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Emerging Business Models for Digital Innovation Intermediaries: Evidence from the Digital Innovation Hubs Initiative

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Abstract

Digital transition is a complex process in which innovation intermediaries play an important role as facilitators of the adoption and diffusion of digital technologies. A multitude of organisations act as innovation intermediaries in the digital landscape. In this paper, we study digital innovation intermediaries focusing specifically on their business models. Building on a rich data covering 20 digital intermediaries in five European countries – Italy, Spain, France, Germany, and UK – we show that a distinction can be made, on one hand, between intermediaries that focus primarily on supporting a local ecosystem and intermediaries that focus primarily on developing an ecosystem around a specific sector or technology, and, on the other hand, between intermediaries that have centralised and decentralised governance. We analyse our sample of intermediaries based on these two dimensions (ecosystem focus and governance), and detail their roles in the digital transition. Our findings thus uncover a link between the organisational forms and business models of digital innovation intermediaries. We discuss the implications of our study, for research, practice, and policy.

Keywords: digital technologies, innovation intermediaries, ecosystem, digital innovation.

1. Introduction

The digital transition is the process of adoption and diffusion of digital technologies at different levels of society, which results in pervasive changes in industries, sectors, value chains, and geographical areas (Borràs and Edler, 2020; Münch et al., 2022). New digital technologies are shaping the geography of innovation and knowledge production (Balland and Boschma, 2021), creating opportunities for those who can leverage them (Russo et al., 2022). A variety of actors operate at different levels of the digital transition process, from the conception and design of digital technologies to facilitating their adoption and diffusion, and integrating digital technologies into the operations of private and public organisations (Russo et al., 2022).

Because the digital transition is a complex phenomenon that involves a plurality of actors and technologies, those organisations that facilitate the adoption and diffusion of digital technologies – called innovation intermediaries – play a crucial role in this process (Rossi et al., 2022). They do so because of their often central position within innovation ecosystems, and their ability to deal with different kinds of constituents and different kinds of interests. While supporting the digital transition,

intermediaries perform roles such as: creating knowledge links between other organisations; sharing knowledge about technologies; providing knowledge-intensive services to firms; networking and brokering between solution providers and solution seekers; and providing advice to policymakers (Howells, 2006; Kivimaa et al., 2019, 2020). Innovation intermediaries take active roles in innovation diffusion within existing innovation systems (van Lente et al., 2003; Howells, 2006), and facilitate the transition to new innovation systems around an emerging set of technologies (Klerkx and Leeuwis, 2009; Gradillas, 2019; Grillitsch et al., 2019; Musiolik et al., 2020), the latter being particularly important in the case of the digital transition (Caloffi et al., 2022).

Innovation intermediaries are sometimes created and/or funded by the public sector as a key policy instrument to promote the digital transition. There are numerous examples of regional, national, and supra-national policies providing funding to such types of innovation intermediaries. A particularly large initiative, both in terms of geographical scope and financial commitment, is the Digital Innovation Hubs (DIHs) initiative launched in 2016 by the European Union as one of the pillars of the Digitising European Industry (DEI) Initiative (European Commission 2017; Teixeira and Tavares-Lehmann 2022). Initially, the EU identified organisations across Europe as Digital Innovation Hubs (DIH) – organisations supporting digital transition. Among the DIH, a variety of organisations can be found, ranging from incubators, accelerators, research institutes, clusters, to associations of private firms. Some of these DIHs have later been included in the European Digital Innovation Hubs (EDIHs) initiative, a core element of the Digital Europe Programme (European Commission, 2021) launched in 2021 to *“improve [the EU’s] digital capacities (including the deployment of digital technologies, as well as the necessary digital skills for EU workforce) [...] develop key digital infrastructures, innovate and strengthen the EU’s industrial base, enhance its resilience and flexibility both in terms of technologies and supply chains”* (European Commission, 2021). Others have not embarked on this journey, but nevertheless continue to support organisations and industries in adopting digital technologies. Indeed, the DIHs are expected to support companies and the public sector in the twin (green and digital) transitions. As they act as enablers and facilitators of such transitions, they all can be considered as ‘digital innovation intermediaries’.

So far, limited knowledge exists (see Crupi et al., 2020 and Hervas-Oliver et al., 2021) about the nature of the organisations that are taking on the role of digital innovation intermediaries in the context of European and national policies supporting the digital transition. There are very few studies about the organisations that operate as digital innovation intermediaries, and a general lack of understanding of their governance and business models, and how their business models are linked to their organisational characteristics. To address this research gap, we aim to investigate: (i) the

characteristics of the organisations that play the role of innovation intermediaries in the context of policies supporting the digital transition, developing a taxonomy of such digital innovation intermediaries, and (ii) how their organisational characteristics are associated with their business models. A better understanding of the nature of digital innovation intermediaries, and how their nature affects the activities they perform, is important in order to enhance our understanding of these organisations and to inform future policy programmes.

In order to focus on a homogeneous policy context and to consider a large, high-profile policy initiative, we analyse the specific case of digital innovation intermediaries that: (i) are involved with the EDIHs or DIHs schemes (either because they are themselves EDIHs or DIHs, or because they are part of consortia recognised as EDIHs or DIHs, and thus help to deliver their services), and (ii) support the achievement of national public agendas on the digital transition. Implicitly acknowledging the general lack of knowledge about what kind of organisations are best suited to play the role of digital innovation intermediaries, the European Commission did not specify any requirements on the type of organisations that could apply to become EDIHs and DIHs, besides the requirement that they should demonstrate sufficient organisational capacity and financial viability to perform the activities expected of them. As a result, we are likely to find a variety of organisational forms associated with performing the functions of EDIHs and DIHs.

We collected a substantial volume of evidence through semi-structured interviews with 20 stakeholders from five European countries (France, Germany, Italy, Spain, the United Kingdom) working for organisations that are EDIHs or DIHs, or components thereof. Each interview was conducted following a template that was designed before the data collection process, to allow for comparative and systematic analysis. The template included questions on the ownership, objectives, main activities, governance, business model, networks, and results (outcomes), of the intermediaries that are the object of our study.

Recognising the challenges inherent in examining different types of organisations in different countries, the diversified sample we selected allows us to map common themes, and to capture how several digital intermediaries that are different in nature can support – whether explicitly or not – the European digital strategy, allowing a widespread effective digital transition in the respective countries' economies and societies. Our study allows us to identify some patterns in the organisational and business models of digital innovation intermediaries and to distinguish their different, yet complementary roles in the digital innovation ecosystems. We find that while digital innovation intermediaries differ in terms of their value proposition, value creation, value delivery and value

capture processes, there are some regularities: (i) while all intermediaries perform commercial activities, these alone are not sufficient to sustain these organisations, and they all, to some extent, rely on public funding; (ii) the majority of intermediaries focus on specific technologies or sectors, while more than half also focus on serving specific localities; (iii) public subsidies and providing services are associated with centralised decision making, while funding from membership fees is associated with decentralised decision making. We find some emerging patterns in relation to digital innovation intermediaries' business models, according to two dimensions: whether intermediaries focus mainly on supporting local or technology/sector-based ecosystems, and whether they have centralised or decentralised decision-making processes. Finally, we analyse how business models are linked to the intermediaries' organisational forms.

The paper is structured as follows. In the next section, we provide an overview of the literature on innovation intermediaries and their role in the digital transition. We then present our methodology and the data we have collected. The results and discussion sections follow. In the concluding section, we outline our contributions, policy implications, limitations, and future research directions.

2. Literature review

Innovation intermediaries – individuals or organisations that help other organisations to innovate (Howells, 2006; Caloffi et al., 2023) – play a vital role in innovation ecosystems, as they broker and bridge between different actors, as well as bond them together. By performing these roles, intermediaries create value for other actors in the ecosystem (Ritala et al., 2023). Not only do innovation intermediaries facilitate technology transfer, but they also support collective innovation efforts, form networks for knowledge exchange, and help the entire ecosystem upgrade (Rossi et al., 2022).

2.1. Typologies of intermediaries

Several attempts have been made to classify the diverse pool of innovation intermediaries into a small number of 'types'. Most of these studies adopt a 'functional' approach, categorising intermediaries according to the activities they perform. The seminal studies by Chesbrough (2006) and Howells (2006) listed different, broad functions of intermediaries, and provided examples of organisations performing each function. Lopez-Vega and Vanhaverbeke (2009) distinguished between intermediaries that focus on connecting activities, collaboration and support services, or technological services. Agogu e et al. (2017) instead proposed a distinction between: intermediaries for problem-solving (they support firms that lack special skills or knowledge in the context of a specific problem

or for developing innovation, by connecting them with external experts or by providing their own knowledge); brokers for technology transfer (they commercialise technological developments); and intermediaries that support innovation systems (they support networking, set up objectives for the system, and recruit new organisations into the system). Some functional taxonomies of intermediaries have been developed concerning specific sectors or technologies, such as agriculture (Klerkx and Leeuwis, 2009; Kilelu et al., 2011), space technology (Vidmar, 2021) or new product development services (Colombo et al., 2015). Caloffi et al. (2023) performed a computational review of the literature on innovation intermediaries and, based on topic modelling of the articles' titles and abstracts, classified organisations performing intermediation functions into six types. These are: (i) university incubators that perform traditional functions of incubation, organisation of events, support for entrepreneurship education and facilitation of networking between potential and existing entrepreneurs (Lamperti et al., 2017); (ii) 'innovation system intermediaries', which are mainly science parks and technology parks, and which often have a policy mandate and a territorial focus in addition to technology focus; (iii) 'open innovation intermediaries', which focus on facilitating open innovation processes; (iv) 'transition intermediaries', which play a role of facilitating systemic and technological transitions; (v) KIBS – knowledge intensive business services firms, which are mostly private and support innovation in private firms, in addition to supporting regional innovation and economic development; (vi) cluster intermediaries, which operate in geographical or technological clusters.

Despite the development of different taxonomies of intermediaries, none of these studies have specifically focused on policy-driven innovation intermediaries whose role is to support the digital transition. Nevertheless, digital innovation intermediation has attracted scholarly work, yielding valuable insights about the specificities of digital innovation intermediaries.

2.2. Intermediaries and the digital transition

The increasing use of digital technologies, also known as digitalisation, is radically changing business practices. Digital technologies such as cloud services, cybersecurity, artificial intelligence, big data and analytics, and Internet of Things (Frank et al., 2019), are driving the so-called Fourth Industrial Revolution. Because these technologies are usually complex, they require the development of new digital competences and the transfer of knowledge between firms and other organisations. Digitalisation is also inducing the transformations of business models (Autio et al., 2018; Dabrowska et al., 2022), including those of innovation intermediaries themselves (Rossi et al., 2022). With the growing use of digital technologies and the resulting systemic changes, the competitiveness of firms

and other organisations has become strongly dependent on their ability to leverage digital technologies in their operations. Yet many of these organisations do not have the competences and skills to navigate the digital landscape and are therefore dependent upon the acquisition or transfer of digital skills from other organisations. Innovation intermediaries can play a crucial role in the acquisition and transfer of digital technologies from one organisation to another, for several reasons such as: they help firms to shorten the search time for external sources of knowledge; they can understand firms' needs for digital technology, their readiness to absorb and deploy a specific type of digital solution; they are usually recognised as knowledgeable, trustworthy, neutral actors (Rossi et al., 2022).

Among different types of innovation intermediaries identified by the literature, many can play a role in digital transition at different levels and in different ways. For example, considering the typology proposed by Caloffi et al. (2023): university incubators can support start-ups that develop or use new digital technologies; innovation system intermediaries facilitate the digital upgrading of entire innovation systems; open innovation intermediaries support open innovation processes in digital technologies (such as ideation challenges, open-source software projects and others); transition intermediaries focus on the technological transition to the new digital paradigm; KIBS help firms adopt new digital technologies; and finally, cluster intermediaries support digitalisation of geographical or technological clusters. In recent research, Ritala et al. (2023) show how intermediaries create value for ecosystem actors and their clients, by promoting co-creation to solve specific challenges, such as the adoption of digital technologies. Innovation intermediaries' actions in the context of digital transition are particularly valuable for small and medium-sized enterprises (SMEs) because these firms usually have fewer resources and are less capable of acquiring digital technologies rapidly (Kamalaldin et al., 2021; Musiolik et al., 2020; Rossi et al., 2022). Innovation intermediaries can help SMEs bridge the gap between their digital knowledge base and the digitalisation level that is dictated by the competitive environment.

Along with playing a role in the digitalisation of companies and other organisations, digital innovation intermediaries can leverage digital technologies for their intermediation activities (Dahlander et al., 2021). They can use technologies such as artificial intelligence and text mining to identify organisations that have specific competences (Di Fiore and Schneider, 2017) in order to involve them in the digital upgrading of other actors or integrate them into digital innovation systems. In a recent paper, Howells (2023) identifies seven intermediation activities that are enhanced by the use of digital technologies: 1) competitions, contests and tournaments, 2) broader online digital technology and innovation platforms; 3) crowdsourcing networks, platforms and events; 4) artificial intelligence to

support innovation in other firms and organisations; 5) management of internal knowledge flows within and between firms and organisations; 6) combinatorial, portfolio and toolkit innovation management; 7) network and ecosystem architecture and development.

Another important factor in understanding the role of digital innovation intermediaries is the public management context in which they operate. Digital technologies have triggered changes in the public management domain, leading to “open government” or “Government 2.0”, where the government opens to the outside world, delivers information and services to citizens where and when they need them (Roberts, 2011) and actively seeks collaboration with citizens and other constituents to design and implement its services (Verhoest et al., 2024). Moreover, the pressure for the public sector to be more innovative is another significant feature of the current public management (Hartley et al., 2013). In this context, public administrations are increasingly using crowdsourcing and outsourcing, in order to seek quicker and better solutions to the problems they have to tackle (Liu, 2017). Relying on digital innovation intermediaries, whether public, private or hybrid, to drive and facilitate the digital transition is evidence of the trend to delegate to other constituents the delivery of public policy goals. It is in such a context that the European Digital Innovation Hub framework is being implemented.

2.3. Business models and policy-driven digital innovation intermediaries

While taking place at a rapid pace on the ground, digital transition is encouraged, framed, and supported at the policy level. Countries and governments have been introducing digitalisation strategies, building frameworks facilitating digitalisation and conferring mandates to specific organisations to support digital transition (Pittaway and Montazemi, 2020; Wang et al., 2023). Examples include national digitalisation strategies in European countries, as well as the European DIH framework, which recognises organisations or groups of organisations that have the ability to facilitate digitalisation in individual companies and manage innovation ecosystems around digital technologies. These organisations are recognised as digital innovation intermediaries, they help some organisations innovate in the digital domain, and others adopt and deploy these innovations. Yet, we have limited knowledge about the nature of the organisations that are taking on the role of digital innovation intermediaries in the context of policy initiatives supporting national digitalisation strategies, including their organisational features and business models.

Business models denote an organisation’s core logic for creating, delivering and capturing value. Business models can be understood as cognitive devices for structuring and designing organisations (Baden-Fuller and Morgan, 2010), or as manifestations of how organisational variables are configured (Winter and Szulanski, 2001; Zott et al., 2011). The latter approach is sometimes called

the ‘configurational’ view of business models. While the components of business models are articulated differently by different authors, the majority of studies generally agree that business models are composed of the following building blocks: value proposition, value creation, value delivery and value capture (Chesbrough and Rosenbloom, 2002; Osterwalder et al., 2005; Chesbrough, 2007; Johnson et al., 2008; Zott et al., 2011; Foss and Saebi, 2017). Value proposition articulates the value to be proposed to the beneficiaries, the product and/or service offering, and the target beneficiaries. Value creation is about the key organisational resources and capabilities that the firm can mobilise to produce value. Value delivery consists of the organisational processes (including metrics, rules and norms) used to deliver the value proposition. Value capture describes the formula that the firm uses to generate profit – including revenue model, cost structure, margin model, and resource velocity (Johnson et al., 2008). Table 1 summarises the key components of business models according to the configurational perspective.

-Insert Table 1 here-

This study addresses the above-mentioned double gap in research on, on the one hand, the different types of organisations that act as digital innovation intermediaries supporting policies on digital transition and, on the other hand, the link between organisational characteristics of these organisations and their business models.

3. Data and methodology

Because we are studying an under-researched phenomenon and because our goal is to uncover and make sense of the phenomenon rather than to test a set of hypotheses derived from theory, we adopted an inductive approach, based on qualitative methodology (Eisenhardt and Graebner, 2007; Yin, 2013). Our methodology relies on semi-structured interviews with stakeholders working within digital innovation intermediaries in five countries. These intermediaries have been funded as part of the Digital Innovation Hubs (DIH) initiative, and/or of the European Digital Innovation Hubs (EDIH) initiative. We interviewed stakeholders involved with 20 of these DIHs or EDIHs (7 in Spain, 4 in Italy, one in Germany, 2 in the UK, 6 in France). The sample was designed to reflect the variety of digital innovation intermediaries delivering national and European digital agendas, including a variety of ownership models (public, private, mixed), and a variety of funding models (public funding, private funding from service delivery, membership fees, and so on). The list of interviewees and details about their organisations are provided in Table 2. As mentioned in the introduction, the goal of this paper is to describe a variety of organisations performing the role of digital innovation intermediaries, identify their business models, and to analyse the links between their organisational

forms and their business models. While the sample has been designed to accommodate a wide variety of organisations in order to identify insightful patterns, the findings of our study cannot be generalised statistically to the whole population of digital innovation intermediaries since the sample is not statistically representative. It is however possible to claim analytical generalisability, to the extent that this study allows us to derive some lessons in the form of *working hypotheses* (Yin, 2018), against which other contexts can be compared (Buchanan, 2012).

-Insert Table 2 here-

The authors' team developed an interview guide before the start of the interview process. The same interview guide was applied to all interviews. It was structured around several themes: the landscape of innovation intermediaries in the focal country, allowing the interviewer to position the intermediary within that landscape; the ownership of the digital innovation intermediary and its legal form; the objectives/mission of the intermediary; the activities put in place by the intermediary; the intermediary's governance; the intermediary's funding model; the networks and ecosystems it is involved with; and its outputs/results. For each theme, a general question and several sub-questions were formulated. The interview guide is provided in the Appendix.

All interviews were fully recorded. For each interview, the authors filled a document with the summary of the responses to the interview questions. This was accompanied by a one-page summary for each of the intermediaries, all written in English language, which allowed all co-authors to gain insight into the nature of the intermediary, its activities, mission, governance, outputs and other relevant issues. The data obtained through personal interviews were complemented by secondary data about the innovation intermediaries, such as information from websites, brochures and presentations obtained from the respondents and other sources.

Using these one-page summaries and the secondary sources, the author team proceeded to produce tables classifying the responses and grouping the intermediaries based on the similarities/divergences in the responses they provided to the same questions. In particular, to map and classify each of the different types of intermediaries in our cross-countries sample, we identified a number of relevant dimensions pertaining to the intermediaries' legal and ownership structure, and their business models. The business model dimensions, based on the configurational view – value proposition, value creation, value delivery, value capture – were mapped onto the answers provided by the interviewees in response to the questions about, respectively, networks and ecosystems, activities, governance, and funding. The legal and ownership structure dimension was mapped onto the answers provided to the question about the ownership of the digital innovation intermediary and its legal form. By coding

these answers, we identified several possible options for each of the legal and ownership structure and business model dimensions, as listed in Table 3. This process was iterative, it involved several rounds of readings and going back from the tables to the interview data and back until an agreement was reached among the authors regarding the relevant options to be included.

-Insert Table 3 here-

Finally, once we had identified the key dimensions (legal and ownership structure and business model), we mapped each intermediary according to these dimensions, selecting the most appropriate option for each. This way we constructed a table associating each intermediary to the framework's dimensions, as follows.

-Insert Table 4 here-

In this way, we were able to analyse the intermediaries according to each dimension, separately, and subsequently to identify the emerging archetypes in terms of combination of features (both business model and organisational) which appeared to be the most recurrent ones.

4. Findings and Patterns

In this section, we will present the key findings of our study. We first illustrate some basic characteristics of the intermediaries: their ownership and legal form, and their business model (in terms of their value proposition, value creation, value delivery and value capture). Subsequently, we analyse the links between the various components of the business models, with the aim to identify emerging digital intermediaries' archetypes.

4.1. Ownership and legal form

The intermediaries in our sample have either public ownership (intermediaries owned by a city, local, regional or national government, or by public organisations such as universities and public research institutes), private ownership (companies, groups of companies, representative associations of companies), or they are consortia/networks of public and private organisations. Although most of the intermediaries are fully or partially publicly owned, their legal form is mostly private. The majority of intermediaries are in fact private not-for-profit organisations. A few intermediaries are entities without a legal form (informal associations for example – this is the case of some EDIH in France) or public entities.

4.2. The digital innovation intermediaries' business models

Value capture: Sources of funding

Ensuring the sustainability of digital innovation intermediaries' business models is a crucial objective for European policymakers (European Commission, 2017, page 16-17). This means that intermediaries have been strongly encouraged to expand their financing model beyond public funding toward a more commercially oriented business model, combining services that generate profits (e.g. service provision) with other activities that are not profit-making (e.g. digital awareness). Regarding the sources of funding, the following possibilities emerged from the responses: i) public funding, including: public subsidies, project funding (through competitive bids); ii) private funding, including: funding from the owner, funding from membership fees, funding from service provision, return on venture capital investment, return on equity investment, philanthropic donations; or (iii) a combination of these possibilities.

Most intermediaries have a variety of sources of funding. The most frequent are public subsidies (16 intermediaries, or 80%) and private funding from service provision (13 intermediaries, or 65%), followed by project funding from competitive bids (9 intermediaries, or 45%) and membership fees (8 intermediaries, or 40%). Direct private funding from the owner (3 intermediaries), returns on venture capital or equity investment (1 intermediary) and philanthropic donations (1 intermediary) are infrequent sources of funding. Hence, while public support for innovation intermediaries plays a significant role, it is not the only source of funding. Indeed, even those intermediaries that receive public subsidies need to provide some services and apply membership fees to be able to stay financially afloat.

Only 4 intermediaries do not receive public subsidies. Even these intermediaries however accrue some public funding, by bidding for competitively allocated grants. The fact that all the intermediaries that do not receive public subsidies are active in putting together projects to be candidates for public grants, suggests that private funding from commercial activities alone is not sufficient to sustain these organisations.

Sources of funding and legal forms tend to have some associations. All three fully public organisations (including associations of public organisations) receive public subsidies, and these tend to be their main source of funding. All private for-profit organisations (including associations or private organisations) also receive public subsidies, but they also all supplement their income with the provision of services, and in about half of the cases with membership fees, and project funding.

Private not-for-profit organisations report a variety of sources of funding. Not all of them receive public funding (only 8 out of 12).

Value proposition: Ecosystem focus

Despite being often depicted as demand-led organisations with the mandate to support the digital transformation of the regional innovation system (Hervás-Oliver et al., 2021), the results from the interviews suggest that digital innovation intermediaries support different types of ecosystems. These include:

- local ecosystems: it is the typology that comes closest to the ideal type described by the European legislator. The identity of the intermediary revolves around the local and regional business community it serves and to which it belongs;
- sectoral ecosystems: in this case the intermediary promotes an ecosystem populated by organisations operating in specific industrial sectors (e.g. service provision or manufacturing);
- technology-centric ecosystems: this typology instead includes intermediaries that promote ecosystems that specifically and primarily focus on the development and the adoption of a specific technology (e.g. robotics or artificial intelligence);
- company-centric ecosystems: the intermediary supports an ecosystem of organisations working with a specific company's technology or responding to a specific company's objectives;
- and combinations of these types of ecosystems (e.g. sector and technology, locality and sector, etc.).

Out of the twenty intermediaries in our sample, very few focus only one type of ecosystem, in particular: four focus only on technology-centric ecosystems, and 2 focus only on local ecosystems. The remaining 14 intermediaries focus on combinations of sector and technology (2), sector and local ecosystem (5), technology and local ecosystem (5), technology, sector and local ecosystem (1) and finally one intermediary focuses on a combination of company and technology-centric ecosystem. The latter intermediary is an informal business association whose objective is to showcase their technologies and suggest how they could be deployed by users e.g., startups or companies that might benefit from them. So, while the ecosystem focus is technology-centric, there is a specific focus on the technology produced by a specific company (I_1 in Table 3). This is the only example in our sample of an intermediary that has a strong connection with one specific company. In all other cases where companies are present in the association, they are part of a consortium along other companies.

More than half of the intermediaries (65%) focus on local ecosystems (with or without other dimensions). Since a technology or sectoral focus is present for most intermediaries, it seems that the main distinction between intermediaries concerning ecosystem focus is *based on whether they have a local focus or not*. When they do, we call them ‘local ecosystem focus’ intermediaries as their primary focus lies in serving a specific local community. When their primary focus lies in supporting organisations operating in a specific sector or with a specific digital technology, we call them ‘technological-sectoral ecosystem focus’ intermediaries.

Value creation: Activities

In terms of activities that intermediaries put in place, respondents listed many of them. We can group them into four main categories:

- Supporting basic and applied research and technological development: accelerating, helping participation in tenders etc. putting together project bids, managing and/or participating in competitively funded projects; collaborative/contract research with firms;
- Helping companies to develop competencies: information provision, providing training and upskilling services, business development, innovation brokering, strategic foresight activities, other knowledge-intensive services
- Helping companies to find resources: incubating firms, accelerating firms, investing in spinoff companies, venture capital investment
- Consolidating and growing the ecosystem: networking, political lobbying (on behalf of ecosystem members)
- Mixed activities: combinations of the above-mentioned activities.

The most frequent activity is the provision of knowledge-intensive services, practiced by 18 intermediaries, followed by information (15), networking (12), project creation, management and coordination (11), training and upskilling (10) and innovation brokering (10). More resource-intensive activities like incubating or accelerating firms and providing equity financing are implemented by few intermediaries (respectively, 3 and 1). Very few engage in collaborative / contract research (3) and political lobbying (3).

Value delivery: governance

The way digital innovation intermediaries perform their activities and deliver their services is evolving. The technological advancements related to the diffusion of new digital technologies such

as digital platforms have the potential to deeply transform the business model of the intermediaries and their value delivery strategies (Howells 2024).

In terms of value delivery, we focus on the nature of the decision-making process within the intermediaries. We consider decision-making processes as characterised by:

- centralisation, when there is a closed membership; this involves tight public influence on (i) what is possible to do, (ii) who can be a member, e.g. there is a significant fee for new members and/or members need to be invited or have a high share of board votes, or a share of votes is kept for only a few members.
- decentralisation, when there is open membership; this involves loose public influence on (i) what is possible to do, (ii) who can be a member, e.g. there is a low fee for new members and/or members do not need to be invited or board votes can be diluted, and each member can have one vote;
- coordinated decentralisation, a form of decentralisation where in the decision-making process there is a combination of founders and new members conditional on votes.

In general, both public and private for-profit intermediaries are more likely to have decision-making processes that are characterised by centralisation or some co-ordinated form of decentralisation. Only some private not-for-profit intermediaries have fully decentralised decision-making processes.

In terms of funding, we find that public subsidies and providing services are associated with centralised decision-making, while funding from membership fees is associated with decentralised decision-making. This is consistent with members having more control over decision-making processes when they pay a fee to join the organisation.

4.3. Emerging business model archetypes

Considering our evidence base, we have inductively developed a taxonomy of digital innovation intermediaries' business models by identifying emerging associations between key business model dimensions. We identify two key dimensions alongside which different business models can be identified.

One is the value proposition, captured by the type of ecosystem that the intermediary strives to support. We identify the presence of a local ecosystem focus as an important differentiating dimension when it comes to value proposition: while most intermediaries have a technology and/or

sectoral focus, the local focus is only present for some intermediaries. Hence, we distinguish between ‘local ecosystem focus’ digital innovation intermediaries, which mainly target a local ecosystem, and ‘technological or sectoral ecosystem focus’ digital innovation intermediaries, which mainly target an ecosystem focused on a specific technology or sector.

The activities of intermediaries are slightly different depending on whether they have a local or technological-sectoral ecosystem focus or not. Activities that are more prevalent in intermediaries with a local ecosystem focus are: providing services (100% vs 71%), providing training (69% vs 14%), incubating/accelerating companies (23% vs. 0%), providing innovation brokering (54% vs 29%), and networking (69% vs 43%). The activities that are more prevalent in intermediaries with a technological-sectoral ecosystem focus are: setting up, managing, and coordinating projects (71% vs 46%), collaborative research (29% vs 8%) and investing (14% vs 0%).

It seems, therefore, that technological-sectoral digital innovation intermediaries are more focused on activities related to basic and applied research and technological development (doing contract and collaborative research, putting together projects). Local digital innovation intermediaries, instead, tend to focus more on activities related to helping companies develop competencies and find resources (services, training, innovation brokering, resources). In other words, intermediaries without a local ecosystem focus seem to engage in intermediation activities positioned more towards the lower technology readiness levels (TRL), while intermediaries with a local ecosystem focus seem to address more the higher technology readiness levels.

In terms of value capture, the main differences between local and technological-sectoral digital innovation intermediaries are that the former are slightly more likely to receive public subsidies (83% vs 75%) and membership fees (42% vs 37%), and that the latter are more likely to receive income from project funding (62% vs 33%). This is consistent with technological-sectoral intermediaries being more oriented to putting together and managing projects, which bring in project funding. Typically, competitive research projects are positioned more towards the basic end of the spectrum (low TRL) while public subsidies are granted to intermediaries to perform more applied work (high TRL) so the funding model is also consistent with the intermediaries’ activities as they emerge from our interviews.

The other key differentiating dimension is the value delivery, captured by the governance of the intermediary’s decision-making processes. We can distinguish intermediaries according to whether their governance is more centralised or decentralised. If we differentiate intermediaries’ value creation activities according to whether they have centralised or decentralised governance, we find

that intermediaries with decentralised governance are more likely to focus on activities that create value for specific ecosystem actors (very often, the members of the intermediary, if it has a membership model), such as the provision of information and training services, putting together applied projects, and incubating or accelerating companies. On the other hand, intermediaries with more centralised governance are more likely to offer services that create value for the whole ecosystem, such as collaborative research projects around early-stage technology development and investing in new initiatives.

Based on the intersections between these two dimensions, we can identify four different types of business models, and associate them with specific organisational forms.

-Insert Figure 1 here-

Intermediaries with technology-sectoral focus and centralised governance. These are RTO-type organisations that mainly focus on supporting early-stage technological development in digital technologies and the diffusion of technology in the technology or sectoral ecosystem. They focus on activities positioned mainly towards the lower technology readiness levels (TRL), such as collaborative research projects around early-stage technology development and have a relatively higher share of income from project funding.

Intermediaries with technology-sectoral focus and decentralised governance. These are sectoral associations that focus on providing information, training and other knowledge-intensive services for their members or key stakeholders in the technology or sectoral ecosystem, and receive a relatively higher share of income from membership fees and the provision of services.

Intermediaries with local focus and decentralised governance. These are local associations that also focus on providing knowledge-intensive services for their members or key stakeholders, particularly around more applied activities at higher TRL, such as managing and coordinating applied projects. They have a relatively higher share of income from public subsidies and membership fees.

Finally, intermediaries with local focus and centralised governance. These are local organisations which have a local digital ecosystem building mission. They focus on activities that benefit the local ecosystem such as networking, lobbying, innovation brokering, putting together value chains. They also have the mission to help local organisations, in particular SMEs, to overcome the digital divide by adopting new technologies. These are typically the EDIHs. They have a relatively higher share of income from public subsidies, specifically from the European Union.

The following table summarises the differences between the four distinct business model archetypes that emerge from our data.

-Insert Table 5 here-

5. Discussion and conclusions

Digital innovation intermediaries are organisations that accompany and facilitate the emergence and rapid diffusion of digital technologies in business and innovation ecosystems. While a variety of organisations can play intermediation roles (Caloffi et al., 2023), the characteristics of intermediaries in the digital domain and of their business models remain poorly understood. To fill this gap, in this paper we set out to examine digital innovation intermediaries that display a variety of organisational forms. Building on the business model literature (Johnson, et al., 2008; Foss and Saebi, 2017; Zott et al., 2011; Chesbrough and Rosenbloom, 2002; Osterwalder et al., 2005; Chesbrough, 2007), we analysed four main building blocks of intermediaries' business models, namely value proposition, value creation, value delivery, and value capture. Drawing from original qualitative evidence from twenty digital innovation intermediaries in four European countries, we aligned the intermediaries in our sample along two main dimensions: their value propositions which we conceptualised through their focus (local ecosystem focus vs. technology/sector focus), and value delivery, which we conceptualised through their governance (centralised vs. decentralised). We categorised our digital innovation intermediaries into four groups, each of which is associated with a specific organisational form: RTO-type organisations (characterised by technology-sectoral focus and centralised governance), sectoral associations (characterised by technology-sectoral focus and decentralised governance), local ecosystem builders (characterised by local focus and centralised governance), and local associations (characterised by local focus and decentralised governance). Each of these groups of digital intermediaries has its own way of creating value for the relevant stakeholders, and an associated funding model.

Our findings suggest that intermediaries with different organisational forms and business models facilitate digital transition. Our sample uncovered a greater-than-expected variety of organisations, which seem to co-exist and co-evolve in the digital technology landscape. This implies that there is not a one-size-fits-all digital intermediary and that, instead, different types of intermediaries contribute in different ways to carry out digital policy strategies. Some intermediaries position themselves at lower TRL thus contributing to advancing fundamental research and moving the

knowledge boundaries in digital technologies. Other intermediaries focus more on the diffusion of digital technologies, their acceptance, and the building of the ecosystems around them.

Our study proposes several insights which can help advance the digitalisation agenda. First, our findings point to the importance of public funding in advancing the digital policy agenda, as pointed out by prior research (Rossi et al., 2022). Most of the intermediaries in our sample receive public funding, albeit to different extents and in different ways. They contribute to the achievement of public missions and to the advancement of the digital policy agenda by creating public value and offering services that otherwise might not have been produced by the market, such as for example allowing free access to innovative infrastructures. This is particularly valuable for small companies which often cannot pay to access such services (Rossi et al., 2022). Second, our findings suggest that ecosystems are crucial in accelerating digitalisation, as this process requires collective adoption and diffusion of digital technologies. However, at the same time, there are important coordination challenges in these ecosystems, which increases the risk of market failure, and emphasises the need for higher public intervention. Third, it appears that, due to the complexity of the digital transition process, *a variety of intermediaries is needed to make the most of the digital transition, and that intermediaries complement each other while advancing digital policy agendas*. Recent analyses (Hammerschmid et al., 2023) showed that, in several EU countries, the pace of implementation of formalised external collaborations to enable digital transformation by the public sector is still very slow, as evidenced by the lesser role they have in digitalisation strategy plans as opposed to internal (or hierarchical) public sector collaborations. In other words, innovation strategies, such as those connected with digitalisation, may trigger or reinforce debates around more hierarchical governance modes, to deal with uncertainties and the need for more holistic and centralised solutions. What our study sets forth is the idea that policy makers dispose of a larger palette of options when these are designed in a multilateral setting (such as the DIH/EDIH initiative), and that these categories of intermediaries can serve different purposes under different conditions, thus unleashing several potential features of collaboration for digitalisation which have been so far overlooked in the literature (Verhoest et al., 2024).

We contribute to the academic literature by shedding light on the organisational and business model variety of digital innovation intermediaries and by explaining their ways of operating in the digital technology landscape. To the best of our knowledge, our study is the first to map out digital innovation intermediaries from the business model perspective.

Our study also contributes to practice in several ways. First, when it comes to public funders, we show how intermediaries use public funding to implement digital policy initiatives, suggesting that whatever the ownership of the intermediary – public, private or mixed, the support of public funding

is crucial to facilitate its operations. Starting from the insights of this study, public authorities could invest in better understanding the best practices, displacement effects and longevity and impact of intermediaries, in order to design appropriate policy schemes. Related to this is the issue of evaluation of intermediaries. As our findings demonstrate, different types of intermediaries exist and there is therefore a need to use different criteria to evaluate their actions. When it comes to intermediaries themselves, it would be useful for them to better understand their impact, by using for example data-driven analyses. Such analyses would allow them to optimise their programmes and activities, avoid overlap between them and engage in collaborative intermediation. Regional agencies could find inspiration in our research to analyse how intermediaries can be part of their local industrial strategies and how they can contribute to maximise the clustering benefits. Finally, individual organisations and in particular SMEs can use the insights of our study to identify intermediaries that have the greatest potential to meet their needs during the digital transition.

Despite its contributions, our study is not without shortcomings. First, as we have pointed out, we studied twenty DIHs/EDIHs across four European countries. Consequently, our findings might not be generalisable to intermediaries operating in other European countries; however, our findings can give rise to working hypotheses that can be examined in other contexts. Hence, the analytical generalisability of this work can open up avenues for further research. Second, some intermediaries focus on specific technologies (for example AI), while others cover a broader set of digital technologies. How this impacts their activities has not been taken into account in our study and would require further investigation. Third, we have not studied in detail the role of different types of intermediaries in supporting specific policies, whether regional, national or European. This could be the focus of future studies.

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Appendix: Interview guide

	Innovation intermediary X (Name & role interviewee)
Name of intermediary (Country)	
[Open Question] To better capture the ecosystem of digital intermediaries in your country, would you be able to point us to other relevant digital intermediaries in your country with a similar role to yours?	
<p>A. Can you define the ownership of your DX innovation intermediary?</p> <p>Ownership could refer to the legal control over a business. It gives the owner the legal capacity to dictate the business operations and dealings.</p>	
<p>B. Can you define what are your organisation's objectives / mission?</p> <p>This might refer to your role in relation to the EU and national strategy and their public missions and more generally what you aim to achieve and kind of impacts you seek. It might be useful to be specific and use KPIs where possible.</p>	
<p>C. Can you define your intermediary's activities and how you would achieve these?</p> <p>This would refer to the actions / activities that your organisation, this might include eg training, stakeholder engagement, financing, research, commercialisation etc.</p>	
<p>D. Can you define Your intermediary's and your programs' governance?</p> <p>This might refer to: i. What is the organisational structure, ii. how are decisions made, iii. what is the composition of the governing board, and iv. does it have a role in the intermediaries' decisions?</p>	
<p>E. Your intermediary's funding model (i.e. target segment, value creation, revenue creation)</p> <p>This might describe how an organisation creates, delivers, and captures value, in economic, social, cultural or other contexts.</p> <p>This might refer to: i. what are your sources of revenue?, ii. who are your main 'customers?', iii. what is the value that you provide for your customers?, iv. do you have any organisations you see as 'competitors' and if so who are they?</p>	

F. Your intermediary's **network**

There could be different types of networks: organisations that supply you with services/knowledge; organisations you collaborate with in delivering services/products; organisations you network with for research projects, etc. Which networks are we referring to?

G. Can you outline and measure the **outputs** & what achieved by your DX innovation intermediary?

It would be useful to provide specific answers using where possible re. KPIs.

In terms of *evaluation* - What are the *performance dimensions* you are evaluated on? How, how often and by whom?

From a government / policy maker perspective, this research might be useful to map out the trade-offs of 'social and economic costs-benefits' from 1 euro invested on your intermediary.

Related to this, how do you consider your organisation performed/s?

Can you suggest who might be the best person/ stakeholder to talk with next?

Table 1. The components of business models in organisations

Business model dimensions	Firms
Value proposition	Customer value proposition, including target segment
Value creation	Key resources: activities, resources/competencies, partners/networks, communication channels, relationships with clients/suppliers
Value delivery	Key organisational processes (including metrics, rules and norms)
Value capture	Profit formula (including revenue model, cost structure, margin model, resource velocity)
References	Johnson, et al., 2008; Foss and Saebi, 2017; Zott et al., 2011; Chesbrough and Rosenbloom, 2002; Osterwalder et al., 2005; Chesbrough, 2007

Table 2. List of respondents and their organisations

Organisation ID	Respondent's job title	Country
I_1	Chairman	Spain
I_2	Vice Director	Spain
I_3	EUNext Funds Manager; Senior Policy Manager	Spain
I_4	Project Management, Innovation & Dissemination	Spain
I_5	Director	Spain
I_6	Director for International Development	Spain
I_7	Responsible of industry issues	Spain
I_8	Coordinator	Italy
I_9	Coordinator	Italy
I_10	Coordinator	Italy
I_11	Chief Executive Officer and Head of Development Strategy	Italy
I_12	Economist	Germany
I_13	Innovation Programme Manager; Manufacturing Lead	UK
I_14	Director of Policy	UK
I_15	Directeur délégué, project coordinator	France
I_16	Project coordinator	France
I_17	Project coordinator	France
I_18	Délégué general (Cluster manager)	France
I_19	Head of innovation and European projects	France
I_20	Manager European affairs	France

Table 3. A framework to classify digital innovation intermediaries

Business model dimensions:	Legal form and ownership	Value proposition (Network and ecosystem)	Value creation (Activities)	Value delivery (Governance)	Value capture (Funding)
Options for each dimension:	<ul style="list-style-type: none"> • Public: government and/or public organisations • Private company • Group of private companies • Representative association of companies • Network of public and private organisations • Mixed legal form and ownership 	<ul style="list-style-type: none"> • Company-centric ecosystem • Sectoral ecosystem • Local ecosystem • Technology-centric ecosystem • Mixed network and ecosystem 	<ul style="list-style-type: none"> • Supporting basic and applied research and technological development • Helping companies to develop competencies • Helping companies to find resources • Consolidating and growing the ecosystem • Mixed activities 	<ul style="list-style-type: none"> • Centralised and closed membership • Decentralised and open membership • ‘Coordinated’ decentralisation: access conditional by minimum quorum • Mixed governance 	<p>Public funding (from subsidies, from competitive project funding)</p> <p>Private funding (from owner; from membership fees; from service provision; from return on investments; from philanthropic donations)</p> <p>Mixed funding (combination of the above)</p>

Table 4. Example of tabulation of digital innovation intermediaries

#	Intermediary's name	Country	Legal form and ownership	Value proposition (Network and ecosystem)	Value creation (activities)	Value delivery (governance)	Value capture (funding)
1	Intermediary's 1	...	...	...	...	...	...
2	Intermediary's 2	...	...	...	...	...	...

Table 5. Emerging business model archetypes

Type of digital innovation intermediary	RTO-type organisations: technology-sectoral focus and centralised governance	Sectoral associations: technology-sectoral focus and decentralised governance	Local ecosystem builders: local focus and centralised governance	Local associations: local focus and decentralised governance
Value proposition	Sector and technology ecosystem focus	Sector and technology ecosystem focus	Local ecosystem focus	Local ecosystem focus
Value creation	Lower technology readiness levels (TRL) activities: supporting early-stage technological development and the diffusion of technology	Lower technology readiness levels (TRL) activities: information, training and other knowledge-intensive services	Intermediation activities positioned more towards the higher technology readiness levels (TRL): networking, lobbying, innovation brokering, putting together value chains	Intermediation activities positioned more towards the higher technology readiness levels (TRL): putting together applied projects, training, and other knowledge-intensive services
Value delivery	Centralised approaches	Coordinated decentralisation or fully decentralised approaches	Centralised approaches	Coordinated decentralisation or fully decentralised approaches
Value capture	Project funding	Membership fees, services provision	Public subsidies, project funding	Public subsidies, membership fees, services provision

Figure 1. Digital intermediaries archetypes based on the intersection of value proposition (ecosystem focus) and value delivery (governance) dimensions

