

Open Design: Exploring the Use of Open Knowledge in Service Design

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Abstract: The aim of this paper is to investigate the usage of open knowledge in service design platforms within the theoretical framework of open design. The paper also explores the innovative outcomes of the integration of knowledge management into service design through available digital environments and tools. The methodology is based on a framework analysis of current research on open design and open knowledge, and a critical review of case studies in the service design industry. The structure of the methodology consists of two phases. For the first, framework analysis is employed to organize and examine open design, through the process of summary, to reach a flexible matrix output. The second phase is to analyse different service design platforms as a case study, considering the theoretical discussions of open design that would allow the positioning open knowledge as an instrument to create innovative solutions within service models. The findings will discuss the importance of open design in the context of knowledge management. A critical review of theoretical discussions will enable the exploration of open knowledge in service design through the utilization of digital technologies, and how it responds to emerging problems, and creates solutions and opportunities using technological systems and infrastructure. The relevance of our findings and implications for knowledge management underline the importance of open knowledge integration within service structures. The case study provides a contemporary approach to open design as a methodology, which leads to improved understanding of service design capabilities for the creation of participant involvement in knowledge generation and management. The paper generates value for knowledge communities and designers in different sectors, while illustrating the significance effect of open design methodology on shaping service flows and structures built up on open knowledge.

Keywords: open design, open knowledge, service design, innovation management, knowledge management

1. Introduction

“Design is about formulating service concepts and generating ideas” (Yu and Sangiorgi, 2018, p.41). As a design practice and research area, service design has gained a vital role in terms of generating new experiences and values for users. Its reach has significantly extended over the past two decades and as a design approach, it has become the main driver on enabling service innovation (Meroni and Sangiorgi, 2011). As a brief explanation, service innovation created by service design is a new process, or a new service offering for users, curated specifically by organizations to create value within certain networks (Snyder et al, 2016). Service design also emerged as a new sub-field of design, where designers address the service context in order to develop their roles among participants and actors, providing new solutions to given problems (Kimbell, 2011). On a contemporary scale, creation of value and knowledge became the focus points of service design throughout its development. In this sense, the concept of *service* has shifted to a more process-based market offering which provides value co-creation among multiple participants, and is guided by institutional or organizational structures, rather than referring only to tangible outputs complemented by tangible touchpoints (Vargo and Lusch, 2016).

Regarding knowledge management within service design, open distribution of knowledge and access to information with the contributions of varied participants and users is crucial for the success for firms and companies in terms of their service deliveries. For instance, absorbing and utilizing customer knowledge would not only become an important aspect while designing user-oriented service flow to create innovation (Ordanini and Parasuraman, 2011), but would also stand as an important component for open design to influence the emergence of open knowledge within service deliveries. In this case, when designers and actors among an organizational structure collaborate with their customers and users through their designed service deliveries, distributed knowledge and data eventually become an openly accessible component in long term development plans.

The aim of this paper is to examine the above-mentioned points within the framework of open design and its core features. To explore the usage and integration of open knowledge within service design and delivery mechanics, paper aims to build a connection within knowledge management capabilities and open design approach while considering the openness ideology within its theoretical positioning.

2. Knowledge Management Through Open Design

Open design eliminates boundaries in terms of knowledge sharing and dissemination, range from the level of decision-making on management level operations to the level of manufacturing methods on production capabilities. Both on manufacturing procedures and for creative processes, open design can create transparency in methods of distributing knowledge and in design-based idea generation. Boisseau, Omhover, and Bouchard (2018, p.17) acknowledges the term as “the state of a design project where both the process and the sources of its output are accessible and (re)usable, by anyone and for any purpose”. Since “knowledge” is considered as an important resource for firms and companies, which can create value and keep sustainable competitive advantage (Wu and Chen, 2014, cited in Wu and Hu, 2018, p.1736), it has become not only the main driver for innovation and development across a whole organizational structure, but also a focus point of open design to propose new ways of producing products and services. In this regard, open design operates with and through knowledge management in terms of providing innovative outcomes, and their connection is evident in innovation strategies. Within a management structure, open design has the potential to provide an influential effect on distributing a more democratized and more equitable knowledge-based information to varied actors in different service or system models through utilizing open knowledge. Since the term operates on a large spectrum and effects the overall knowledge generation and distribution through design attitude, these fundamental abilities enable researchers to consider it within the framework of knowledge management. In order to explain the true and integral connection between open design and knowledge management, the following terminologies were specifically selected to show the influential factor of design thinking on knowledge generation and ideation within the framework of open design ideology. Methodologies of open design: *co-creation, co-design, participatory design and peer-to-peer* keywords perform as foundations for knowledge management through open design processes. Each method is utilized as an approach to make design-based knowledge accessible, visible and most importantly, openly configurable to users and related actors in respect to open knowledge usage and integration. Each method, with their own specific operation areas on design-based systems, enable knowledge transfer and sharing on multiple layers on a wide-ranging spectrum, ranging from the level of individual level ideation to organizational level executions for desired outcomes. Research considers given four main methodologies under three specific categories, which signify their usage levels: *systems, processes and tools*. Given levels separate each method to provide a more controlled and focused approach when it comes to explaining open design’s integration to service and system models.

The following section is narrated through four specific foundations, derived from their categorization. It explores how each foundation is related to open design in terms of their structure as well as their potential contributions on knowledge management.

2.1 Systems: Peer-to-Peer

Peer-to-peer (P2P) proposes a more democratized management approach within organizational structures to understanding the overall picture in terms of knowledge and information sharing. It generally refers to the decentralization of communication and knowledge distribution without considering any hierarchical collaboration within organizations, thus enabling a more lateral approach in terms of executing design and project development processes (Menichinelli, 2016).

Regarding the previous explanation, Menichinelli (2016) considered P2P from a socio-technological perspective and proposed a framework integrating P2P and open dynamics. Derived from this integration, P2P was divided into four sub-systems to explain its true contribution to knowledge and innovation management through open approaches; *diffused, distributed, decentralized and centralized* systems. Following explains each system’s functions and focus points according to the pre-defined framework.

- *Diffused Systems*: Refers to the system models, where there is no certain pattern of flow of information, and agents are not specifically organized in terms of homogenously distribution of operations.
- *Distributed Systems*: Refers to computer and digital networks, where data and information are stored and shared among each coordinated device.
- *Decentralized Systems*: Refers to the distribution of functions, information and data without reliance on any central authority. Decentralized systems enable the equitable distribution of activities and assets between agents and selected peers.
- *Centralized Systems*: Refers to systems where main operation and functions are stored within a selected focus point to provide control and central monitoring

Each sub-system act as skeleton structure to enable P2P within socio-technological networks. Furthermore, their relationship with the ideology of openness plays a vital role regarding the information and knowledge management for organizational level procedures through software networks and infrastructures.

2.2 Processes: Co-Design

Chesbrough, Vanhaverbeke and West (2006) underline the importance of co-design approach's potential to act on multiple layers, such as organizational level structures, and refer to the management of open innovation through the combination of ideas and knowledge of varied users from different organizations and divisions. Similarly, Kleinsmann (2006, p.30) examines the term on design scale and emphasizes its importance in knowledge creation, stating that, "Co-design is the process in which actors from different disciplines share their knowledge about both the design process and the design content. They do that in order to create shared understanding on both aspects, to be able to integrate and explore their knowledge and to achieve the larger common objective: the new product to be designed". The term "co-design" is crucial when it comes to knowledge sharing, creation, and distribution between multiple and different actors in service models, system structures and design development processes. In this regard, Sanders and Stappers (2008) envisions co-design in a broader sense as a creative act where non-designer and designer participants collaborate to develop innovative solutions in the overall design processes.

2.3 Tools: Co-Creation & Participatory Design

Co-creation provides a fundamental approach by enabling multiple actors to come together and create ideas or solutions for specific issues on both institutional and organizational levels. By nature, co-creation embraces every other mentioned key word of knowledge generation within open design ideology, since its core beneficial aspects can be applied on any other term or operational field. From an organizational perspective, co-creation is a crucial concept that provides engagement between employees, improved supply chain integration, re-defines stakeholder commitment, and enhances workflow and knowledge sharing with external stakeholders and competitors in the market to create innovative outputs (Hatch and Schultz, 2010; Jüttner, Christopher and Godsell, 2010; Madden, Fehle and Fournier, 2006; Kohlbacher, 2008).

Ranjan and Read (2016) considers the concept in terms of its contribution to value creation and suggests two main dimensions followed by their complimentary sub-layers. The initial dimension is co-production, which refers to the involvement of customers in production phases and realizing their engagement with companies (Frow et al, 2015). There are three main sub-dimensions for co-production, each compliments the others, and facilitate co-production process in terms of openness, equity, and also considering user interaction with services and products; *Value-in-use*, on the other hand, a co-creation dimension which refers to collaborative value creation practices, derives its core expansion from a user's evaluation or perception towards product and service functions and affordances when compared to their own individual motivation and goals (Edvardsson, Enquist and Johnston, 2010). Likewise, value-in-use also carries three sub-dimensions that address the value and knowledge creation, focusing on user needs and capabilities. Research has so far focused on selected three sub-dimensions as follows: *equity*, *experience* and *personalization*.

- *Equity*: Refers to user empowerment through sharing companies' management capabilities and control to enable co-production and creation in terms of equally distributed knowledge.
- *Experience*: Refers to a firm's ability to create cognitive and emotional perception within users through utilizing their services and products to make them able to generate value.
- *Personalization*: Refers to the potential change on creation processes through alterations and customizations provided by the users. These changes can be realized by changes in how users perceive any created services or products in terms of their own unique backgrounds.

The second methodology from tools layer, participatory design, emphasizes the role of collaboration both in the process of designing and of ideation. It enables users and stakeholders to generate solutions to resolve certain problems while participating in the whole structure of design projects. It adds a perspective on mutual development through participation between multiple participants (Simonsen and Robertson, 2013). Democracy and participation appear as two main principles of participatory design (Bratteteig et al, 2013), these concepts provide opportunities for different users to work collaboratively without inequalities in terms of development and knowledge sharing with equalised power relations (Kensing and Greenbaum, 2013). Like the co-design approach, participatory design refers to a collection of design practices which involves target users of design outputs as collaborators during the design processes (Velden and Mörtberg, 2014). Furthermore, participatory design deals not only with the designing process, but also with the aftermath and results of each project. Iversen

and Dindler (2014, p. 154) emphasizes participatory design's inclusiveness and state that, "as researchers or designers engage with more ambitious goals, such as ensuring that participants and organisations enjoy lasting gains from their participation, it becomes important to consider not only what happens during the project, but also what happens after the project has ended." Their explanation shows the importance of realizing that there are multiple actors to consider during the process, and that, through design, knowledge and idea generation expand their reach through each participant's influence on both during and after the process ended.

Methodologies of open design and their categorization according to their usage levels provide sufficient information about how they are related to knowledge management in terms of distribution and democratization of access to data. System level, for instance, through the peer-to-peer approach, deals with infrastructural capabilities, and acts as a main layer of executing data-based systems for managing knowledge-based solutions. At the process level, co-design suggests the involvement of non-designers and other actors in the overall designing processes within the perspective of open design's ability to transform diverse knowledge into an integrated component within design teams and organizations. The final level, tools, and its sub-topics, co-creation and participatory design, focuses on mass participating actors in any given project within organizational and institutional structures. Following table 1, it configures itself as a toolbox of open design's selected methodologies and collects selected keywords to present a brief summary of previous explanations.

Table 1: Open Design methodologies and drivers

Levels	Methodologies	Existing Drivers of Open Design
Systems Layer	Peer-to-Peer	Diffused Systems Distributed Systems Decentralized Systems Centralized Systems
Processes Layer	Co-design	Dialogue Interaction Relationships Knowledge Exchange
Tools Layer	Participatory Design	Equity, Experience, Personalization Knowledge Sharing
	Co-creation	Democracy, Participation

3. Investigation of Open Knowledge in Service Design Industries

Regarding the collaborative nature of open knowledge through co-creative acts, Xin et al (2021) focus on the user participation on knowledge management capabilities in the delivery of innovative services. According to this perspective, in the digital era, by using provided products or services, users leave traces revealing their characteristics, capabilities and demands, but currently, users can additionally give crucial feedback and share their perspectives of service structures. Constant user feedback and data input is a crucial process for open knowledge to integrate itself to any given service model as a main driver for innovation and improvement. Integration between external and internal factors also facilitate information-sharing within service structures and affects the total innovation process. Peñalvo, Figuerola and Merlo, (2010) understand this integration and highlight innovation through collaboration as an open system, where the meeting of internal capabilities and possible external resources (users, participants, providers and networks etc.) enable the creation of value.

To explain the status of open knowledge and analyse its role as an instrument within service design industries to create innovative outputs, this research focuses on three different service and platform examples as cases with the aim of expanding its theoretical framework through contemporary systems. Each case was selected specifically according to its potential to utilize open design's methodologies, its possible contribution to enable the integration of open knowledge through open design framework, and its potential for collaboration with external sources (users, participants, experts etc.) to utilize knowledge management capabilities.

Following attributes were also considered as crucial points while searching for each case and selecting them for further analysis. Each case is:

- A non-profit organization (NGO).
- Utilizes openness ideology.
- Collaborates with users and they are active co-creators.
- Established as a community-based operation system.
- Gathers related data through their digitally established platforms.
- Located within the European region.

The following section describes each case and establishes a perspective based on previous discussions with the contribution of open design's methodologies and drivers.

3.1 Case No.1: FixMyStreet

FixMyStreet (FMS) is an independent web platform established in 2007 by mySociety, a non-profit group, created specifically to encourage the usage of online tools and systems to enable civic empowerment. Their stated main goal is to enable a democratized digital environment where each member of society can become active collaborators in change and development through participation and data exchange. FMS focuses specifically on reporting problems which citizens may encounter during their daily routines within specific public areas or any locations. The platform encourages certain service design attributes contributed by geographical capabilities, such as crowd mapping and sourcing to generate substantial data from each participant. Every reported problem is completely open to access by citizens, and alteration for further development to encourage them become active collaborators. Thus, total service acts as strong decentralized system from peer-to-peer methodology.

Basic service and usage flow of the platform contains three main and simple steps:

- **Location:** Users define their locations and where they encountered the issue.
- **Description:** Users describe the problem.
- **Conformation:** Users follow the conformation of the reported problem via e-mail or selected channel.

Utilizing openness ideology, this case clearly exemplifies alteration of data into useful and accessible tools, which results into an open knowledge-based system in which each citizen is an active collaborator.

3.2 Case No.2: D-Cent Project

Decentralised Citizens Engagement Technologies (D-CENT) was a project aimed to bring together different citizen-led organizations to empower the usage of the next generation of open source, distributed and privacy-aware tools for democratic purposes. The project ran between October 2013 and May 2016 and executed its main goals and targets through proposals of four different digital networks located within specific European geographical areas:

- **Barcelona: "Decidim Barcelona"** is a digital platform for enabling participation to build democratic, open and a transparent city.
- **Reykjavik: "Better Reykjavik"** is a participatory platform for citizens to propose ideas and guidance in terms of budgeting of city-wide operations.
- **Helsinki: "Decisions Helsinki"** is an open API (application programming interface) tool for citizens to follow municipal policy decisions through notifications and data sharing.
- **Madrid: "Decide Madrid"** is a democracy platform which allows participants to propose, debate and implement policies for the city.

Related to given proposals, D-Cent utilizes following drivers to provide open standards on development and improvement: *ownership of data, opensource / open standards, open authentication, blockchain trust*.

3.3 Case No.3: DECODE Project

Funded by the European Union's Horizon 2020 Programme, DECODE is a key project proposed by Dyne Foundation, a non-profit organization established in 2005 in Amsterdam, Netherlands. It aims to provide online tools for citizen empowerment. DECODE Project acts as a response to people's concerns about the privacy of their data, and helps them utilize their information, regardless of whether they want it to become public or not, with the help of digital tools to change overall data input into useful components for development. Project focuses on IoT (internet of things) capabilities to promote digital citizenship through co-creation methodologies

on a wide range of operation scales. In order fulfil its goal, the project proposes collaboration with specific actors, and considers open knowledge and its components as its main utilities:

- **Citizens and local communities:** Integration of feedback from end-users and citizens.
- **Open-source developers:** Offering knowledge exchange, inspiration and networking.
- **Startups/SMEs (Small and medium sized enterprises):** Introduction of decentralized networks and data architecture to provide data-driven applications within ecosystem building with the collaboration of industry.
- **Academic and research communities:** Distribution of data and knowledge through different levels of expertise and academic backgrounds.
- **Cities and policymakers:** Implementation of data sovereignty and decentralized technologies through city governments and policy makers.

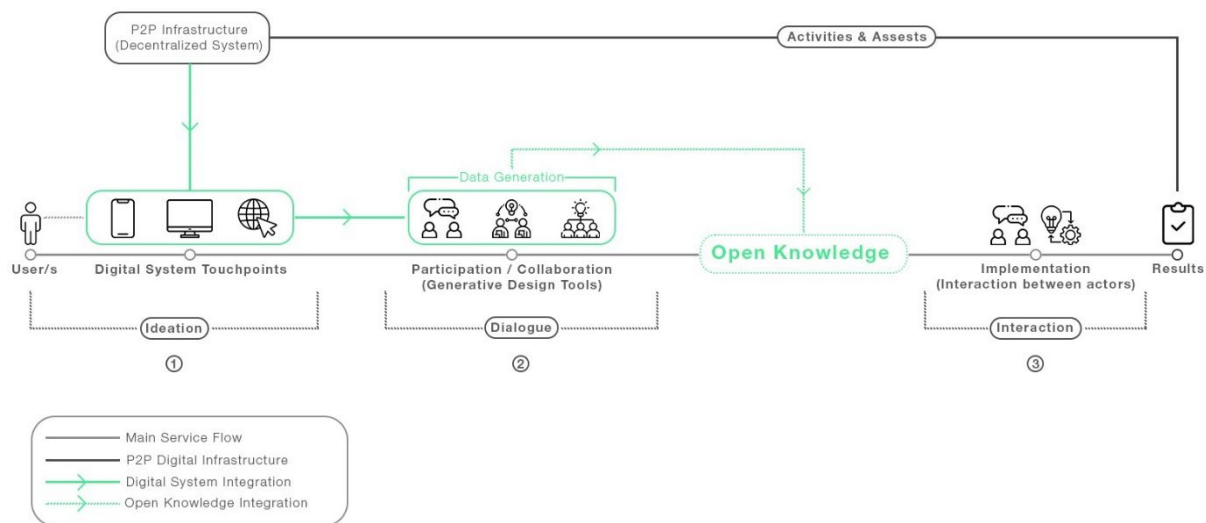
Each case analysis identifies drivers and sub-operation areas related to their utilization of open knowledge and its core capabilities to enable service integration within defined system structures. Regarding previous discussions about openness ideology, the investigation shows an evident relationship between open knowledge and open design methodologies at three main levels (systems, processes, tools). To provide a brief and a concise summary of the given analysis of each case, table 2 presents each observed drivers of open knowledge within provided service industries and project examples and summarizes each main point.

Table 2: Significant drivers for open knowledge within service design cases

Cases	Levels	Significant Drivers for Open Knowledge
FixMyStreet	Systems	Decentralized System
	Processes	Knowledge Exchange
	Tools	Participation
D-CENT Project	Systems	Decentralized System
	Processes	Dialogue
	Tools	Democracy, Knowledge Sharing
DECODE Project	Systems	Decentralized System
	Processes	Dialogue, Knowledge Exchange, Interaction
	Tools	Democracy, Equity, Participation

4. Conclusion

In scope of the research, the overall investigation and the analysis of prior literature shows the evident relationship between knowledge management and open design in utilizing openness ideology, while shaping service and system structures. Within the framework of open design, open knowledge emerged as the main driver for innovative, facilitative and democratic means of distributing information and data. Across the two phases of the research, the following were identified as methodologies of open design: *co-creation, co-design, participatory design and peer-to-peer* within *systems, processes and tools* layers. These possess the ability to convert acquired data into a valuable knowledge capital, which can become a transparent component allowing the emergence of open knowledge-based design solutions. Following the second phase, overall theoretical approach was complemented by specified cases to illustrate the current state of open knowledge within contemporary service design industries. Development of selected system and service structures is supported by participants and collaboration with users, building on decentralized digital layers which considers P2P as their main infrastructural operation area. Even though each case proposes a linear flow as a simple approach to shape a basic system integration, openness ideology and collaboration allow services to become self-regulating and sustaining, thus providing a significant opportunity for open knowledge to emerge and become integrated into the total flow. Table 3 summarizes this analysis and helps visualize the desired service and system flow.

Table 3: Open knowledge integrated service/system flow

Regarding the table above, as a whole delivery process, consideration of decentralized system layer as the main infrastructural ecosystem, total service and system flow becomes available for open knowledge to emerge and integrate itself through the usage of digital mediums and touchpoints, which are specific user access points for initiating the service to generate data. Furthermore, with the integration of open knowledge, new model becomes multi-dimensional through multiple users and collaborators. To propose a concise and a brief look, general flow of the given service model is divided into three specific phases: *ideation*, *dialogue* and *participation*. With the collaborative processes, users participate and produce relevant information and share their knowledge among themselves through ideation. Next phase is to alter generated data into a transparent tool for further implementation through dialogues and communication between participants. With the help of open knowledge, the delivery phase becomes realized through interactive processes, thus results with innovative outcomes for every actor. Regarding knowledge management capabilities, all three steps compliments the integration process of open knowledge and its distribution to the total service structure, in order to provide an efficient service delivery process as a result.

The findings of this research suggest that the ongoing utilization and integration of open knowledge to knowledge management capabilities is an important aspect to provide the sustainability of service structures and platforms. Shaping up new and innovative service flows where value creation through the utilization of data is a co-operative procedure with the help of participants, would become an important factor in terms of knowledge management capabilities. Regarding practical implications, research contributes to the total framework by explaining the capability of open knowledge on providing social value between actors through dialogue, networking capabilities and sustainable communication, competitive advantage for companies not only from the perspective of producing outputs but also for the sake of collaboration and co-creation to develop and innovate by new service opportunities. Alternative approaches of identifying and observing the integration of open knowledge on service delivery procedures would be necessary for subsequent research to enlarge the framework and the total scope. Theoretical implications of the given research might enable to propose a certain question like, how would open knowledge emerge, if the service capabilities of different system layers such as diffused, distributed or centralized models become the main infrastructural backbones? Moreover, future research can also focus on implementing the proposed open knowledge integrated service model in different industries and service areas like community driven mobility within public transportation systems, within health sector to provide multi-dimensional medical interventions or in education sector where open knowledge sharing is the top priority goal. This possible implementation, complimented by further research can deconstruct and challenge the overall service delivery processes. Next step would be trying to understand the business capabilities through service deliveries and structures in practice, so it can be important to search about the necessary dynamics between participants and actors while utilizing generative design tools during the data and knowledge generation processes within a total service delivery scenario to conduct further research and contribution.

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