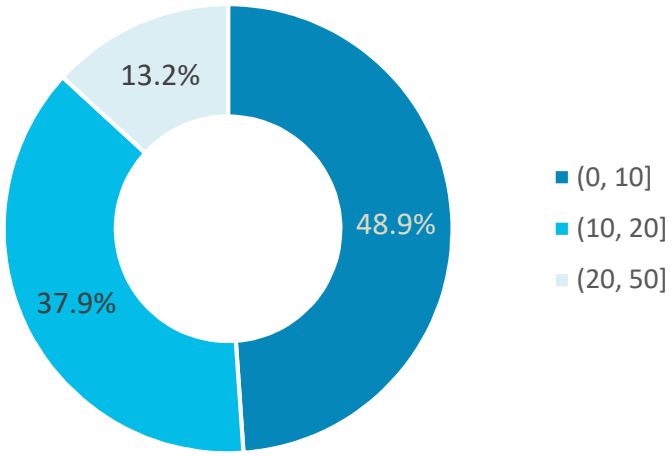
Throughout our analysis we encompass both the EDIHs funded unter the Digital Europe Programme and EDIHs that received Seal of Excellence. In total, all EDIHs include 2355 unique organisations covering private companies, research organisations, universities and public sector actors and a remainder category called "Other", including, for example, industry umbrella organisations, university networks and civil society organisations. In Table 2.1, we display basic statistics on the EDIHs size, in terms of number of participants, and on the organisation categories.

While the average EDIH has 11 participants, the EDIHs display a large variance, ranging from a single organisation consortium to large ensembles composed of up to 46 organisations. They likeswise exhibit a large variance when breaking down into categories. The number of private companies can for instance rise up to 24 participants. According to Figure 2.1 showing the distribution of the EDIHs by number of participants, roughly half the EDIHs population is composed by less than 10 participants and 37% is in the range 10 to 20 participants.

**Table 2.1. Number of participants by organisation type per EDIHs**

| | Minimum | Median | Average | Maximum |
|---|---|---|---|---|
| Number of participants | 1 | 11 | 11 | 46 |
| Number of Private Companies | 0 | 3 | 4 | 24 |
| Number of Higher Education Institutions | 0 | 2 | 2 | 14 |
| Number of Research Centres | 0 | 2 | 2 | 16 |
| Number of Public Organisations | 0 | 2 | 2 | 10 |
| Number of Other | 0 | 3 | 3 | 16 |

**Figure 2.1 Distribution of the EDIHs by number of participants**

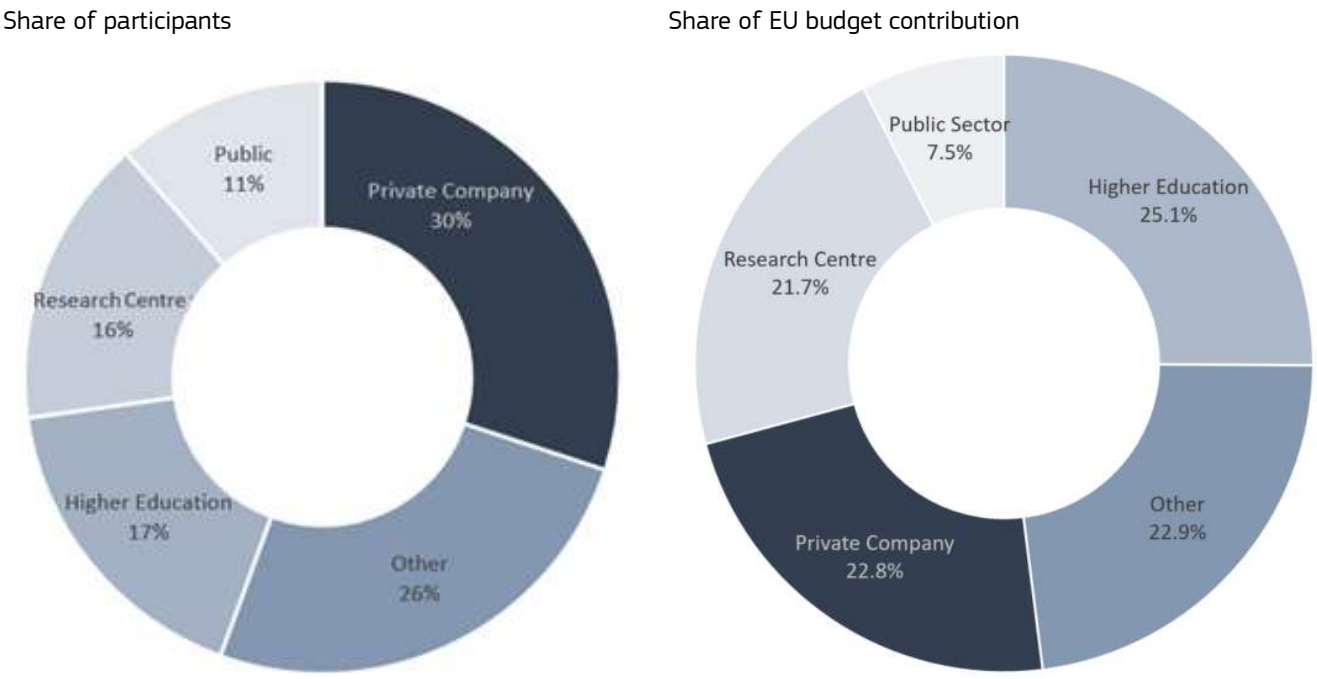



Source: Corda data, JRC elaboration.

As mentioned above, there are five types of organisations that form the EDIHs. In Figure 2.2 we display the total breakdown of EDIHs participants by organisation in terms of the share of participants per type and in terms of the share of budget they received from the EU. For the former, i.e. just looking at the number of organisations (Figure 2.2 left), private companies and research and education institutions contribute roughly equally, 30% and 33% respectively and the other strongest category is the "Other" one. Hence, **the majority of organisations forming the EDIHs are private companies, universities and research organisations**. On the other hand, looking at the distribution of the budget contributed by the EU (Figure 2.2 right), the outlook changes considerably. Research centres and higher education institutions which account for 16% and 17% of participants, receive 21.7% and 25.1% of the EU contributed budget, respectively. Private companies, which account for 30% of participants, receive 22.8% of such budget. **Thus, universities and research organisations are not only the majority of EDIHs participants but, also, they receive the largest share of EU budget, approximately 47% of it.**

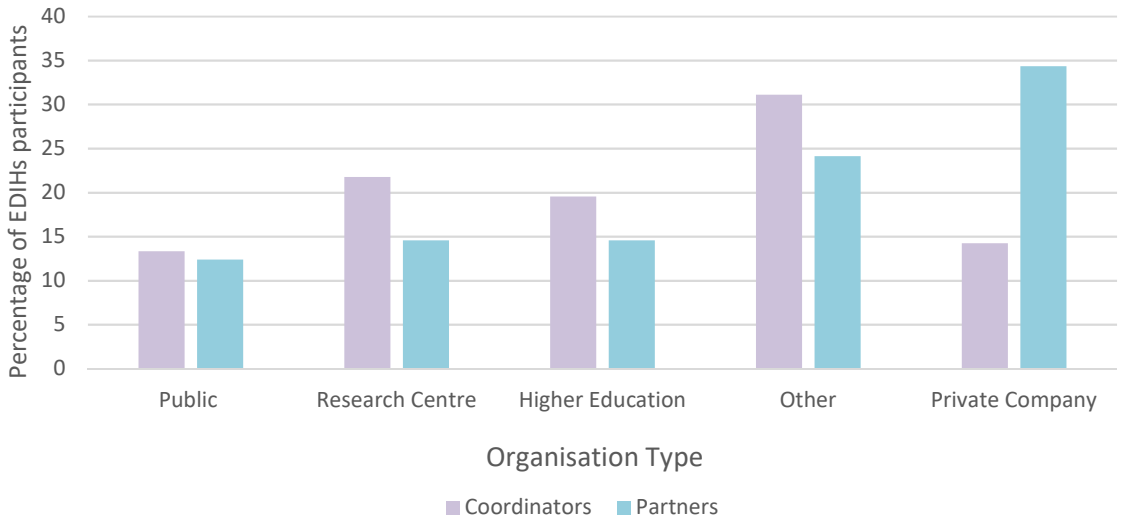
In Figure 2.3, the EDIHs organisation categories are also divided into coordinators and partners, where it shows that roughly 40% of the coordinators are universities or research centres, while, 14% are private companies. On the other hand, the presence of private companies is much higher for partners, as they account for 34% of all the EDIHs partners.

**Figure 2.2. Distribution of EDIHs participants by organisation type**




Source: Corda data, JRC elaboration.

**Figure 2.3 EDIHs participants by organisation type and role**

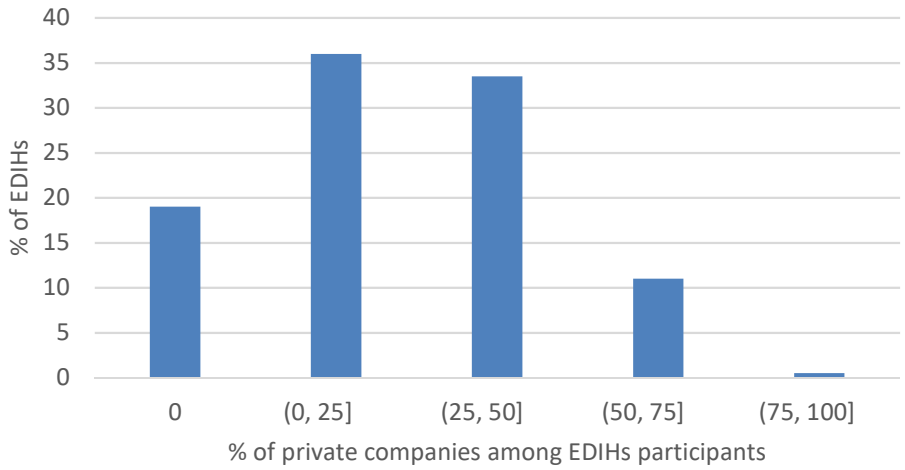



Source: Corda data, JRC elaboration.

According to Figure 2.2, private companies account for one third of EDIHs participants. In order to better understand the presence of the private sector in the EDIHs, Figure 2.4 displays the percentage of private companies per EDIH, i.e. per each EDIH, we divided the number of private companies by the total number of participants in the EDIH. This shows that the EDIHs have a very different percentage of private companies among their participants. **20% of EDIHs do not** involve **any private company at all**. In addition, looking at

the EDIHs with private companies, one can see that over half of them have less than a quarter of participants belonging to the private sector. Another strong cohort (33.5% of the EDIHs) are the ones where private companies constitute from one quarter up to a half of the participants. This evidence implies that most EDIHs display a prevalence of organisations in research and higher education and a rather low participation of private companies.

**Figure 2.4 Distribution of EDIHs by the percentage of private companies among EDIHs participants**




## 2.2. **Sector of activity of EDIHs participants**

The information on the sector of activity of EDIHs participants provides additional insights into their characteristics.[17] To this end, we looked at the characterisation of EDIHs participants according to the Nomenclature statistique des activités économiques dans la Communauté européenne (NACE)[18] taxonomy of sectors.

In Figure 2.5, we display the distribution between sectors of activity for EDIHs participants at NACE Level 1 and Level 2. At the more general level, NACE Level 1, we see that roughly 90% of organisations act in the sectors research activities, education, ICT, membership organisations activities and the public sector.

Figure 2.6 displays the sector distribution for specific types of organisations. The category "Other" is predominantly formed by associations and membership organisations (42%). Private companies offer a more varied landscape. Roughly 30% of them are in the ICT sector and, more specifically, in the development of software products and consultancy. The other strongest macro area is "Professional, scientific and technical activities". It accounts for 33%, suggesting a strong presence of private research actors in the EDIHs setup.

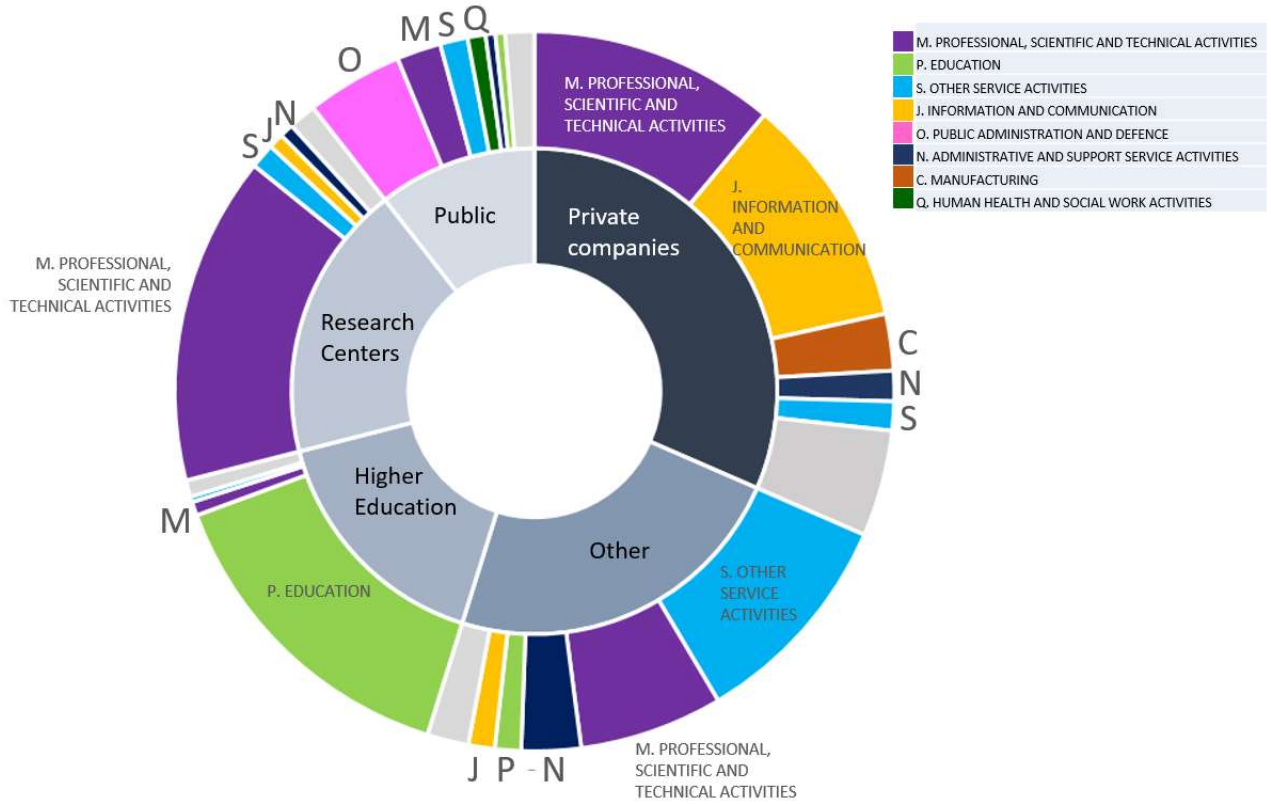
[17] This analysis relies on CORDA data enriched with organisation level data extracted from ORBIS by Bureau van Dijk (see Annex B).

[18] More specifically, we use the NACE Rev.2 version of the taxonomy. See the official documentation for further information.

**Figure 2.5 EDIHs participants by NACE Level 1 (inner circle) and Level 2 (outer circle) sectors of activity**


Source: Orbis and Corda data, JRC elaboration.

**Figure 2.6 EDIHs participants by organisation type (inner circle) and NACE Level 2 (outer circle)**




Source: Orbis and Corda data, JRC elaboration.

## 2.3. **Size of EDIHs participants**

To complete the characterization of EDIHs participants, we investigate their organisational features, namely size in terms of their size measured by the number of employees.[19]

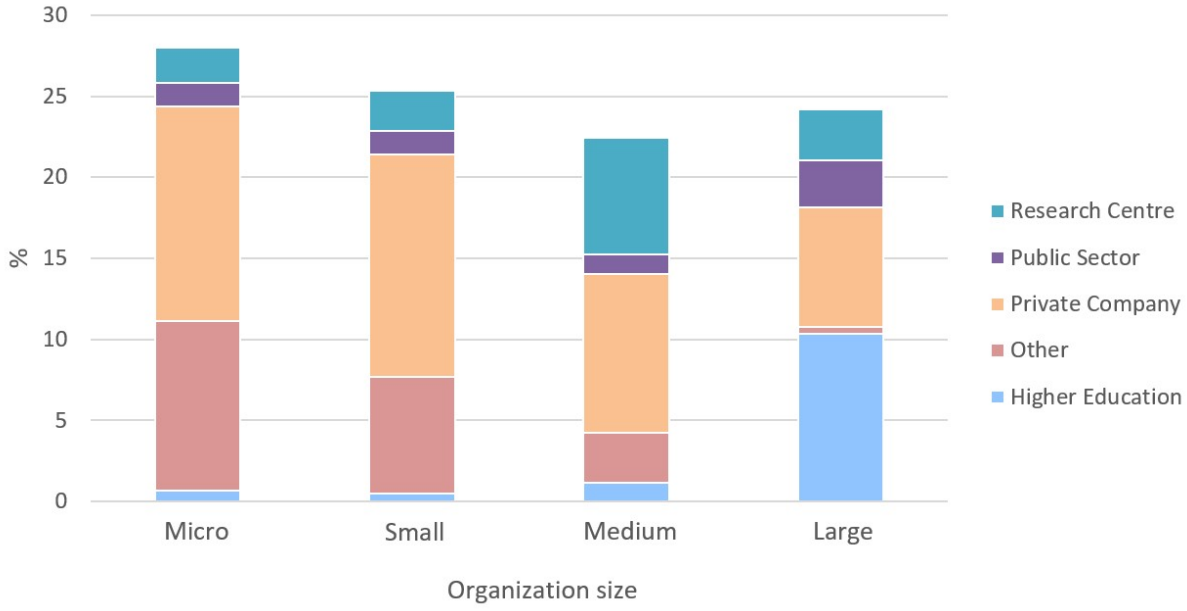
According to Figure 2.7, the EDIHs participants are roughly evenly distributed between micro (28%), small-sized (25%) and medium-sized organisations (22%).[20] The remainder category of large organizations accounts for 24% of all the EDIHs participants.

The distribution of organisation types inside every cohort varies a lot. Higher education institutions and public sector organisations in the large organizations cluster. Research centres accumulate in the medium-sized one. Private companies are, on the other hand, present in each of the cohorts, but predominantly in the micro and small-sized organisations. The organisations in the "Other" category show a similar pattern to private companies, accumulating in the micro and small-sized end of the spectrum.

[19] As in the case of sectorial analysis, this analysis relies on relies on CORDA data enriched with organisation level data extracted from ORBIS by Bureau van Dijk (see Annex B).

[20] The breakdown by organization size classes is organized as follows: micro enterprises (fewer than 10 employees), small enterprises (10 to 49 employees), and medium-sized enterprises (50 to 249 employees). Large enterprises employ 250 or more people.

**Figure 2.7 EDIHs participants by organization size and type**




Source: Orbis and Corda data, JRC elaboration.

# 3. Location and geographical coverage of the EDIHs

Wide geographical outreach of the EDIHs network and the availability of their services in all European regions is a fundamental feature to achieve their digitalisation objectives. Thus, this section aims at giving a general outlook of the EDIHs geographical dimension.

The EDIHs are located in the European Union, Iceland, Norway and Liechtenstein and deliver their services in a capillary manner across the European regions.[21] As the geographical outreach of the EDIHs cannot be grasped by a single quantitative measure, the following analysis distinguishes between:

- **Location of an EDIH participants** expressed in terms of the number of regions in which participants forming an EDIH are located,
- **Regional coverage of an EDIH services** defined as the regions where a given EDIH delivers its services. Regional coverage of an EDIH can stretch beyond the borders of the physical location regions, possibly encompassing the whole country the EDIH is located in.

Box 2 provides key facts about the location and geographical coverage of the EDIHs.

**Box 2: Location and geographical coverage of the EDIHs**

- 213 or 85% of the European regions host organisations forming the EDIH network.
- EDIHs services are available in 223 or nearly 90% of the European regions.
- Organisations forming an average EDIH are located in 3 regions.
- The average EDIH covers 3 European regions with its services.

According to Table 3.1, participants of a single EDIH can be located in as many as 14 different regions. This is the case of DAMAS, an Italian EDIH. It comprises of 26 participants. Excluding this outlier, most EDIHs, over 65%, are geographically very concentrated, having participants located in up to three regions.

Regarding the number of regions covered by services of a single EDIH, we observe a strong variance. Looking at the higher end of the spectrum, the maximum number of regions an EDIH covers with its services is 21. This wide coverage corresponds to the EDIHs who covers all the regions in a country. In these specific cases, 11 EDIHs are located in Italy. The EDIHs network features over 80 hubs which have a national target for their services, that might stretch beyond the regions they are geographically located in. On the other side of the spectrum, where we have the EDIHs with lower coverage, half of the EDIHs network (114 hubs) declares covering primarly one region.

**Table 3.1. Number of regions with EDIHs partners and service coverage per EDIH**

| | Minimum | Median | Average | Maximum |
|---|---|---|---|---|
| Number of regions with an EDIH partner | 1 | 3 | 3 | 14 |
| Number of regions with an EDIH services | 1 | 1 | 3 | 21 |

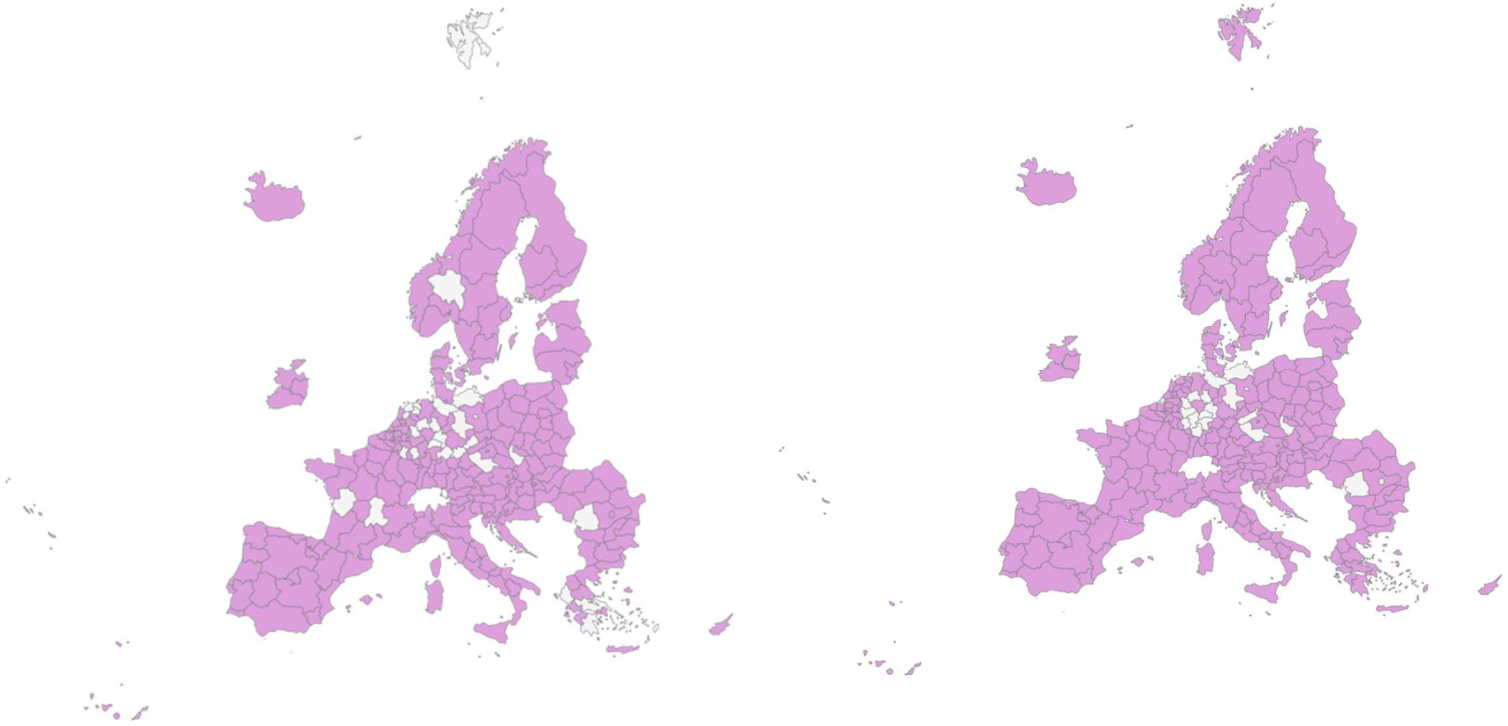
Overall, the EDIHs participants are located in 213 of the 251 European regions (Figure 3.1 left). This represents 85% of the regions of the EU27, Norway, Liechtenstein and Iceland. In terms of their geographical outreach, the EDIHs services are available to companies and public sector organisations in 223 regions or nearly 90% of the European regions (Figure 3.1 right).

[21] Regions refer to units at Level 2 of the Nomenclature of territorial units for statistics (NUTS).

**Figure 3.1. Location of and regional coverage of the EDIHs**

Location of EDIHs participants

Regional coverage of EDIHs services



# 4. Technological offering and sectorial focus of the EDIHs

The offer of the EDIHs spans a large palette of technologies, sectors and services. Tables A.1-A.3 in Annex A include the full lists. In this section, we characterise this offer to further understand the technological and sectorial regional coverage and diffusion of EDIHs services. Box 3 summarises the main takeaways of this section.

**Box 3: Technological offerings and sectorial focus of the EDIHs**

- EDIH have a portfolio of, on average, 7 sectors, 9 technologies and 8 services.
- The most targeted technologies are Artificial Intelligence (91%), Cybersecurity (70%) and Internet of Things (64%).
- The most targeted sectors are Manufacturing (64%), Health Care (47%) and Public Sector (44%).
- The three top services are SME support (81%), Ecosystem building (72%) and Technological Innovation (71%).
- Artificial Intelligence and Cybersecurity are the technologies with the widest regional coverage.
- The services in sectors with the widest geographical coverage are Manufacturing, Health Care and Public Administration. They are present in 74%, 62% and in 60% of the covered regions respectively.

## 4.1. Scope of EDIHs offerings

To characterise the scope of EDIHs offerings we leverage data from the EDIHs Catalogue[22] and first outline the basic statistics of sectors, technologies and services of the EDIHs in Table 4.1. The scope of EDIHs technological offering and sectorial focus exhibits a large variance with a maximum of above 30 sectors and technologies and 16 services, while the average is 9 for technologies, 7 for sectors and 8 for services.

**Table 4.1. Number of sectors, technologies and services offered by EDIHs**

| | Minimum | Median | Average | Maximum |
|---|---|---|---|---|
| Sectors | 1 | 6 | 7 | 33 |
| Technologies | 1 | 7 | 9 | 32 |
| Services | 2 | 7 | 8 | 16 |

Looking at the outliers from Table 4.1, the queues of the distribution are scarcely populated. In the case of EDIHs targeting one sector, we find eight EDIHs mostly targeting Manufacturing and Public Administration. For EDIHs focusing on one single technology, there are five EDIHs, mostly in Artificial Intelligence and Cybersecurity and Additive manufacturing. Lastly, there are four EDIHs that offer two services, mostly in SME support and Knowledge and Technology Transfer. We observe that, notwithstanding their very narrow technological and sectorial focus, these EDIHs can be both small and medium-sized in terms of number of participants. The EDIHs adressing the maximum number of the available technological, sectorial and services palette, there is one per each operational feature with a size spanning between 10 and 20 participants.

In terms of the most frequent operational features, shown in Table 4.2 and in Figure 4.1, for sectors, the strongest are Manufacturing (64%), followed by Health Care (47%) and Public Sector (44%). For technologies, two of the Digital Europe Programme technologies are the most present: Artificial Intelligence is the dominant

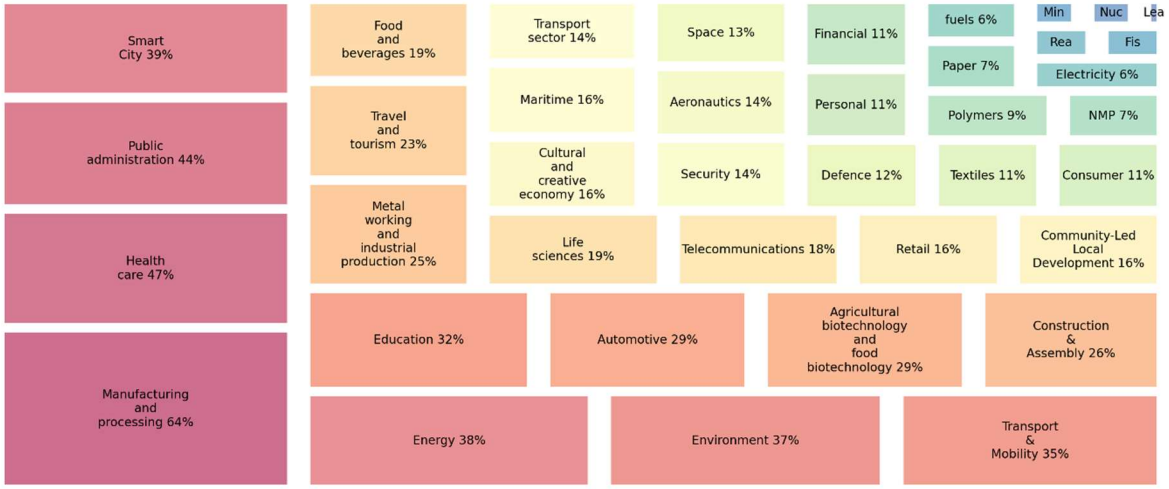
[22] The EDIHs data was collected on the 17/05/2023 and it has the following scope: 182 EDIHs (80%) input their technological profile, 181 their sectoral profile (80%) and 176 their services profile (78%).

one (91%), followed by Cybersecurity (70%). The third most common technology covered by the EDIHs is Internet of Things (63%). Lastly, for the Services, the top ones are linked with SME support (81%) and Ecosystem building (72%) and Technological Innovation (71%).

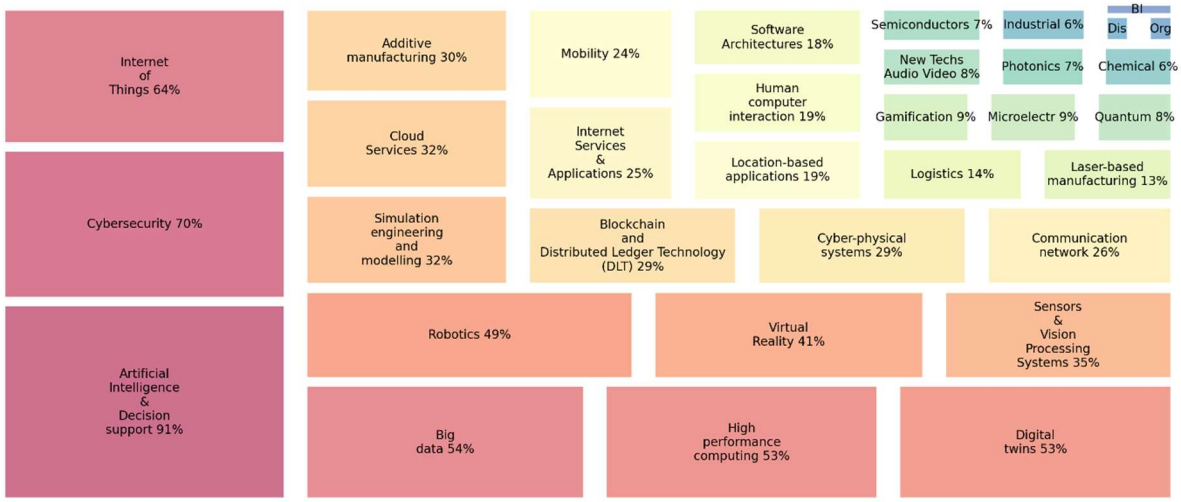
| Table 4.2. Top three sectors, technologies and services offered by the EDIHs | |
|---|---|
| Sector | Manufacturing (64%), Health care (47%), Public Sector (44%) |
| Technologies | Artificial Intelligence (91%), Cybersecurity (70%), Internet of Things (64%) |
| Services | SME Support (81%), Ecosystem building (72%), Technological Innovation (71%) |

**Figure 4.1. Breakdown of sectors, technologies and services targeted by EDIHs**

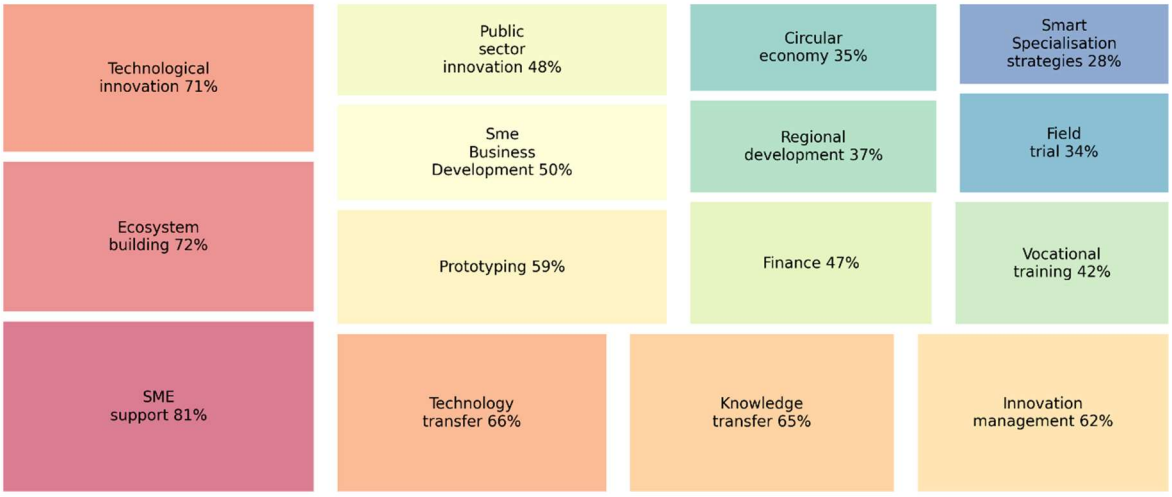
Sectors




Technologies



Services




Source: EDIHs Catalogue, JRC elaboration.

## 4.2. **Sectorial and technological diversification of the EDIHs**

Considering the large variance with respect to the number of sectors and technologies (see Table 4.1) and the similarly wide span of sizes of EDIHs (see Figure 3.1), it is possible to relate an EDIH's size with the size of the technological and sectorial portfolio it offers to better understand the interplay of these features. Figure 4.2 shows such relationship, where each EDIH is categorised by the size of its sectorial and technological portfolio and by a color related to its size. The EDIHs are grouped as follows: small EDIHs with 1 to 10 participants, medium size EDIHs with 11 to 20 participants and large EDIHs with more than 20 participants. Considering the scope of technological and sectorial offerings of EDIHs, Figure 4.2 distinguishes four types of EDIHs divided by the median number of sectors (6) and technologies (7) an EDIH targets. The four EDIHs profiles can be characterised as follows:

- **Focused Generalists:** EDIHs with a wide technological portfolio and a focused sectorial profile (top left);
- **Focused Specialists:** EDIHs with a strong technological and sectorial specialization (bottom left);
- **Diversified Specialists:** EDIHs with a strong technological specialization and a diversified sectorial profile (bottom right);
- **Diversified Generalists:** EDIHs with a wide technological and sectorial profile (top right).

In addition to the visual representation of the EDIHs by their size and specialisation profile, Table 4.3 details the distributions of EDIHs by the above defined types. Such an analysis aims to test the existence of EDIHs with a more generalist or with a more specialised profile, both from the sectorial and the technological point of views.

According to Figure 4.2, first, we observe the presence of small EDIHs in each of the quadrants, in particular in the diversified generalist quadrant and the focused generalist one. This suggests that these EDIHs may also rely on strong networks to address a large portfolio of sectors and technologies, acting as brokers between client SMEs and services providers in their region. Second, looking at large EDIHs, we observe that they cluster in the diversified generalist quadrant, which could be related to the effect of their sizable number of participants. Third, for medium-size EDIHs, we observe that they split almost evenly in the diversified generalist quadrant, with 24 hubs, and the focused specialist quadrant, with 25 hubs. We check if this split could somehow be related

to other features, such as the Member State they are located in, but find no apparent correlation. Hence, the different strategies with respect to the portfolio shaping of EDIHs could partially be related to factors unobservable at this stage, such as network effects or the regional context.

**Figure 4.2. Technological and sectorial focus of EDIHs by their size**

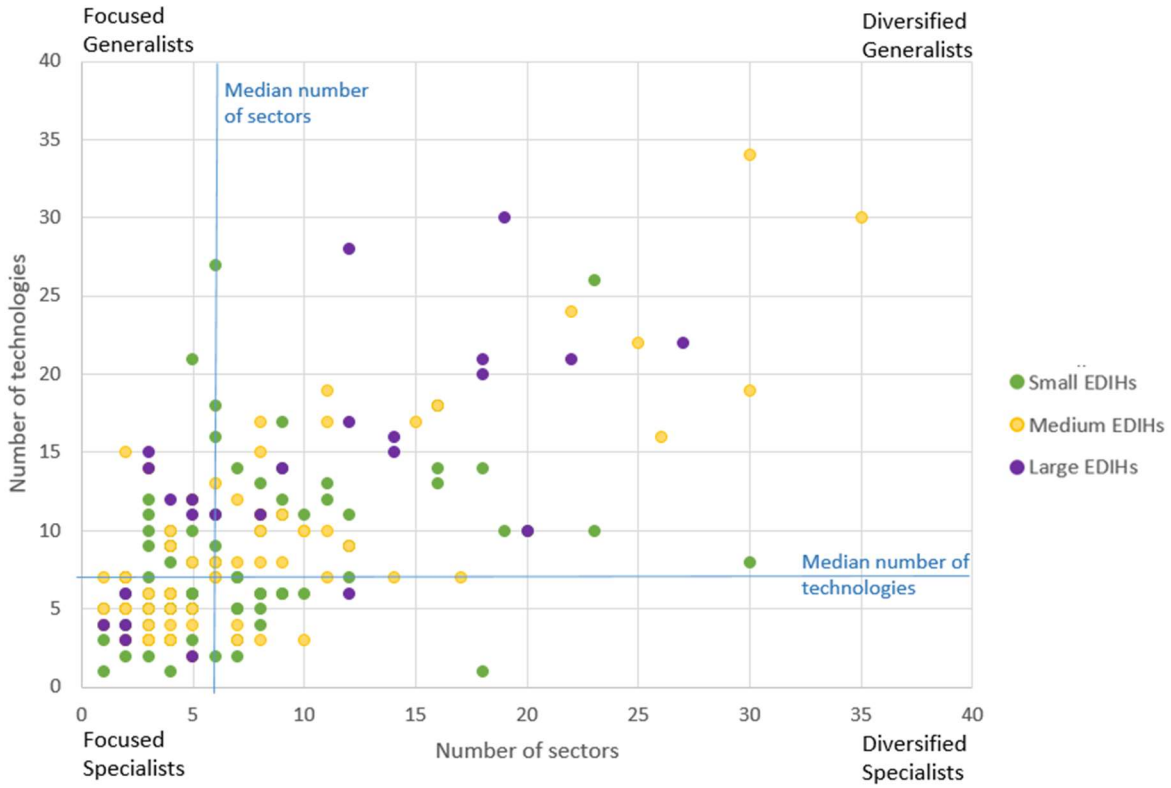



**Table 4.3. Technological and sectorial focus of EDIHs by their size**

| Sectorial scope | Technological scope | Small EDIHs | Medium EDIHs | Large EDIHs | Total |
|---|---|---|---|---|---|
| Focused | Generalists | 18 | 8 | 6 | 32 |
| | Specialists | 36 | 25 | 5 | 66 |
| Diversified | Generalists | 21 | 24 | 12 | 57 |
| | Specialists | 15 | 7 | 1 | 23 |

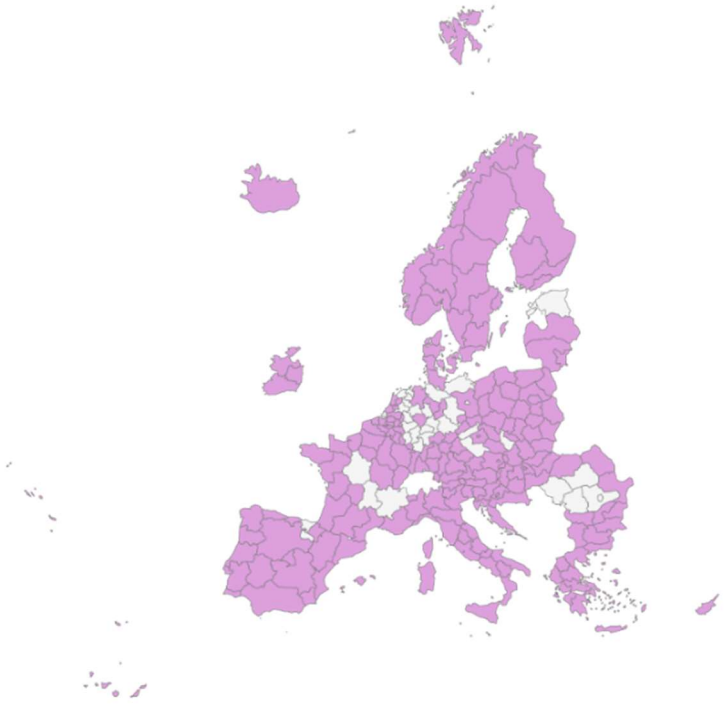
## 4.3. **Geographical coverage of EDIHs technological and sectorial offers**

Leveraging the regional coverage data of section 4, it is possible to characterise the EDIHs offer in terms of technologies and sectors from a geographical standpoint. To this end, we show in Tables 4.4 and 4.5 the number of regions covered by a given technology or sector and the relative coverage in percentage of the total number of the covered European regions and percentage of employed EU citizens. Thus, the companies located in the covered regions for a given technology or a sector could be directly catered by one or several local EDIHs. Nonetheless, as the EDIHs form a synergistic network, companies located in a non-covered region can seamlessly access EDIHs services.

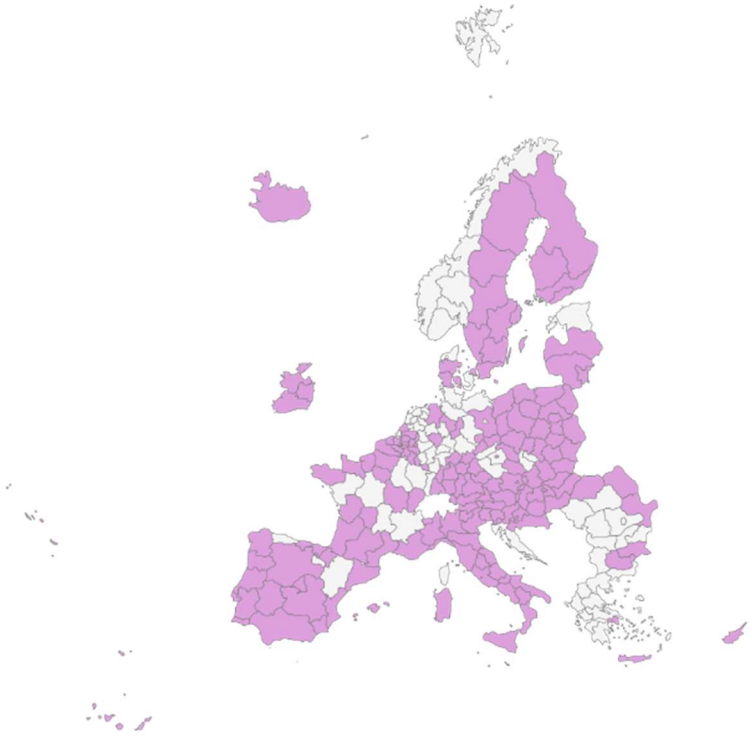
For technologies (Table 4.4), the most ubiquitous is Artificial Intelligence, reaching 88% of the covered regions (Figure 4.2). Other 13 generalist software and hardware technologies lay in the 40 to 70% coverage interval. At the other side of the spectrum, for a coverage of below 10%, it is possible to find several technologies linked to Materials, Semiconductors and Biotechnologies, probably due to the higher degree of specialisation of such technologies.

**Figure 4.3 Regional EDIHs coverage of AI, Cybersecurity and High Performance Computing technologies**

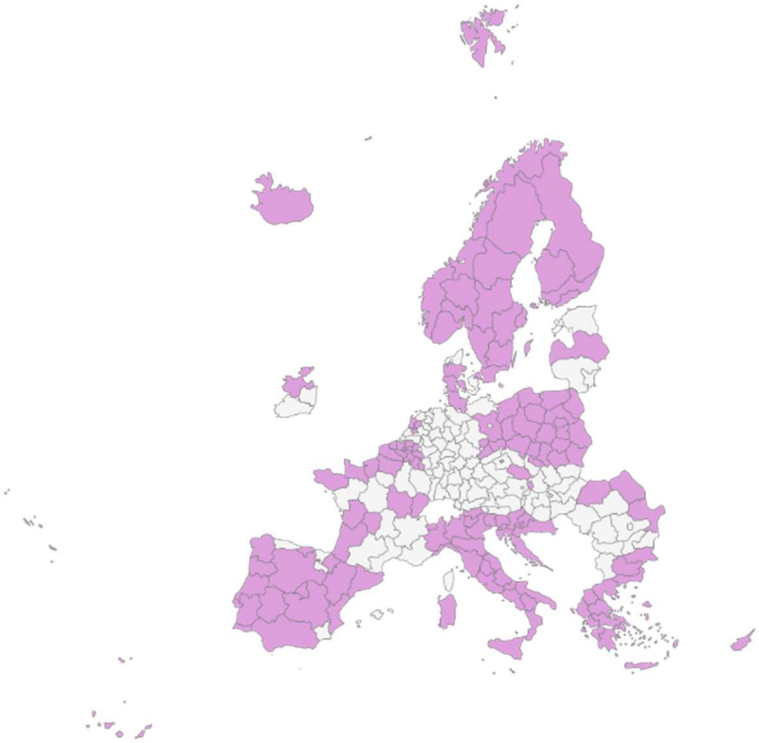
Artificial Intelligence



Cybersecurity



High Performance Computing



Source: EDIHs catalogue data, JRC elaboration.

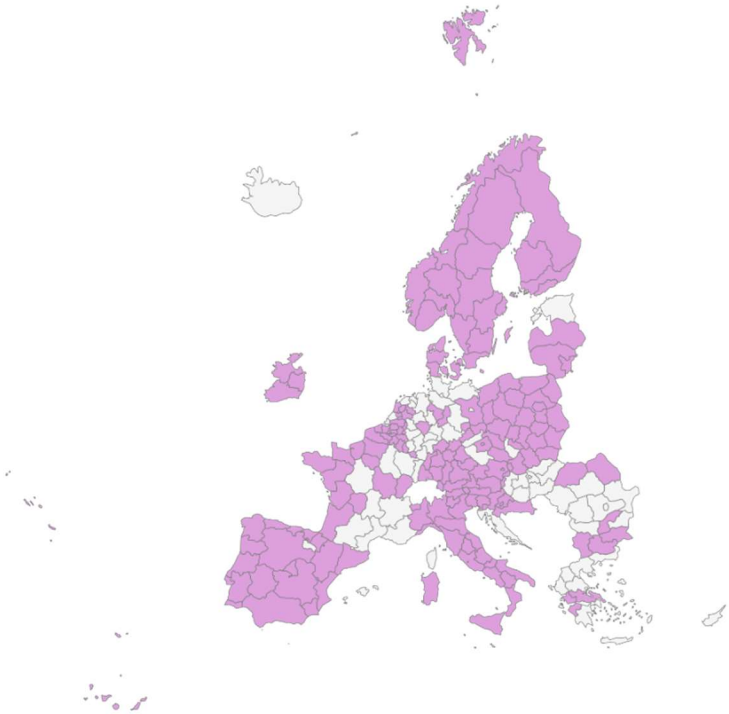
| Table 4.4. Regional coverage of EDIHs technologies | | | |
|---|---|---|---|
| Technology | Number of regions | % of covered regions | % of employed EU citizens covered |
| Artificial Intelligence & Decision support | 207 | 88% | 83% |
| Cybersecurity | 171 | 73% | 74% |
| Robotics | 158 | 67% | 64% |
| Internet of Things | 157 | 67% | 62% |
| Big data | 152 | 64% | 60% |
| Digital twins | 151 | 64% | 62% |
| High performance computing | 143 | 61% | 55% |
| Virtual Reality | 119 | 50% | 49% |
| Cyber-physical systems | 117 | 50% | 46% |
| Sensors & Vision Processing Systems | 117 | 50% | 48% |
| Simulation engineering and modelling | 115 | 49% | 45% |
| Blockchain and Distributed Ledger Technology | 114 | 48% | 44% |
| Cloud Services | 109 | 46% | 44% |
| Additive manufacturing | 104 | 44% | 46% |
| Communication network | 96 | 41% | 39% |
| Internet Services & Applications | 90 | 38% | 33% |
| Software Architectures | 84 | 35% | 37% |
| Mobility | 79 | 33% | 32% |
| Logistics | 78 | 33% | 35% |
| Human computer interaction | 77 | 32% | 33% |
| Location-based applications | 76 | 32% | 33% |
| Micro- and nanoelectronics, optoelectronics | 49 | 20% | 23% |
| Laser-based manufacturing and materials processing | 46 | 19% | 16% |
| Gamification | 45 | 19% | 21% |
| Photonics | 27 | 11% | 11% |
| Semiconductors and Nanotechnology | 27 | 11% | 11% |
| New technologies for Audio-Visual sector - Media | 26 | 11% | 11% |
| Quantum Technologies | 24 | 10% | 13% |
| Chemical engineering | 24 | 10% | 8% |
| Industrial biotechnology | 17 | 7% | 8% |
| Displays | 14 | 5% | 4% |
| Organic and large area electronics | 10 | 4% | 5% |
| BI tools | 4 | 1% | 1% |

Source: EDIHs catalogue, Eurostat and ARDECO data, JRC elaboration.

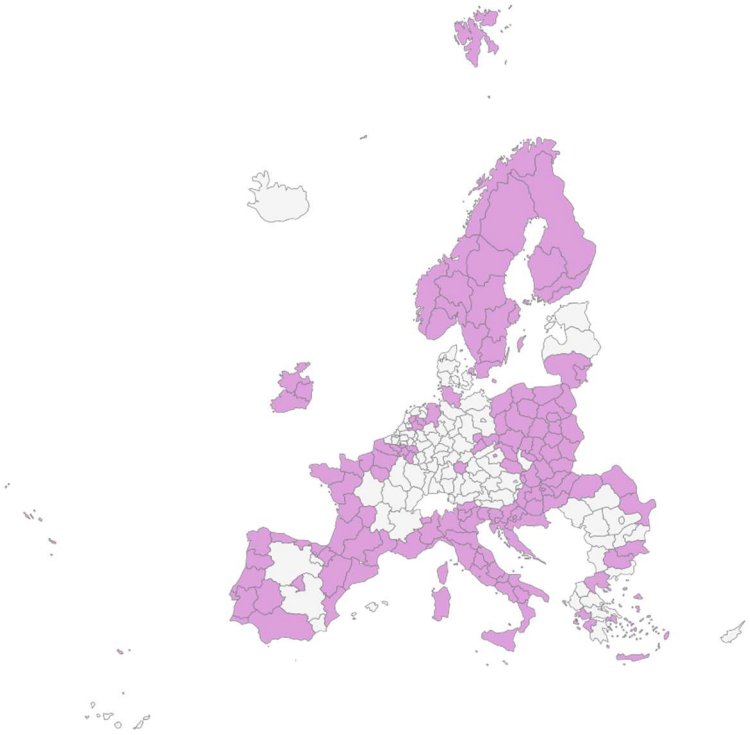
For the sectorial coverage, according to Table 4.5, EDIHs services in the Manufacturing sector are available in most of the covered regions (74%). Health care and Public Administration are covered in 62% and 60% of the regions, respectively. Other crucial sectors, such as Transport, Automotive and Environment, also have a relatively wide regional coverage of between 40% to 50%. Similarly to the technology coverage, the sectors with less than 20% coverage are more focused sectors, such as Fishery, Energy or Mining and extraction.

**Figure 4.5 Regional coverage of EDIHs services for the Manufacturing, Health Care and Public Administration sector**

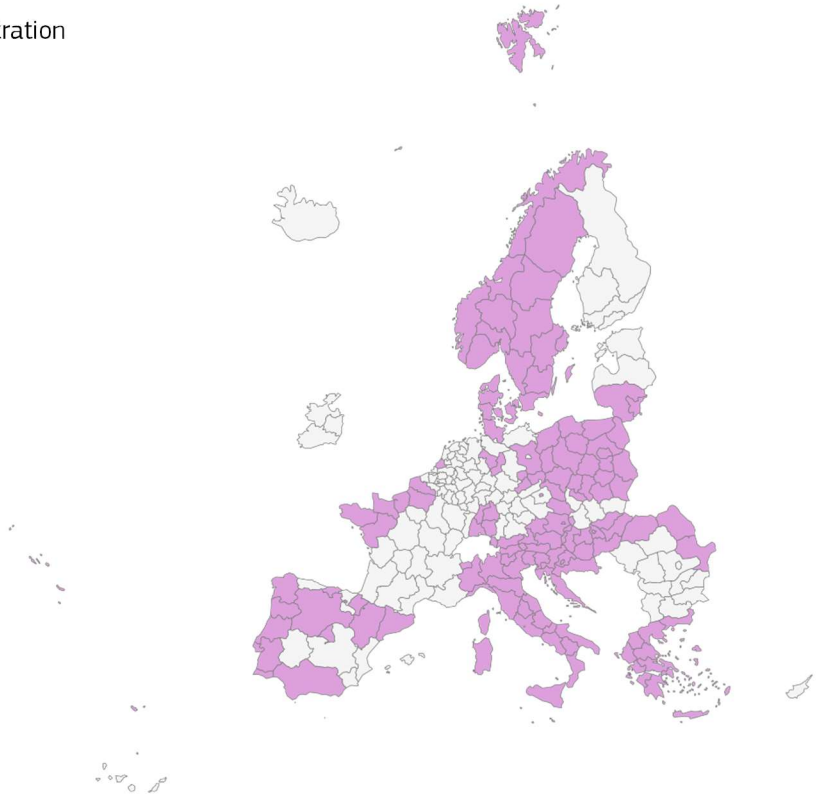
Manufacturing



Health care



Public Administration



Source: EDIHs catalogue data, JRC elaboration.

| Table 4.5. Regional coverage of sectors targeted by EDIHs services | | | |
|---|---|---|---|
| **Sector** | **Number of regions** | **% of covered regions** | **% of employed EU citizens covered** |
| Manufacturing and processing | 172 | 74% | 72% |
| Health care | 146 | 62% | 61% |
| Public administration | 141 | 60% | 56% |
| Smart City | 122 | 52% | 50% |
| Transport & Mobility | 119 | 51% | 48% |
| Energy | 118 | 50% | 53% |
| Metal working and industrial production | 116 | 50% | 46% |
| Automotive | 110 | 47% | 47% |
| Education | 107 | 46% | 49% |
| Environment | 100 | 43% | 37% |
| Construction & Assembly | 98 | 42% | 34% |
| Travel and tourism | 90 | 38% | 38% |
| Life sciences | 88 | 37% | 34% |
| Telecommunications | 85 | 36% | 32% |
| Agricultural biotechnology and food biotechnology | 80 | 34% | 34% |
| Security | 74 | 31% | 33% |
| Community-Led Local Development | 72 | 31% | 35% |
| Space | 72 | 31% | 28% |
| Food and beverages | 70 | 30% | 29% |
| Defence | 70 | 30% | 34% |
| Maritime | 69 | 29% | 34% |
| Transport sector | 69 | 29% | 29% |
| Financial | 65 | 28% | 30% |
| Retail, wholesale or distribution | 62 | 26% | 26% |
| Personal services | 58 | 25% | 30% |
| Aeronautics | 58 | 25% | 27% |
| Cultural and creative economy | 56 | 24% | 28% |
| Textiles | 50 | 21% | 24% |
| Consumer products | 48 | 20% | 21% |
| Polymers and plastics | 47 | 20% | 20% |
| Fishery | 42 | 18% | 13% |
| Real estate | 40 | 17% | 13% |
| Energy, fuels and petroleum engineering | 32 | 13% | 14% |
| Paper and wood | 30 | 12% | 9% |
| NMP Non-Metallic Materials & basic processes | 25 | 10% | 9% |
| Electricity | 18 | 7% | 5% |
| Mining and extraction | 16 | 6% | 5% |
| Leather | 11 | 4% | 6% |
| Nuclear | 10 | 4% | 3% |
| Tobacco | 7 | 3% | 2% |

Source: EDIHs catalogue, Eurostat and ARDECO data, JRC elaboration.

Lastly, for services, in Table 4.6, we observe that most services have a wide coverage, larger than 50%, both in terms of covered regions and employed EU citizens. In particular, the services with the wider coverage follow the ranking of the most targeted ones: SME support, Technological innovation and Knowledge transfer, which have above 70% of coverage. On the other hand, the services with the smallest coverage in the 30 to 40% range, are the most focused ones, targeting Smart Specialization Strategies and Circular Economy.

**Table 4.6. Regional coverage of EDIHs by service**

| Service | Number of regions | % of covered regions | % of employed EU citizens covered |
|---|---|---|---|
| SME support | 185 | 79% | 74% |
| Technological innovation | 182 | 78% | 74% |
| Knowledge transfer | 174 | 75% | 71% |
| Prototyping | 170 | 73% | 69% |
| Ecosystem building | 168 | 72% | 67% |
| Innovation management | 164 | 70% | 67% |
| Technology transfer | 159 | 68% | 65% |
| Public sector innovation | 156 | 67% | 59% |
| Finance | 153 | 65% | 63% |
| Sme Business Development | 135 | 58% | 55% |
| Vocational training | 123 | 53% | 56% |
| Field trial | 122 | 52% | 53% |
| Regional development | 105 | 45% | 43% |
| Circular economy | 94 | 40% | 39% |
| Smart Specialisation strategies | 87 | 37% | 36% |

Source: EDIHs catalogue, Eurostat and ARDECO data, JRC elaboration.

# 5. Networking patterns of the EDIHs

As outlined in Section 3, each EDIH is a complex consortium in size and blend of the organisations it brings together. In the wider national and European context, the EDIHs form a network. The aim of this section is to analyse the links between the EDIHs, which could arise through previous collaborations in EU-funded initiatives, such as Research and Innovation (R&I) Framework Programme (FP).

**Box 4: Networking patterns of the EDIHs**

- The EDIHs have a strong rooting in past R&I FP initiatives: 27% of EDIHs participants were involved in Horizon 2020 or Horizon Europe projects in the field of ICT.
- 89% of EDIHs have participants who were involved in past FP ICT projects.
- 25% or more of the participants of nearly 60% of EDIHs have a history of collaboration in ICT R&I FP projects.

The organisations that successfully participated to the EDIHs call display a strong rooting in the R&I Framework Programmes, such as Horizon 2020 or Horizon Europe. For example, over 52% of EDIHs participants were already participants in R&I FP projects. This overlap could be an indication of pre-existing linkages and collaborations between EDIHs participants on top of which the EDIHs network could further develop.

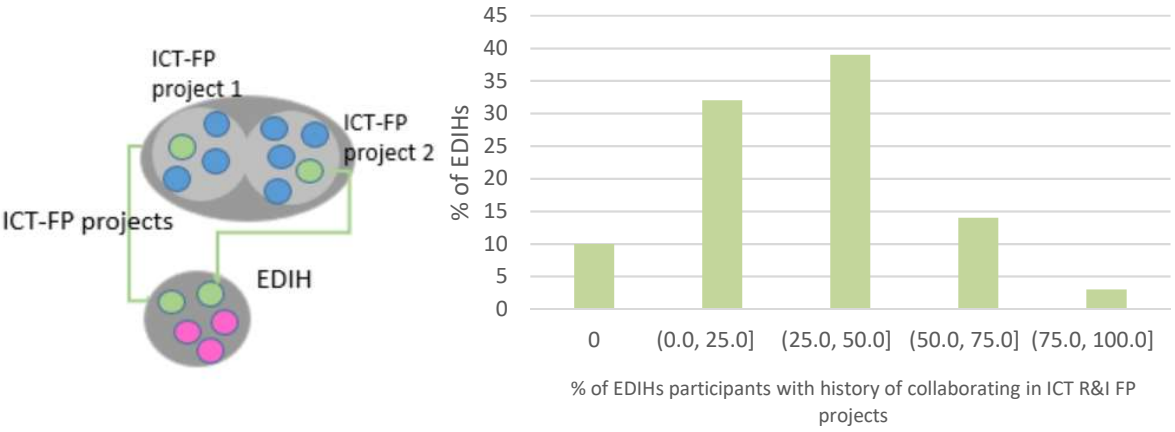
Considering the EDIHs objectives of fostering the digital transformation in Europe, we focused our analysis more specifically on R&I FP projects delving into ICT to target projects of particular relevance to the EDIHs. In this context, 634 or 27% of EDIHs participants were involved in such projects.

To quantify the connection between R&I FP projects in ICT and the EDIHs, we look below at the percentage of organizations forming an EDIH that were previously invovled in ICT R&I FP projects. This is represented by the number of organisations which were involved in such projects divided by the size of the EDIH. It illustrates the degree of overlap between a given EDIH and past R&I FP initiatives in ICT, quantifying how many organisations already participated to a project together with another organisation in the same EDIH. At one extremen, 0% implies that, for a given EDIH, none of its participants was involved in a previous FP initiative. At the other extreme, 100% would mean that all the participants in an EDIH were previously involved in such projects. Figure 5.3 (left) visualises this relationship.

Figure 5.3 (right) displays the distribution of the percentage of EDIHs participants previously invovled in ICT R&I FP projects across the EDIHs population. Firstly, we observe that for most EDIHs (90%) this value is different from zero. Hence, most EDIHs have participants which were also involved in past FP projects in ICT. Only 10% of the EDIHs are composed of “new” participants, without previous involvement in projects in ICT ICT R&I projects.

The distribution EDIHs by the % of participants with history of collaborating ICT R&I FP projects is quite evenly split between the two largest categories: a first cohort of 42% with between 0% and 25% and the second largest cohort of 39% of the EDIHs with between 26 to 50% participants who participated to ICT R&I FP projects. Thus, in these two groups, the first has a thin connection with previous FP initiatives; while the second bears a stronger one, where up to half of the EDIHs participants in this cohort have previous experience in ICT FP projects. Lastly, 17% of the hubs have 50% or more participants with previous experience of the R&I FP projects in ICT, indicating a very strong rooting of such EDIHs in past research initiatives.

**Figure 5.3. Distribution of EDIHs by the % of participants with history of collaborating ICT R&I FP projects**




Source: Corda data, JRC elaboration.

The figure on the right depicts the linkages between past involvement in ICT R&I FP projects of EDIHs participants. In this example, an EDIH composed of five organisations, has two of them which were also involved in ICT R&I FP projects (ICT-FP in the figure). Given that it has five participants, this implies that 40% of them collaborated in past FP projects.

# 6. Conclusions

The European Digital Innovation Hubs display a very pronounced heterogeneity, reminiscent of the heterogeneity of the regional context they operate in. Along most of the features of the current analysis, the average would fail to entirely convey such richness. Nonetheless, taking the whole network into account, overarching characteristics emerge. This section summarises them briefly as the results of this early-stage analysis of the EDIH initiative.

**As a first take away, the EDIHs are strongly research oriented.** As shown in Section 2, 33% of EDIHs participants are either higher education institutions or research centres, which also receive the largest share of EU funding. Furthermore, when analysing private companies' sectors of activity, scientific research is the second strongest sector. It is also present for organisations in the public sector and in the "Other" category. In addition, while 80% of EDIHs have a private company among their participants, 36% of them has less than a quarter of their participants in the private sector.

For the sectorial profile of organisations in the EDIHs, beyond research and education, we observe that the other prominent sector of activity is ICT sector, in particular for private organisations, which is in line with the EDIHs digitalisation objectives.

**The geographical outreach of the EDIH network is very wide.** It stretches across most of Europe and, as shown in Section 3, the EDIHs are present, both in terms of location of the partners and of their coverage, in 85-90% of the 251 European regions. Furthermore, at the level of a single EDIH, the average EDIHs has organisations located in three regions, with a similarly wide service coverage.

**The top technologies targeted in EDIHs services and with the widest coverage are Artificial Intelligence and Cybersecurity.** The former is targeted by 91% and the latter by 70% of the EDIHs. Similarly, with respect to regional coverage, AI is covered in 88% of the regions reached by EDIHs' services. For Cybersecurity and High Performance Computing, the coverage is 61% and 73% of the regions.

**The most targeted and most diffused sector is the Manufacturing sector**. It is targeted by 64% of EDIHs and available in 82% of regions. Health Care comes second, with a diffusion of 47% EDIHs and 66% of regional coverage. Public Sector comes third, with 44% of EDIHs and 63% of regional coverage.

Beyond these three pivotal sectors and technologies, **the average EDIHs portfolio is quite wide. It encompasses 9 technologies and 7 sectors, as well as 8 services, thus addressing a large palette of different needs**. Furthermore, as shown in Section 4.2, both small and large EDIHs can have a generalist profile regarding technologies and sectors, but also a more specialised one, suggesting that there is a strong diversity of EDIHs strategies and designs of how to deliver relevant services in their respective environment.

**The EDIHs are meant to become a European-wide network.** There is evidence pointing to a substrate of potential collaborations and interactions which already exist, thus possibly further sustaining the development of the EDIHs network. From an historical perspective, the EDIH initiative displays a strong rooting in R&I Framework Programmes. Almost a third of the EDIHs organisations have experience from such projects and 89% of the EDIHs include organisations that have participated in such projects. This indicates that most EDIHs are a blend of, from one side, more experienced participants who already have a track record in the European R&I landscape, and, on the other side, new actors coming from various backgrounds. This heterogeneity of ties among the suppliers and users of digital technologies and their ability to exploit the potential of digital innovation in diverse regional and economic environments is a sound foundation for catering to the needs of SMEs and public sector organisations in their digital transformation.

## Annex A. Lists of technologies, sectors and services offered by the EDIHs

| Table A.1. Technologies targeted by the EDIHs | Percentage of EDIHs |
|---|---|
| Artificial Intelligence & Decision support | 91% |
| Cybersecurity | 70% |
| Internet of Things | 64% |
| Big data | 54% |
| High performance computing | 53% |
| Digital twins | 53% |
| Robotics | 49% |
| Virtual Reality | 41% |
| Sensors & Vision Processing Systems | 35% |
| Simulation engineering and modelling | 32% |
| Cloud Services | 32% |
| Additive manufacturing | 30% |
| Blockchain and Distributed Ledger Technology (DLT) | 29% |
| Cyber-physical systems | 29% |
| Communication network | 26% |
| Internet Services & Applications | 25% |
| Mobility | 24% |
| Location-based applications | 19% |
| Human computer interaction | 19% |
| Software Architectures | 18% |
| Logistics | 14% |
| Laser-based manufacturing and materials processing | 13% |
| Gamification | 9% |
| Micro- and nanoelectronics, optoeletronics | 9% |
| Quantum Technologies (computing/communication) | 8% |
| New technologies for Audio-Visual sector - Media | 8% |
| Semiconductors and Nanotechnology | 7% |
| Photonics | 7% |
| Chemical engineering (plants, products) | 6% |
| Industrial biotechnology | 6% |
| Displays | 2% |
| Organic and large area electronics | 2% |
| BI tools | 1% |
| Other | 0% |

| Table A.2. Sectors targeted by the EDIHs | Percentage of EDIHs |
|---|---|
| Manufacturing and processing | 64% |
| Health care | 47% |
| Public administration | 44% |
| Smart City | 39% |
| Energy | 38% |
| Environment | 37% |
| Transport & Mobility | 35% |
| Education | 32% |
| Automotive | 29% |
| Agricultural biotechnology and food biotechnology | 29% |
| Construction & Assembly | 26% |
| Metal working and industrial production | 25% |
| Travel and tourism | 23% |
| Food and beverages | 19% |
| Life sciences | 19% |
| Telecommunications | 18% |
| Cultural and creative economy | 16% |
| Retail, wholesale or distribution | 16% |
| Community-Led Local Development | 16% |
| Maritime | 16% |
| Transport sector | 14% |
| Security | 14% |
| Aeronautics | 14% |
| Space | 13% |
| Defence | 12% |
| Personal services | 11% |
| Financial | 11% |
| Textiles | 11% |
| Consumer products | 11% |
| Polymers and plastics | 9% |
| NMP Non-Metallic Materials & basic processes | 7% |
| Paper and wood | 7% |
| Energy, fuels and petroleum engineering | 6% |
| Electricity | 6% |
| Real estate | 3% |
| Fishery | 3% |
| Mining and extraction | 2% |
| Nuclear | 2% |
| Leather | 1% |
| Tobacco | 0% |

| Table A.3. Services offered by the EDIHs | Percentage of EDIHs |
|---|---|
| **SME support** | 81% |
| **Ecosystem building** | 72% |
| **Technological innovation** | 71% |
| **Technology transfer** | 66% |
| **Knowledge transfer** | 65% |
| **Innovation management** | 62% |
| **Prototyping** | 59% |
| **SME Business Development** | 50% |
| **Public sector innovation** | 48% |
| **Finance** | 47% |
| **Vocational training** | 42% |
| **Regional development** | 37% |
| **Circular economy** | 35% |
| **Field trial** | 34% |
| **Smart Specialisation strategies** | 28% |

## Annex B. Data coverage from Orbis

In Section 2, for the analysis of EDIHs participants' sector of activity and size, the EDIHs participants data issued from CORDA database with company data from Orbis[23], a company registry database, issued by Bureau van Dijk. Table A.1 presents the results of the matching results and the availability of sector and size of information.

**Table A.1. Results of matching EDIHs participants data with ORBIS by organisation type**

| Organisation type | % of matched | % of organisations with sector data | % of of organisations with size data |
|---|---|---|---|
| **Private Companies** | 92% | 75% | 65% |
| **Research Centres** | 98% | 83% | 43% |
| **Public organisations** | 95% | 65% | 29% |
| **Higher Education** | 97% | 67% | 32% |
| **Other** | 89% | 65% | 35% |
| **Total** | **95%** | **71%** | **44%** |

Source: Orbis and Corda data, JRC elaboration.

[23] https://www.bvdinfo.com/en-gb/our-products/data/international/orbis

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