# Digital Innovation Hubs Proposing Digital Platforms to Lead the SMEs Digital Transition

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**Abstract**

DIHs could offer a marketplace and play the role of a broker facilitating cooperation and networking among important stakeholders, harmonizing companies with customers and providing European connections as well. In this framework, DIHs express an increasing need for having platforms bolstering users-producers transactions, fostering to detect what is needed, by grouping a large variety of services and goods together. This paper presents the main platforms grounded on the D-BEST reference model developed by different networks of DIHs. The main characteristics of each of them have been detected and the differences among them unveiled.

**Keywords**

Digital innovation hub, digital platform, marketplace, D-BEST.

## 1. Introduction

The relevance of digitalization and the advantages it can produce in the EU socioeconomic context has been widely analyzed and emphasized nowadays [1, 2]. It is estimated that in the post-COVID19 era the diffusion of the digital will be further extended and humanity will need of policy plans fostering and catalysing the acquisition of digital skills to overwhelm the negative economic impact of this calamity. In this context, small and medium enterprises (SMEs) are the spine of the EU economy, require to be initiated to a breakthrough in terms of work processes, business models and innovative portfolios of products [3, 4]. Digital Innovation Hubs (DIHs), playing the key role of sustaining SMEs in taking advantage from innovative digital technologies (e.g. Artificial Intelligence, Cyber-Physical Systems, Cybersecurity) [5], are strategic organizations for policy makers, at both national and regional level, looking for solutions able to foster the growth of their economies [6, 7], playing the role of knowledge broker among different stakeholders [8].

Hence, European DIHs (EDIHs) [9] and DIHs could ease the process of bringing together industry and administrations requiring innovative digital solutions, with key companies offering these solutions (or able to develop them) [10, 11].

DIHs could offer a marketplace and play the role of a broker bolstering collaboration and networking among important stakeholders, harmonizing firms with customers and providing European connections as well [12,13]. In this framework, DIHs express an increasing need for having platforms bolstering users-producers transactions, fostering to detect what is needed, by grouping a large variety of services and goods together. In addition, it is important the collaboration with other DIHs at EU level to build a pan-European network of networks where it is possible to meet, give-and-

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take, collaborate, get know-how, enhance competences and skills, and detect the lacking capabilities that can be obtained from other European DIHs [14, 15]. A first attempt was made by the European Commission (EC) with the development of the S3 platform [12] where the services offered by the DIHs registered on the platform were categorized. Then, several DIH networks, often funded by the EC actions as innovation action projects, developed digital platforms [5, 16]. On one side, there are projects proposing their own platform, as DIH4CPS [17]. On the other one, there are projects based on the DIHIWARE platform, as HUBCAP [18], AI REGIO [19], DIH4AI [20] and DIH4INDUSTRY [21]. It has been unveiled that most of these platforms are grounded on a specific reference model, named Data-driven Business-Ecosystem-Skills-Technology (D-BEST). Therefore, this paper is aimed at presenting each platform, providing their main characteristics and unveiling the differences among them to foster their integration and bolster the DIH network collaboration.

The paper is structured as follows. Section 2 presents the research context (introducing the D-BEST and DIHIWARE), Section 3 the results obtained and Section 4 their discussion. Finally, Section 5 concludes the paper and lists further research.

## 2. Research context: the D-BEST model and the DIHIWARE

DIH are described as support facilities that support companies to enhance their competitiveness through innovations, bolstering the development and adoption of latest digital technologies [22] and a set of services to support SMEs' digital transition [23]. A reference model to categorize these services is the D-BEST, composed of five macro-classes of services [14, 15, 24]: Data, Business, Ecosystem, Skills, Technology.

The DIHIWARE Platform is a solution created within the MIDIH project [25] and currently employed in different ecosystems in Europe. It provides a collaboration environment grounded on the Enterprise Social Software concept, realizing a bridge among stakeholders with different experiences backgrounds, providing access to the up-to-date knowledge and expertise, pulling teams together and supplying a fertile ground for experimentation. These knowledge-driven services are fully integrated with collaborative services to create a digital space where stakeholders can collaborate to boost innovation. The main users of this platform can be reconciled to the following three families (Manufacturing SMEs (demand); Technology SMEs (offer); DIH (broker)).

## 3. Results

This section is aimed at providing the main features of the platforms grounded on the D-BEST model developed by different networks of DIHs.

### 3.1. DIHIWARE-based projects grounded on the D-BEST model

So far, the DIHIWARE platform has been instantiated in several projects (as the collaborative portal for their ecosystems) and in combining several communities together (DIH4INDUSTRY) to exploit synergies among different initiatives.

The AI REGIO project proposes a platform to enable cross-collaboration inside its two main communities: DIHs and Didactic Factories (DF). DIHs have at disposal the Service Marketplace section to manage their portfolios of services according to the D-BEST taxonomy, as well as the catalogue of their Experiments and a collection of operational technologies, data analytics tools and platforms, designed to provide support to system integrators and technology adopters. DF have at disposal the Service Marketplace where their services are showcased following the DR-BEST taxonomy (where the “R”, specific for DFs, stands for Remote).

The DIH4AI platform is tailored for the needs of DIHs acting for the development and adoption of Artificial Intelligence (AI) solutions. The marketplace is shaped according to the L-BEST taxonomy: “L” stands for “Legal and ethical” and displays all the services fitting with the request of preventing the risks deriving for AI adoption.

The HUBCAP collaboration environment delivers both "Access to" and "Collaborate with" services, not only offering access to up-to-date knowledge, expertise and technology but also providing MBD assets for testing and experimenting. In particular, HUBCAP has two catalogues of MBD assets (models and tools) usable through a sandbox by industrial players, technical developers, and decision makers [13].

On top of the aforementioned examples of collaborative portals at project-level, the DIHI4INDUSTRY platform has been conceived at Network-level to piece together several communities of DIHs active in the Digital Transformation of European Manufacturing Industry, encompassing hubs with different specialisations and expertise, coming from different projects, and it aims at representing a single access point for DIH practitioners and policy makers. The platform presents the DIHs communities and Service Marketplace, as well as the catalogue of Experiments and success stories deriving from the implementation/provision of their services.

## 3.2. The DIH4CPS project platform grounded on the D-BEST model

DIH4CPS platform's users can be service provider and/or service consumer. To have such a role, the user should have some prerequisite competences (i.e., the needed competences related to a given service or activity, grouped under the D-BEST model) needing a proficiency level in a given domain (the competence area). The interface has been developed for the core network services, both for the ontology navigation (to help users to find the right partners for experiments/development tasks) and for managing the network model/ontology (allowing to enrol new DIHs and alter the model).

# 4. Discussion

Table 1 shows an overview of the main characteristics of the digital platforms provided by different DIH networks. The drivers of the analysis are the type of users, the D-BEST categories supported, the assets showcased and the level of marketplace. It comes out that only HUBCAP and DIH4CPS portals can manage all the main four types of network users, as the AI REGIO, DIH4AI and DIH4INDUSTRY platforms are mainly addressed to the community DIHs as collaborative tools. In addition, concerning the D-BEST dimensions supported, a couple of them (in the AI domain) are adding a further macro-class to the traditional ones. Then, the platforms are able to categorize and manage different assets (for example HUBCAP is providing MBD models and tools and AI REGIO provides a direct link with the IoT Catalogue [26]), and DIH4CPS is potentially able to add them to its catalogue. Finally, concerning the marketplace, only the HUBCAP and DIH4CPS platforms offer assets to SMEs, all of them to a specific network of DIHs and only DIH4CPS and DIH4INDUSTRY proved to have potentialities for triggering synergies among different networks of DIHs, respectively as marketplace and showcase.

**Table 1** Main characteristics of the DIH digital platforms ("x" means that it is already addressed; "→" means it can be addressed in the future)

| Characteristics/DIH Project | | DIH4AI | AI REGIO | DIH4 INDUSTRY | HUBCAP | DIH4CPS |
|---|---|---|---|---|---|---|
| Type of users | Manufacturing SME | x | x | X | x | x |
| | Technology SMEs | x | x | X | x | x |
| | DIHs | x | x | X | x | x |
| | Universities, DFs, RTOs | x | x | X | x | x |
| D-BEST categories | Data | x | x | X | x | x |
| | Business | x | x | X | x | x |
| | Ecosystem | x | x | X | x | x |
| | Skills | x | x | X | x | x |
| | Technology | x | x | X | x | x |
| | Remotization | | x | X | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Legal | x | | X | | |
| **Assets** | Competences | | x | | | x |
| | Services | x | x | x | x | x |
| | Technologies/Facilities | | x | | | x |
| | MBD models and tools | | x | | x | → |
| **Marketplace (M) / Showcase (S)** | SMEs | | | | M | M |
| | A single DIH network | S | S | S | M | M |
| | More DIH networks | | | S | | M→ |

## 5. Conclusions

This paper presented the main platforms grounded on the D-BEST model developed by different DIH networks. The main characteristics of each of them have been detected and the differences among them unveiled. The paper has some limitations, being focused only on the DIH networks developing their platforms grounded on the D-BEST. At the same time, this is a potential point to integrate the platforms based on their similarities and to trigger synergies among the different networks of DIHs.

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