The Research and Practice Framework for Designing the Digital Social Innovation

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Abstract. This paper focuses on the research and practice of digital social innovation (DSI). The rapid progress in the era of information provides many possibilities for social innovation. At the meanwhile, the development of science and technology has significantly boosted the breadth, depth and efficiency of social innovation. Through years' of research and practice, we improve the definition and conclude the features of DSI from a large number of case studies. Then, by combining the SET factors, we develop the general standard framework for DSI. At last, we use and confirm the righteous and effectiveness of this instruction in practice.

Keywords: Social innovation · Information technology · Framework · Grounded theory · Service design

1 Introduction

With the arrival of information age, a large amount of information is flooding our city life, and the digital form of social innovation has appeared. Digital social innovation (DSI) has become a hotspot for policy-makers, entrepreneurs, researchers, and start-ups. It presents us with a brand new vision.

Previous research like NESTA's research on DSI [1] has pioneered the field of DSI from both research questions and methods, and created many cases that laid the foundation for our research. Nowadays, for academic institutions like Parsons DESIS (Design for Social Innovation and Sustainability) Lab [2], DSI has become their new thematic group, and its work provided the theoretical basis for our study and reference. Their focus on digital technologies and platforms are considered as the organization tool for connecting community to individuals. Based on the assumptions of the previous research, we believe that digital technology is a dominant and pivotal new way to support people, customers and communities to collaborate and co-create a wide range of social needs. Consisting of a group of DESIS laboratories and partners, DSI group is currently exploring a different approach, focusing on the literal aspect of digital technology which is more technical and academic. The purpose is to investigate not only the cases and trends in social innovation, but also the corresponding design research issues and strategies in the digital, social and ubiquitous network context.

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From the perspective of design, the definition and features of DSI need to be concerned. What is more important is how to apply DSI to real social practice scenarios in a standardized and process-oriented way. In order to make the project closer to reality, we worked with NGOs, charities and social enterprises to develop interdisciplinary cooperation among governments, organizations and research institutions to find new possibilities during the exploration process, Also, following the trend of globalization, we actively cooperated with Urban Studies Program at Stanford University, and formed cross-regional, cross-cultural, and interdisciplinary teams to test and practice DSI. We found that urban design is not only about physical infrastructure, but it is also about the services and amenities where infrastructure inhabits. In addition, we use four pillars of sustainability - social equity, environmental quality, cultural continuity, and economic vitality, as the framework to guide the direction of the project [3]. The four pillars have significant referential meaning to the summarized features and evaluation standard of DSI.

1.1 Society Background

According to our previous research [4], the initial prototype of the city is formed by aggregation of population and commodity exchange. A real sense of a city is to make its citizens live well with support of urban infrastructure and energy, food, water, transportation, recreation and finance system etc. The intervention of new ICT technology changes the built environment to a sensible, interactive and transferred place where support human activities in all levels, and make the city's physical space and intangible networks merge together to form a very complex ecosystem.

In the current state, the smart city is envisioned as wired and ICT-driven cities that provide better urban life [5], innovative services [6], new business opportunities [7], efficient governance and sustainable environment development [8]. More and more cities are beginning to consider civic participation, and regard the smart citizen as a new direction of smart city. Currently, governments around the world are taking actions to cooperate with their citizens in the process of designing and constructing smart cities, based on their specific situations and objectives. Social media is being widely used as a way to get citizens involved. Participatory sensing, which is empowered by the development of ICT, is also a significant approach to collecting data from citizens. Some government municipalities also launched urban sensing applications, such as the NYC 311 service [9]. New York City held its annual city hackathon 2013 with the theme of "Reinvent Green", aiming to help build digital tools and applications to support New York in leading greener lives [10].

From public benefit to social innovation, companies increasingly turn to CSR3.0 (Corporate Social Responsibility 3.0) [11]. They will focus on a more sustainable model and revolutionize our understanding on concepts such as product, consumption, wealth and inventions with new methods, ideas and technologies, for instance, in the Intel Core World Social Innovation Week [12].

1.2 Technology Background

Digital technologies and the Internet play an increasingly important role in how social innovation happens. Today's urban development is gradually turning to smart city. New technologies such as the Internet, big data, cloud computing, wearable devices, intelligent home, artificial intelligence and SNS (Social Networking Services) have been applied to social innovation [13], and extend the width and breadth of social innovation from the aspects of the process, performance and content, increasing its efficiency and reducing its complexity significantly.

The growth and development of social computing has greatly increased the complexity of the system. On the other hand, coping with complexity also brings new solutions to social innovation. Collective intelligence harvested from relationships among designers, users and organizations, and collective wisdom that acquired from things on Internet can generate greater value from the interaction between people and things. Eventually, innovative, hopeful and sustainable lifestyle can be created [14, 15].

1.3 Research Questions

We hope to offer a set of methods to contribute to DSI research in the urban context, and meanwhile to practice it and cooperate with the society from all walks of life. In the practice, we will offer insights and tools from the angle of schools.

What is the Main Participant of DSI? In recent decades, many philanthropic and charitable organizations have often turned to non-profit, especially non-governmental organizations (NGOs), to address some of the world's most intractable social problems. With the rise of those groups, the number of similar social organizations increases. However, their projects and solutions are almost homogenous, and they are also lacking in new theories or thoughts. By carefully re-tooling these organizations with the latest technology and guiding them with the best innovation practices at our disposal today, we can start fresh with a re-booted version of traditional non-governmental organizations: NGO 2.0 [16, 17].

What is the Method of DSI? With the goal of social innovation, we focus on the reflection of culture and social value on the aspects of research methods and design tools. Focusing on research questions from the community level, the more mature mode is the Bottom of the Pyramid (BOP) [18]. In the design field, collective action toolkit developed by Frog Design Company [19], HCD Toolkit developed by IDEO [20] and the DIY innovation toolkit produced by NESTA [21] are all tools for inspiring and supporting social innovation.

1.4 Methodology

Our train of thought is: first analyzing the real cases; second concluding the features of them when referring to designing process; then forming the framework of DSI suited to city sustainable background; at last testing our conclusion by practicing. During the process, we used case study and grounded theory as our method and tool.

Case Study. According to Thomas [22], "case studies are analyses of persons, events, decisions periods, projects, policies, institutions, or other systems that are studied holistically by one or more method. The case that is the subject of the inquiry will be an instance of a class of phenomena that provides an analytical frame – an object – within which the study is conducted and which the case illuminates and explicates." We studied many DSI cases in order to find a vision for the common features of DSI.

Grounded Theory. It's a systematic methodology in the social sciences involving the construction of theory through the analysis of data [23]. From our case studies, we also collected many data. After having done the statistical analysis, we conclude the statistical meaning of these data and deduce the general framework for DSI.

Contribution.

This paper focuses on researching and practicing DSI in the urban context and makes following contributions:

- Define DSI in the urban context.
- Summarize and conclude the features and framework of DSI.
- Support the relative research.
- Support innovation teams to take part in DSI practices in the urban context.

2 Related Research

2.1 Social Innovation

There is a possible future in which services are explicitly designed to tackle social challenges such as climate change and unemployment. Social innovation is now embraced around the world as legitimate public policy in both economic and social arenas. According to the Open Book of Social Innovation [24], the three most significant problems of social innovation are intractable social problems, rising costs and paradigm.

There is a growing interest in social innovation among policymakers, foundations, researchers and academic institutions around the world. Despite this interest, there are no a shared or common definition of social innovation. Currently, there are a large number of different definitions in circulation.

Goldenberg defined social innovation as the development and application of new or improved activities, initiatives, services, processes, or products designed to address social and economic challenges faced by individuals and communities [25]. In 2003, Stanford had defined social innovation as "the process of inventing, securing support for, and implementing novel solutions to social needs and problems". Five years later, Stanford redefined and broadened the term. The latest approach involves "dissolving boundaries and brokering a dialogue between the public, private, and nonprofit sectors". The current Stanford definition of social innovation is "a novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals." It describes that, "a social innovation can be a product, production process, or technology (much like innovation in general), but it can also be a principle, an idea, a

piece of legislation, a social movement, an intervention, or some combination of them" [26]. Some define social innovation as a type of innovation more broadly. Timo Hämäläinen outlines five types of innovation: technological, economic, regulative, normative and cultural [27]. According to a report of TEPSIE, it defines social innovation as "new solutions (products, services, models, markets, processes etc.), which simultaneously meet a social need (more effectively than existing solutions) and lead to new or improved capabilities, relationships and better use of assets and resources" [28].

TEPSIE found the eight common features of social innovation, which are cross-sectorial, open and collaborative, grassroots and bottom-up, pro-sumption and co-production, mutualism, creates new roles and relationships, better use of assets and resources, and develops assets and capabilities [28]. Robin Murray, Julie Caulier-Grice and Geoff Mulgan from the Young Foundation had identified six stages of social innovation from inception to impact. The six stages are [24]: prompts, inspirations and diagnoses, proposals and ideas, prototyping and pilots, sustaining, scaling and diffusion, and systemic change. In the book, they explored each of the stages in depth, and listed some of the main methods used for each one.

2.2 Case Study

Grounded theory believes that a theoretical framework can only gradually be formed through in-depth analysis of data. Therefore, we selected five typical DSI cases in the urban context, Yibo [29], Coca-Cola Hello Happiness [30], Pugedon [31], Yitu [32] and FixMyCity [33], as our primary data to analyze.

Yibo provides a novel solution to add advertisements on the Internet. It collects "404 not found" web pages that provide the advertisement service to social organizations. Now, over 200,000 websites have joined in Yibo to provide noncommercial advertisement. The advantage is that it spreads noncommercial advertisements online by fully using resources of Internet. The whole procedure can be easily recorded and traced.

Pugedon is a well-designed recycling machine. It feeds stray animals when it receives plastic bottles. At the same time, Pugedon recycles plastic materials for environment protection. On the other hand, it provides a solution to feeding stray animals. By combining these two features, Pugedon motivates people to protect environment and meanwhile care for animals.

"Hello Happiness" is a new video from Coca-Cola. In March 2014, Coke installed five special phone booths that accepted Coca-Cola bottle caps instead of coins in Dubai labor camps. In exchange for a 54-cent Coke bottle cap, migrant workers could make a three-minute international call [30]. Similar with Pugedon, Coca-Cola Hello Happiness project is totallyan offline solution. It modifies the traditional telephone booth by replacing the coins with Coke bottle caps. Apparently, Coca-Cola's innovative solution created a positive impact on the society, especially to migrant workers.

Yitu provides a multiple-field and map-based solution targeting different social problems such as environment, society and disaster. It is the first multiple-layers social map on which every person can upload and search for different social problems and requirements. Social organizations can generate corresponding social service maps

based on the Yitu platform. The maps can be imbedded into the web pages to reduce the cost of development.

FixMyCity is a framework for easily building and deploying citizen reporting platforms. Based on web technologies, it enables citizens to report local issues to the responsible local authorities. Through the combination of FixMyCity platform features, bidirectional channels are created between citizens on the one side and local governments on the other. FixMyCity focuses on the extensive support to end-user mobile cross-device and the tight integration of Social Media [33].

During the research of these five DSI cases, we collected keywords in related works, such as project introductions, news and research papers, and summarized the feature descriptions as shown in table. Based on the 5W2H theory, a method in Grounded Theory for microanalysis, which is what, when, where, who, why, how, how much, we selected seven corresponding aspects - deliverable, generation, service model, object, orientation, approach, and operation to categorize the features.

We learned from other cases that the content of DSI could also be open data offered by the government or relevant departments and organizations.

3 Digital Social Innovation

3.1 Definition

DSI is the best solution to city life problems in the era of information. Science and technology have provided guarantees for many unimaginable and undoable things, making efficient and large-scale innovations possible. Today, at a time when urban lifestyle is so fast, science and technology has become more and more essential as a tool of assisting social innovation. DSI is one kind of social innovation that is based on Internet or uses digital ways. Its purposes are to improve the life quality of different groups and help raise different solutions to the same problems in digital way.

NESTA had defined DSI as “a type of social and collaborative innovation in which innovators, users and communities collaborate using digital technologies to co-create knowledge and solutions for a wide range of social needs and at a scale that was unimaginable before the rise of the Internet” [34].

In a report of NESTA [13], they proposed six areas of DSI, which are open democracy, open access, collaborative economy, awareness network, new ways of making and funding acceleration and incubation. Also they said that the technology focused on open hardware, open networks, open knowledge, and open data.

We define DSI in the urban context as a type of social innovation in which all of the society members get involved both physically and digitally through using digital technologies to co-create and co-design our neighborhood.

3.2 Features

We have concluded seven features of DSI through research and practice. They are from the seven aspects shown in Table 1. The seven features corresponding with the seven aspects come out in pairs, complement and reinforce each other. According to

Table 1. Features of the 5 typical DSI cases

Aspects	Yibo	Hello Happiness	Pugedon	Yitu	FixMyCity
Deliverable	Noncommercial advertisement platform	Pay phone	Recycling machine	Map platform	Citizen reporting platform
Generation	"404 not found" web pages Web technology	Pay with Coca-Cola bottle caps instead of coins	Put in plastic bottles Get pet food	SNS Computer-assisted data analysis Information visualization	Mobile application Web technology SNS Computer-assisted data analysis
Service Model	Online	Offline	Offline	Online	O2O
Object	Broad audience NGOs	Migrant workers	Stray animals	Grass-roots Widespread NGOs	Broad audience Responsible local authorities
Orientation	Broadcasting noncommercial advertisement	Free IDD	Environmental protect Care for stray animals	Map-based solutions for social issues	Connect citizens with authorities
Approach	Open UGC	Customized	Recycling	Open source UGC	Open source Expandable UGC
Operation	Simple operation Free	Free	Free	Simple operation Free	Cross-platform Free

Grounded Theory, the features are the substantive theory that we get from the primary data. Through practicing and validating, they gained great guidance to classify the researches on DSI.

Platform/Product. Solutions can self-generate or be improved by users on the platform and are open to many other users. A product is effective, professional, complete and validated. Usually, due to unprofessional quality or financial problems, a product comes out at the situation in which users cannot inefficiently find the solution.

Original/Reformed. Science and technology has changed our behaviors. An exited and effective social innovation will become a new DSI after digitally reformed. The development of technology has broadened our horizon and motivated social innovation. Whether social innovation is supported by a completely new technology or a combination of existing technologies, it's all original DSI.

Online/Offline. The application of Internet can be seen in almost every case of DSI. Online means state of connectivity. Offline means real activities or events. The offline part shortens the distance between innovation result and real life, while the online part provides chances for creating new business models and solutions.

Collective/Individual. Collective intelligence helps us solve complex human problems. Crowdsourcing and crowdfunding have already been new modes of generating and incubating innovation. "Collective" means the DSI is executed by the whole society, such as crowdsourcing and crowdfunding. While "Individual" means the DSI is initiated or executed by one person.

Result/Process. Results-oriented DSI emphasizes the final output – a solution or a product. While process-DSI emphasizes the middle output. It can be data or social network between the participants generated or established in the DSI process.

Open/Customized. Open indicates transparent data, self-generation, low threshold and broad audience. While customized stands for DSIs that have special requirements, targeted audiences, and experts.

Light/Heavy. Light operation means less or none cost and manpower resources, using freely, and operating simply. Heavy operation means complex development and maintenance.

3.3 Design Framework

Based on the SET factors [35], which are social, economic, and technology, we categorize the features. Then we get the formal theory, a standard DSI design framework, as the guide of our practice to evaluate the sustainability, economic benefits, and efficiency during the process of studying and practicing DSI cases. We summarize them as four evaluation indexes in our DSI design framework based on what we have learned from Tim Brown's Design Thinking [36]. The four evaluations indexes are desirability, viability and sustainability, and feasibility (Fig. 1).

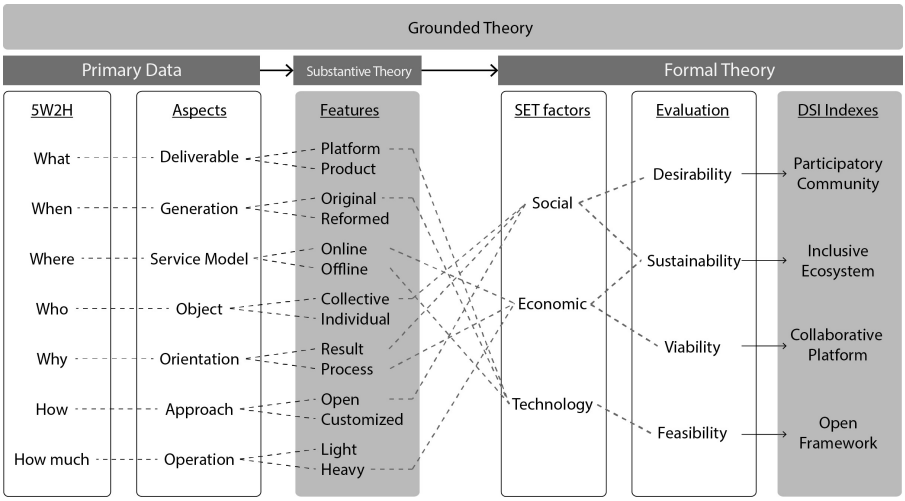


Fig. 1. Design framework of DSI

From the perspective of DSI, social desirability is about building the participatory, vibrant community to support the humanized innovation. Social and economic sustainability means it's an inclusive ecosystem that can create sustaining social values. Economic viability means aggregating the physical and digital resources to build the collaborative platform. Technology feasibility means it's an open, flexible framework based on the new technologies, such as social media, big data, and crowdsourcing. In conclusion, the four indexes of DSI are participatory community, inclusive ecosystem, collaborative platform, and open framework.

3.4 Project Practices

To explore the opportunities and services for social innovation and sustainable design patterns in the urban context, we cooperate with NGOs and public institutions to help the students to build a better concept of society problems and find the real demand, and in the same time, we apply our framework for generating solutions. There are 3 examples from the class below.

Case1: Urban Walkability and Walking Experience.

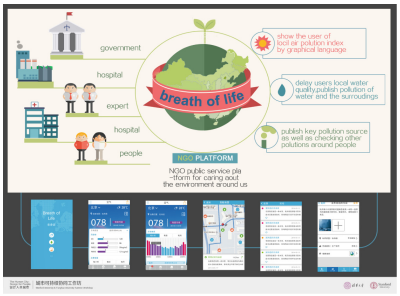
Urban walkability is a problem concentrated on sustainability of future cities from a macro perspective, and it can determine the citizens' life quality and living cost (Fig. 2).

Case2: Open Air Quality Platform for Government.

The haze and smog can directly damage human respiratory system. On one hand, limiting the airborne pollution is an important aspect; on the other hand, the communication among government, enterprises and public has a significant meaning (Fig. 3).

Description	Features	Evaluation
Through crowdsourcing, inspire citizens to participate in and spread the concept of walkability. Based on UGC, put forward scientific advices for city development, and make the measurement of walkability more meaningful.	Platform Original Online Collective Process Open Light	Participatory Community: ★★★★☆ Inclusive Ecosystem: ★★★★ Collaborative Platform: ★★★★☆ Open Framework: ★★★☆

Fig. 2. Urban walkability and walking experience – Walkability APP

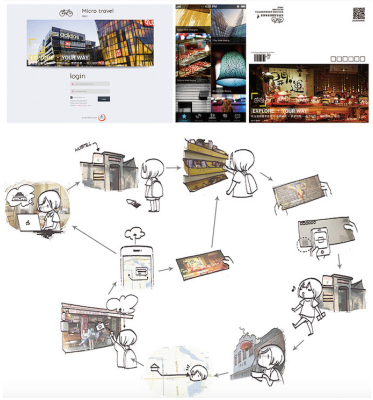


Description	Features	Evaluation
Using open data, establish an interactive relationship between the government and the public. Through crowdsourcing, the citizens can collect and upload the pollution source. Based on the map, the government and environmental organizations can upload the solutions and arrangement of environmental protect.	Platform Original Online Collective Process Open Light	Participatory Community: ★★★★★ Inclusive Ecosystem: ★★★★★ Collaborative Platform: ★★★ Open Framework: ★★★

Fig. 3. Open air quality platform for government – breath of life

Case3: Youth Hostel Service Design.

Youth hostel is a microcosm of society, which has a close relationship with youth's attitude and manner toward life. It also includes many elements: travel, making friends and accommodation (Fig. 4).



Description	Features	Evaluation
Establish a mobile app, which can socialize and share travel information. Targeting the users of the youth hostels, it provides the opportunities to find common interests and make cooperation during travelling.	Platform Original Online Collective Process Open Light	Participatory Community: ★★☆ Inclusive Ecosystem: ★★★☆ Collaborative Platform: ★★★★★ Open Framework: ★★★★☆

Fig. 4. Youth hostel service design

4 Discussions and Future Works

During our study and practice, we did a lot of research on existing related methods and tools that have already been used and practiced thousands of times. By combining and recreating them, we make our own DSI methods and tools for college students in our courses. In order to validate them in real urban context, we conducted some projects together with NGOs and other society organizations. As shown above, our projects have standardized process and completed result. Because of our expertise, our results are drawn mostly from design concern.

After this, we still have other valuable things to do:

- Firstly, build a DSI sharing platform for the organizations and companies who are planning to do DSI. The platform will contain large quantities of DSI cases and related data, which will be quite helpful for those organizations and companies especially startups. Of course there will be a committee to supervise the platform and keep it working by certain rules. If some groups profit from the platform, in return, they will share their cases and data on the platform.
- Although DSI has the social attributes, we can concern the micro aspect of the whole DSI process – the innovation groups. How to make the group more efficient and more creative is the key point. We need to discover what tools, platforms or specialties influence DSI results and how they influence.

5 Conclusions

Starting with the definition of DSI, we used case study to conclude the features of DSI, and on the basis of these features we developed the DSI's framework used on urban context. Referring to the course practices cooperated with Stanford, we practice and confirm the relevant method, and so that we believe the conclusion have the guiding significance. We will continue perfecting and verifying our conclusion and pay attention on development and promotion of creativity of innovation participant. Also, we will develop more distinctive products and services for society.

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