



# Innovation intermediaries in a digital paradigm: A theoretical perspective

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## 1. Introduction

It is argued here that innovation intermediaries have been in existence for a long period of time and their role, delivery and nature have constantly changed. This paper reviews this change as a lens to investigate the emergence of new digital forms of innovation intermediaries, and, in so doing, provides a theoretical perspective and understanding of this change. In this context, does this new digital agenda mark a radical paradigmatic<sup>1</sup> change as to how innovation intermediaries function? Or should it be viewed more as an incremental, if significant, change to how intermediaries operate?

The key issue is whether new digital forms of intermediation will change how innovation intermediation is undertaken and whether it creates new organisational forms and business models. It is interesting to note that, in the current literature at least (Caloffi et al., 2023), the digital agenda has not made its mark yet (although in their analysis this is no doubt subsumed under the open innovation intermediary category). This is not to say it will not, and indeed this special issue will undoubtedly have an impact here in developing more research in this field (Section 5).

## 2. Reasons to exist and innovation intermediation roles

A useful starting point for the conceptual analysis of how innovation intermediaries are evolving and developing now and in the future, is to go back to explanations and descriptions of their very origins of existence, and the roles and functions they provided. Thus, the question that Dalziel (2010) posed “Why innovation intermediaries exist?” still remains valid. For Dalziel (2010, 12) it was about (new) agents or organisations bridging the innovation gap. Thus, “Innovation intermediaries that conduct or support technology development activities are the only organisations that purposefully position themselves in the innovation gap.” This innovation gap represents an opportunity for innovation intermediaries to conduct or support technology development activities that otherwise would not be satisfied by existing actors in the marketplace and includes activities which: generate revenues or scientific

publications; focus on the problem solving; technology development; and, testing activities that other actors are reluctant to undertake. It also has widened over time to cover orchestration and transition activities within the innovation systems in which they operate. This includes, amongst other things, networking activities and new ways to facilitate collaboration in the business community. Intermediaries that perform these wider interorganizational networking activities in the research and innovation community are not therefore restricted to private sector firms, but increasingly occupy a much wider and diffuse public and social sphere, including associations of universities and research organisations.

This is not to suggest that intermediaries are the only organisations fulfilling intermediary type roles, but rather they represent organisations that undertake this role more permanently and in a more extensive manner (Howells, 2006; Dalziel 2010). For Dalziel (2010), though, intermediaries to fulfill their missions must operate effectively and sustainably in their respective innovation gap and must evolve these activities to remain in the middle ground and avoid getting pulled towards either the scientific or commercial poles of research and innovation activity.

The existence of innovation intermediaries therefore can be seen to be going back to and reflecting the function intermediaries provide. Intermediation more generally covers the following key functional elements or roles outlined in Table 1.

Aside from the substantive literature of innovation intermediaries, there is a significant and growing body of literature and analysis of financial intermediation and arbitrage and the role of financial intermediaries (see, for example, Allen and Santomero, 2001; Allen and Gale 2004). More recently, and to a somewhat lesser degree, the role of knowledge intermediaries and knowledge brokers (Lim and Park, 2010; Kilelu et al., 2011; Schlierf and Meyer, 2013; Parker and Hine, 2014; Shearmur and Doloreux, 2019; Temel et al., 2021); ‘system’ architects (Van Lente et al., 2003; Barrie et al., 2017; Dutt et al., 2016) or ‘transition’ intermediaries (Kivimaa 2014; Kivimaa et al., 2019); and, (e-)tourism intermediaries (Buhalis and Licata, 2002; Valeri and Baggio, 2021) have become their own developing sub-themes in the field of

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<sup>1</sup> The word ‘paradigm’ has been variously defined but I use it as “a framework, model, or pattern used to formulate generalizations, models and theories on shared assumptions, concepts, questions, methods, operational practices, and values that structure analysis and inquiry.”

**Table 1**  
Basic intermediation functions.

Intermediary Function	Description
1. Arbitrage	Lowering transaction costs, i.e. the time and effort needed to search out, negotiate and complete an economic transaction in terms of sharing: a) information b) finance c) knowledge
2. Bridging	Bridging, partnering and networking activity, including search and signalling activity and transitioning
3. Standards	Standard setting and technical verification
4. Resourcing	Resourcing, including financial support and taking equity stakes, to support individual partners, networks and ecosystem development
5. Development	Developing new products and services that support the activities, 1–4, above

intermediary development and policy. More specifically in terms of the important taxonomic work on innovation intermediaries (including technology brokers) that has been produced, this includes the work of Howells (2006), Lopez and Vanhaverbeke (2009), Agogu e et al. (2017) and Caloffi et al. (2023). However, as Caloffi et al. (2023) have noted, different approaches have been taken in relation to categorisation and function of innovation intermediaries, and this is still evolving.

**3. Emergence and evolution: framing the future**

In looking forward to investigate an evolving digital paradigms and trajectory, it can be helpful to look backwards. Thus, question such as ‘When did innovation intermediaries first emerge? Or ‘What are the origins of the earliest forms of innovation intermediary or what might be termed ‘proto’ innovation intermediaries?’ The origins of the intermediaries, it is argued here, came primarily through trade and finance, but then also branched into the regulation and technical governance of key sectors, through medieval guilds, and latterly through providing technical advice and maintenance. Traders helped expand markets by moving produce and goods beyond local boundaries into new and different regions and nations. Thus, powerful craft guilds were key in the development of the textile industry across pre-industrial Europe (Soly, 2008). However, these effects were more than just expanding the size of markets, guilds also helped to equalise prices over much wider economic areas and provide verification of the quality and hence the technical profile of key products, such as cloth or leather.

Traders, particularly for food and natural products, soon realised that carrying stocks built up in good harvests and distributed when harvests were bad, also helped smooth prices. Trade moved from simple distribution to stock building and market shaping (manipulation) through price adjustments (fixing). Traders, by their very nature through their geographical mobility, also helped spread ideas and best practice. They, in turn, traded new agricultural tools and, latterly, agricultural machinery, textile and milling equipment. These intermediaries, therefore, had a clear role in the diffusion of ideas and innovations, not just skills and equipment, with traders also moving into providing financial and credit for the goods that they sold.

The emergence of the role of intermediary or broker in amore identifiable innovation process dates back somewhat later to the early seventeenth century in Britain and Europe with the rise of middlemen and jobbers (Westerfield, 1915), who travelled the land picking up cloth, delivering advice and providing finance, to carders and textile producers on their early spinning machines. Middlemen were seen as early entrepreneurs (Gwartney et al., 2014) providing buyers and sellers with information and supporting trade and exchange. They were good at searching out, negotiating and completing economic transactions, and thereby reducing costs (Boldorf, 2017). It was therefore not just information they traded. Mechanics and millwrights also journeyed around

and helped build, maintain and repair wind- and water-mills and emergent agricultural machinery. Such mechanics subsequently then moved to maintain and repair the new machines being established in the first factories in Britain and France, as well as indicating where technical improvements to the machines could be made.

The origins of innovation intermediaries have therefore come from several different strands: organisations, such as the medieval craft guilds (Epstein, 1998), as well as individuals, including jobbers, journeymen and skilled artisans through the emergence of middlemen as individual intermediaries. Equally, in terms of function, intermediaries gradually started to centre on specific niches in trade and financial information as well as technical change in the machinery. They also had systemic effects both through early governance and regulation, but also in terms of diffusion of both ideas and knowledge. Nevertheless, many craft guilds survived until the late eighteenth and early nineteenth centuries and were then superseded or absorbed by industry and trade associations in the middle of the nineteenth century in Europe and North America. These industry and trade associations began attracting the support of national governments who were concerned about the need to develop a strong industrial base for overseas expansion and national defence.

**4. Innovation intermediaries: a dynamic, open digital future?**

Moving into the twentieth and twenty-first century, the role expansion and evolution of innovation intermediaries has continued as their business models have developed and broadened (Lopez and Vanhaverbeke, 2009; Rossi et al., 2022). Shaw (1985, 289) charts the rise of groups of individuals, funding bodies and government departments in the UK medical equipment industry performing the role of intermediaries in the absence of a set of actors that could be defined as primarily undertaking this role. In other more established sectors, industry associations and their research and technical support facilities moved into this type of function much earlier in the twentieth century and indeed ‘morphed’ into becoming innovation intermediaries in their own right or through subsidiary spin-outs. Feser (2022) notes the continued growth in the brokering role of innovation intermediaries across the innovation system, encompassing ever wider groups of firms and organisations. Naturally innovation intermediaries are evolving ways in which adds value both to their own intermediary value chain as well as that of their clients (Tran et al., 2011). One element to note here is the longevity and survivability of innovation intermediaries (Kivimaa, 2014), which is, as already noted above, due to their adaptability and evolution. Indeed, being able to support this dynamism is seen as important in developing a successful long term innovation policy (Kant and Kanda, 2019).

With the advance of digital and online systems, interactions also have become more multi-layered and differentiated. Thus, Kuenne et al. (2013, 7–8) outline five levels of interaction in their review of ‘health 2.0 platforms’ going from: information; communication; consultation; through to cooperation; and, collaboration. In the healthcare systems that were studied, the collection, synthesis and exploitation of users’ knowledge in these systems was becoming ever more important in the role and activity of innovation intermediaries. The growth of more open, networked and distributed innovation systems in combination with the growth of online platforms and digital technologies has therefore created further opportunities and new ways of undertaking intermediation over the last twenty years. Thus, new forms of relational market transactions has meant that older formal forms of market exchange, such as formal market research or trade shows, have been superseded (Perry, 1996) or at least overlain by more online, digital provision.

Lanzolla et al. (2020) particularly stress the way digitalisation can alter the nature and balance of value creation in markets. They note (Lanzolla et al., 2020, 342) that digitalisation can have a dramatic effect on value creation in markets by.

- a) expanding the range of goods and services that sellers can offer;

- b) expanding the range of buyers that sellers can reach;
- c) decreasing the search costs associated with identifying a buyer-seller match; and,
- d) providing data about buyers' unmet preferences that can, in turn, improve product development.

Indeed, one of the key ways that digitalisation has transformed many markets is through providing online search and transaction channels that both increases the range of goods and services that are offered by a client firm or organisation, whilst simultaneously lowering the search costs for selecting among them by users.

A number of studies have indicated new avenues and roles that innovation intermediaries have sought to develop and support in this new open digital era (Table 2). Thus, briefly taking category in Table 2 in turn, competitions and contests have been around for several hundreds of years with the one of the earliest being the prize legislated by the British parliament under the 1714 Longitude Act which promised £20,000 for a practicable and useful method of determining longitude at sea (Stallbaumer, 2006). In the context of innovation contests and tournaments, digital platforms have facilitated the extension of a range of different contest formats, with the ability to provide both short and long term duration of contests, as well as opening up engagement to a truly global catchment arena (Juell-Skielse et al., 2014).

Such contests are a way of identifying possible solutions and other more generalised open innovation platforms provide an innovation *problem posting* system that then is configured to engage potential 'solvers' to come up with 'solution'. This matching services can range from running more generic digital platforms, where problems and solutions are posted (Kokshagina, et al., 2017), to more bespoke 'dating' services where an intermediary can engage more proactively in searching for solution partners (Howells and Thomas, 2022). Again intermediaries have seen an opportunity by moving into, or sometimes

**Table 2**  
Innovation intermediaries: Digital and online enhanced sub-market evolution.

Sub-market developments linked to digital and online developments	Literature
1. Competitions, contests and tournaments	Juell-Skielse et al. (2014); Stefan and Bullinger (2014); Agogue et al., 2017; Piazza et al. (2019); Pollok et al., 2019; Hossain et al. (2022)
2. Broader online digital technology and innovation platforms, especially problem-solution focused	Kuene et al. (2013); Bengtsson et al. (2015); Abbate et al. (2019); Kokshagina et al. (2017); Troise et al. (2021); Howells and Thomas (2022)
3. Crowdsourcing networks, platforms and events	Zynga (2015); Piazza et al. (2019); Pollok et al., 2019; Foege et al. (2019); Schenk et al. (2020); Kiran, B. S., and Rajat Sharma. (2021); Cricelli et al. (2022)
4. Use of artificial intelligence (AI) to support innovation in other firms and organisations	Brynjolfsson and McAfee, (2017); Brynjolfsson et al., (2018); Cai et al. (2019); Belhadi et al. (2021); Waardenburg et al. (2021); Wei and Pardo (2022); Bouschery et al. (2023)
5. Managing internal knowledge flows within and between firms and organisations	Janssen and Zuiderwijk (2014); Zuiderwijk et al. (2014); Lin et al. (2016); Felin et al. (2017); Gamidullaeva (2019); Rossi et al., (2021), 2022; Conroy et al. (2023)
6. Combinatorial, portfolio and toolkit innovation management capability	Katzy et al., (2013); Kivimaa, 2014; Randhawa et al. (2017); Randhawa and Wilden (2018); Borner et al. (2023)
7. Network and ecosystem architecture and development	Klerkx and Leeuwis (2009); Van Lente et al. (2013); Lee et al. (2010); Agogue et al. (2013); Claudel (2018); van Rijnsvoever (2020); Schepis et al., (2021); Randhawa et al. (2022); Bertin and Schaeffer (2022)

creating, these digital marketplaces by offering to support, host and maintain such platforms (Pollok et al., 2019). Thus, those developing digital innovation contests have been seen as producing new forms (Juell-Skielse et al., 2014, 250) and types of innovation intermediaries (Aquilani et al., 2016, 47; see also Aquilani et al., 2017). Lastly, crowdsourcing has been seen by intermediaries as an opening not only to facilitate research and innovation funding, but also as a commercial opportunity to expand their services portfolio into this new market segment by running such crowdsourcing platforms (Schenk et al., 2020).

Intermediaries as platform owners have, not surprisingly, started to integrate artificial intelligence (AI) technologies into their platform offerings (Brynjolfsson et al., 2018; Brynjolfsson and McAfee, 2017), AI-driven innovation centred on designing and facilitating information sharing, information processing and system integration has been a new opportunity of innovation intermediaries to enhance their own services, but also as a way to support firms that want to seek to develop their own expertise in this AI supported innovation development and learning. As firms as innovation seekers search for ever more precise, and sometimes idiosyncratic, preferences they reveal to intermediaries (and those who ultimately solve and deliver innovation solutions) ever more information about potential untapped market opportunities. Firms, therefore, that can recognize and acquire external knowledge and are capable of assimilating, transforming, exploiting such knowledge through wider system level capabilities, can generate better long term performance (Dzhengiz and Niesten, 2020). AI, however, may also act as a threat to innovation intermediaries. The ability of language models to interact with different knowledge sources, learn from them, and share and transform knowledge allow this kind of AI to act as a 'knowledge' broker that facilitates sharing of knowledge between different stakeholders, whilst also fostering the creation of new knowledge (Waardenburg et al., 2021). Potentially, in this way, AI can take away some of the functions that were traditionally provided by innovation intermediaries.

Innovation intermediaries are being increasingly used to help advise and run both knowledge and innovation intranets for individual firms, especially Multi- National Enterprises (MNEs) (Conroy et al., 2023), thereby seeking to overcome some of the institutional and cultural silos that occur within large organisations (Newell et al., 2001). However, intermediaries also run internets for wider firm, industry and community associations and networks. These are clearly new elements here with the development of new digital platforms for sharing information and enabling knowledge flows and exchange (Faraj et al., 2011; Janssen and Zuiderwijk, 2014; Zuiderwijk et al., 2014; Felin et al., 2017). Thus, specialised innovation intermediaries have emerged that are increasingly becoming global 'aggregators of talent' by engaging a global pool of world-class talent. They do this by building learning communities thereby attracting organisations that seek platform-enabled talent to not only solve innovation problems, but also outsource business functions (Sarkar and Kedas, 2023). These new forms of innovation intermediaries (Aquilani et al., 2016, 46) may be much more focused and specialised than more generalist innovation intermediaries that have developed in the past.

There is also the new agenda confronting firms of the Internet of Things (IoT) which intermediaries see as an opportunity to advise and support firms in this area, but also one which requires that they develop new or adapt existing business models to handle this opportunity space (Rossi et al., 2021, 2022; see below). Certainly, the inter-operability of information and data through digital transformation has allowed innovation intermediaries to take on more management support functions for cooperation, such as portfolio management of research and innovation projects and the development of toolkits for research and technical collaboration (Katzy et al., 2013; Kivimaa, 2014; Randhawa et al., 2017; Randhawa and Wilden, 2018). Borner et al. (2023) stress the combinatorial role that innovation intermediaries can provide allowing the generation of additional value creation for their clients and themselves.

Intermediaries, together with their users, therefore support their

client firms in establishing and leveraging complementarity assets (Nambisan and Sawhney, 2011; Mele and Russo-Spena, 2015). Intermediary toolkits contribute to innovation ecosystem development by assisting users and firms to create technical compatibility (Smith et al., 2016; Borner et al., 2023). These developments can therefore be seen as a natural extension to the combinatorial aspects of the work of intermediaries in designing and configuring networks, communities and mini ecosystems to support their work (Lee et al., 2010; Agogu e et al., 2013; Randhawa et al., 2018; Randhawa et al., 2022; De Silva et al., 2022). Innovation intermediaries, by seeking to orchestrate and configure networks and innovation and entrepreneurial ecosystems, leverage value for both their clients and themselves as well as contributing to the overall development of their local (Doloreux and Turkina, 2023) or sectoral communities (Klerkx and Leeuwis, 2009). Again this orchestration and transitioning role is something novel that innovation intermediaries have identified as a new market opportunity and something supported.

In summary, it is acknowledged that these role/sub-market categories listed in Table 2 are evolving and emerging are cross-cutting in some instances, and not necessarily mutually exclusive. However these categorisation issues are to be expected as intermediaries move into new roles and markets or develop existing ones (in turn associated with increasing fragmentation and specialisation of innovation intermediary markets). This is seen more widely in the evolution of the technology marketplace which innovation intermediaries both reflect but also help shape (Lopez and Vanhaverbeke, 2009). Thus, although some are only indirectly related to digital and online developments, most of these developments depend on digital and online platforms for their emergence, development and spread.

## 5. Conclusions and future research directions

This paper has set out key changes associated with online and digital developments related to innovation intermediaries and how they have been conceptualised. As the Caloffi et al. (2023) paper suggests, not only have foci varied, but also the conceptual frameworks used in the analysis. Moreover, the paper by Lanzolla et al. (2020, 343) in reviewing wider theoretical developments in the digital and online transformation of business models, outline a divide between ‘pro generalist’ and ‘pro specialisation’ perspectives and models in terms of digital transformation and the scope of the firm. In one camp, they suggest that digital and online trends will encourage generalists and aggregators by increasing the scope of the firm. In the other the camp there will be further growth in the number of specialists and bifurcation of markets and roles. It could be argued that this is true of not only for firms as a whole, but also true for intermediaries. Certainly previous conceptualisation of knowledge trends by the author (Howells, 2012; Lanzolla et al., 2020 note as an example) has emphasised the increasingly knowledge specialisation of firms and the use of this to create new and extend existing specialist markets and activities. However, the author does not see the two trends as necessarily mutually exclusive: specialisation can also be accompanied by increased scope. Indeed, Winch and Courtney (2007) noted changes in the technical scope and scale (geographical range and size) of innovation brokers in terms of the market and how this may change through digital developments. In this context, it is also important to note the ongoing intersection between digital changes and the role of geographical proximity in the dynamic development of innovation intermediaries’ business models (Delorme, 2023).

In terms of a future research agenda, it is this highly dynamic shifting and ‘morphing’ of innovation intermediaries that makes some them so interesting as a research field. Research questions relating to innovation intermediaries remain numerous (and are indeed growing), but some key ones are posed below. Firstly, we come back to the question of why intermediaries exist, but more particularly move onto a second question of whether they will continue to exist? This latter question is particularly

pertinent to this Special Issue, and is associated with continuing developments in the online world of digitalisation, AI and enhanced cognitive characterisation which may threaten the need for intermediation. A whole series of studies examining the role of intermediaries in finance, tourism, general searching, as well as in innovation, have sought to question whether ongoing digital transformations will lead to a widespread of disintermediation and the dissolution of intermediaries. Early on there was a discussion of whether online developments would be a serious threat to intermediaries or not (see for example, Goodhart, 1989; Van der Heijden, 1996; Jallat and Capek, 2001) and this discussion and analysis has continued. More recent evidence however in areas such as finance (see Duygun et al., 2021; Kaja et al., 2021) and e-tourism (see for example Law et al., 2015; Rojas and Reardon, 2022) suggest that the impact of disintermediation has been (and will be) more limited than expected and that clients will still require the services of intermediaries. More particularly, intermediaries seem to be adapting to these changes, moving away from easier and more routine processes towards more specialised and bespoke practices (Wigand, 2020). Certainly the rise of open innovation based on online networks and new digital platforms was seen as development where innovation intermediaries would have few opportunities. As a consequence intermediation was rarely studied within the context of open innovation. This has, however, changed as subsequent studies have revealed the importance of intermediaries to progressing the rise of open innovation (Agogu e et al., 2017) and the development of new business models and ‘ways of doing’ (Rossi et al., 2022).

Secondly, and closely related to this, is a continued development of typological work, both to chart a typology of intermediary functions, but also to chart the continued evolution of innovation intermediaries. We need a clearer evidence base that will help interrogate and help revise existing typologies here, but more particularly provide a better understanding of innovation intermediaries as a distinct organisational form. This leads to third line of enquiry; the organisational form and structure of innovation intermediaries requires more in-depth analysis. Innovation intermediaries vary significantly on terms of size, shape and market (geographical and sector) coverage and we still lack this more detailed research here. Fourthly, is the role of innovation intermediaries as ‘animateurs’ within innovation networks and clusters. Further work needs to be undertaken at this level, especially in terms of network and spatial analysis *over time*. This, in turn, leads lastly to the importance of innovation intermediaries in developing successful innovation policies. Thus, Kant and Kanda (2019) outline ways policymakers can support the adaptability of intermediaries so that they survive and contribute to long term sustainability-oriented transformations that policymakers seek.

In conclusion, whether taking the long view over many centuries, or a short view of the last two or three decades with the rise of digitisation, it is this capacity of innovation intermediaries to adapt, develop and evolve that means they continue to exist and create worth, not only for themselves but also for their clients and wider innovation networks and ecosystems.

## Data availability

No data was used for the research described in the article.

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