

## The Innovation Intermediary: A Review and the Widening Roles

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### Abstract

The role of innovation intermediaries has received increased attention from the academic and practitioner community as a result of more collaborative approaches to innovation together with rapid advances in the application of internet technologies in support of innovation activities. There have been significant developments in this field since the last reviews were published (Howells, 2006, Gassmann et al., 2011) and so the aim of this paper is to review the extant research to explore the changing nature of the role of innovation intermediaries, map the current knowledge and outline a future research agenda. The review has been conducted using bibliographic coupling. This is the first time that a quantitative review method has been used to analyse this research area and it provides an opportunity to bring new insights to complement previous qualitative reviews. This paper makes a contribution to the on-going debate by proposing a framework that explains the widening role of innovation intermediaries and the varying nature of this role at different network levels and stages of the innovation process. The paper concludes by discussing the implications of the framework for theory and practice and detailing the key areas for future research.

*Keywords:* innovation intermediary, innovation network, innovation systems, bibliographic coupling

## Introduction

How can innovation intermediaries enhance businesses/communities? How can crowd intelligence transform businesses/communities? How can intermediaries facilitate innovation and mobilize innovation ecosystem actors to act together to achieve and share goals and solve societal problems? With the help of online platforms and social media, innovation intermediaries become powerful innovation catalysts (Klerkx and Leeuwis, 2009) as well as change agents for innovation ecosystems during every stage of the innovation process (Colombo et al., 2015, Gassmann et al., 2011).

Their role varies by tapping into, sharing and co-creating the knowledge and experience of actors; identifying and selecting new technology options; forming linkages between external and internal knowledge providers to develop, commercialize and even diffuse new products, technology or even experience in societies. They help organizations and communities from building inclusive markets for the "base of the pyramid" (Mair et al., 2012) to developing ecosystems of resources and participants during the innovation process. For example, P&G is one company that works with a partner (i.e. NineSigma) as an intermediary. NineSigma seeks solutions from thousands of globally dispersed solution providers to P&G's problems (Huston and Sakkab, 2006). This example shows the important role of the innovation intermediary as the bridge which connects a firm with external parties to support the innovation process.

Howells (2006) first explained the role of intermediaries in innovation as '*an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties* (p.720)'. Howells's (2006) article saw intermediaries as a knowledge broker during the innovation process based on the concept of obtaining and sharing new knowledge, leveraging a broad community of people to create and develop innovative ideas. Organizations are using intermediary firms in innovation activities. The role of intermediaries in innovation research conducted in organisations has focussed in three main

areas: 1) integrating the role for the whole process in addition to managing the operation (Hargadon and Sutton, 1997, Katzy et al., 2013), 2) supporting the transfer of knowledge and technology (Bessant and Rush, 1995, Tsai, 2001, Doganova, 2013, Lim and Park, 2010), and 3) linking firms that are looking for problem solvers (Billington and Davidson, 2013). These narrow research streams seem confused in this digital age, since the effects of the role of innovation intermediaries are not fully understood i.e. the relationships between collaborative-social networks, the technology used by intermediaries and innovation performance.

Since the publication of Howell's paper in 2006 there has been an exponential growth in the relevance of intermediaries in the innovation process but this has not been fully reflected within the academic literature. Furthermore, research on innovation intermediaries uses several theoretical perspectives including innovation systems, open innovation, knowledge and learning, social network theory and principal-agent theory. To date, this diversity in theories offers little guidance to innovation scholars who 'need a better theory of the determinants, enablers and barriers of intermediaries in cross-industry innovation, as well as in the open innovation process (Gassman et al., 2011, pp. 466)'. For the purposes of following the current understanding and thereby facilitating the research towards an integrative theoretical framework, a state of the art review of the extant literature on intermediaries' role in innovation is warranted.

Recent conditions where collaboration in innovation is widely used with the utilisation of the internet in addition to the power of the intermediary's practices leads to new disruptive business implications, which results in new roles of innovation intermediaries that are not currently reflected in the definition and activities of innovation intermediaries. This has led to many conflicts, opposing theoretical agendas, dissimilar conceptualizations of innovation intermediaries' role, and knowledge gaps within the innovation intermediary literature

(Colombo et al., 2015; Watkins et al., 2015). We can conclude that the accumulated academic contribution in understanding the roles of innovation intermediaries remains undeveloped.

To fulfil this gap, our paper's objective is twofold. First, to provide a broad overview of the changing role of intermediaries in innovation and second, to study the development of the intellectual structure of intermediation research and map the current state-of-the-art in order to outline a future research agenda. To achieve these objectives, we used the systematic literature review and bibliographic coupling methods, which enabled identifying new emerging topics and trends in innovation intermediaries and also their implication for theory and practice. Based on the findings from the bibliographic coupling analysis we propose an analytic framework by structuring the analysis in five dimensions and identifying several emerging themes and areas for future research.

The objective, therefore, is to conduct a systematic review of the literature on the new, changing roles of innovation intermediaries making the following contributions:

- a. We provide the first review on innovation intermediaries during the innovation process since the review of Howells (2006) and Gassman et al. (2011). In doing so, this paper provides a comprehensive view of the innovation intermediary roles from different levels of analysis, different innovation process phases and with a detailed consideration of the effects of openness in the innovation process.
- b. We make a major methodological contribution by introducing a quantitative method to complement the systematic review method (Tranfield et al., 2003). We used the bibliographic coupling method, one of the bibliometric analysis methods that use a quantitative approach, in analysing the literature in this particular area. This paper is among the first to use the bibliographic coupling method to identify the intellectual structure of innovation intermediary research. With the support of cluster mapping we provide a visualization of the state of the art of intermediation in the innovation

research field, the research development in this area over the years, the integrative framework of the role of intermediary, and suggest topics for future research development.

- c. It provides information to practitioners, policy makers and executives who wish to use an intermediary in their innovation process. In addition it can also inspire the emergence of valuable understandings for executives about how to use intermediaries.

The review is structured as follows. First, we outline the systematic literature review process that was used in collecting, identifying and analysing the relevant the changing roles of intermediaries in the innovation literature. This is followed by a brief review of the theoretical approaches that researchers have used when analysing innovation intermediaries. We then use the bibliographic coupling method to summarize the current understanding of intermediaries' role in the innovation process, looking at both the different innovation sub-processes (ideation, development and commercialization), while also examining the activities of innovation intermediaries in different levels from individual to system as well as the gaps in the current understanding of intermediaries' role in the innovation context. We conclude the review by suggesting directions for future research.

## **Methods**

A quantitative systematic review approach has been adopted to carry out the analysis of the literature on innovation intermediaries. Based on the work by Tranfield et al. (2003), Easterby-Smith et al. (2004) and Pittaway et al. (2004) we defined a clear set of steps for conducting the systematic literature review (Table 1).

Table 1 Review steps adapted from Tranfield et al. (2003), Easterby-Smith et al. (2004) and Pittaway et al. (2004)

Steps	Activities	This review
1	Planning the review	Forming a review panel; framing questions for the review; mapping the field of study.
2	Identifying and evaluating studies	Searching the literature; defining search terms; identifying keywords and phrase; selecting relevant database(s); narrowing the search.
3	Selection criteria	Developing inclusion and exclusion criteria.
4	Extracting and synthesizing data	Conducting bibliographic coupling.
5	Reporting	Interpreting bibliographic coupling result, build a framework and reporting the finding.

### *Data collection*

In searching the literature, we limited the review to double-blind peer-reviewed journal articles, excluding books and non-refereed publications. The use of validated knowledge serves to strengthen the robustness of the review. We used a three-stage selection process to identify relevant articles from innovation/management journals. First, we used the Thomson Reuters' Web-of-science database which provides the Social Science Citation Index (SSCI) and was used as the main data source. The database is generally considered as the most comprehensive database for scholar work and includes thousands of high-quality journals (Dahlander and Gann, 2010).

We then chose articles which were published from January 2003 to September 2015. We chose 2003 as the cut-off point because prior literature is comprehensively summarized by Howells (2006) and open innovation proliferation had started to develop at that time. Third, this review searched the titles and abstracts of journals using combinations of the keywords 'intermedia\*' and 'innovation'.

Outputs were further restricted to management related disciplines only, which resulted in an initial database of 621 journal articles. In order to minimize subjective selection biases, the authors read each of the 621 articles' titles and abstract to ensure the relevance of the innovation intermediaries research. A number of 127 articles were finally selected for further analysis.

### *Data analysis*

We used a two-stage process to conduct the analysis of the literature with the aim of minimising bias and enhancing the validity of the review (Ginsberg and Venkatraman, 1985). First, we used the qualitative approach of narrative literature reviewing, and second we used the quantitative approach of meta-analysis and of science mapping or bibliometric research methods (Zupic and Carter, 2014). The bibliographic coupling method was used to map the current research front (Boyack and Klavans, 2010) and to identify the intellectual structure of innovation intermediary research. The quantitative approach tends to be used by researchers to avoid the subjectivity and bias of review results (Vogel and Guettel, 2013).

Bibliometric coupling is one type of bibliometric research (Zupic and Carter, 2014). It has been utilised widely, by many researchers to identify the connection between two documents as a measure of similarity between them. The more the bibliographies of two articles overlap, the stronger their connection. The connection is based on the numbers of the same article being cited in two documents. If two documents cite the same articles, it can be identified as bibliographic coupling. The frequency of the two articles citing the same articles shows the level of connection. The more frequently they cite the same articles, the stronger the connection. References to several articles can be analysed and clustered based on its citing. Bibliographic coupling analysis produces a map of grouped connected articles based on its similarity in references.

This study used the Bibexcel tool to measure coupling and to find document relationships. Bibexcel is a versatile bibliometric toolbox developed by Persson that helps to do most types of bibliometric analysis (Person et al., 2009). The software is mostly used for performing bibliometric analysis in management and organisational studies (Zupic and Carter, 2014). Bibliometric data is provided at the beginning of the measurement process that can be downloaded from a database source. Bibexcel helps restructure the data, perform bibliometric calculations and conduct analytical functions to measure the similarity matrices between items (documents, authors, journals, words). The output of the Bibexcel tool is a file that can be used to visualise articles' clusters mapping as the result of bibliographic coupling. The next step was performed to show the graphical representation of bibliographic coupling cluster utilising the VOSviewer tool. VOSviewer was used for analysing bibliometric networks, based on the cluster file produced from the previous stage. The tool creates maps of publications, authors based on citations, co-citations, or bibliographic coupling networks (Eck and Waltman, 2014).

VOSviewer produced a distance-base map (Figure 1). This map shows the distance between two dots, which indicate strength. A smaller distance reflects a stronger relationship. The dots are often unequally allocated and it helped to show clusters of related items (Eck and Waltman, 2010).

## **Intermediaries Role in Innovation**

Previous research in innovation has shown how the role of innovation intermediaries develops in line with changes in the innovation process. Sieg et al. (2010) stated that there are crucial shifts in roles toward openness. We define innovation intermediaries as different kinds of agents, such as individuals, organisations and also networks or spaces, which link people, organizations, ideas and resources within the innovation process.



Earlier studies on intermediaries in the context of innovation captured the source of innovation as a way to find a competitive advantage. It was focused on internal firm resources such as the R&D department which relies on its researcher capabilities (Dyer and Singh, 1998). At this time, innovation intermediaries assisted the innovation process of a firm in the form of consultants or university faculty (Billington and Davidson, 2013). Basically, intermediaries bring together relevant resources and key actors and intermediary firms act as ‘bridging institutions’ (Watkins et al., 2015). The role of intermediaries in earlier dated publications tends to be very task-focused i.e. helping firms to transfer technology, generally operating on a hub-on-spoke model. As a hub, intermediaries are expected to help companies to develop innovation/technology management responsibilities including capabilities development, technology know-how, knowledge development, intellectual property, customer management, regulatory compliance, partnership agreements and so on. On the other hand, a spoke is administered as an implementation actor that can develop business and innovation strategies, locating key sources of new knowledge and so on. Examples of these kinds of intermediaries include specialised government agencies, university technology transfer offices, regional technology centres, and cross-national networks.

Subsequent studies on innovation intermediaries mainly focused on intermediary institutions as a facilitator of knowledge transfer between policy makers and innovators (Kelly, 2003) and take the consultancy roles during technology transfer (Bessant and Rush, 1995). These papers are focused generally on technology or knowledge transfer aspects, based on the realisation that firms have different competencies and capabilities in absorbing and assimilating new inputs of technology. Firms could use consultants as intermediaries to assist and advise them during the knowledge or technology transfer process to compensate for a lack of capability (Bozeman, 2000). These organizations as intermediaries provide technical, networking services that firms cannot individually generate innovation to solve their problems (Saxenian, 1990).

More recently, studies on innovation intermediaries have started focussing on social network interactions and the associated learning processes (i.e., Mair, Marti and Ventresca, 2012; Watkins et al., 2015). It consists of various types of companies and individuals embedded in different types of networks. The activities of this intermediary facilitate and build new forms of collaborations whilst reinforcing long-term relationships across participants in the innovation ecosystem through getting to know people around common areas of interest. Moreover, there are virtual knowledge brokers or open innovation accelerators (e.g. Innocentive), which provide virtual environments for an innovating institution to connect effectively with relevant experts, customers, or value chain actors wherever they might reside.

### **Theoretical Perspectives Used in Highly Cited Papers**

Our systematic literature review results indicate that the role of intermediaries in the innovation theme is not limited to management aspects of innovation, but also overlaps with other themes and fields. As such, the theoretical development of innovation intermediaries varies from information systems theory, institutional theory, open innovation and technology transfer to psychology and sociology (building on insights from social network theory, social exchange theory and self-determination theory). We find great variation in papers in terms of the level and nature of the benefits and challenges of collaborating with intermediaries in the innovation process. This section explains the underlying theory of innovation intermediaries and summarises the findings in table 2 based on key references, main contributions and implications to understand the role of innovation intermediaries. In doing so it shows the evolution of the roles of innovation intermediaries over the years.

Table 2 The theories, key references, main contributions, and implications for understanding the role of innovation intermediaries

The Underlying Theories	References	Main Contributions	Implication
Transaction Cost	Shohet and Prevezer (1996) Benassi and Di Minin (2009) Johnson (2008) Gambardella et al. (2007) Gehrig (1993)	<ol style="list-style-type: none"> <li>1. Innovation intermediaries bridge unconnected knowledge between buyer and seller.</li> <li>2. Innovation intermediaries provide specific resources and plays specific roles due to a lack of the necessary resources.</li> <li>3. Intermediaries reduce the cost of search and match.</li> </ol>	Intermediaries help organizations to give organizational boundary choices
Social Network	Powell et al. (1996) Lynn et al. (1996) Dhanaraj and Parkhe (2006) Ryall and Sorenson (2007) Turpin et al. (1996)	<ol style="list-style-type: none"> <li>1. The locus of innovation is in a network of learning.</li> <li>2. Social network analysis to explore the tension and structure of the innovation network.</li> <li>3. Centre of many networks are hub firms playing important roles through individual action in the formation, growth, and success of the networks.</li> </ol>	The role of innovation intermediaries can be identified from its network structure.
Organisational theory	Bessant and Rush (1995) Fleming and Waguespack (2007) Chesbrough and Brunswicker (2014) Hargadon and Sutton (1997)	<ol style="list-style-type: none"> <li>1. The role of the intermediary is to bridge the managerial gap during technology transfer in the innovation process.</li> <li>2. Brokering and boundary spanning unites the open innovation communities.</li> </ol>	Intermediaries support the innovation process especially during technology or knowledge transfer.

		3. Intermediary connects a firm with external parties to support innovation process.	
Social Capital	Kirkels and Duysters (2010) Adler and Kwon (2002) Burt (2004) Zheng (2010)	1. Innovation intermediaries fill structural holes between different groups and can build a bridge for knowledge. 2. Individual resource capability to access, transfer and develop external knowledge.	Intermediaries merge different kinds of knowledge from different types of actors

*Transaction cost.* Transaction cost theory is widely used as a fundamental theory explaining exchange relationships for organizational boundary choices (De Vita et al. (2011). It explains cost minimization to gain innovative input from inter-organization strategies. The longer the relationship of transactions lasts between organisations, the stronger the mutual dependence and the trust between transaction partners, which lead to reductions in transaction costs (Zajac and Olsen, 1993). Innovation intermediaries also reduce the cost of search for buyers and sellers and act as third party ‘connectors’ (Gehrig, 1993, Johnson, 2008, Gambardella et al., 2007, Shohet and Prevezer, 1996). Unconnected buyers and sellers play in between technology demand and supply, intermediaries are acting as agents between institutions in the presence of an imperfect knowledge market (Benassi and Di Minin, 2009, Shohet and Prevezer, 1996). According to Johnson (2008) transaction cost is used to understand the existence of innovation intermediaries in managing the organization towards effective technology development and commercialisation and states that innovation intermediaries provide specific resources and play specific roles due to a lack of necessary resource.

*Social Network.* Within social network (SN) theory the innovation intermediary’s role is seen as connecting all innovation players in a network. Powell et al. (1996) emphasised this and stated that the locus of innovation is within learning networks of inter-organisational

relationships rather than in individual firms. In addition, Dhanaraj and Parkhe (2006) identify hub firms that orchestrate network activities. Ryall and Sorenson (2007) defined these type of firms as brokers who have profitable positions in networks. The social network perspective can be used to investigate the innovation intermediary role by its social structure through the use of network and graph theories. Social network theory characterizes networked structures in terms of nodes (individual actors, people or things within network) and the ties or edges represent connection between nodes. This analysis is used to study patterns of relationships that connect actors. Lynn et al. (1996) explore the innovation community to understand the structure of inter-relationship among organisations, which consist of substructure and superstructure, based on social network theory. Superstructure refers to an organisation with an information-collecting role and who diffuse new technology.

*Organisational theory.* Organisational theory literature discussed leadership, boundary spanning and brokerage in innovation (Fleming and Waguespack, 2007, Hargadon and Sutton, 1997). Organisational literature plays an important role in explaining innovation intermediaries from the technology or knowledge transfer point of view. Technology transfer is known as one of the areas in organizational theory. It reflects the process of transferring skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities to ensure scientific and technological development are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services (Bessant and Rush, 1995). Brokerage of innovation is one example of innovation intermediaries. Its activities are linking a “searcher” organisation with an open innovation problem and “solvers” a network of organisations or individuals with potential solutions (Chesbrough and Brunswicker, 2014). Internet technology development and its application creates possibilities for a firm to open themselves up and access a wide range of external sources of innovative ideas. Gassmann et al. (2011) argues that open innovation intensifies the use of

external source and knowledge-intensive technical services in the innovation process. Intermediary organisations support open innovation particularly in recognising innovators and also the innovation process (Feller et al., 2012).

*Social capital theory.* Social capital is the concept in network literature which captures the value of individuals connected to others (Adler and Kwon, 2002, Lee, 2009, Zheng, 2010). For example, innovation intermediaries use online platforms to connect firms with the crowd (knowledge providers, online participants). Crowds interact with each other as well as managers/employees from the firm by commenting on each other's ideas or voting the posted ideas. In this way, the specific knowledge resources start building up as a result of interaction among online participants and exchanges of knowledge, which are called social capitals. Innovation intermediaries merge different kinds of knowledge from diverse types of actors. Social capital assists this mergers (Zheng, 2010). In explaining innovation intermediaries, social capital includes two main arguments: closure and structural holes (Kirkels and Duysters, 2010). Structural holes are unconnected groups of people or organisations in a social structure (Burt, 2004) where brokers span these holes in order to improve information exchange. Closure refers to a group of connected people that share information. This concept is to capture the value created by brokering activity.

Based on the information summarised from table 1 regarding the innovation intermediary roles, in this study the innovation intermediary is identified as the actor, which could be an organisation or individual, of the innovation network structure that has multi-character and facilitates the innovation process. This identification emphasises that studying the role of the innovation intermediary should be related to its position in the network, the dynamic roles of the innovation intermediary could be explained from the structure of the network (Lynn et al., 1996).

## Bibliometric Coupling- Pathways for future research

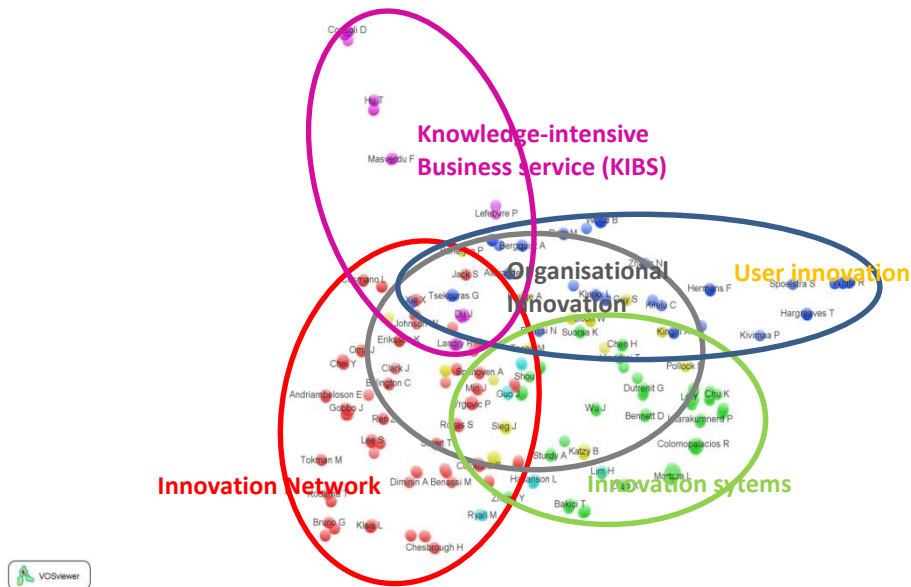
We conducted a bibliometric coupling analysis of the database of 127 focal innovation intermediaries' publications to identify patterns between them and examine the current state-of-the-art. Table 3 provides highly cited articles in the innovation intermediary literature. Howells's (2006) article, that gave a brief explanation of the definition and the typology of innovation intermediary, sits at the top of the list. Two of Chesbrough's articles about open innovation are also included on the list. It shows that open innovation is used by most researchers as a perspective to explore the concept of innovation intermediaries. In addition the absorptive capacity article by Cohen and Levinthal (1990), a book by Burt (1992) about the social structure of competition, and network learning article by Powell (1996) are also included in the table.

Table 3 The top-10 most-Cited References

Article	No. of Items	Total Percentage
Howells (2006)	59	46%
Bessant and Rush (1995)	32	25%
Cohen and Levinthal (1990)	27	21%
Chesbrough (2003)	18	14%
Hargadon and Sutton (1997)	17	13%
Klerkx and Leeuwis (2009)	15	12%
Chesbrough (2006)	12	9%
Burt (1992)	12	9%
Sapsed et al. (2007)	12	9%
Powell et al. (1996)	11	8%

All clusters developed through the bibliographic coupling process are presented in figure 1. Extracting the shared references from the innovation intermediary literature provides a visualisation of a dense network document clustered according to its similarity.

Figure 1 Clusters resulting from bibliographic coupling

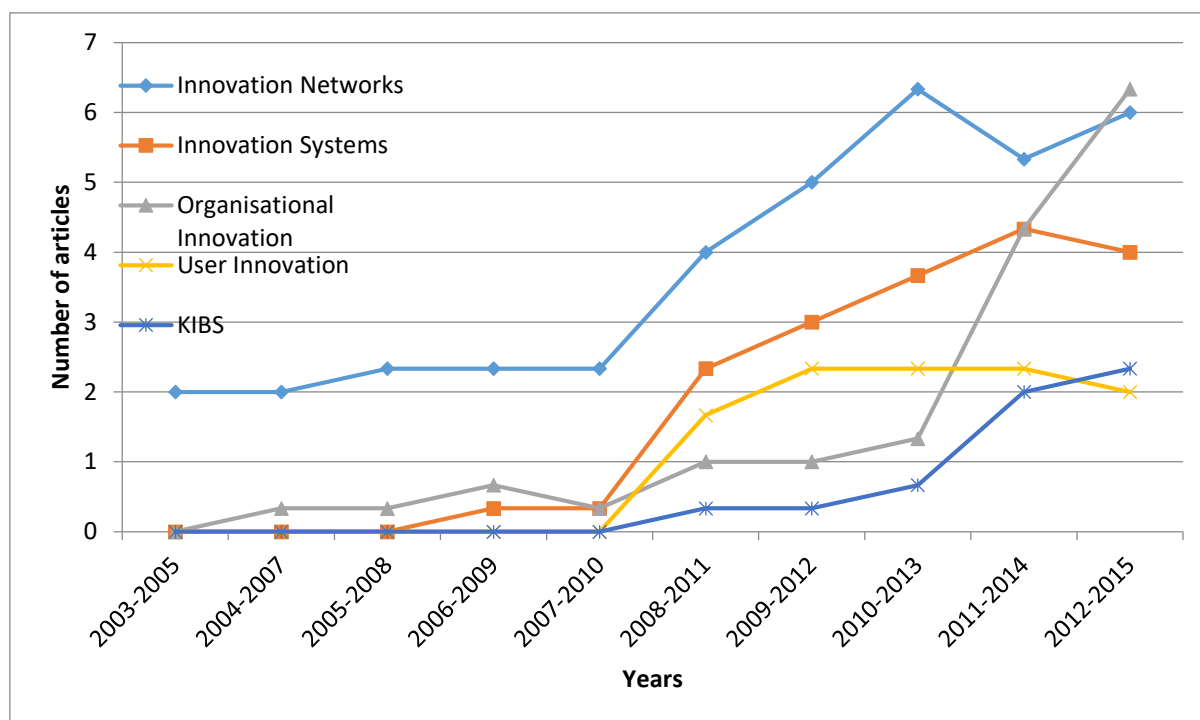


The following five themes were identified from this process: *Cluster 1– innovation networks, Cluster 2–the innovation system, Cluster 3-user innovation, Cluster 4-organisational innovation, and Cluster 5- knowledge-intensive business service (KBIS)*. To interpret the contents of each cluster the keywords, paper titles and articles were reviewed. Two authors read the 127 publications in their entirety and discussed the structure of the results until a consensus on interpretation was achieved. Through a detailed review of the references in each cluster we distinguished the keys idea and themes that take priority within this field of research. Figure 2 illustrates the growth in publications for each cluster since 2003.

Next we discuss our interpretation of these themes.

Figure 2 Growth in Numbers of Publications (Moving Averages) in Each Cluster





### *Cluster 1: Innovation Network cluster*

This cluster contains 47 articles, the dominant cluster in the entire bibliographic network. It was named ‘innovation network’ because it contains articles that mostly explore innovation as a multi-player game with a network-based activity. The articles it contains show that innovation is the output of a network with various types of members. Intermediaries exist to connect the members and influence the innovation process. Articles in this cluster demonstrate that intermediaries play roles at every phase of innovation process: ideation (Billington and Davidson, 2013, Chen et al., 2014), development (Colombo et al., 2015), and commercialisation (Benassi and Di Minin, 2009, Benassi et al., 2012, Clausen and Rasmussen, 2011, Hoppe and Ozdenoren, 2005). This reveals that intermediaries are a crucial factor on the innovation process outcomes.

This cluster also emphasises that there is no single type of intermediary. As the connector of networks’ members, intermediaries could take the form of a person or agent (Cabanelas et al., 2013), an organisation (Cantner et al., 2011, Johnson, 2008, Kodama, 2008,

Lee et al., 2010, Liu et al., 2013), an internet application or website or IT system (Brown and Lockett, 2004, Gupta and Woodside, 2006, Knockaert et al., 2014), supply chain intermediaries (Clarke and Ramirez, 2014, Lockett et al., 2013, Roxas et al., 2011), incubator (Clausen and Rasmussen, 2011), investment funds (Gredel et al., 2012, Eriksson et al., 2007) or government (Kim et al., 2010). It extends the view from Howells (2006) who focused only on the functions of intermediaries in the form of organisations.

In terms of network structure, some roles of innovation intermediaries are facilitating horizontal and vertical cooperation (Brown and Lockett, 2004, Eriksson et al., 2007, Fukugawa, 2005, Julien et al., 2004, Stuart et al., 2007, Zeng et al., 2010), the role of broader agent or gatekeeper in the network (characterized by a high degree of specialized knowledge and a key position in network for creating value) who has experiences in multiple industries and can facilitate cross-industry and wider cooperation (Cabanelas et al., 2013, Gassmann et al., 2011, Malecki, 2010), connecting different networks for collective action (in manufacturing) (Clark, 2014) and building network collaboration by setting up databases, the building, construction, and management of networks (Lee et al., 2010, Liu et al., 2013, Lockett et al., 2013, Min and Kim, 2014, Vrgovic et al., 2012). It is also evident that there is a close link between the density of networks in a region and its capacity to learn, and its innovative performance (Cabanelas et al., 2013).

For example Airbnb (Tassi, 2014) as an intermediary organization has created a social online platform that has been turning millions of people into part-time entrepreneurs encouraging people to make spare rooms or parts of their home available to travellers and thus creating a market for these resources. As such, if we define the role of intermediaries as a collective intelligence in the interest of innovation development, then intermediaries' aims are to portray the reflection and collective actions and how intentions diffuse through members of

networks to become shared norms and values, and how patterns of behaviour developed genuinely embedded in the social network (Zhang and Li, 2010; McEvily and Zaheer, 1999).

Overall, the research that this cluster represents contributes to show that innovation is the result of networking and the result depends on choosing the right partners during the innovation process. Intermediaries with various types exist to accomplish the specific activities related to network characteristics.

### *Cluster 2: Innovation Systems cluster*

There are 25 articles in this cluster discussing innovation networks considering collaborations in term of supply-demand knowledge and policy to foster innovation, in particular the regional or industrial sectors. Articles in this cluster reveal that innovation intermediaries as part of innovation systems take a role in producing a policy to foster innovation in a particular area and also facilitating knowledge transfer (Poncet et al., 2010, Inkinen and Suorsa, 2010, Bakici et al., 2013). An Innovation system is defined as a group component consisting of actors, networks, and institutions contributing to the overall function of developing, diffusing, and utilizing new products and processes (Bergek et al., 2008, Markard and Truffer, 2008). Some areas that are covered in the article are agricultural (Dutrenit et al., 2012, Haigh et al., 2015, Poncet et al., 2010), the high technology industry (Inkinen and Suorsa, 2010, Intarakumnerd and Chaoroenporn, 2013a, Wu and Xu, 2013), higher education (Rantisi and Leslie, 2015), SMEs (Shou et al., 2013, Shou and Intarakumnerd, 2013), and the public sector (Bakici et al., 2013, Theodorakopoulos et al., 2014). For these reasons, this cluster is labelled as innovation systems.

As part of the innovation system, intermediary organisations build bridges between the demand and supply of knowledge (Dutrenit et al., 2012, Theodorakopoulos et al., 2014, Zhang and Li, 2010, Zhao and Zheng, 2011). For example, it facilitates information transfer between

scientists and farmers and also includes translated and added value of information to be used in management decision making by the farming sector. In this case, the intermediary's role is as a climate advisor for farmers, informing them of the appropriate time for planting (Haigh et al., 2015). Regarding innovation systems, intermediaries' functions are also to develop innovation policy in a particular sector (Inkinen and Suorsa, 2010, Bakici et al., 2013), to facilitate local innovation and linking firms to more global innovation networks (Poncet et al., 2010, Shou and Intarakumnerd, 2013), to facilitate collaborations between actors by creating and managing innovation networks (Bakici et al., 2013, Rantisi and Leslie, 2015, Chu, 2013, Dutrenit et al., 2012, Theodorakopoulos et al., 2014, Wu and Xu, 2013) and to provide funding and resources (Inkinen and Suorsa, 2010).

### *Cluster 3: Organisational innovation*

Figure 2 shows that this cluster has the most increased publication numbers since 2012. Consisting of 24 articles, this cluster mainly focuses on organisational factors that have to be considered by the innovation intermediary in relation to its role. Sanyal (2006) focuses on the innovation intermediary as an organisation and governance-related issues. The study showed the innovation intermediary role for capacity building development can be achieved through partnership. In addition, Alexander and Martin (2013) and Audet and Guyonnaud (2013) highlighted the governance of the innovation intermediary, as transactional or relational relating to knowledge transfer. It is relational when the interaction is based on partnering and transactional when based on contracting. Clarke and Ramirez (2014) argued that to support governance, the organisation needs the process of interactive learning and skill development. Tsekouras et al. (2013) also study the support of the learning network in governance with ICT (information and communication technology) to facilitate the process.

Innovation intermediaries have to consider the coordination aspects: activities, interventions, relationships, mechanisms, and performance, in order to gain benefit from the network (Hessels, 2013, Kilelu et al., 2013). With regards to networks position, the innovation intermediary must decide its strategy partnership (Fox et al., 2013). Strategy niche development, as often discussed in this cluster, relates to the innovation intermediary roles for novel innovations (Hargreaves et al., 2013, Raven et al., 2010, Kivimaa, 2014). It all showed that organisational aspects of the innovation intermediary institution are beyond the management boundary (Spoelstra, 2013).

Overall this cluster emphasises on interaction issues regarding the relation and governance of innovation intermediaries with other members in the network. These issues depend on the characteristics of the network and will influence the role of the innovation intermediary.

#### *Cluster 4: User innovation*

The number of articles in the fourth and fifth cluster includes the least number of papers compared to the other three. The fourth cluster consists of 15 articles while the fifth consists of 12. However, it was identified that the number may increase as research grows in the future as depicted in figure 2. The fourth cluster contains articles with various topics. Having explored the article content, it was apparent that the key connection between the articles was about innovation processes that use the user as a key source of ideas. Additionally, the topic was also related to product customisation based on user requirement. Based on this, the fourth cluster is labelled ‘user innovation.’

Boon et al. (2011) and Myoken (2010) work results in learning processes inside intermediary user organisations that contribute to articulating societal demands for innovation. Another topic in the interaction among producers, intermediaries, and lead users in localised

and regional settings in order to produce quality, differentiation and have regional advantage of a winter sports product, was discussed by Hauge and Power (2013). In their study, the intermediary works as a translator to communicate the quality of the product with the user. Katzy et al. (2013) explored the intermediary role in coordinating all the stages, early stage, development, and late stage of co-creation process. Special consultants named 'industry analysts' played a role in the productions, commodification, and selling of future-oriented knowledge. This special intermediary focus is on organising the expectations between the procurement and innovation markets (Pollock and Williams, 2010).

To make a contribution to the innovation process involving users, intermediary roles have to consider three challenges: positioning, representing and levelling proactivity (Boon et al., 2011). The position of the intermediary organisation varied because the organisation interacts with different actors. The position can be neutral, impartial, a coordinating role or an activist role. Representation reflects how intermediaries communicate on behalf of the firm and connect to the users. Synthesising user demands and interacting with them are the ways in which intermediaries communicate with the user.

In terms of connection with its clients, the innovation intermediary used different approaches. Chen (2011) discussed the meeting-flow approach. The transaction of customized products considering the value of customisation in procuring, Chen and Tseng (2010) presented a negotiation-credit-auction approach.

The level of proactivity involves a lot of pressures. For example, innovation intermediaries meet and work with clients with diverse needs in different situations, contexts or with new technologies. The intermediary should proactively clarify its position and expectations demands from other actors. In summary, research in this cluster is cumulative with regard to how innovation intermediaries connect its client with the customers.

### *Cluster 5: Knowledge Intensive Business Services (KIBS)*

Articles in the fifth cluster were grouped based on the similarity in exploring knowledge intensive business service (KIBS) as intermediary institutions. There are 12 articles in this cluster. KIBS are innovation intermediary firms of various types, which specialise in knowledge screening, assessment and evaluation, and trade professional consultancy services (Castrogiovanni, 2012, Landry, 2013, Mas-Verdu, 2010). Universities, technology centres and consultants are some of the examples of KIBS that interact with multiple parties to facilitate the innovation process. In general, the services of KIBS are aimed at helping firms to specify research and technology needs, also access to relevant technologies, equipment, and patents; helping firms with prototypes, scaling up, patenting, and certification; helping firms on legal issues, access to capital and commercialisation (Landry et al., 2013). KIBS also consider its characteristics to decide the role it plays in innovation process (Consoli, 2010).

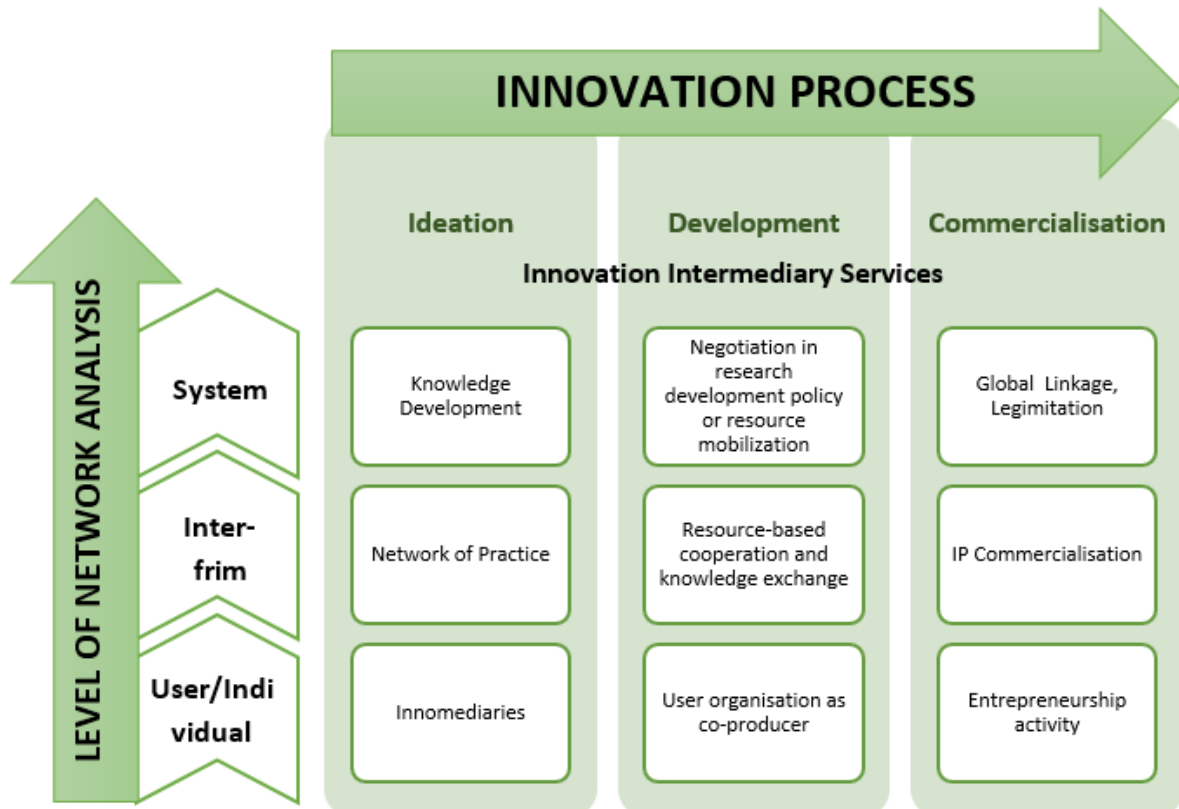
In this cluster, the focus of the debate is around the services of KIBS as a knowledge provider and promoter of research (Rodriguez, 2013, Lefebvre, 2013, Hu et al., 2013, Du et al., 2013, Consoli and Elche-Hortelano, 2010, Castrogiovanni et al., 2012, Anthony and Austin, 2008) as well as their role in regional innovation development (Meliciani and Savona, 2015, Mas-Verdu et al., 2010, Hu et al., 2014). The role of IT as a key enabler of KIBS services is also highlighted in the literature within this cluster (Hu, 2014).

## **Framework of Innovation Intermediary**

Based on the findings from the bibliometric coupling analysis we propose a framework (figure 3) that integrates the different perspectives on the role of innovation intermediaries and provides the basis to define a future research agenda. The framework links the role of innovation intermediaries with the different layers of network analysis associated with different stages of the innovation process. Our analysis reveals the differences in the nature of the roles that

innovation intermediaries can play across three network levels (individual, firm, system) and along the stages of the innovation process (ideation, development, commercialisation).

Figure 3 The role of innovation intermediaries with different levels of analysis and different stages of the innovation process



Based on the results from the bibliographic coupling, we identified five clusters that reflect three levels of network analysis, three phases in the innovation process and specific innovation intermediary roles and services at different junctions. Figure 3 shows the widening and dynamic role of innovation intermediaries. The role is widening considering the position of innovation intermediaries in relation to the environment of firms, as a consequence to new roles that have probably not been detected in previous reviews.

Different stages in the innovation process have unique problems to tackle. To deal with this, the innovation intermediary plays different roles that depend on the types of intermediary,



the challenges, and the solution offered (Billington and Davidson, 2013, Colombo et al., 2015). Future research therefore needs to carefully consider the distinct type and roles played by innovation intermediaries at different stages of the innovation process and to explicitly address the specific stage of the innovation process that the innovation intermediary works in. The difficulty of fulfilling this research gap is comparing the empirical and theoretical findings because the literature is fragmented. Based on the fundamental components of innovation intermediaries identified in the literature via our bibliocoupling approach we propose an integrated framework that bridges the disparate theories and perspectives that underpin the current state-of-the-art. We follow the innovation process by Mount and Martinez (2014) that show different stages of the innovation funnel, namely: ideation, development, and commercialisation. Ideation is the stage when the innovation intermediary connects the firm with external parties for idea generation. Development is the stage when the innovation intermediary connects firms with external parties in research activity for developing innovation products or services. Lastly, commercialisation is the stage when the innovation intermediary bridges parties external to the firm during the launch and implementation of innovation products/services.

## **Directions for Future Research**

The framework depicted in Figure 3 identifies three emergent themes that we articulate in the form of specific research gaps (RGs). Our proposed framework enables the identification of key areas for future research. These areas alongside specific research questions are discussed in the following sections.

*Intermediaries' role at different stages of the innovation process*

The bibliometric analysis identified the widening role of innovation intermediaries to different levels of analysis and also capabilities required to support its activities. Previous literature reveals that different roles of intermediary play at different stages of the innovation process (Landry et al., 2013) and also at different levels of analysis (Gobbo and Olsson, 2010). Our overall result attempts to have an integrative view of those perspectives and proposes a framework that visualises these relationships. The result complements existing quantitative reviews of innovation intermediary research. It is related to the widening role (Bozeman (2000) that focused on technology transfer role from universities and government laboratories concerning scientific knowledge, technology devices, processes, know-how in the development or commercialisation phase. Our review completes work by Bozeman (2000) by adding the ideation phase, one of the processes in the open innovation funnel (Mount and Martinez, 2014), which ideas in the form of the proposal could be the object of intermediary, as suggest by Colombo et al. (2015). Moreover, our review supports Howells (2006) work that explored the role of an innovation intermediary in firm-level innovation activities.

At the ideation stage, starting from the individual layer, the innovation intermediary could form a community of practice (CoP). A CoP's main function as an intermediary has an emphasis on brokerage, boundary interactions, boundary objects, and development of identities and meanings (Theodorakopoulos et al., 2014). A CoP is one innomediaries that create networks of customers or communities and provide access to specific segments, interests or products. Innomediaries also have functions in creating marketplaces for innovation between buyers and sellers of innovation (Sawhney et al., 2003). Moving to the development phase, user organisation as co-producer during technology development is needed for demand articulation, therefore the innovation intermediary role is in organising users, attempting to influence new technologies by learning processes, namely agenda – synthesis – expression – evaluation (Boon et al., 2011). At the commercialisation phase, innovation intermediaries could facilitate

entrepreneurial activity relating to IP transfer and knowledge sharing (Alexander and Martin, 2013). An example for the role of innovation intermediary at the user level network analysis during the innovation process is that of the Dutch intermediary organisation in the health care and emerging technologies industry called the ‘Steering Committee on Orphan Drugs’ (WGM). This committee founded by the Dutch Government to support the health of patients with rare diseases, attempting to influence new technologies, especially new medicine by initiating a network of patients for the ideation phase, and setting up small projects as experiments to stimulate research on a more general level for the development phase (Boon et al., 2011).

One step up to the firm level, in the ideation phase, the innovation intermediary role can act as a network of practice creator (Nambisan et al., 2012). This is one kind of information based-cooperation when the innovation intermediary acts as an information transmitter (Shou and Intarakumnerd, 2013). At the development phase, resource-based cooperation and knowledge exchange are facilitated by an innovation intermediary through exploratory and exploitative learning. It helps to locate and obtain many crucial resources, such as financial, experts, and new raw materials (Shou and Intarakumnerd, 2013). Innovation intermediaries are also linking to the supply side of innovation activities with creating and maintaining wider innovation networks (Poncet et al., 2010, Wu and Xu, 2013). Lastly, in the commercialisation phase, innovation intermediaries enable IP management and transaction (Chu, 2013, Nambisan et al., 2012). IP2Biz LLC is an innovation intermediary based in the US that focuses on sourcing ideas and technologies from universities and national laboratories. The company’s roles vary from searching worldwide activities that might offer solutions by establishing an extensive network of 600 university-based researchers, detailing potential research projects being developed and executing the commercial potential of a technology (Nambisan et al., 2012).

In the system, the top level of analysis, the ideation phase of the innovation process, the innovation intermediary’s function is to capture the breadth and depth of the knowledge and

how it changes over time. One technology innovation system in Germany managed the technology development of the solar cell. It started developing from firms' R&D with application-specific knowledge following further knowledge development in universities for new design concepts, and then the technologies were developed by the capital goods industry. Lastly the development continues with the building of automated production lines for manufacturing (Bergek et al., 2008). At the development phase, the innovation intermediary plays a role in negotiation in research and development policy and resource mobilisation. In 2005, a European industry association consisting of large companies, directly lobbied the European commission and influenced a policy in new environmental and efficiency requirements of electronic equipment (Watkins et al., 2015). Lastly at the commercialisation phase, the innovation intermediary role is in global linkage and legitimation. The European banking industry launched a European patent-based innovation fund in 2005 (PBIFs) for SMEs corporation. PBIFs followed an organised and offensive approach to licensing in local and international markets by accessing and developing an international network of commercialisation partners (Gredel et al., 2012).

Literature suggests that innovation intermediaries' capacities can influence different stages of innovation. Interestingly, there is reason to believe that intermediaries in different levels may not affect all components of an innovation process in the same capacity. This leads us to our first research question for further exploration:

*RQ.1: How do the different roles of intermediaries enable different stages of innovation process, either directly by enabling the innovativeness of one or more firms or through collaborative networks, or indirectly by enhancing the innovative capacity of regions, nations, sectors or networks?*

In terms of its position in the network, innovation intermediaries should consider a strategic partnership to obtain greater access to external knowledge (Fox et al., 2013). Widening its relation to different networks will help its clients to reach potential partners. The development of internet technology has made it possible to connect globally with therefore ICT systems are necessary to establish networks between the intermediary, the members, and the experts supplying knowledge (Tsekouras et al., 2013).

In each phase of the innovation process, innovation intermediaries have a special ability to support its role (Alexander and Martin, 2013). If the competence-base is divided into each phase of the innovation process, then at ideation, innovation intermediaries need the ability to create knowledge externalisation and socialisation. Following on to the development phase, the ability to facilitate research projects between different actors, share best practices, and develop knowledge-based support services are required. Lastly, at the commercialisation stage, the ability to transfer IP and facilitate entrepreneurial activity is necessary for innovation intermediary. This leads us to our second research question:

*RQ.2. Why and to what extent do organizations rely on innovation intermediaries for the creation and support of various networks (e.g.. knowledge networks, learning networks, social networks) for the different stages of innovation?*

The review of earlier work suggests that there new types of innovation intermediaries will continually emerge. When a firm involves the user in its innovation process, the innovation intermediary supports the communication process to understand user requirements of a product (Hauge and Power, 2013). On the other hand, the innovation intermediary also facilitates managing projects and performs a variety of ways to communicate with users or clients (Chen and Tseng, 2010, Chen, 2011, Myoken, 2010). Work by Boon et al. (2011) shows three challenges for intermediaries. Firstly, positioning, the innovation intermediary should decide

the position it wants to take, considering it will relate to many actors and balance the interests of the organisation. It can take up a neutral, impartial, coordinating role, or more activist role. Secondly, representation, the innovation intermediary must have the capability to speak on behalf of their members and present the demand in representative ways. Thirdly, the level of proactivity, the innovation intermediary role depends on its ability to be congruent with different situations and contexts. It should proactively clarify what clients expect and assume in relation to the innovation intermediary roles. Theoretically, researchers have analysed the benefits of intermediaries that can accumulate from involvement in various kinds of user to address these challenges. The open innovation and intermediary literature has integrated these ideas, resulting in a growing interest from innovation scholars, users as well as policy makers. However, it is not clear how these three challenges influence the role of the innovation intermediary.

Users provide valuable feedback on the new ideas, idea development; testing the idea, and help to diffuse the innovations ((Djelassi and Decoopman, 2013; Mount and Martinez, 2014). These users can have a pull as well as a push effect on the innovation process and organizations with different needs would benefit from different forms of user communities. We have little understanding of how the innovation intermediary plays a role in establishing and managing the relationship between users (user communities) and different stages of innovation (ideation, R&D, commercialization).

Therefore, we ask the following third question,

*RQ.3. How and to what extent does user involvement influence the role of the innovation intermediary at different stages of the innovation process?*

Another area for future research is in exploring the role of intermediaries as part of innovation systems. Innovation intermediaries can be private or public where the government supports its existence (Bakici et al., 2013). Public innovation intermediaries have additional roles compared to private firms. The differences are mainly on its focus to support the

development of start-up companies or actors in a rural areas (Dutrenit et al., 2012) where one of the tasks is facilitating the funding of solutions for its client (Inkinen and Suorsa, 2010). In contrast the private innovation intermediary's main job is finding solutions for clients, public innovation intermediaries contributes to building and activating ecosystems also in addition to providing structure as well as the governance of the ecosystem (Bakici et al., 2013). Additionally, the public innovation intermediary role is to know 'what works' regarding instruments for designing interventions. Therefore, such intermediaries know future technology initiatives for innovation to flourish in particular systems. Different roles of the innovation intermediary need different capabilities (Intarakumnerd and Chaoroenporn, 2013b). It is still unclear what the capabilities that a public innovation intermediary must have to face all the challenges in innovation systems. Hence, we ask,

*RQ.4. Are there differences in the patterns of cooperation and support of building innovation eco-systems between public and private innovation intermediaries at different stages in innovation process and for different types of innovations?*

#### *Innovation intermediary and openness*

Open collaboration is now acknowledged as one of the models of innovation that proliferates the development of the internet and information technology. In open collaboration, innovators are letting their innovation information be freely accessed, used, and diffused by others (Baldwin and von Hippel, 2011). The practice of open collaboration is evident in open source software which programmers use at various levels contributing to create and collectively improve the software programs (Hutter et al., 2011). Wikis are an example of open collaboration in the context of knowledge creation where participants voluntarily create and update information in a particular topic. InnoCentive and some other innovation intermediaries with online platforms facilitate community forums for contributors who are willing to

collaborate with others and cooperate in a group for innovation problem solving. From the evidence, open collaboration mostly works in the user level of network analysis and at the ideation and development phases of the innovation process.

The existence of innovation intermediaries in open collaboration was explored by Fleming and Waguespack (2007). They identified the individual position in open innovation community, one form of open collaboration, as a brokerage in working relationships in order to integrate and bind the members together. Mele and Russo-Spena (2015) identifies four practices of innovation intermediary agencies, labeled 'innomediary agency', in shaping market innovation: engaging, exploring, exploiting, and orchestrating. According to Faraj et al. (2011), open collaboration is characterized by a lack of structural mechanisms and the absence of existing social relationships, that needs a boundary organization as an intermediary to manage the community's tensions. The intermediary will manage the tensions in order to reveal the collaborative potential between members. However, knowledge about the roles of innovation intermediaries that matter for collaboration and knowledge creation and how to achieve this is still under development. von Hippel and von Krogh (2006) also suggest that further research is needed to investigate the functions of intermediaries in free revealing.

The more that users/ online participants succeed in developing innovative ideas, the more challenging it is for firms to keep track of authorship. In this situation, the role of innovation intermediaries becomes crucial in in facilitating open innovation processes and ensuring proper management of intellectual property issues. For example, who owns the authorship of the submitted ideas that were developed over the time through co-creation processes with online solvers and the focal firm. When and how it is appropriate to share and protect ideas with users is a timely and important research question in this regard. In summary, the impact of the open innovation model on innovation-related roles of innovation intermediaries is to ensure transparency of IP related issues, the success of innovation,



governance structure as well as assisting cooperative behaviour which is far from being clear, requiring further research.

*RQ.5: What are the roles of intermediary in open collaboration? How do the different roles effect user or individual cooperative behavior and new knowledge creation in open collaboration?*

### *Innovation Intermediary and Knowledge/ Collaboration Networks*

The source of organizations' innovation has shifted from internal initiatives to dyadic external collaboration, and now into network-centric innovation (Nambisan and Sawhney, 2011, Billington and Davidson, 2013). With the proliferation of internet technology, a firm can connect with various entities and link into networks, worldwide. As part of networks, firms exchange experiences, information and knowledge with other network members and initiate collaboration for innovation purposes. However to find and get access to the right partner in networks, the firms need an intermediary that acts as a bridge or knowledge/technology broker or consultant for the innovation collaboration to perform effectively.

In terms of regional innovation, city governments generally acts as an intermediary who are responsible for fostering innovation networks of city resources consisting of individual, universities, industries, trade centres or other institutions. It also releases supporting policies hence, the network activities have economic contributions to the city's wellbeing. In 2010, the city of Helsinki started a new policy to build innovation networks of SMEs and other stakeholders. This network is to support the innovation approach that develops and delivers new citizen-focused services for economic development in areas such as energy, health care and urban living. The city government supports the network's member innovativeness by linking with a financial institution for funding from both local and European projects, and initiating the use of open data with open data competition to attracted programmer developed

mobile applications (Bakici et al., 2013). Therefore the intermediary, in this case, is the city government which exists to orchestrate the innovation network (Dhanaraj and Parkhe, 2006, Nambisan and Sawhney, 2011).

According to Wang et al. (2014) knowledge networks and collaboration networks are embedded in innovation networks. Collaboration networks pertain to the social relation of members. Knowledge networks have different perspectives to describe it among researchers in the innovation study. On one side, the knowledge network could be seen as a working relationship, communication and interaction among technical staff or researcher enabling knowledge transfer (Beckmann, 1993, Allen et al., 2007, Becker, 2007). Meanwhile other perspectives define knowledge networks as the linkages of knowledge elements in specialized technologies and knowledge domains in prior inventions (Carnabuci and Bruggeman, 2009, Belussi et al., 2010).

Both perspectives have the same level of analysis namely the individual firm level or the network level. Most of the current literature is limited to firms or institutional level of analysis instead of a regional or network level. At the regional level, the Government is one innovation intermediary that is responsible for developing the network in order to grow the regional economy. There is a lack of research studying the innovation network (incorporating the knowledge network and collaboration network approach) at an inter-firm level. According to Carnabuci and Bruggeman (2009), in the technology domain, it needs a broker to grow knowledge in the network. Therefore, research investigating the role of governments in the network, and at the inter-firm level of analysis, needs to be conducted. Investigating regional innovation systems is important to identify optimal structures and working in the sectoral system and for the development of new public policies (Malerba, 2002). Meanwhile in knowledge and collaboration networks, knowledge regarding how to build them, knowledge

flows and their development in addition to the role of Governments to foster innovation is undeveloped.

Although scholars have begun identifying future research on how intermediaries can facilitate and build a collaborative networks during joint innovation processes in fruitful ways (Huggins, 2010), the literature is still in its infancy about how this happens. How can collaborative network and knowledge flows be developed and managed by innovation intermediaries? As such, future studies on innovation intermediaries within the network level should be more focused on how knowledge flows and new collaborations emerge over time. Such research might portray the initial ideas, how knowledge is shared and evolves within the collaborative networks in response to innovation challenges, and how these changes generate new directions for organizations and how organizations in networks collaborate and react to idea generation. A line for future research is the study of the role of the innovation intermediary as a social network builder or collaborative network developer by showing how the transfer of knowledge occurs within and across firms.

*RQ.6. How do innovation intermediaries facilitate firms' innovation in a knowledge network and collaboration network? How much innovation emerges from knowledge and collaborative networks supported by an innovation intermediary and how much from the enhancement- and capability- building of the firm over time?*

## **Conclusions and Limitations**

This study reviews the literature on innovation intermediary research showing the growing relevance of this academic field and identifies opportunities for future research. By conducting a systematic literature review and using bibliographic coupling to synthesise the

literature, this review complements and further develops the insights from previous reviews conducted using a more qualitative approach.

This review shows that literature published in this research can be clustered in five topic groups: innovation networks, innovation systems, organisational innovation, user innovation, and knowledge-intensive business services (KIBS). From those clusters, we built a framework to understand the widening role of innovation intermediaries. The framework shows that the role of innovation intermediaries can be identified by the intersection of the level of network analysis and the innovation process. From this we identify various opportunities to focus future research activities.

Our study supports Gobbo and Olsson (2010) research stating that innovation intermediaries play a role at different levels of analysis and that they facilitate vertical and horizontal cooperation (Zeng et al., 2010). It also confirms that intermediaries have different forms and take a different role at each stage of a firm's innovation process (Landry et al., 2013).

A limitation of this study could be related to the fact that the literature included in this review is based on a broad range of different backgrounds, including agriculture, biotechnology, education, and social life. The reason for this is the limited research on innovation intermediaries carried out within the innovation management field. The role that innovation intermediaries play in different contexts can be very specific to the needs and challenges of each particular case. Aggregating the findings from such a diverse range of contexts could have an impact on the validity of the findings.

## **Implications for managerial practice**

Understanding the role of the innovation intermediaries is critical to approach innovation. Firms involving intermediaries in their innovation process are required to carefully consider the organizational factors that will enable an effective intermediation in order to

enhance the innovation outcomes. Prior to engaging with innovation intermediaries and identifying the most appropriate one(s), it will be important for managers to define the specific requirements based on the stages of the innovation process they are at and the network level that they want to engage with. Firms may create lists of the needs, priorities and working styles that suit with their circumstances and the innovation intermediaries' services. This will allow them to engage with intermediaries with the appropriate resources and capabilities to address the specific organizational challenges.

Innovation intermediary organisations need to be aware of the different type of networks they might be connecting (e.g. professional network, supply chain network, or network of communities) and, depending on their expertise and capabilities and those of the other institutions they can reach within the network, define the appropriate position within the different networks. This will enhance their ability to influence network activities and enhance the outcomes of the innovation initiatives they intermediate in.

The lack of understanding of the innovation intermediaries' capabilities, business models and working styles make it difficult for firms to either strategically invest or measure returns from connecting with the innovation intermediaries. The findings from this paper provide an initial platform towards tackling these challenges.

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