DESIGNING AN INTEGRATED OPEN INNOVATION SYSTEM: TOWARDS ORGANIZATIONAL *WHOLENESS*

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ABSTRACT
Increasing use of collaborative technologies has transformed organizational dynamics in novel ways. In this paper, we adopt the principle of *wholeness* in designing an integrated open innovation system. We provide an overview of existing collaborative technologies and situate the proposed sociotechnical arrangement within the paradigm of open innovation. We explore how effectively technological platforms address emergent collaboration and innovation practices within and across organizations and to which extent existing technologies act as strategic catalysts of open innovation. We argue that in embracing wholeness and in treating technologies as inseparable constitutive parts of organizational architecture, we foster organizational and institutional collaboration and encourage innovative practices. The focus of the paper is on how the design of sociotechnical systems as *wholes*, that is systems that are concurrently acting as corporate websites, internal collaboration spaces, extranets and social media aggregators, actively promotes open innovation in practice. We close with a presentation of six cases that are illustrative of how such a system could be applicable within the open innovation paradigm, namely, citizen participation, crowdsourcing and open innovation contests, open source innovation, reviews and social media, social enterprises and open teaching.

Categories and Subject Descriptors
H.5.3 [**Group and Organization Interfaces**]: Organizational design; K.4.3 [**Organizational Impacts**]: Computer-supported collaborative work.

General Terms
Management, Design, Human Factors.

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Keywords
Open Innovation System, Collaborative Technologies, Organizational Wholeness.

1 INTRODUCTION
In the era of open innovation new opportunities emerge and prompt us to further explore how 'openness' is increasingly intrinsic to the ways we think, organize, work and live. In the last decade we have witnessed a rapid development of co-creation practices in all aspects of everyday life, ranging from User-Generated-Content, Crowdsourcing, Open Source, to collectively produced Recommendation Systems, Social Tagging and Wikis.

All these practices, although differ from each other, they offer new opportunities for people to create things, code and processes together in open collaboration systems. Such systems are online environments that support the collective production of artifacts through technologically mediated collaboration platforms embedded in persistent but malleable social structures [23]. Research in the area of co-creation has yielded a substantial body of knowledge with many scholars being inspired by Ostrom's self-organizing communities [34], Benkler's commons-based peer production [4] and Granovetter's strong and weak ties [25].

In the organizational context, openness has significantly changed the notion of innovation. Long time has passed since Chesbrough introduced open innovation as the paradigm that encourages organizations to use external ideas as well as to license internal ideas to external partners in order to advance their portfolia, technologies and competitive advantage [12]. In short, open innovation principles describe the strategic decisions related to opening up the solid boundaries to let valuable knowledge flow in from the outside and vice versa to create opportunities for co-operative innovation processes [24]. Chesbrough and Bogers in explicating what open innovation is, they define it as "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model" [13]. They go on to clarify that open innovation should be differentiated –or employed acknowledging the differences in the scope and focus- from 'user-centric innovation' and von Hippel's 'open collaborative innovation'. In this paper, although we do not explicitly address the role of the business model, we embrace open innovation and the associated collaborative processes, as originally introduced and as further clarified in Chesbrough and Bogers' latest work. More specifically, we focus on the "coupled process" of open innovation, which is understood as the combination of inbound and outbound processes that are made manifest through alliances,

cooperation, joint ventures and other forms of co-creation and collaborative development [6].

Key to the transition to the era of open innovation has been the role of new sociotechnical arrangements, in the form of information systems and web platforms. The questions that arise are formulated as follows: How effectively do technological platforms address emergent collaboration and innovation practices within and across organizations? Do existing technologies act as strategic catalysts of open innovation? How can organizations adjust their approaches to technology in the open innovation milieu? The paper is divided into three main sections. The first section presents the setting in which collaborative technologies operate. The next section presents the proposed open innovation system which is inspired by the notion of "wholeness". The final section discusses the implementation of open innovation systems in six illustrative areas.

2 THE ROLE OF COLLABORATIVE TECHNOLOGIES IN PROMOTING OPEN INNOVATION

In this section we are reviewing emerging collaborative technologies and their alignment with the open innovation principles. Management scholars have highlighted the role of Information and Communication Technologies (ICT) in supporting "the shift towards more open, collaborative and network-centered innovation practices" [43, 14]. Several studies have shown how web-enabled technologies have transformed production–consumption processes and have made organizations reconsider where to draw the boundary line between customers and producers. Apart from introducing new possibilities for involvement and co-creation, the use of such technologies enables new ways of collaborating and managing activities across geographies [18, 29]. In this vein, Dodgson *et al*. [21] extend existing literature and discuss how new technologies such as simulation, modeling, virtual reality, data mining and rapid prototyping technologies support open innovation practices.

On the intra-organizational level, much ink has been spilled on the role of technologies in promoting collaboration. Organizational and IS scholars have shown how the use of intra-organizational social software platforms of various forms improves knowledge sharing [16], enhances collaboration and communication [19], increases employee engagement and community morale [28], enhances organizational intellectual capital [10], improves efficiency of collaborative enterprise reporting [7] and fosters innovative performance [1].

Drawing on technologically deterministic approaches scholars have also shown how management and innovation evolve hand in hand with the evolution of technology. McAffee [30] coined the term "Enterprise 2.0" to describe how organizations employ Web 2.0 functionalities to improve internal collaboration and employees' productivity. Enterprise 2.0 promotes an open culture against the creation of silos and involves both top management as well as end users in defining the collaborative environments requirements [10]. Along these lines, Hafkesbrink and Schroll [26] present open innovation as innovation 2.0, which they define as the application of web 2.0 functionalities that promote social inclusion and participation ("the collaboration web"). They also explain how the evolution of the web (semantic web and the Internet of things) has inspired the parallel evolution of innovation, what they call Innovation 3.0 and Innovation 4.0 respectively.

User communities have also been mentioned as online spaces organizations can use to create brand loyalty, advertise products and exploit customers' creativity [33]. In the context of open innovation, West and Lakhani [46] define communities as *ad hoc* associations of actors united by a shared instrumental goal. Readers can think of such communities either as co-creation platforms, ideation spaces or tools to conduct open innovation contests. Bullinger and Möslein [11] in their review of innovation contests, identify ten design elements but propose the need for further research in order to better understand and design online innovation contests. Some of the aforementioned activities oftentimes are performed on social media, such as Facebook, Twitter, Pinterest and YouTube. Customers can therefore participate in co-developing products and services or give feedback, submit reviews, complaints and compliments on third party external sources and review websites.

Social Media functionalities have been embraced on the corporate level as an advancement of groupware and intranets. In the recent years corporate social platforms have attracted increasing attention. They resemble Social Networking Websites, but their objective has been to enhance organizational productivity, performance and innovation. Key players in the sector of collaborative social software platforms include large corporations such as IBM (IBM Connections platform), Microsoft (SharePoint 2010 Communities), SAP (SAP Jam) and a long list of tools such as Yammer, Jive, Salesforce, Bitrix, Saba Cloud People, ClearVale and Social Cast, just to name a few. A KPMG survey further illustrates that corporate social platforms' main benefits include improved collaboration levels, enhanced innovation and increased productivity[1].

The aforementioned technologies can be considered as facilitators of open innovation in various ways. However, they enable only instances of openness, in that they either engage a particular group of people (e.g. users, employees, suppliers) or they are designed and used for a specific open activity (e.g. co-creation of a product, ideation contest). In their review of existing collaborative software development platforms, Peng *et al.* [35] discuss the extent to which crowdsourcing platforms, platforms as a service (PaaS), open source platforms, collaborative testing platforms and enterprise collaboration platforms manage to support communication, collaboration, coordination, awareness and value transfer and they conclude that the next generation of crowd-sourcing platforms will need to combine degrees of "internal and crowd-oriented development". To further illustrate the isolation among the different groups, we can think of how and by whom technologies are used: social media as a form that circumvents formal schemes has empowered the group of users/customers, intranets are meant to be used by employees, corporate websites represent the official voice of the organization, whereas extranets primarily engage external groups like suppliers or job candidates in operational tasks.

In this paper we argue that collaborative systems fall short when it comes to treating technologies as parts of a holistic open innovation approach. For instance, even though enterprise social platforms provide a wide variety of organizational collaborative functions, some of which are indeed very sophisticated, they are reported to have serious limitations in that they mainly take the form of standalone wikis, social software suites, and enterprise

[1] Gary, M., (2007), Enterprise 2.0 - The Benefits and Challenges of Adoption. KPMG International.

collaboration software [37] that operate on the intra-organizational level. Although open innovation as a new paradigm encourages the active involvement of different stakeholders in the making of products and services, what we mainly witness is the use of isolated 'spaces' and tools designed specifically for each relevant group. Existing platforms in their majority provide applications/functions to support some of the various phases of the collaborative process (e.g. brainstorming, implementation and evaluation of ideas). This in turn prevents knowledge sharing and reuse –among other things-, which becomes an important limitation when opening up the boundaries for innovation to emerge is a priority.

To conclude this overview on open collaborative technologies, we claim that there is still long way to go towards fully embracing open technologies in the spirit of open innovation. In the following section we move towards this direction by proposing a hybrid design for open innovation systems.

3 PERCEIVING TECHNOLOGY AS A *WHOLE*

3.1 The Notion of Wholeness

Theorizing what the role of artifacts and technologies is and how they are embedded in organizational and sociocultural settings is necessary to take informed decisions about their design, implementation and anticipated use. Although it is beyond the scope of this paper to review the philosophical discussions about technologies, it is critical to note that (open innovation) systems are here understood as phenomena in themselves, rather than elements of larger phenomena; or in other words they are not perceived as parts but as "wholes".

Such a conceptualization draws its inspiration from Process Philosophy and the ontology of becoming analyzed in the work of thinkers from Heraclitus to twentieth century philosophers such as James, Bergson and Whitehead, all of whom construed reality as a ceaseless process rather than as a series of unchangeable entities [31]. According to this tradition, "[p]rimacy is given to movement, flux and emergence, over that of end states, entities, stability, and discrete periods" [36]. Henri Bortoft, physicist and philosopher, aptly summarizes the quintessential nature of the 'part' and its inseparability from the 'whole':

> *"If a part is to be an arena in which the whole can be present, it cannot be any old thing. Parts are not bits and pieces, because a part is only a part if it is such that it can bear the whole…By itself the part is nothing, not even a part, but the whole cannot be whole without the part. The part becomes significant itself through becoming a bearer of the whole" [8].*

Although this section is by no means any thorough presentation of the theory of wholeness, touching upon the notion of wholeness serves as an introduction to how we envision open innovation systems; namely as wholes that both manifest the organizational architecture as well as engage all relevant stakeholders in co-creation and co-innovation practices. Perceiving open innovation systems through this framework allows us to move beyond treating technologies as add-ons or 'technological fixes' that will magically engender innovation or fix a problem. It is suggested that open innovation systems should rather be embedded within a holistic organizational strategy. In the following section we present the proposed open innovation system and the rationale behind its design. The technical specifications are beyond the scope of the paper and are therefore omitted. What is of importance is to illustrate how the organizational and design principles are strategically aligned in the era of open innovation.

3.2 Designing An Open Innovation System: Towards Organizational *Wholeness*

The realization that current technologies used in the context of open innovation mostly support disperse collaboration without necessarily being in line with the underlying principles of the open innovation paradigm, motivated efforts to develop an open innovation system that actively embraces the principles of openness and wholeness. Existing technologies such as corporate social platforms (or social software platforms) have addressed many of the contemporary organizational challenges, but have either focused on enabling intra-organizational collaboration or collaboration among public and private organizations. As has been discussed in the previous section, these tools in their majority, act as isolated standalone systems and are thus not integrated with the corporate websites and external open innovation platforms –like Innocentive- or social media.

The open innovation system we are proposing aims at facilitating collaboration among all stakeholders that co-create what the organization *is*; namely employees, top management, board of directors, customers, business partners, job candidates etc. Furthermore, it is fully customizable to accommodate interaction between private and public organizations as well as NGOs, NFP organizations and social enterprises. It is an online space where all stakeholders within and across organizations can share relevant information. The creation of subgroups with specific access rights allows organizational members to share content with the relevant stakeholders allowing partial openness when necessary, or different degrees of "private-collective" arrangements [45].

The most important aspect of the open innovation system, which is in line with the principle of wholeness, is that it is designed to simultaneously act as a corporate website, intranet, extranet and user-generated-content aggregator (see Figure 1). By assigning user rights to the respective categories of content, it becomes possible to make the content uploaded within the corporate platform (or Intranet if you prefer) publicly available on the corporate webpage of the organization. The opposite direction is also possible: user-generated-content submitted by users on the corporate website is exported to the internal platform -which is the same digital space- and initiatives or projects can be decided accordingly. By making both directions more open and transparent users actively participate in the making of practices and processes. Depending on the configurations of the platform, certain categories of content may allow social functionalities such as liking, commenting and rating.

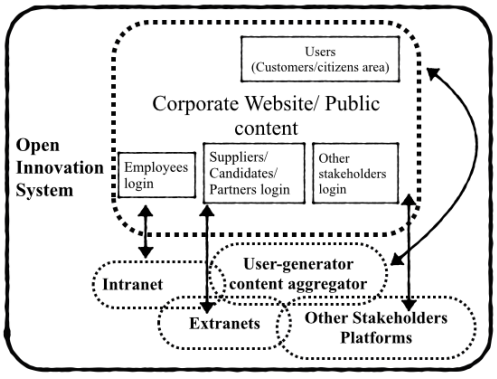

Figure 1. Holistic design of the Open Innovation System

The platform facilitates both top-down and bottom-up knowledge creation. Users (any group depending on the rights) have the opportunity to suggest ideas, accompanied by attachments, videos, images or URLs, to be evaluated (see Figure 2). The community votes and comments upon suggestions and anyone can filter ideas (e.g. most recently created, top rated, most commented under the relevant category). The top rated ideas can potentially become "Initiatives" with specified start and end date, leaders and participants (see Figures 3 and 4). Besides the top initiatives suggested by the users, administrators (e.g. managers or municipal authorities) have the opportunity to add all the initiatives/ projects and changes undertaken that also appear on the Calendar and the Map. In a similar way, users can evaluate the success of the implementation phase, which in turn fosters accountability and transparency throughout every stage of collaboration and innovation. It is not only the decision-making process and ideation that is of importance, but the (post)-implementation phase as well.

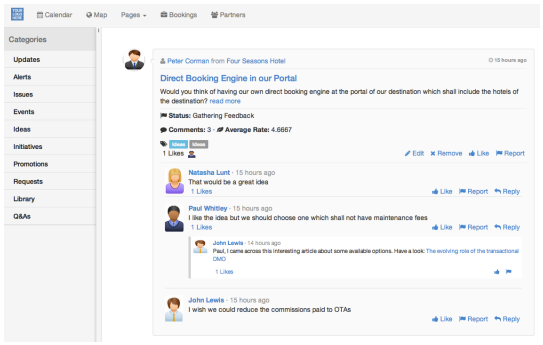

Figure 2. Idea management

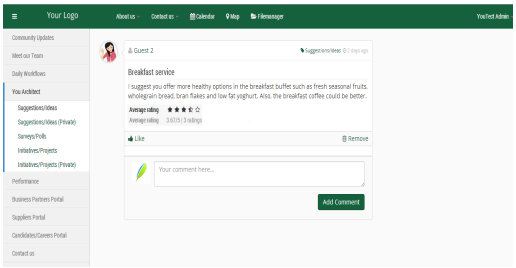

Figure 3. Suggestions that are made on the website of the organization are shared with the relevant organizational members

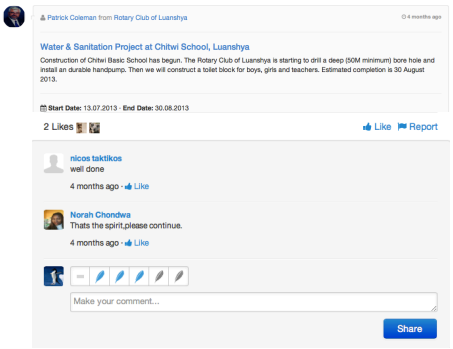

Figure 4. An example by an initiative suggested by a citizen and rated by the community

Being in line with openness and wholeness, two further functions supported are "Business Process/ Issue Management" and "Requests". The first enables the identification and collaboration towards solving reported problems. For instance, in the example of the platform being used by a municipal council, citizens can upload pictures of a broken pavement and identify the exact location on the map (Geotagging) for the authorities in charge to take action (see Figure 5). Filtering the issues that are pending would allow the authorities to prioritize and take action that also subjects to evaluation by the community. External websites and applications of that sort already exist, but are not integrated within a structured and holistic framework of action. 'Requests' as a functionality takes different forms in the various sectors: For instance, in the case of an NGO in Sub-Saharan Africa citizens request help with regards to blood donation, orphan care, senior care, waste management, road safety and disease surveillance (see Figure 6). As it is the case with all menus, requests are tagged and can be searched with the use of filters. Users can also post tenders and build collaborations with business partners (e.g. suppliers). The platform supports a personal messaging system, automatic newsletter and real-time chat. Currently it is at the stage of beta testing and is used by two for-profit organizations in the hospitality sector, an NGO, a social enterprise, a local authority and a university, all of which have inspired the next section. In the following section we look at six cases in which the principle of wholeness can foster open innovation in practice.

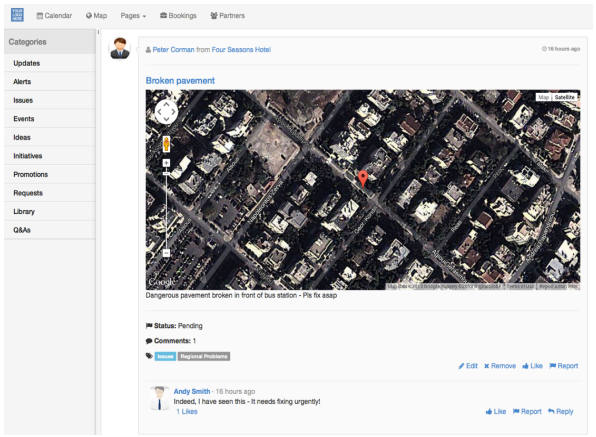

Figure 5. Posts on the map (Geotagging)

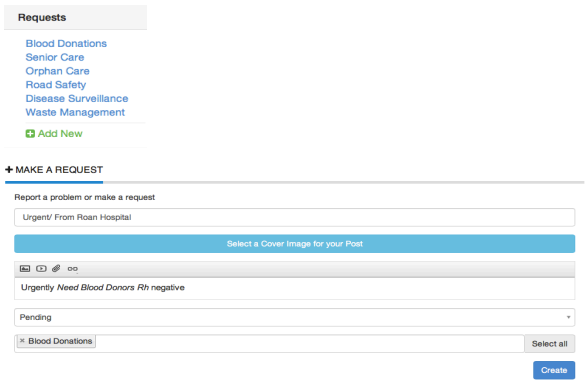

Figure 6. Requests menu

4 APPLICABILITY AND PRACTICAL IMPLICATIONS

The architecture of the platform makes it applicable in contexts with mixed degrees of openness and closure, where heterogeneous combinations of actors co-exist. The main contribution of the proposal lies in the multiple purposes it serves at any given time. In what follows, we illustrate six cases in which we argue open innovation could be facilitated more effectively with the use of the suggested architecture.

4.1 Citizen Participation

Citizen participation emerges out of the e-governance domain and is related to how citizens can be more actively engaged in policy-making processes. Seltzer and Mahmoudi [40] note that "citizen participation is a variety of approaches and practices associated with key decisions and judgments entered into from the moment that a planning problem is conceived". Throughout each stage, collaboration among all stakeholders—citizens, planners, and decision makers—is essential. In essence decisions are taken based on the interactions among participants. Different degrees of openness and transparency are needed during the different stages and for the various groups. For instance, project leaders and participants implementing ideas need to have access to the details and possibly to workflows, agendas and other sources, whereas the general public -citizens- would need to have access to the overview of the initiatives, the rationale behind them and the possibility to rate their implementation.

The multiple identities that the open innovation system can take in this case could be the main website of the region, also available to prospective tourists as well as an e-governance platform for citizens to vote, submit forms and workflows and co-decide about policies and agendas. Last but not least, the website and e-governance platform becomes (note the use of singular, as we are talking about the 'whole') an internal collaboration platform for authorities and leaders in charge to coordinate their agendas and take action. According to the principle of wholeness, all these seemingly different spaces are parts of a broader whole and need to be treated as inseparable for the whole to be meaningful, or in other words for openness to be actualized in practice.

4.2 Crowdsourcing and Open Innovation Contests

Sieg *et al.* [41] in classifying open innovation intermediaries, divide them in two categories: knowledge brokers innovation intermediaries who innovate by brokering knowledge (e.g. IDEO, consulting firms) and web-based innovation intermediaries termed 'virtual knowledge brokers (VKB)' [44]. VKBs are online communities that gather feedback and ideas and distribute structured knowledge to their clients to support innovation and give solutions to problems. In both categories customers are co-creators to some extent and are involved in the organizational processes.

VKBs can be also understood as crowdsourcing platforms. Crowdsourcing can be used by different groups for a variety of purposes: For non-commercial purposes (e.g. polymath mathematicians at Cambridge University, OpenStreetMap), or commercial purposes (e.g. GoldCorp, Innocentive for the private sector, Philoptima, NESTA for the public/third sector) [29]. Brabham [9] presents four categories of crowdsourcing that are summarized by Marjanovic *et al.* [29]:

- The knowledge discovery and management approach, whereby the crowd is asked to organize existing and often unstructured knowledge (e.g. Peer-to-Patent project).
- The broadcast search approach, which is usually a given problem or challenge presented in the format of a contest and the crowd is invited to provide testable solutions. (e.g. InnoCentive and NineSigma).
- The peer-vetted creative production approach, which is about creating design ideas. Threadless is the most common example, in which the crowd submits T-shirt designs. Other examples are The Noun Project and FontYou, the first collaborative type factory.
- Distributed human intelligence tasking refers to analyzing vast amounts of data (e.g. Rosetta@home which needs thousands of computers to be connected).

All these intermediaries serve as extensions of the organizational initiatives and aim at involving other groups of stakeholders like customers and users in the innovation processes. What we are proposing is the incorporation of crowdsourcing and open innovation contests in the corporate space –website- (see Figure 1). As explained earlier, customers would have the chance to not only suggest ideas and give solutions but also monitor how implementation is organized and then further participate in evaluating the realization of their ideas. At the same time, project leaders and participants can coordinate the tasks on the same space, without having the need to use additional external platforms.

4.3 Open Source Innovation and Open Design

OSI is inspired by Open Source Software development and is "characterized by free revealing of information on a new design with the intention of collaborative development of a single design or a limited number of related designs for market or non- market exploitation" [39]. Key to open design of artifacts and OSI is the modularity of the projects and hence an integrated system for project management, communication and collaboration is essential.

It is worth noting at this point that collaboration needs to be distinguished from concepts such as cooperation, coordination [17] and communication. Collaboration presupposes working together and exploring options in deciding what to do or how to do it (ibid). Collaboration therefore cannot be simply actualized through a project management tool but needs to be supported by tools that enable "working together" throughout every phase of the initiative/ project as well as tools that embrace a mechanism to evaluate the actions taken. Existing technologies mainly focus on the decision making process and the management of the project, primarily due to the fact that most companies adopting such tools belong to the private sector.

The different access rights for the various groups of stakeholders apply in this case as well. The distinction proposed by West [47] between 'open parts' and 'partly open' is highly relevant. "According to the 'open parts' strategy, the project coordinator 'grant[s] all rights to a subset [of the design]', whereas 'partly open' refers to the release of a design 'under restrictive terms". Open design can be facilitated by the proposed system, whereby contributors, designers, programmers, customers, suppliers and any other group would have different access rights and degrees of involvement.

4.4 Reviews and Social Media

The importance of everyday opinions as opposed to the official marketing material is evident in the number of websites that host this content, such as products (Epinions, Viewpoints), restaurants (Yelp), movies (Rottentomatoes, Netflix), travel (TripAdvisor, Flyertalk) etc. According to a survey conducted by The Pew Internet & American Life Project "among internet users, 78% say that they at least occasionally conduct product research and 32% report that they have posted online product comments[2]", which is indicative of the influence reviews have on buying decisions and reputations [2]. Apart from review and recommendation websites, users also comment on the their experiences on Facebook and Twitter, they check in on Foursquare and post additional material or 'evidence' on Instagram, Flickr and YouTube, just to name a few.

Organizations that have realized the impact of those reviews on reputation and in the long term on their viability have been engaging with the phenomenon in various ways. For instance, hotel managers respond to TripAdvisor reviews while new job descriptions have been created for (online) reputation managers who monitor what is being written about the brand with the use of sophisticated tools that aggregate all reviews and comments.

What we witness is that organizations of any type are forced to participate in conversations that happen somewhere on the Internet. In other words, when it comes to social media openness means that third party sites have the control –and massive content- over all available brands, and firms have to either cope with this situation or in many cases quit. Having acknowledged the undisputable power of user-generated-content, we propose that organizations should provide this option on their own corporate website and engage customers in constructive ways.

The proposed open innovation system as used in the case of a hotel, invites customers upon check-in to have access to information about the cocktail of the day, the trip of the day etc., as well as to praise members of staff, complain about what they do not like and provide feedback- all at the same place. Although this option is available in various social media, customers who participate through the corporate space actively co-create the services and products, in that they see how their ideas have been taken on board, by whom and by when. On the very same platform employees of the hotel and suppliers have access to the bits of information relevant to them. By opening up all stages that range from submitting an idea or complaint to implementation and then to reviewing the implementation phase, customers can track in which ways their time and feedback has been taken into consideration. It is then up to the organization's discretion to decide how open the process should be for the general public or whether partial openness would be more appropriate.

The rationale behind is that organizations can have their corporate website, Content Management Systems (CMS), Intranet, Extranet and social media space in one place and decide according to their needs who should have access to what and how. Of course gamification and incentive mechanisms should be further developed to increase participation and involvement.

4.5 Social Enterprises and Crowd-Funding

Social enterprises have been portrayed as an emerging 'fourth sector' of the economy [22] with a focus on generating social, environmental and economic benefits through enterprising activity [42]. They aim at addressing social issues while assuring their survival and viability through market based approaches [27]. They thus differ from private enterprises in terms of their objectives, structures, governance and accountability and from Non Profit Organizations that mainly rely on subsidies, donations and membership fees [20].

The proposed open innovation system is currently used by a Social Enterprise as a matching and collaboration tool for volunteers embarking on international projects. The hybrid and holistic nature of the system allows the organisation to easily design the website and publish the initiatives as well as have a closed space for the registered volunteers who participate in specific projects. Different stakeholders (e.g. volunteers, project initiators, accommodation providers, NGOs, local authorities) are involved and they all need to have different access rights for different purposes.

The applicability of the tool in social enterprises is of particular interest, as they are meant to operate on the cross-sector boundaries. The system can be used in a similar way for crowd-funding purposes, in the sense that crowd-funding activities can be incorporated in the official website and decisions and activities can be transparently shared with the crowd. Plugins can be embedded to facilitate the payment procedure.

4.6 Open Teaching

The principle of wholeness is also applicable in the context of teaching. Universities use online closed spaces, such as Moodle, to upload supporting material for students as well as host blogs, fora, assignments and to support any type of interaction. Part of the information oftentimes needs to be publicly available for prospective students or other groups interested in a particular topic (e.g. LSE blogs).

The proposed open innovation system is in line with the varying needs of openness required. Inspired by Neyer and Abdelkafi [32], who have adopted an external teaching tool with the aim to educate Open Innovation Ambassadors and integrate an open perspective into universities, we have customized the proposed open innovation system to accomplish three things: First, to interact with students through status updates, supporting material and a Q&As space (all of which is subject to students' ratings and comments), second to organize an open innovation contest, whereby students have been asked to upload their submissions and then peer review and vote each others' ideas and lastly to make part of the content publicly available for practitioners, prospective students and other interested audiences.

While the interface resembles Facebook and similar social networking websites, the hybrid nature of public and private gives space for freedom, creativity and innovation to emerge through both controlled and unanticipated interactions. Facilitating open innovation contests, as opposed to outsourcing or using third party technologies, ensures better control over IP rights and security issues. The following table summarizes the cases presented above as some indicative illustrations that are by no means exhaustive.

Table 1. Applicability of the proposed open innovation system

Cases	Description	Contribution
Citizen Participation	Citizens actively participate in voting, reporting problems, suggesting ideas,	Organizational wholeness as a principle encourages

[2] http://pewinternet.org/Reports/2010/Online-Product-Research/Findings.aspx?view=all

	monitoring progress	openness in practice. Traditionally isolated spaces and practices are merged and integrated, while access rights and levels of openness can be customized.
Crowdsourcing and open innovation contests	Crowdsourcing activities and open innovation contests can take place on the official website	
Reviews and Social Media	UGC can be embedded within the official website	
Open Source Innovation	Widely dispersed groups collaborate in designing physical artifacts	
Social Enterprises	Different groups can be connected as well as recruit more people and promote their mission	
Open Teaching	Open innovation contests can co-exist with regular teaching practices and communication with externals	

5 CONCLUSIONS

The intensification of collaborative work practices, the wide adoption of mobile applications, the advent of pervasive Business Intelligence Systems and Social Computing have urged the introduction of a new management paradigm [37] and can be reported as some of the contemporary 'erosion factors' that intensify the need to consider the notion of openness more seriously. We started this paper with questioning how effectively existing technological platforms address emergent collaboration and innovation practices within and among organizations in the different sectors of the economy with a special emphasis on the coupled process within the open innovation paradigm.

To address this fundamental question we reviewed how technologies are used in the context of open innovation and the extent to which they promote an open culture as opposed to information silos [10] in practice. Although a wide range of technologies for innovation and collaboration is available, they are mostly treated in an instrumental way, and as Bianchi *et al.* [5] also note, there has been limited research into how organizations translate the management technology of open innovation into practice (see also [15]).

The open innovation paradigm and the notion of wholeness have inspired us to design an open innovation system that actively considers the nuances of openness. Engaging different groups of people in co-creation processes requires a holistic approach to how technological artifacts as sociotechnical arrangements should be treated and embedded within the broader organizational and institutional contexts. The proposed open innovation system integrates functional and strategic tasks taking into account the fact that we work in open ecosystems and brings to the fore the idea of organizational wholeness. Six specific domains that open innovation is made manifest are included as indicative illustrations of the applicability of such a system: Citizen participation, crowdsourcing and open innovation contests, open source innovation, reviews and social media, social enterprises and open teaching.

To conclude, the crux of the argument is that the architecture of the open innovation system presented in this paper opens up new possibilities for collaboration and innovation within and across organizations in all sectors. It embraces the principles of open innovation by transcending boundaries and it serves as a practical manifestation of the emergent management paradigm. Thy hybrid design allows a systematic integration of currently isolated and standalone digital collaborative technologies such as the official website, intranets, corporate social platforms, social media, extranets, talent management platforms and third party websites, all in one space: what we call the *whole*.

We acknowledge the limitations of this study, which is purely theoretical. Extended research (both qualitative and quantitative) is required to draw conclusions about the use of the proposed open innovation system in real contexts. Action research and case studies will be conducted as part of a larger research project, having in mind that looking at emergent technologies as artifacts embedded in and at the same time co-constructive of socioeconomic contexts invites reflection on the broader role of IS usage and their intended and unintended consequences.

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