Using the D-BEST Reference Model to Compare Italian and Polish Digital Innovation Hubs

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Abstract

In recent years, the increasing importance of Digital Innovation Hubs (DIHs) in supporting manufacturing Small and Medium Enterprises (SMEs) has been widely studied and several works listing lessons learnt and success stories have been published. To further foster the impact of these entities on the SMEs' environment, The European Commission has recently introduced the Smart Specialisation Platform, which contains a web service returning to its users a geo-distributed list of DIHs, allowing the user also to cluster and visualise them according to some pre-defined filters, such as the types of technologies employed. The data provided by this platform has been downloaded and a secondary data analysis, based on the websites of the DIHs has been carried on to frame the single DIHs according to the axes of the D-BEST methodology. A comparative analysis with respect to the Italian and Poland situation completes the study, to understand eventual differences and affinities among the two countries.

Keywords

Digital innovation hub, service portfolio, digital transformation

1. Introduction

Since its introduction in 2011, "Industry 4.0" (I4.0) has been retained a "game changer" for the manufacturing scenario [1], leveraging on its technological pillars [2] to provide quantifiable benefits for the manufacturing firms which embraced its paradigm [3]. These benefits have been widely studied in literature and have been generally inflected in several areas of the manufacturing business and strategy: supply chain management, internal logistics, maintenance and decision-making are maybe the most well-known applications of the I4.0 paradigm [4], but recent studies have also demonstrated the implication of "4.0" practices with respect to some long-term objectives, such as the accomplishment of sustainable practices [5] or the extension of the productive life of elder workers [6]. As for the benefits, several studies have at the same time addressed barriers and issues of this paradigm too, focusing, inter alia, on the ethical drawbacks. Among these, several studies in peculiar trade journals have been focused on the ethical consequences of the particular technologies involved, such as the so-called Cyber-Physical Systems (CPSs) [7], or the Artificial Intelligence, highly debated because of its blameworthiness-related issues [8]. On the other hand, other works highlighted a specific drawback, as the paradigm of I4.0 itself seems to be an inherent policy maker: the high skills' level required by the technology integration [9] making indeed the paradigm adoption biased towards big enterprises, leaving behind Small and Medium Enterprises (SMEs) [10] which are threatened by

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their own nature in the acquisition of highly-specialised personnel, preventing them from getting the aforementioned benefits [11]. In this context, given the great importance of manufacturing SMEs in the European economic framework [12], the need of a digital transformation of these entities – towards the I4.0 paradigm – emerges as well, and, in order to ease the access of this kind of companies to the digital services [13], a European-driven public initiative aiming to connect manufacturing SMEs to digital services providers has arisen, generating the "Digital Innovation Hubs" (DIHs), entities aiming at supporting these manufacturing companies in their digital transition [14]. DIHs can hence act as brokers between customer and suppliers for what concerns the digital service, but their role could also be extended to wider areas of the digitalisation of manufacturing. For example, the gathering of funding actions supporting revamping/refurbishment activities is one of the activities where SMEs lack the administrative skills to properly apply for grants, and where the DIH assistance could constitute a bonus [15], but a tailor-made business strategy for the digitalisation of a manufacturing firm is a typical task performed by a DIH as well [16, 17].

To provide an organic offer to the end users, an initiative of the European Commission (EC) has assessed the DIHs on the European territory according to their geographical position, as well as according to the types of services offered to SMEs. This type of clustering is supposed to allow the users to filter the DIHs available on the platform according to their needs, to select the closest one offering the type of service the end user is interested in, and has been released under the Smart Specialisation Platform (S3) [18].

To frame the same problem under a different theoretical lens, the list of the DIHs – both fully operational and in preparation – has been re-assessed, not on the basis of User Generated Content (UGC) but on a D-BEST analysis based on the website data.

The D-BEST analysis constitutes hence Section **Error! Reference source not found.**; Section 3 depicts the methodology and the results obtained analysing the DIHs of Italy and Poland; Section 4 closes the work providing some evidence from the study.

2. Methodology

2.1. The D-BEST model

The Data-based Business-Ecosystem-Skills-Technology (D-BEST) is a reference model to categorize DIHs' service portfolio [14, 19, 20], developed, validated and applied along the years in several innovation action projects funded by the European Commission and related to both the cyber-physical systems (CPS) domain (i.e., MIDIH, DIH4CPS, HUBCAP) and the artificial intelligence one (AI REGIO and DIH4AI). Indeed, it is the result of several iterations of development along the years. The original model was named "ETB", proposed by [21] and grounded on three main macro-classes of services (Ecosystem, Technology, and Business). The ETB was enriched with the Skills and Data macro-classes, strictly needed to better answer to the digital needs triggered by the I4.0 domain. The resulting model, named in a first moment ETBSD and then D-BEST, is composed of five macro-classes of services (Data, Business, Ecosystem, Skills, Technology), and is broken down according to a three-levels taxonomy defined to better detail and classify the type of activity [19].

2.2. Data extraction and evaluation

A standardised extraction has been performed on the S3 platform: from the embedded interface, filters have been set for what concerns "Countries" ("Italy" and "Poland") and "Evolutionary stage" ("in progress" and "fully operational", discarding "in preparation"). All the other voices have been left unmarked, resulting in no additional filters.

The downloaded content has been hence clustered in four different datasets, according to the DIHs' origin (Italy or Poland) and evolutionary stage (fully operational or in preparation). A total of 82 DIHs (including duplicated entries and inactive items) has been gathered, and, for each of these ones, the respective website has been systematically explored to find proofs of declared and performed activities.

The factors considered in driving the exploration have been the accomplishments to the activity types characterising the D-BEST methodology and every active and unique DIH has been flagged with the activity it provides services about.

3. Results

For what concerns Italy, a total of 68 DIHs results on the S3 platform. This number results from the merge of 53 fully operational ones and 15 in preparation. Among the 53 ones, 8 items have been discarded as duplicates and among the 15 ones, 5 websites resulted not active yet.

With respect to the Polish DIHs, a total of 14 DIHs has been returned by the platform: one half of them belongs to the fully operational ones, while the other half is not active yet. All the websites resulted unique and active. Figure 1 depicts, for each country and evolutionary stage, the number of DIHs offering a service related to the D-BEST activity types.

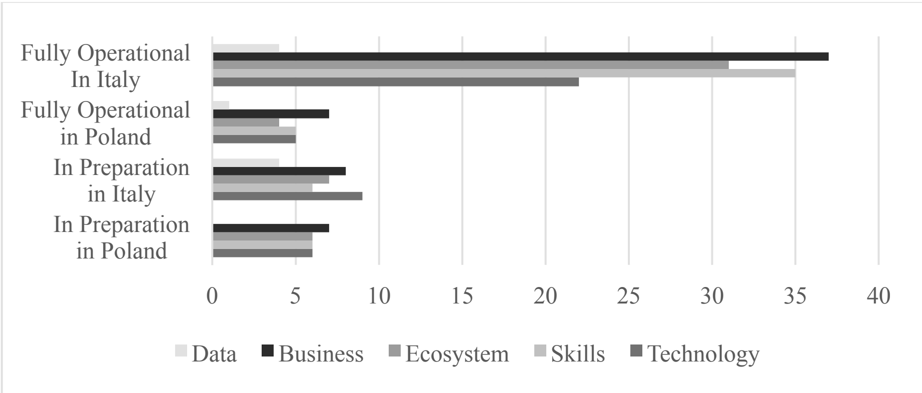

Figure 1. Italian and Polish DIHs D-BEST clustering

4. Discussion and conclusions

As depicted in the figures above, Italian and Polish DIHs appears quite aligned despite the territorial differences. Considering the specific activity types implied by D-BEST, Table 1 offers an overview of the percentage of DIHs offering these services.

Table 1
Percentage of DIHs offering D-BEST activity types

	Current (“Fully operational” at Dec 2021)		Future (including also “In progress” ones at Dec 2021)	
	Italy	Poland	Italy	Poland
Data	9%	14%	15%	7%
Business	72%	100%	82%	100%
Ecosystem	69%	56%	69%	71%
Skills	78%	71%	75%	79%
Technology	49%	71%	56%	79%

A certain consistency can be noticed for some kind of services, (i.e., those related to Ecosystem, Data and Skills). All Polish DIHs are, then, offering Business-related services. This could be linked to the smaller pool of Polish DIHs, which doesn’t mirror the existence of some specialised DIHs like in the Italian framework. Technology-related services present some differences too, where Polish DIHs seem to be more active. A likely interpretation could lay in the geographic difference, which sees the Central-Eastern Europe level of digitalisation below the EU average [22] bringing companies to demand more technology-based services, but further studies on a wider dataset (e.g. including other countries) could confirm or deny this assumption. There is also visible significant difference in direct number of DIHs in Italy (45 fully operational and 10 in progress) and Poland (7 fully operational, 7 in progress), but also in DIHs per capita ($9.3*10^{-7}$ DIH/person in Italy, $3.6*10^{-7}$ DIH/person in Poland) but appear quite aligned if considering the number of DIHs per GDP ($2.6*10^{-5}$ DIH/mln€ in Italy, $2.4*10^{-5}$ DIH/mln€ in Poland). Analysing causes of such situation is not the purpose of this work, but further research could provide drivers able to justify the aforementioned numbers, with the eventual proof of concept given by a more heterogeneous dataset.

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