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Analysis of open innovation intermediaries platforms by considering the smart service system perspective

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Abstract

Open Innovation and Services Science are two distinct paradigms that share some principles 0. While some attempts to investigate open innovation according to a service science perspective exist, there is currently a gap with regards to the analysis of intermediaries of open innovation according to a service science perspective and even more regarding to recent trends about smart service system. This paper aims to fill this gap and, to this purpose, we present two interesting and original results. After an analysis of the key features of Open Innovation Intermediaries, we discuss a characterization of these intermediaries as service systems by mapping their features on the ten fundamental concepts of a service system. Next we propose a new model that goes in the direction of the convergence between service and cognitive system (smart service system) and aims at overcoming some traditional issues of the intermediaries. The new model foresees the distribution of Open Innovation Intermediaries features, enhanced with a set of cognitive assistants to the stakeholders within open innovation processes, and proposes the adoption of responsible innovation frameworks as a base to add right and responsibilities to cognitive assistants.

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Keywords: Open innovation; Open innovation intermediaries; Service science; Smart service systems

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1. Introduction

The radical changes characterizing the international economic arena have induced the formulation of new philosophical and theoretical approaches in the different fields. New and broader paradigms and theories, such as Service Science [2] and Open Innovation [3], have been developed to describe and explore the complex processes that take place when value is created by the interaction and collaboration of people, organization and technologies and in a mutually reciprocal manner. Although these paradigms have been explored in different domains and industries [4-5], they underline that better value is to be gained from collaboration and co-creation activities that involve different external resources, such as customers, suppliers, research organizations, experts, etc. In this context, intermediaries are assuming a strategic role because they facilitate interaction, participation and build relationships between the heterogeneous players involved in the innovation process [6-7]. Some examples of Open Innovation Intermediaries (OII) are Ninesigma, Innocentive, etc. Through the Internet and online web 2.0 tools, OII with their advanced platforms help individuals and organizations across the globe to cross-fertilize their resources and competences in a wide variety of specialized fields, providing wide range of services [8].

Nevertheless, little attention has been paid in literature to the analysis of OII according to a service science perspective and even more regarding to recent trends about smart service system. Aiming at filling this gap, we developed a new model that goes in the direction of the convergence between service and cognitive system and aims at overcoming some issues of the intermediaries. This model foresees the distribution of OII features, enhanced with a set of cognitive assistants, to the stakeholders of an open innovation process, and proposes the adoption of responsible innovation frameworks as a base to add right and responsibilities to cognitive assistants.

The paper is organized as follows. Firstly, we present a brief overview of the literature on OII and their web-based platforms, useful to foster and support the interactions and different forms of collaborations, examining their main features in terms of services and characteristics. Then, we focus on OII as service systems and, therefore, we propose a possible evolution of the OII that goes in the direction of enhancing the actors of an open innovation process (solvers, seekers, individuals, government) with a set of cognitive capabilities devoted to implement OII services. Finally, we highlight our conclusions, limitations and future research.

2. The framework for the analysis of Open Innovation Intermediaries Platform

The work of Chesbrough [3] highlights that "*open innovation is paradigm that assume that firm can and should use external ideas as well as internal ideas, and internal and external path to market as firm look to advance their technology*" (p. vii). The preeminent idea concerns the opening up of innovation processes outside the traditional boundaries of organizations [3], claiming a higher involvement of external actors in their innovative activities. Organizations cannot merely innovate in their internal R&D functions, but they have to encourage the interaction with their environment and integrate resources and competences derived by external entities to create different opportunities for product development, to exploit new ideas, to meet market demands and, consequently, to stay abreast of competition [3, 9]. External actors can include: customers, suppliers, experts, universities, private/public R&D institutions, partners, competitors, and the general community as a whole. However, these activities with different partners (across different contexts and backgrounds) are not straightforward and characterized by several difficulties concerning to their efficacious definition and implementation [10, 11]. To this regard, firms can be supported by intermediary organizations that play a useful role in the complex phases of the innovation process, moving from the idea generation and development, to commercialization the products to the market [12]. Their objective is to facilitate interaction, participation and build relationships between the heterogeneous players involved in the innovation process [6, 11, 13] and, in this way, bridge the unavoidable knowledge gaps between partners and move towards overcoming their miss-matching. Operating in several ways, across different domain areas and sectors, these organizations tend to realize an effective intermediation role, stimulating the innovation processes with the involvement of an useful network of actors, supporting customers (as innovation *seekers*) to effectively catch the innovative opportunities of customer's business models, linking requests of innovation solutions with potential, globally distributed providers (*solvers*, such as researchers, research organizations, lead users), creating and maintaining innovation networks and, finally, enabling outward and inward innovation results commercialization [6]. According to academic literature [6], OII, identified as independent *third parties*, perform a

wide range of functions: helping to provide useful information on potential partners for profitable collaboration forms; assisting in the transfer process of specialized knowledge between individuals and companies involved in innovation activities at different levels; helping the knowledge combination among different entities and brokering transactions between two or more parties within innovation processes; operating as mediators between various private/public organizations that are already collaborating; facilitating finding advice, funding and support for the innovation outcomes; adapting technologies for alternative applications, IP management and activities associated with the commercial exploitation of the inventions and activities associated with the commercial exploitation of the invention.

2.1. Key features of the OII

Through the Internet and online web 2.0 tools, these OI platforms promote and facilitate collaborative innovation forms, sustain worldwide R&D projects, and intensify interactions among subjects in a significant and on-going dialogue to explore new solutions. Every day, Internet-based platforms help individuals and organizations across the globe to cross-fertilize their resources and competences in a wide variety of specialized fields. In these sophisticated platforms OII provide heterogeneous services that have recently been mapped by Aquilani and Abbate's [8] empirical analysis, examining a sample of eight OII and considering OII main functions as highlighted by Howells [6]. In this perspective, OII services are the following [8]: (i) support services directed essentially to support all phases of innovation processes (i.e., text elaboration and revision of post by innovation seekers, analysis of idea/request/problem); (ii) communication services using a wide set of tools (i.e., personal contact, email, phone); (iii) support services on different technical aspects that require specialized competencies (i.e., new product design, product launch activities); (iv) consultant services related to diverse topics, such as financial, market, technology; (v) services oriented to discover and/or generate useful innovation opportunities (i.e. training and coaching services, collaboration within big projects related to questions of relevant global interest). It is necessary to highlight that OIIs tend to differentiate their platforms in terms of services. This means that the bundle of services, provided by OIIs, is used for elaborating efficacious differentiation strategies and, in this way, obtaining a clear and distinctive positioning in the competitive arena. In fact, there are so many different operators: some are specialized in the creation and management of the marketplace (Innocentive) for the exchange of technological innovations; others offer a wide range of services that covers every stage of the production process; others are only scouting ideas.

In addition, the platforms show some interesting characteristics [8]: a) collaboration, facilitating different forms of collaborations between seekers and solvers and stimulating online-communities that involve different subjects as appreciated solvers; b) interactivity, sharing information among different involved entities; c) networking, in terms of scanning and establishing connections for identifying innovative solutions that meet seeker's requests and other potential needs; d) articulation, providing useful and clear sections that facilitate search of information by users; e) accessibility, defining search link and screens that facilitate experiences on the web site; f) multimedia, providing efficient web 2.0 tools (e.g., blog, community, forum, etc.) oriented to stimulate relationships among participants; g) groups formation, concerning the creation of a distinctive group of experts for solving problems posted on the platform. With one or more useful characteristics, these Internet- based platforms enable and support open networking of individuals and organizations that move from a closed to an OI approach.

3. OII as services systems

Service science is based on ten foundational concepts 00 that are discussed also in 0 and 0. In this section we propose a mapping of the above mentioned ten concepts on the key features of the OII. The following table reports in the first column the ten concepts discussed in 0, in the second column the OII features that are related to the concepts and, lastly, we report our explanations on the mapping.

Table 1. Characterization of an OII as a Service System.

Concepts	OII	Explanation
Resources	Persons, ideas, business models, knowledge, tools, technology	In 0 is discussed how there can be four type of resources: physical-with-rights (e.g., a person), not-physical-with-rights (e.g., an idea), not-physical-with-no-rights (e.g., shareable information or documents, such as a description of a patent), and physical-with-no-rights (e.g., a technology).
Entities	Principal: the organization acting as intermediary (owing the OII platform). Other entities: different offering of the OII (e.g. specific configurations of OII resources)	Service system entities are dynamic value-cocreation configurations of resources, including people, organizations, shared information, and technology 0
Access Rights	Typically access rights to OII resources are LC or SA. PA rights can be associated with resources dealing with inalienable rights (e.g. space with private information of a customer)	Access rights deal with the social norms and legal regulations associated with resource access and usage. As discussed in 0 there are four dominate types of access rights are owned outright (OO), leased-contracted (LC), shared access (SA), and privileged access (PA).
Value Cocreation Interactions	In general: Improving collaboration, enabling and accelerating innovations. Specifically we could consider three types of value co-creation: *i)* For itself (the OII): money-for-temporary-use-of-resources (rental or leasing of OII services); *ii)* For the seekers: money-for-solving-a-problem (saving time and money by providing solutions offered by third parties, by connecting solvers and seekers and supporting their collaboration), *iii)* For the solvers: money-for-chance-at-more-money-in-the-future (a sort of investment in order to gain more money via patents or IPR, or consultancy), or thing-for-thing exchange (solvers offers their competences to OII in order to receive some other things)	This includes all the possible value-proposition interactions. A partial list is discussed in 0. In particular, the items of value-cocreation process are: thing-for-thing exchange (barter), action-for-action-exchange (division-of-labor), money-for-thing-or-action-exchange (purchasing or buying), thing-for-money (selling), action-for-money (job or labor), money-for-peace-of-mind-and-potential-reimbursement (insurance), money-to-authority-for-security-emergency-response-and-other-routine-public-services (taxes), money-for-attention (advertising), money-for-temporary-use-of-resources (rental or leasing), money-for-change-at-more-money-in-the-future (gambling and investment), money-for-a-collective-good (donation), money-for-a-greater-good (tithes) 0.
Governance Interactions	Contract negotiations, enforcement, resolutions	Governance interactions are a type of value-proposition between an authority service system entity and a population of governed service system entities 0
Outcomes	Value realized: assistant offered at various stage of the innovation process (innovation management, R&D, negotiation, ideas and knowledge gathering, etc.)	In 0 it is discussed how value-cocreation is only one of the possible outcomes but reality is much more complex. For this preliminary mapping, we focused only on this aspect.
Stakeholders	Customer: seeker; Provider: solver; Authority: Government; Competitor: other OII	As discussed in 0 there are four primary types of stakeholders: customer, provider, authority, and competitor
Measures	Quality: higher and sustainable performance in the specific business areas of the seekers; Productivity: measures on research and innovation productivity (e.g. R&D/Sales, Patents/R&D) Compliance: to law and regulations (e.g. patent infringement, IPR violations, etc.)	As discussed in 0, there are four primary types of measures: quality, productivity, compliance, and sustainable innovation. Each of these corresponds to a stakeholder perspective: customers evaluate quality, providers evaluate productivity, authorities evaluate compliance, and competitors evaluate sustainable innovation
Networks	Internal: staff members, experts, consultants External: Solvers and seekers, government, other OII	It refers to the interactions of service systems entities with other service system entities (normatively) via value-propositions.
Ecology	The OII platform (viewed as a shared collaborative environment where ideas and solutions can be developed with the involvement all the stakeholders).	It refers to the macro-scale interactions of the populations of different types of service system entities 0

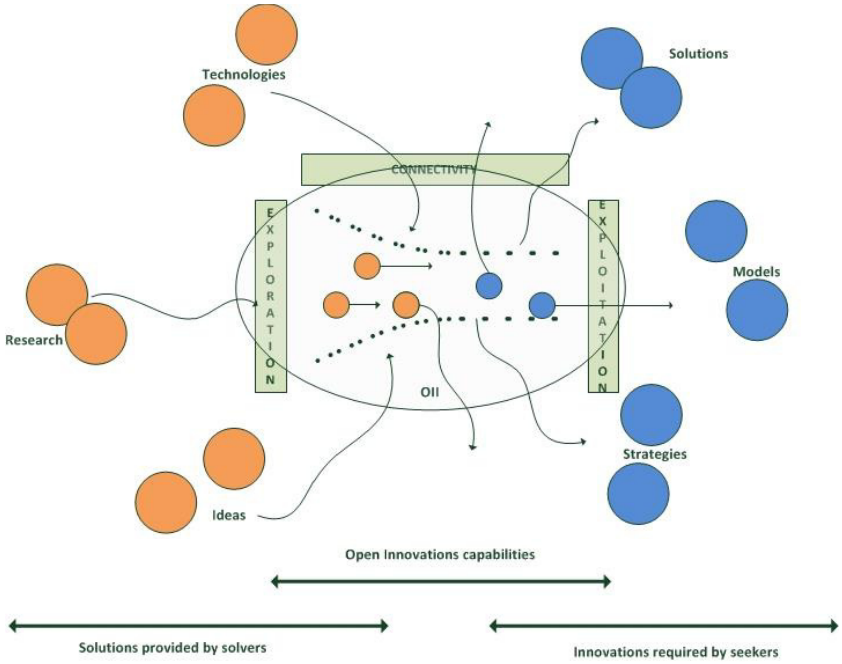

Fig . 1. The three processes of an OII.

4. The way forward: service system, cognitive system and OI2.0

In the previous sections, we have discussed Open Innovation according to a services system perspective and have shown that OII can be considered as service systems. In this section we propose a possible evolution of the OII that goes in the direction of enhancing the actors of an open innovation process (solvers, seekers, individuals, government) with a set of cognitive capabilities devoted to implement OII services. This evolution aims at designing and managing distributed open innovation communities making more effective the adoption of internal and external knowledge. Companies leveraging on OII have the possibility of expanding their boundaries in a tremendous way but indeed the adoption of intermediaries have some disadvantages such as:

- OII generally are private companies that have their own mission and business model, not always clear to the customers. They charge for services they offer, they have some IP policies (e.g. IP are shared, stay with the client, etc.) and have missions that could be not consistent with the customers;
- Seekers rely on OII to find solvers. This aspect poses the problem of biases, raising issues about objectivity, quality of services and harmfulness of the relationships;
- Intermediaries can be facilitators or bottlenecks. This is particularly true in case of agents (e.g. solvers and seekers) that can only communicate to each other through a chain of intermediators 0.

To avoid these and other disadvantages of the intermediaries without losing their benefits, the idea we are going to describe is to distribute among the actors of a network of innovation the capabilities of the OII. The approach we propose is aligned to recent trends related to Cognitive and Service System and to the recent vision of Open Innovation 2.0 (OI2.0) 0.

An OII is agent that can be present in any aspect of the innovation process between two or more parties including, but not limited to, selection of ideas, knowledge and technologies, problem solving, expertise finding, linkage building, etc. For our purposes, we can model an OII as in Figure 2 that evidences the three main processes of an OII: *i)* exploration, refers to the process of search, identification and evaluation of knowledge and

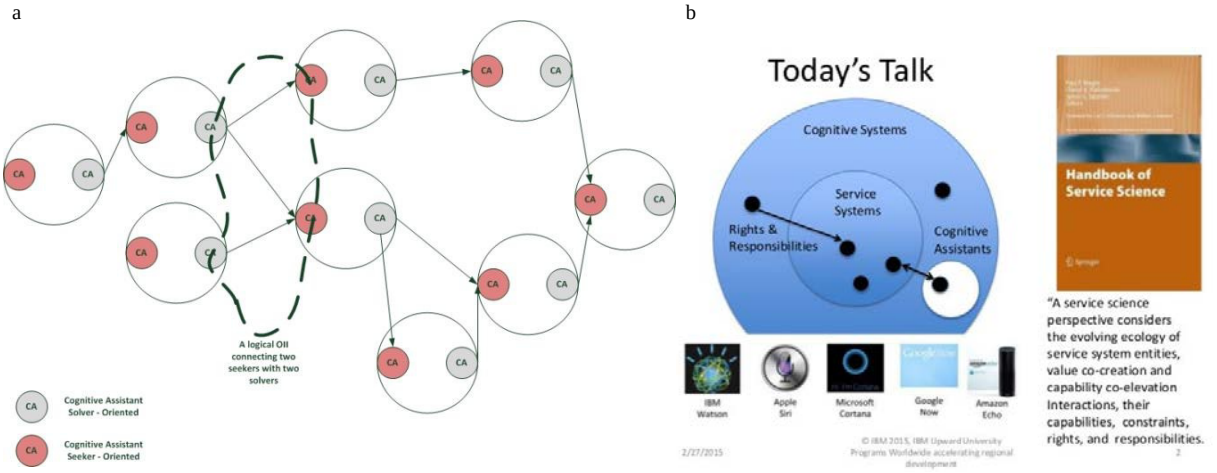

Fig. 2. (a) The proposed model; (b) Cognitive and Service Science.

technological sources; *ii)* connectivity, refers to the process of linkage building, management and governance between seekers and solvers, and among intangible assets (such as knowledge and ideas). It includes collaboration services, R&D capabilities, services devoted to negotiation and management of agreements, expert finding 0 as well as the management and governance of the established connections; *iii)* exploitation, refers to the process of search, identification and evaluation of exploitation possibilities. It includes training services, marketing and communication, domain specific services, patent and IP management.

These three processes are typical of the open innovation and have been deeply investigated in organizational theories such as absorptive capacity 0, organizational learning 0, dynamic capability 0, and others. The correct execution of these processes is such to enable an OII to recognize and assess valuable ideas and knowledge, connect this knowledge to already existing one, and lastly apply it for innovation purposes but, indeed, is function of learning and presents a dependence on prior related knowledge and diversity of background.

In other words, the three processes above reported can be considered as instances of cognitive processes and can be supported with a set of cognitive assistants, such as the "Cogs"[1]. Cogs represent a sort of lightweight cognitive agents, something like apps, that can learn, reason, create connections, take decision to support entities and organizations in the different roles that they can have (e.g. seekers, solvers). Enhancing the actors of an open innovation process with cognitive assistants, enables a networked model of innovation where the central role of the OII disappears (overcoming thus the traditional disadvantages of the intermediaries reported at the beginning of this section) and the services offered by an OII can be executed by the actors of the process that are supported by cognitive assistants. This model is shown in Fig. 2(a) where, for simplicity, we depicted only two kinds of cognitive assistants (seeker-oriented and solver-oriented, avoiding the issue of governance). The dashed line represents the logical role of an OII connecting two seekers with two solvers.

A cognitive assistant seeker-oriented has to support seekers in the process of search, identification, evaluation of solvers, linkage building with the solvers, management of the connections and of the collaboration, negotiation and agreement formalization. It has at least the following features: memory of the past experiences and of the network of solvers already involved in past experiences; analytics to analyze and measure R&D and innovation collaboration, in order to support partner search, decision making, assessment of ideas and knowledge; rules and learning capabilities that can be used to modify and update the network of collaboration; monitor the contract and the agreement reporting eventual violations; has domain specific knowledge on the seekers solutions (tools, platform, knowledge) and can reason on the possible connection between the solutions proposed by the solvers and the knowledge base of the seekers.

[1] https://twitter.com/ThinkBig/status/438732184212766720, last access 09/03/2015

A cognitive assistant solver-oriented has to support solvers in the process of search, identification, evaluation of exploitation sources, management of the connections and of the collaboration, negotiation and agreement formalization. Besides the features of analytics and learning capabilities, and contract and agreement monitoring that are similar to the seeker-oriented ones, it includes among the others the following features: adaptability of training paths, marketing and communication strategies to the needs and competences of the seekers; support for management of knowledge spillover, by evaluating its criticality and relevance with regard to strategy and missions.

Anyway, to frame the proposed networked model in the service science and gaining the advantages of analysis, design, management and governance of service system, the proposed cognitive agents has to be related to service system, e.g. should become service system entities. The relationships between cognitive and service science is current under investigation by James Spohrer and others. In a recent talk[2], Spohrer emphasizes the importance of right and responsibilities for cognitive agents, in order to allow them to be included in service systems. This is graphically reported in the Fig. 2. (a) The proposed model; (b), reproduced from the previously cited talk.

According to Spohrer, *all service system entities are cognitive system entities, but not all cognitive system entities are service system entities*[3]. The differentiator is the set of right and responsibilities: without rights and responsibilities cognitive agents (e.g. cogs) cannot be considered as formal service system entities.

In the frame of the service science it is argued and recognized that rights and responsibilities are fundamental to achieve value co-creation, progress and innovation 0. If we aim to refactor OII services and distribute them between the actors of an open innovation network we have to design cognitive assistants supporting the actors of the network in implementing an open innovation process and with clear rights and responsibilities.

Besides discussion on IPR 00, the issue of right and responsibilities in innovation has not been, so far, deeply investigated. Recently, the concept of Responsible Innovation is leading to a number of investigations for the development of a framework for responsible innovation 0, some of them also in the context of European Framework Programmes 0. The debate is mainly centered on science and technology based research and innovation, and on the adoption of emerging technologies (e.g. nanotechnologies, genomics, biology) to achieve ethical, social and environmental benefits. The problem of Responsible Innovation is wide and complex since involves several communities, such as corporate responsibility communities, human right communities, consumer groups, and several regulatory frameworks that are not homogenized so far.

Making aware Cogs of rights and responsibilities of a Responsible Innovation framework is an open challenge that is key to enable the model proposed in this section. A possible way is to leverage on dialogic capabilities 0 of a cognitive assistant. In 0, for instance, authors in proposing their framework for responsible innovation emphasize the importance of raising, discussing and answering questions of uncertainty, purposes, motivations, social and political constitutions, trajectories and directions of innovation. Dialogue with expert of different discipline is necessary to reflect and answer questions on responsible innovation. Cognitive assistants can reason on regulatory framework formalized in an ontological model (and thus give advices on patent, IPR protections, legislation), interact with other cognitive agents of their innovation network and/or expert in other discipline (e.g. ethic, human rights, etc.) and exploit consensus building techniques to find a consensus on responsible innovation questions.

We conclude this section with a consideration on the technologies enabling our proposal. Current trends on *analytic as a service*[4] are such to support the vision proposed in this section, making more easy its implementation. The idea is to leverage on the software as a service paradigm and cloud technology in order to provide the most complex features of the Cogs, such as for instance, a set of analytics specifically dedicated to open innovation[5].

5. Conclusion and future works

We presented our results relating to a characterization of OII as service system and a new vision enabling the distribution of OII features, enforced with cognitive capabilities, among stakeholders of an open innovation process.

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[2] http://www.slideshare.net/spohrer/smart-service-systems-20150228-v2, last access 10/03/2015
[3] http://service-science.info/archives/3489, last access 11/03/2015
[4] See for instance http://www.enterpriseappstoday.com/business-intelligence/ibm-offers-cloud-analytics-as-a-service.html, last access 09/03/2015
[5] See for example the set of analytics offered by http://www.kenedict.com/, last access 09/03/2015

This new vision presents some advantages if compared with the traditional one (including physical intermediators) such as improving the network effect and adaptability to changes in the innovation network (due to adaptability of the cognitive agents). The presented results, even if in an early stage, are quite original. As future works we are going in two directions. First, we aim to refine and improve the mapping of the OII on the ten fundamental concepts of service science. Second, we aim to investigate more in the details the issues of governance and rights and responsibilities of cognitive assistants devoted to support the open innovation process.

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