How Can the D-BEST Model Support the SMEs Digitisation?

Claudio Sassanelli[1,2] and José Ferreira[3]

[1] *Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Piazza Leonardo da Vinci, 32, 20133 Milan, Italy*
[2] *Department of Mechanics, Mathematics and Management, Politecnico di Bari, Via Orabona 4, 70125, Bari, Italy*
[3] *UNINOVA, Instituto de Desenvolvimento de Novas Tecnologias, Lisbon, Portugal*

The Data-based Business-Ecosystem-Skills-Technology (D-BEST) reference model built and adopted so far in different European innovation projects (DIH4CPS, HUBCAP, REACH, AI REGIO, and DIH4AI) and digital domains (e.g., Cyber-Physical and Embedded Systems (CPES), Artificial Intelligence (AI)) to support the main DIH functions. Indeed, DIHs provide a set of supportive services that help companies to become more competitive by improving their business/production processes by means of digital technology. In particular, in the AI domain, two additional macro-classes of services have been added to better answer to the needs of SMEs involved in the development of such technologies: Remote (R) and Legal & Ethics (L). Finally, during the workshop, the results obtained by the different projects have been presented and it was identified that, since the different projects are using the same model to structure both their digital platforms and offers, there were not many and critical divergences. Therefore, interoperability among the different DIH networks is possible and promising to establish and create multiple communications and collaborations among the several stakeholders belonging to the DIH ecosystems, fostering exchange and development of joint services. These conclusions pave the way to define the future activities to exploit the model as catalyser for triggering collaborations among the different DIH networks.

The workshop has been conducted to present the various instances of the Data-based Business-Ecosystem-Skills-Technology (D-BEST) reference model built and adopted so far in different European innovation projects (DIH4CPS, HUBCAP, REACH, AI REGIO, and DIH4AI) and digital domains (e.g., Cyber-Physical and Embedded Systems (CPES), Artificial Intelligence (AI)) to support the main DIH functions. Indeed, DIHs provide a set of supportive services that help companies to become more competitive by improving their business/production processes by means of digital technology. In particular, in the AI domain, two additional macro-classes of services have been added to better answer to the needs of SMEs involved in the development of such technologies: Remote (R) and Legal & Ethics (L). These macro-classes of services have been explored, defined, and detailed based on workshops and brainstorming sessions with networks of DIH engaged in the AI domain, obtaining as a result an exhaustive and complete three-level set of services that could be useful in assisting SMEs in the development and adoption of AI-based solutions. From the analysis conducted in the AI REGIO and DIH4AI networks, these two macro-classes of services are still under-offered by DIHs but strongly needed by SMEs. Therefore, a huge effort is needed from the DIH and service/technology providers side to try to meet this need and fill the gap in this domain developing such types of services to be added in their service portfolios.

In general, it has been demonstrated that the D-BEST reference model is able to configure the service portfolios of DIHs, classify the extant service portfolios of the DIHs belonging to the network, detect which new services should be provided in the future by the network of DIHs, identify opportunities for collaboration among DIHs and their stakeholders to be combined in a pan-European DIH.

Through the discussion done during the workshop, it has been realized that a core set of macro-classes of services should be defined (i.e., BEST), adding then modules (i.e., D, R, L) to characterize the reference model in the different networks and domains. Practical evidence has been provided concerning the impact and advantages obtained using the model to organize the assets and services that the DIHs and other innovation ecosystems have in their portfolios and offer to SMEs.

It has also been presented that, grounded on the D-BEST taxonomy, a set of methods and tools (gathered under the name of MethoDIH or D-BEST Suite) have been implemented with a twofold scope. Some methods were built to bolster the DIHs entitled to foster SMEs digitalization (through the service portfolios configurator). Thanks to these tools, potentialities for synergies and collaborations (under the shape of joint provision, development, or matchmaking of services) among DIHs and their stakeholders can be unveiled, guidelines for expanding the network offer could be defined and gap analysis of the DIH network offer could be performed. On the other side, the MethoDIH/D-BEST Suite can support the SMEs approaching the DIH ecosystems to go through their digital transformation. In this case, typical paths are defined through which such companies should go, named Customer Journeys (CJs). Indeed, the D-BEST DIH CJ analysis method has been developed to implement DIHs unique value proposition, building and defining flexible service workflows for DIH customers connected to the DIHs service portfolios. This method has been implemented not only to support DIH users in their path towards digitization but also to help DIHs to build a service pipeline and improve their offer.

The MethoDIH/D-BEST Suite also proposes a method (built in the DIH4CPS project, flanking the ECOGRAI method to the D-BEST model) to develop KPIs for DIHs cross-collaboration and measure the effectiveness of these collaboration in their support action towards SMEs.

Finally, using the Business Model (BM) Canvas template, a BM tool is being developed to define how a BM can change in the case of DIHs, exploring how each of the 9 blocks changes in this case. For sure, this tool will be strongly needed to address the hot topic of DIHs sustainability.

Grounded on the D-BEST model structure as well, the workshop presented and compared the several integrated collaborative platforms launched online by the DIH networks, either based on the DIHIWARE (HUBCAP, DIH4AI, AI REGIO, DIH4INDUSTRY) or completely developed by a single network (i.e., DIH4CPS). During the workshop, both technical and business issues have been discussed to try to connect the different platforms existing so far and thus create concrete synergies among the networks belonging to the different projects. In this context, a broad statement of intent for connecting DIH networks via a unified API has been raised. A starting point to trigger this collaboration is represented by the results of the analysis made in the paper "Digital Innovation Hubs proposing digital platforms to lead the SMEs digital transition" that analysed the platform based on a set of drivers (type of users, D-BEST categories, assets, marketplace/showcase for types of users), that detected the DIH4CPS platform as the most promising one. Indeed, in the DIH4CPS project, an ontology has been created which models both the "human factors" and competences as well as the technological factors in terms of platforms, technologies and facilities of the network. Through a navigation tool, this formalised knowledge is made available to the network and enables collaborative solution engineering and the organic generation of cross-border application experiments. Associated to the competencies, the catalogue of services mapped with the D-BEST reference model is also included to feed the network services design and give relevant information regarding the services that can be brought by well-identified companies. However, to connect the platforms and the related portfolios of assets, some problems could arise since the competences categorized through the D-BEST categories in the DIH4CPS platform should then be linked or extended to the new assets belonging to the dimensions of the macro-classes introduced with the other projects (i.e., Remote, and Legal and Ethics).

Using the categories of the D-BEST, another analysis has been made with the aim of comparing information retrieved from the S3 platform about the offer of DIHs coming from different countries (starting with Italian and Polish ones). However, in performing this activity, the problem of language arose when the DIH websites were explored. Thus, it was deducted that researchers from different countries are needed to analyse the offer of DIHs belonging to different countries. In addition, a huge quantity of the DIHs on S3 changed their status (e.g., some of them were no more existing or were merged with other organizations). Therefore, a platform governance mechanism should be introduced

to update the information that could be found on S3. All these issues could be even more evident if an attempt to extend the analysis to all the European DIHs will be performed.

Finally, during the workshop, the results obtained by the different projects have been presented and it was identified that, since the different projects are using the same model to structure both their digital platforms and offers, there were not many and critical divergences. Therefore, interoperability among the different DIH networks is possible and promising to establish and create multiple communications and collaborations among the several stakeholders belonging to the DIH ecosystems, fostering exchange and development of joint services. These conclusions pave the way to define the future activities to exploit the model as catalyser for triggering collaborations among the different DIH networks. As a limitation of the D-BEST reference model, it has been highlighted that often the use of the model could be time-consuming for DIHs since there could be uncertainties for their managers to decide to which dimension a given service should be allocated in the reference model. At the same time, it is good for DIH managers to have a wide set of possible services to use to recognize the actual offer of their DIH or to try to develop a service pipeline.