Chapter 17
Understanding the Context of Design for Social Innovations: A Methodological Case Study

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ABSTRACT

The chapter describes the applicability of designers to the space of finding solutions to social issues through the generation of social innovations. Based on a literature review, it was evident that design requires new methods to apply to the resolution of social issues, and as such, this chapter presents a new method that supports designers in the development of solutions within the design for social innovation (DfSI) framework. The proposed method consists of six stages: (1) identifying the challenge, (2) analyzing the system in which the challenge co-exists, (3) understanding the system using user-centered design techniques, (4) defining the design brief, (5) generating proposals, and (6) evaluating and concluding. The chapter also introduces a design case study that describes in detail the implementation of the design method. The results indicated that the method supports designers to structure their process when aiming to design for social innovation and in particular to define the potential solution, which is reflected in a design brief.

INTRODUCTION

Social innovation is significant to the addressing of local and global challenges that seek the common good and this may explain its current interest in academia and practice. Research has identified that there are differences between social and economic innovation, showing that social Innovations aims are often harder to measure and require thinking up-front to compare them. In the field of design, the influence of social innovation is acknowledged as Design for Social Innovation. At present, it is unclear how the differences between Social and Economic Innovation impact on the design process.

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This manuscript describes Social Innovation as the management of a social mess, a type of wicked problem associated with social mechanisms that are typically difficult to define and also difficult to resolve, however, the aim is particular, to create a common wealth and enhance society's capacity to act (Murray, Cualier-Grice & Mulgan, 2010). To address the latter challenges, up-front homework is undertaken in order to fully understand the social mess, including the contextual complexities that are discovered during the important Fuzzy Front End. Designing as a part of Economic Innovation, and designing as a part of Social Innovation are not identical, they require different methods to manage the different types of fuzziness and developing an open brief that cuts through the complexity in order to develop a clear context within which the designing can occur. The fact that each type of innovation requires particular approaches does not mean that there aren't overlaps exist in the undertake of specific design tasks, e.g. ideation, or that designers that focus on developing Economic Innovation cannot work on Social Innovation solutions and vice versa.

The aim of this chapter is to introduce a design method to support designers in the development of Social Innovation. The method focuses on supporting designers in defining the design brief when addressing a social challenge. Thus, the method focuses on the Fuzzy Front End of Innovation. The method is explained in detail and a case study is introduced to report its implementation.

To define the overall context of this research it is important to discuss basic concepts that help to frame this particular project. For instance, this manuscript addresses the following issues: wicked problems, the fuzzy front end of innovation, the development of an open brief, and theoretical issues in design methods.

BACKGROUND

This section demands conceptual and contextual clarity, especially in the definitions and characteristics of much researched Economic Innovation and its comparable peer, Social Innovation. The understanding of their differences will be achieved through a cross-comparison of the two concepts, starting with the more familiar Economic Innovation.

Differences Between Economic and Social Innovation

Generally, Innovation is seen as the successful exploitation of new ideas (Cox, 2005), and can also be defined as any departure from existing practice (Schumpeter, 1934). This is largely considered in terms of trends, such as consumer, organizational, or financial. This innovation process that takes a creative concept and makes it somehow concrete and pragmatic goes beyond simple creativity because innovation is relatively valueless if the idea remains in its abstract creative form. It is unusable, therefore has no applicable user.

The nature of the change or break in trend is typically what defines the type of the innovation, and these various types, include but are not exclusively Economic Innovation and Social Innovation (see Franz, Hochgerner, & Howaldt, 2012 for a thorough discussion). Economic Innovation seeks changes in consumer or organizational behavior within an economic system or network that may eventually lead to a financial reward. In comparison, Social Innovation seeks changes in Social Behaviour within a social system or network. This is introduced by the works of Schumpeter who suggests five methods by which innovation can occur with the outcomes being consumer market disruptions (Schumpeter, 1934); these are measured by financial changes experienced by the organization to characteristics such as profit and

growth. Social Innovations in comparison generate, through trend-breaks, disruptions in social systems and ultimately lead to the delivery of social benefits. An example of such a Social Innovation would be the acceptance of household recycling during the 1990s where the benefits are often unquantifiable or immeasurable, and may be perceived to have no economic benefit or possibly seen to be uneconomic (c.f. landfill disposal of plastics).

The true definition of Social Innovation is perceived as being a fuzzy notion with other perceived differences between it and Economic Innovation as being directly linked to the involvement of stakeholders and differing activities (Djellal & Gallouj, 2012, p. 121). Djella goes on further to suggest that Social Innovation is perceived to be a wider topic than economic innovation is often seen as a lot closer to the users (Djellal & Gallouj, 2012). As such the usual go-no-go decision gateways as used in economic innovation would be difficult because there may be qualitative, rather than quantitative output characteristics (e.g. A business case may not have clear financial outcomes) (see Cooper & Kleinschmidt, 1986). On the other hand, in Economic Innovation the consideration, or assessment, aspect relies upon financial discussions and projections when considering the business case for continuing the development. These often do not exist in terms of Social Innovation, where the benefits are harder to quantify.

Wicked Problems, Messes, and Social Innovation

It is evident from the literature that different researchers and policy writers have looked into the problems associated with social issues and have generally come to a consensus that they can frequently be categorized as something called a wicked problem (Conklin, 2005; Rittel & Webber, 1973; see also Zwicky, 1969). These so called wicked problems or social messes came originally from studies into the complex area of social planning, another area of government policy (e.g. Environment, social care, homelessness, climate change, et cetera). In an example case of urban pollution, there are issues such as the frustrations aimed at the production of airborne car pollutants caused by a social trend in the use of petrol or diesel vehicles. In another example case of social care, there are issues about the intransigence in the resolution of urban homelessness within developed countries. Although not immediately obvious, many design problems are also seen to be characterized by wickedness (Lawson & Dorst, 2009, p.40) and resolution of these problems is a skill set already developed in design practitioners. It is, therefore, an important research area to look at how designers apply their skills to managing these social issues most effectively.

These so called wicked problems avoid delineation and understanding of causation; completely hiding their problematic nature (Rittel & Webber, 1973), and according to the philosopher Churchman are characterized as having thoroughly confusing outcomes. This is caused by unclear and complex information, large numbers of clients and decision makers with similarly large numbers of opinions, which are often contradictory (Churchman, 1967). The implication is that these problems are difficult to resolve. Social Messes, a type of wicked problem with a closer association with planning problems in social systems, are seen as being unclearly defined and ambiguous (Ackoff, 1981) and additionally are seen as being reactive to attempts to resolve them (Ritchey, 2011b). As such many social issues are also social messes. These are a form of wicked problem, which means that the relationship between determinants and the outcomes is clouded (Ritchey, 2011a). Ritchey more specifically states that they "defy efforts to delineate their boundaries and to identify their causes, and thus to expose their problematic nature" (Rittel & Webber, 1973; Conklin, 2005). This is typical because of emergence from an underlying highly complex or chaotic model, such as a social system.

At a holistic level, wicked problems are complex, ambiguous, and uncertain. Researchers have sought to categorize methods that manage the complex aspects of wicked problems (see Roberts, 2000). Roberts has suggested that solutions can be:

- Authoritative, where the complexity is reduced by limiting the number of stakeholders, thereby reducing the size of the system model;
- Competitive, where the ambiguity is reduced by allowing two or more teams to develop competing solutions based upon their own interpretations of the model;
- Collaborative, where the complexity is reduced through agreement upon the interpretations of the underlying system.

Although useful as categories, these methods are frequently used in parallel within the design process, for example where designers seek to simplify and prioritize the requirements (authoritative), retain parallel opportunities (competitive), and work with other groups to determine the best possible solution (collaborative).

Within design research, it is common to see all problems as wicked and 'indeterminate' due to the lack of specific focus of the subject of 'designing' (Buchanan, 1992); with design research, in general, seeking to improve the expertise of designers and effectiveness of methods associated with these wicked problems. Social messes and design problems require specific methods to discover understand and model the underlying behaviors of the users, and such a framework is User-centred Design. These methods and skills that fundamentally are in demand in design are those that allow them to manage the complexity, uncertainty, and ambiguity that describe wickedness.

Design, Innovation, and Wickedness

Designers are in their most basic form concept-generators (Yilmaz & Seifert, 2011) and are skilled in bringing together unstructured and mercurial environments in a meaningful way through the use of methods such as ideation. But the role of the designer is not clear in Social Innovation because the role of the designer is not clear in innovation generally. Several researchers have tried to address this including Manzini who seeks to understand the role of the designer within the social process (Manzini, 2014; Manzini & Coad, 2015). This obfuscates further the outcome of the economic innovation process that is typically focused upon making money. In comparison, the outcome of the design process could be far more varied, including the making of an elegant and timeless artefact. The role of the designer within innovation is important though, largely due to their non-creative skill set of being able to take the undefined and make it defined.

In real terms, Social Innovation, like Economic Innovation, can and does occur independently of design. There is no demand to have designers involved in the process; however, this is not to say that the skill-set of a designer is not important in the successful delivery of innovation, as they are seen to be solvers of problems. Complicating matters further is that Innovation and Design, although lazily used as similar terms, are very dissimilar activities that are often conjoined and aligned in their goals, but not always. Economic benefits of a nicely designed sculpture or a well designed park may add cultural value to a space within which people can enjoy say their lunch breaks, again are often hard to quantify.

Based on the work of Nigel Cross this manuscript argues that designers have skills to address wicked problems. Cross describes designerly thinking in terms of six key activities (Nigel Cross, 2006, p. 12).

These are: (1) dealing with uncertainty, (2) decision making on the basis of limited information (e.g. Decision making in uncertainty), (3) resolve ill-defined wicked problems by adopting solution-focusing strategies (e.g. Managing ambiguity and complexity), (4) employing creative/productive thinking, (5) using graphic or spatial modelling media (e.g. Structuring complexity). It is evident from the first three of these ways of thinking that they support working with wicked problems as designerly thinking involves working with uncertain problems that are complex and ambiguous (Lawson & Dorst, 2009, p. 33). As such designers are incredibly well placed for resolving them using methods and styles of thinking. Another method used by designers in navigating social messes is the framing, reframing, reformulation, and organization of ill-structured problems (Lawson & Dorst, 2009).

In addition to previously mentioned skills, designers are adept in building an understanding of social networks thereby partially unpacking the context of a social mess (Cross, 2006). This complicates the problem further with designers considering the subjective opinions and beliefs of each of these individuals (network-nodes). However, they still are capable of bringing together stakeholders during the early phases of the design activities into a coherent mass, which is most difficult during the Fuzzy Front End.

Design Briefing as Part of the Fuzzy Front End

The Fuzzy Front End is an important aspect of the innovation process as it embodies the initial undefined and ambiguous parts of the innovation process that organizations often fail to properly understand. This is in part because of the unstructured nature of these predevelopment activities (Cooper, 1994). The characteristics of the Front End make it dynamic, unstructured and with very little formalization (Murphy & Kumar, 1997). As such this requires a new skill set that is not commonly held within the risk-averse world of management where characteristics such as repeatability and dependability are rewarded. This leaves many economic and social organizations unprepared for the Fuzzy Front End and as such makes it more important as a research focus. The Fuzzy Front End is defined as being when an idea is initially considered as worthy of further consideration and ends when the business considers it suitable for development (Kim & Wilemon, 2002). Khurana and Rosenthal further describe this phase in a more holistic sense, as being an intersection between several key activities: the processing of complex data, managing conflicting organizational forces, coping with large amounts of uncertainty, and combining cross-functional desires and demands (Khurana & Rosenthal, 1998). These uncertainties, complexities, vagueness and incomplete information pose a threat to innovation models that currently exist within organizations (Cooper & Kleinschmidt, 1986).

In the design process of concept generation, there is a need to have a direction that evolves during the duration of the design process, and this is typically referred to as the brief. The briefing is important in Social Innovation because, like in Economic Innovation, the starting point of the endeavor could be very fluid and undefined. The briefing is a method used by the designer to structure and delineate the activities in opposition to the mercurial and complex nature of the environment (Lawson, 2005). The briefing process allows the gathering and structuring of customer needs and constraints, something that is seen as being a vital activity in under-determined design situations problems (Lawson & Dorst, 2009, p. 42). This structuring of inputs to the design process can originate from something so simple as a statement of intent or a mission statement that can be embryonic to the entire design process, in addition to being reinterpretable (Ambrose & Harris, 2009).

Some designers see the brief as simply the client's requirements (Ambrose & Harris, 2009). In many cases, designers do not deal with briefing development because the design task starts with the brief from

the client (Crilly et al, 2009). Design problems, especially within the early phases of design and also the Fuzzy Front End, often cannot be clearly stated and so open briefs are vague, are not uncommon and vary in what they contain (Lawson, 2005). Lawson explains that one issue is that designers are adept at crafting the design problem and so prefer to be included from the very beginning of the project in order to develop a meaningful brief, from what could be as small as a statement of intent. The brief can often be only a few pages in length, however, the task of building the brief and adding the detail is what is of most value to the designer (Lawson, 1994). This process of determining what the actual problem is allows the designer to start from fuzziness and end with concreteness (Ambrose & Harris, 2009). In terms of categories, design briefs mainly come in two varieties: open briefs and closed briefs. Open briefing is the design method where the designer is able to have greater interpretation and designer assembles information from the design process such as requirements, constraints, and allows the requirements and desires to be absorbed in a more gradual rate following a slower rate of discovery (Franck & Sommaruga Howard, 2010). In contrast, closed briefing is where the outline, goals, and delimitations are clearly defined from the outset, and often both the user and designer are clear about what is to be delivered. Research related to briefing development has focused on Economic Innovation, thus research might ask, how effective is briefing in the context of Design for Social Innovation?

Briefing is one of the key aspects of designing and embodies the building up of knowledge about the situation. The designer can then look at this design situation in multiple ways and allows them to take 'stabs' at the design problem from many different perspectives (Lawson & Dorst, 2009). This, in turn, helps identify the design task that latter will be defined in a brief. Without a clear understanding of this design situation it reduces the effectiveness of the design process, and in the case of social problems, this may reduce the effectiveness of the overall design process. Understanding the situation or environment into which the design project has been placed is an important activity for the designer, if not because of the situation factors that originate from the environment directly (Kim & Wilemon, 2003). In response to these factors, the environmental discovery typically is described by periods of research. Examples of activities within this period include ethnographies, which aim to reduce to 'objective seperatedness' between the designer and the user (Guba & Lincoln, 1994; Christensen & Raynor, 2003). This provides the designer with a clear understanding of the day-to-day practices of the user and allows them to effectively frame the interactions with the future artefact.

The Fuzzy Front End in Social Innovation

This section combines two important concepts in Innovation that are characterised by uncertainty, complexity, and ambiguity, and these two concepts are the Fuzzy Front End and Social Innovation.

The concept of the Fuzzy Front End has been addressed to show its fundamental role in innovation in general and Social Innovation in particular. In the specific context of Design for Social Innovation, this manuscript has identified that there are many examples of design solutions and good practices to consider for social issues in designing (Papanek, 1985; Witheley, 1997; Manzini & Coad, 2015; Tromp and Hekkert, 2016; Ortíz Nicolás, 2016a). However, there are few studies that report a proper method to design them. The few examples that address this issue identify basic steps that should be considered; e.g. engagement, assessment, planning, implementation, evaluation, and termination (Margolin & Margolin, 2002). Other methods focus on similar areas such as behavioral change (Tromp, 2013), which is

arguably similar. These methods can be improved if designers are supported in the Fuzzy Front End to identify relevant tasks within the context of addressing a social challenge, which is usually a wicked problem. This task later will be synthesized in a brief.

Theoretical Issues in Design Methods

To complete the literature review it was deemed important to have a brief report of relevant findings in the area of design methods.

Schön carried research into the field of design, and in particular focussed upon how people generally learn to design (Schön, 1987). He synthesized his findings in the concept of a 'reflective practitioner', which is a role embodying the importance of conscious reflection, especially within design practice. Schön's idea is in line with the synthesis that Daalhuizen (2014) has made in terms of the benefits that new method usage has in design practice:

- Extend the ability to design, e.g. based on methods that address particular issues, as in this case Design for Social Innovation.
- Enhance reflection on design, e.g. improving designer's expertise on the design activity
- Enhance learning to design, e.g. developing capabilities or awareness and strengthening of existing ones.

It is also relevant to mention that research into methods presents some novel challenges, for example, Dorst (2008) argues that design research aimed at directly improving the design process through methods often ignores the subtle differences between designers, differences between design contexts and the differences between the overall future design outcome. Improvements in methods focus upon generating efficiencies and increases in effectiveness for the inclusion of the people who implement them. Therefore, an area of opportunity to improve design methods is to simply pay more attention to the opinions of method users (Daalhuizen, 2014). A similar situation occurs in Social Innovation where it is important to increase the speed of Social Innovation (Mulgan, 2007), seemingly to reduce the risk of a failed delivery. Within Economic Innovation the speed of the innovation cycle is equally as important for the same reason (Kessler, & Chakrabarti, 1996).

Research Aim and Question

A common way to enhance design learning is based on improving process and methods (Schön, 1987; Blessing & Chakrabarti, 2009). In order to enhance design learning, these new methods have to be experienced and appreciated by designers (Schön, 1987). It is widely accepted that methods that stay purely in the theoretical domain are failures. This research, therefore, aims to develop a method that assists the designer in Design for Social Innovation and focuses on the early phases of design, and more specifically during the Fuzzy Front End of Social Innovation. The remainder of this article describes the development of a qualitative case study to show the effectiveness of such a method within a Social Innovation project.

MAIN CONTENT

This section describes the development of a design method that relies upon the ecology model during the early phases of the design project. This method was then adapted and used within a case study based in a municipality in Mexico City. The discoveries from the method are presented within this section and discussed in terms of the benefits to the design process.

Method: Developing a Method to Design for Social Innovation - DfIS

In general, designers have routinely shown an interest in the social impact that their work has on other people and society e.g. artefacts, architectural spaces, or services. This interest can be traced back to the Eighteenth Century when John Ruskin (Ruskin, 1849) published his seminal work The Seven Lights of Architecture, in which he proposed to start social change through Art and Architecture. Another designer that emphasized the relationship between social issues and design practice was William Morris, a central figure in the Arts and Crafts Movement. He stated that designers' main purpose was to save society, and the way he proposed to do it was through the creation of useful objects for individuals. Furthermore, he encouraged designers to take responsibility with the environment through the use of local materials and forgotten production techniques, that were seen not to pollute as much as the industrial revolution's great machines. This is something that is equally applicable in the modern era when considering the polluting effects of producing the rare earth metals that are required for modern computing devices. His techniques were generally created through formal patterns primarily inspired by nature in order to be more natural in their effects.

This research was initially missing a key aspect; a generalized method for Design for Social Innovation, which would be used as a basis for the on-going research. The literature review involved the inclusion of different types of literature sources as the focus of the study is largely based upon design practice and as such should not discount sources that are from design practice and not just academic design theory.

It was evident that Social Innovation literature does broadly acknowledge the positive role that design might have on the development of its outcomes (Murray, Cualier-Grice, & Mulgan, 2010; Cajaiba-Santana, 2014). However, it is rarely reported exactly how the design process exists within Social Innovation, in part because it is rarely discussed where design fits within the greater Innovation process. Additionally, innovation processes rarely refer to briefing, which is a cornerstone of the design process. With this in mind, four key methods were identified that are relevant to discussions on Design for Social Innovation (DfSI). Three of these aimed to consider the social impact that design solutions may have; the other being more generic but it has potential to contribute to fulfill the aims of Social Innovation. Table 1 introduces the two general steps of the identified methods.

For each of the methods in the Table 1 important phases were unpacked in each; these phases were the Preparation phase and the Design phase. The Preparation phase includes the activities that designers have to carry out in order to understand and define the broader design challenge. The Design phase includes standard activities that are undertaken to deliver a design solution. In this research, the focus is upon the first phase, before the typical design process when the brief has not been developed and agreed.

Each of the models evidently framed the innovation process in different ways, making them subtly dissimilar in the way they categorized the activities. Firstly, Margolin & Margolin (2002) propose six steps to social design, and these are: 1) Engagement, 2) Assessment, 3) Planning, 4) Implementation, 5) Evaluation and 6) Termination. There is little detail for each step, however, it can be inferred that the

Table 1. Models of social innovation

	Preparation	Design
Margolin & Margolin (2002)	• Engagement • Assessment	• Planning • Implementation • Evaluation • Termination
Tromp (2013)	• Phenomenon • Social Statement • Behaviours	• Strategy • Design Proposal
Standarization (2010)	Understanding Users	• Involve Users in the Design Process • Refine and Evaluate • Iterative Process • Includes UX • Multidisciplinary Approach
Murray et al. (2010)	Prompts, Inspirations, and Diagnoses	• Proposals and Ideas • Prototypes and Pilots • Sustainability • Scaling and Diffusion • Systemic Change

two first steps are oriented to engage with a particular social challenge, and assess the situation. The other four steps are standard activities of a design process. Secondly, Tromp (2013) proposes five design steps: 1) Phenomenon, 2) Social Statement, 3) Behaviours, 4) Strategy, and finally 5) Design Proposal. This method starts by defining the phenomenon of interest, and then designers can define what they want to contribute to society and establish a strategy that will deliver such a solution. The method has a direct focus on the design phase, which is of interest to this research and as with any method, it focuses on a particular issue, which in this case is behavior. Social Innovation indeed considers behavior but also other broader aspects, such as interactions among different groups, e.g. intra-, inter-, or extra- group (See Cajaiba-Santana, 2014). The latter is relevant because Cajaiba-Santana (2014) states that in Social Innovation it is fundamental to understand not only how people act but also how they give meaning to their actions. Thirdly, ISO 9241-210:2010(E) (Standardization, 2010) introduces principles of User Centred Design (UCD), which include: 1) The design is based upon an explicit understanding of users, tasks and environments, 2) Users are involved throughout design and development, 3) The design is driven and refined by user-centred evaluation, 4) The process is iterative, 5) The design addresses the whole user experience, and 6) The design team includes multidisciplinary skills and perspectives. UCD can support Social Innovation to develop an understanding of the reality of people involved in a social challenge. Furthermore, many of the principles suggested by UCD are relevant to improve a design solution, for instance, evaluation is becoming a standard activity in professional practice. Fourthly and finally, Murray et al. (2010) propose six steps to Social Innovation, and these are: 1) Prompts, Inspirations and Diagnoses, 2) Proposals and Ideas. 3) Prototypes and Pilots. 4) Sustainability 5) Scaling and Diffusion, and 6) Systemic Change. This method is aimed at Social Innovation and that as such it broadens its scope in comparison to other three methods that are suggested by designers. For instance, steps 4, 5 and 6 are aimed at inserting the solution and maintaining it, while the first three steps are linked to activities that designers also consider in the reviewed methods.

The literature review helped to identify the following issues. Firstly, there are many examples that show how design can contribute to Social Innovation. Secondly, there are methods that can stimulate

Design for Social Innovation (DfSI). Thirdly, many of the activities that are suggested on the four reviewed methods are aligned to activities that designers usually perform. Fourthly, the preparation phase is vaguer in comparison to the design phase (see Table 1), which may in part be because the activities within the early phases of design are not as obvious to predict, especially when defining open briefs. Therefore, designers need to further develop skills or have access to tools that help them carry out the preparation phase.

Introducing a Method to DfSI

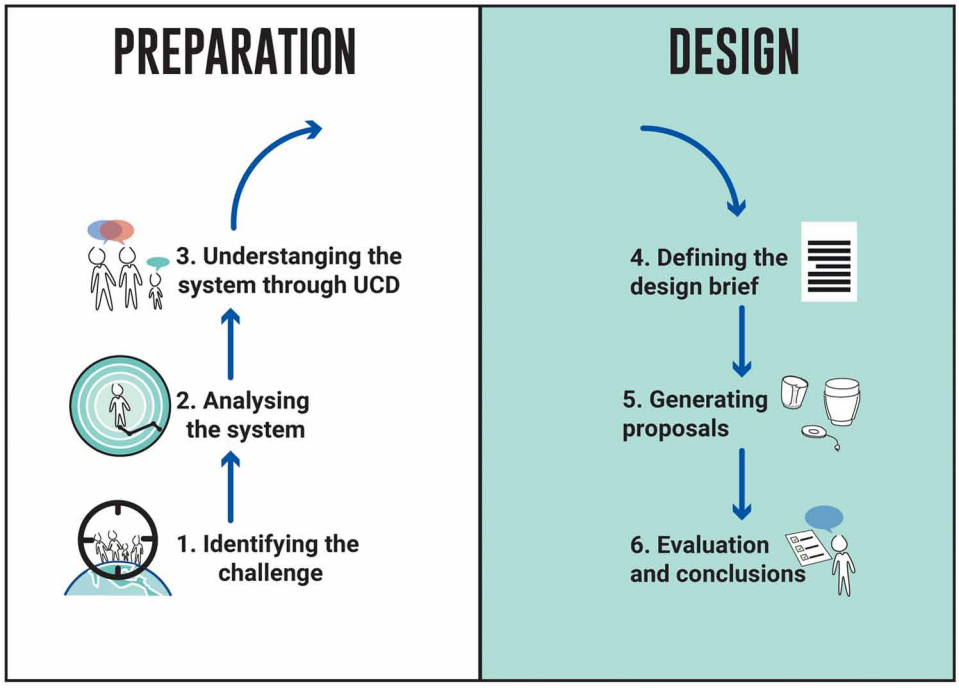
The development of the two phases introduced in Figure 1 was informed by the methods reviewed in the previous section.

Figure 1 shows that the DfSI framework is described by two general phases, which are named Preparation and Design. In the first of the two phases, different activities are undertaken to understand the social challenge. This includes an approximation of the people that are affected by the selected social challenge. This information leads to a clearly defined design brief, which is traditionally the start of the design activity.

Identifying the Challenge

This first step focuses upon the selection of the phenomenon. In México and Latin America, there are many social challenges presenting such phenomena, it is, therefore, an issue to consider if the discipline of design can address them. For an example, some major social issues relating to health are difficult

Figure 1. DfSI: A method to design for social innovation



to be dealt with the design because of their size. As such two aspects that can help select a relevant phenomenon are: a group of people really demands a need and it is a phenomenon that is meaningful for the designer(s). Some strategies that can be used to select the challenge are documentaries and electronic media reviews. It is common that local media report current social challenges, which have the potential to become the phenomenon to work with. Another strategy is to select a community to which design specialists belong to, or have as one of their interests, in order to identify non-covered needs, for example, NGOs. Papanek (1985) has also suggested general subjects that have social relevance, among them are: design for people with disability, design for human life under marginal conditions or a popular suggestion, design for the third world. Furthermore, Whiteley (1997) mentions the Lucas Plan, which strongly emphasizes on social responsibility, an example of this: be accessible and useful to everyone in the community and not confined to fulfilling the needs of the selected few (Whiteley, 1997, p. 108).

Whiteley also argues that designers or the people affected by a social issue are the ones who should define their priorities to establish what is produced. This is instead of leaving that choice to the market's forces that are generally oriented to consumption. This supports the use of UCD techniques to define a relevant challenge to be addressed in a particular community. Another guide that could help to select a relevant social phenomenon is the National Economic Development Plan of each country as each country has particular and relevant issues to be addressed. It is important to keep in mind that Social Innovation does not intend to help people generally; it instead aims to generate solutions with the community to consider and include their reality.

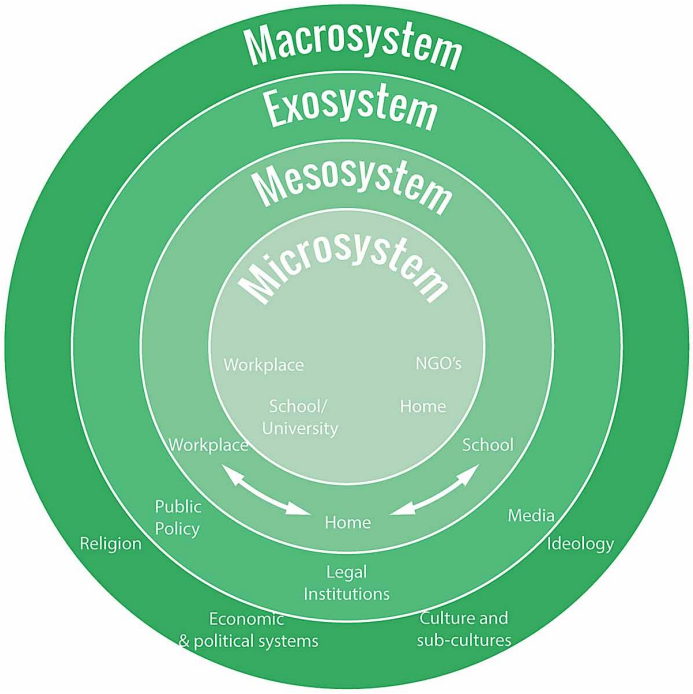
Analysing the System

The objective of this step is to define where designers work. This is important because a potential solution will be inserted into a particular context that has specific dynamics. To map the context this research relied upon the ecology model suggested by Bronfenbrenner (1995). Based on the fact that ambiguity plays a role in the preparation phase there is reliance upon the ecology model to define the level of intervention at which designers can work (e.g. it is unclear how to structure it and previous research do not report tools that could help a designer to more fully define the design brief). The decision to use the ecology model is based around the issue that many social challenges are perceived to be wicked problems (Manzini & Coad, 2015; Ortíz Nicolás, 2016). Furthermore, Forlizzi (2007) suggests that environments can be described in terms of their relative scale and complexity; their inhabitants can be studied at various levels including individuals and small groups (micro level analyses), organizations or neighborhoods (meso level analyes), and regions or populations (macro level analyses). It is fundamental for DfSI to explore potential solutions that could be inserted at different levels. This implies that many potential solutions can be developed for a particular challenge (e.g. diabetes) and with Social Innovation being highly contextual the ecology model helps develop understanding about these contextual conditions. To structure those potential solutions, designers can rely upon the four systems of the ecology model (micro-, meso-, exo- and macro- systems). In other words, the ecology model can help designers decide at which level they will develop a solution.

The ecology model includes four interconnected levels: microsystem, mesosystem, exosystem, and macrosystem. Figure 2 shows how such a system analysis can be presented with the most immediate aspect of the system. The context presented is a summary of the larger part of the diagram due to its immediacy.

In order to more fully describe the system map as shown examples will be used and first an example for a microsystem would be a family unit. A mesosystem is related to the different interactions among

Figure 2. The ecology model



microsystems, e.g. between a family and a school. An exosystem would include upper social levels, for example, those in which a regular person does not usually access where public policies are developed and this influences a community. An example is a policy affecting public education, which affects both the micro- and mesosystems. Finally, the macrosystem connects and goes through all the sub-systems from low to high order, such as cultural values that affect the family, community, and public politics. For a detailed description of the ecology, model see Bronfenbrenner (1995). Mapping a social challenge based on the four systems of the ecology model helps visualize the different factors that influence it.

Furthermore, it supports designers to define the level at which they will work (e.g. micro-, meso-, exo- and macro-) and understand to some degree the dynamics of the context. It also helps designers understand that solutions work at different levels, for example, a solution aimed at the microsystem will not necessarily work at the exosystem.

Understanding the System (UCD Techniques)

Once the area of intervention has been defined (e.g. micro-, meso-, exo- or macro- systems), the next step is to use User-Centred Design (UCD) techniques to grasp people's reality, especially those who are directly affected by the problem. If the potential solution will be inserted in the microsystem is relevant to interview, observe, talk to the people who are directly involved in the social phenomenon. This helps comprehend the different influencers of a particular social challenge. It is important to point out that designers should first develop a strategy in order to use a UCD approach, which should at least consider the study's goal, data collection method, and data analysis techniques. UCD is also useful in questioning designers' beliefs or biases. They may believe that creating a particular solution, based only on their

personal knowledge, will be good enough to address a particular social challenge. The dynamics of reality, however, make it really difficult to create plausible solutions without a deep understanding of context and people affected by a social challenge.

Defining the Design Brief

The fourth step of this method is to synthesise the acquired knowledge in a brief that describes the design task. The brief provides a guide to the design process. This step cannot be completed if the previous ones have not been concluded because they all inform the design brief. The general plan that is suggested is to establish the phenomena, then define the level of intervention (e.g. micro-, exo-, meso, or macro- systems) and finally understand the selected system based on UCD techniques. Based on the gained knowledge, designers can then more fully propose a particular design brief with a richer supporting argument. As Wendt (2015, p. 67) reports, framing problems and opportunities is a sense-making task. It involves finding meaning in the vast amount of observational data (e.g. a UCD technique). This research process generates a wealth of findings. Framing attempts to make sense of them and develop a coherent point of view for the designer to adopt.

Generating Proposals

Once the design brief has been generated, designers can use it to produce and explore alternative solutions. This describes aspects of a typical design process that can include sketching, mock-ups, and prototypes. The main issue in this aspect is to respect the spirit of the design brief. As in any design process, it is important to develop many solutions, this helps designers reflect on the pros and cons of each of them and select the one that fulfills the brief. At the same time it also helps designers to better understand the challenge that they are addressing (Wendt, 2015).

Evaluation and Conclusions

As in any iterative process, once a potential solution has been developed, it is expected to evaluate it with its potential users as a quality measure. This can deliver users' feedback and will help refine the solution before inserting it into the context of use. The evaluation process has to be prepared in advance to avoid pitfalls. Another important final step is to report the main lessons learned during the development of the project. This can help other designers or people interested in the development of similar projects.

Case Study: Social Innovation in Xochimilco

To offer more detail to the implementation of the method that was introduced in the previous section, a design project case will now be detailed. This project was the result of a university module delivered at the Design School of Industrial Design at the National University of Mexico (UNAM). The aim of the module was to implement Design for Social Innovation and was divided into 15 sessions of two hours per week. The first author assisted them with the implementation of the method using the structure shown in Figure 1. Three undergraduate students from the industrial design programme developed the design project. While the method initially seemed linear, when put into practice, it was very dynamic due to the project's complexity and the students' reflections on the method's implementation.

Identifying the Challenge

Within the challenge identification stage, the students expressed an interested in addressing one of the several issues that exist within their hometown community; the municipality of Xochimilco in Mexico City. In particular, the designers worked on the farming production in Xochimilco's Chinampas. A Chinampa is small floating land that farmers create over lakes and canals and at present, the Chinampas are used to cultivate flowers and vegetables. This farming technique has been used in Mexico City since pre-Hispanic ages for its effectiveness. However, its use has diminished over time.

Analysing the System

Once that the general phenomenon was defined the designers were introduced to the ecology model in order to assist in the analysis of the system. This helped them to develop a system map (see Figure 3), which offered a general overview of the identified relevant issues in the Municipality of Xochimilco. These included the number of inhabitants, the regions into which Xochimilco is divided, the products that are produced in the region and many of the cultural attractions and academic institutions. The map also includes information about particular farming activities, for instance, the students realized that Xochimilco is divided into three zones: the Mountainous zone, the Chinampera zone, and the Touristic zone. Farming was identified as a concern to all three zones and as such occurs was chosen to be the axis of the process.

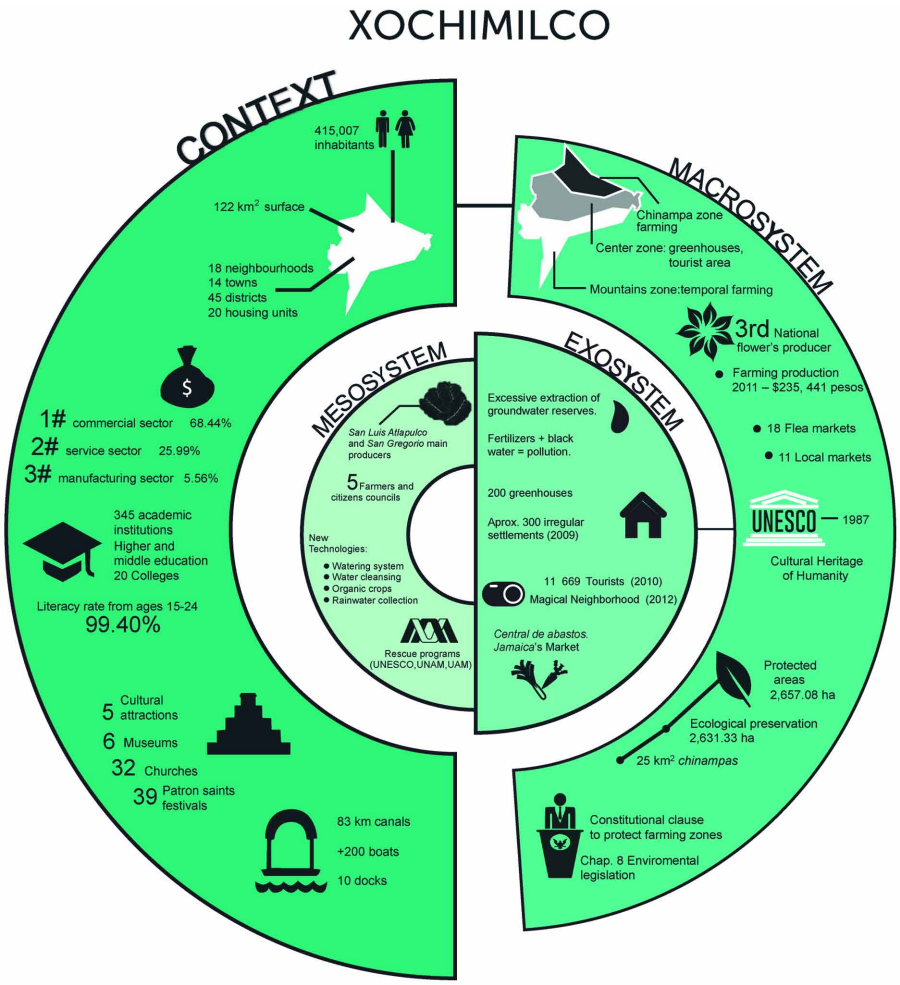
By further utilizing the ecology model the students were able to decide to exclude the microsystem. Thus, they established to seek a social solution that could be embedded into the other interactions that affect farming in Xochimilco. Based on the gathered information from the different sources, e.g. news, records of Xochimilco's farming activities and informal observation, the students decided to work on the mesosystem. They identified an opportunity in the interactions that occur among canals, Chinampas, and farmers.

Understanding the System (UCD Techniques)

Having built and analyzed the system using the ecology model, which helped define the level of intervention at the mesosystem level the students prepared an interview to gain deep knowledge about farming in Xochimilco. Interviews used as a popular UCD technique to understand users. The gathered data allowed them to identify several challenges, for example, students identified that farmers needed a device to plough the Chinampas; tractors cannot be used because they are very heavy and can destroy the foundation structure. Figure 4 presents identified general problems and areas of opportunity, such as something that designers did not realized before of the interviews was the role that irregular settlings have in the pollution of water. How this is affecting the ecosystem of a landmark animal of Xochimilco, the Axolotl, was a key finding.

Designers also identified that the irrigation water was directly extracted from Xochimilco's canals. This water was polluted because the canals receive water from the sewages of irregular settlings that are located in Xochimilco, some of them in prohibited areas. At this point, designers acknowledged that canals' non-treated water was a central problem in the municipality of Xochimilco. The polluted water not only affected farming but also inhabitants' health. Based on designers' observations it was identified that locals used homemade filters to reduce water's pollution. Considering that a key issue

Figure 3. Xochimilco's systemic analysis (environmental awareness map)



on the overall challenge was water pollution designers decided to further develop a water filter aim at irregular settlements

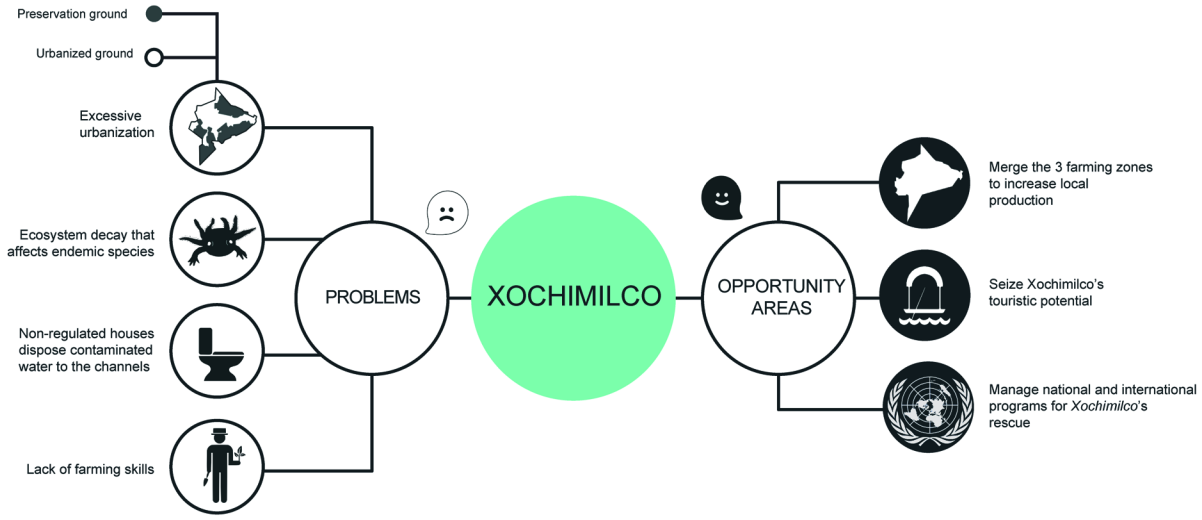
It was important to reflect that at this point there was a significant shift, which was strongly based on users' input. Students defined to focus on a particular phenomenon: farming in Xochimilco. However, based on the different activities that were undertaken they realized that there were other challenges that affected not only farming but also the ecosystems and its living flora and fauna. Considering that this was a key issue to be addressed, students decided to refocus from farming to cleaning polluted water.

Defining the Design Brief

Based on an extensive analysis of current problems in the municipality of Xochimilco, in particular in the Chinampas' zone the brief of the design project was defined as follows:

To design a filter that can be connected to sewers from irregular settlements that drain polluted water to Xochimilco's canals. The sewers are variable in diameter, which is a condition that the design would

Figure 4. Detected design challenges



have to take into account. Furthermore, the filter's materials have to be easy to access, maintain and use, and cheap to replace.

Generating Proposals

Once the design brief was defined designers were basked into their comfort zone. They started to develop solutions that aligned to that brief. In this particular case, several solutions were developed and one of these options can be seen in Figure 5.

The filter, in Figure 4, included four trays with natural and artificial materials, for example, stones or plastic pellets. Each tray aimed to clean the water at different levels, from Residual to Biological. The Residual filter consisted of Tezontle, a porous and available volcanic rock that can filter large particles (e.g. litter, insects). The Biological level was based on materials that attract bacteria (in tray 3) and plants (tray 4). This idea also considered that the filter had to be cleaned and the trays could be easily removed once that the filter was located in place. Areas of improvement within this solution included the connector system; most sewage pipes are circular and consist of different diameters, and the solution has to adapt to this requirement. The design solution was further refined, however, it was decided to present this solution because as in any design process it is important to develop different ideas.

Evaluation and Conclusions

The filter that was developed as a solution to the selected challenge in Xochimilco was introduced to the community that was aimed to, people who lived in irregular settlements. The feedback was positive and their feedback was used to refine the solution. The solution, however, was not progressed beyond the design phase as it had fulfilled its educational purpose.

The case study aims to show how the method introduced in the previous section can be adopted by a group of designers when aiming to design for social innovation. Based on the analysis of existing meth-

Figure 5. One of the first design proposals

ods, it was identified that there is fuzziness in the definition of a design brief. It can be understood why a particular phenomenon has many potential solutions. To define the most relevant, within the terms of a design module, it relied upon the ecology model to define the level of intervention, in the reviewed cased it was the mesosystem. Then, it sought to grasp the complexity that affects the selected phenomenon through users' interviews. The gathered data redefined the focus of the project from farming to cleaning water. The particular case showed how designers identified different challenges and decided to focus on the one that they believed that was the most significant to the challenge at hand. It also showed the relevant role that designers can play in the implementation of design methods. In particular, the designer reported that to improve the method's implementation, it could be useful a set of examples of different social challenges and structured on the four systems of the ecology model.

DISCUSSION

The aim of this research was to introduce a method that assisted designers during Design for Social Innovation. The method focused on the early phases of design and more specifically during the Fuzzy Front End of Social Innovation. This aim was fulfilled based on the case study introduced. It details the different method's steps, and emphases on the preparation phase, which includes the Fuzzy Front End. It is acknowledged, however, that other means may be necessary to validate the introduced method. This is a first approach from industrial design to structure designers' thinking when developing social innovation projects.

It has been reported that methods consist of information – describing the structure of certain design phenomena – which needs to be taken in and be transformed by its user in order to be effective; a pro-

cess that is called learning (Kolb, Boyatzis, Mainemelis, & others, 2001). The designers' opinion and experiences, however, are often ignored when design methods are evaluated (Dorst, 2008). This study acknowledges the designer's central role in the use of the DfSI method based on their use, guidance, and evaluation. In other words, the designers used the method, were guided when needed and delivered a particular solution. They also evaluated the solution and acknowledged the social influence that it had. Furthermore, areas of improvement were identified, e.g. collecting a set of examples of different social challenges and structuring them on the four systems of the ecology model. To further develop gain insights linked to the method's implementation the authors will structure this discussion based on the three aspects that impact on methods: designers (users), design task and the context in which the task is performed.

The users of the method were undergraduate students of industrial design and they could complete and deliver a solution as a result of the use of the DfSI method. It is acknowledged that the expertise of novice designers (Lawson, 2005) has an impact on the results; for instance, they are starting their professional education and have very little experience within design practice. Other designers, e.g. professionals, may rely upon particular strategies to develop a concept once that it has been defined (See Cross, 2004). Similarly, their experience may help them analyze data more effectively, develop creative solutions or keep the systemic view in the potential solution.

In relation to the design task, this manuscript has argued that many social challenges align well with wicked problems (Farrell & Hooker, 2013), for instance, the novel designers who participated in the module identified different potential solutions to the particular challenges they were dealing with. Thus, it may be relevant to consider in more detail how to address wicked problems and the Front End of Innovation (Koen et al., 2001; Harrison & Aurisicchio, 2011). It is important to report that the introduced method may not be useful when closed problems are involved because the first steps aim to identify the potential challenge to be addressed based on an open design brief. In this line, the method has potential to address wicked problems. For instance, in the DfSI method, the exploration of different design opportunities was based first on the ecology model, considering that a particular solution may be relevant only for one of its four systems. A second step was to study the system at which the potential solution was going to be inserted through UCD techniques. This helped understood the complexity of the system (Hassan, 2014). A strong difference of the DfSI method in comparison to others is that in many cases the design process starts with the design brief. In the method used in this study, novel designers defined it based on a particular challenge, prior to analyzing and selecting a particular level of the context in order to understand it fully. This implies that they developed skills to evaluate and select the relevant phenomena and improved their skills in reflection and analysis.

The design method helps students define the project and develop a solution to a particular social challenge. The first author supported novice designers in the understanding of the ecology model (see Step 2 in Figure 1) and in the use of the User Centred Design techniques (see Step 3 in Figure 1). These are fundamental tasks that required particular skills. As such, a condition of the use of the DfSI method is to first hold a basic knowledge of the ecology model and UCD techniques. It is relevant to mention that the use of UCD brings knowledge of what is to be changed (Hassan, 2014; Wendt, 2015). As the context becomes more complex in understanding, UCD techniques can help identify what is required within that particular messy context. This, of course, demands developing design skills to explore, observe and research. Additionally, all the projects were carried out by groups of two to three students. This helped undertake all the activities that involved the DfSI method and supported the reflective practice (Schön, 1987) that is relevant in this type of projects.

Design methods are not strict instructions or recipes that a person can automatically follow to create and deliver the best solution for the task at hand (Daalhuizen, 2014). Nevertheless, they are useful tools that designers rely upon to learn design. Thus, design methods can be considered tools that are embodied by designers to help them become professional designers. The latter is of great interest to academia, considering that every person can engage in designerly behaviors (Cross, 1993). Furthermore, involving designers in the evaluation of a particular method has shown positive results (Ortíz Nicolás, Aurisicchio, & Desmet, 2013).

A relevant aspect that is frequently ignored in Design for Social Innovation is the measurability of the delivered solution. However, the methods suggested within such frameworks identify the need to identify measurable social benefits in order to evaluate the success of programmes. Non-measurable social benefits are problematic because they are difficult to pass through go-no-go decision gateways as used in the Fuzzy Front End (Cooper & Kleinschmidt, 1986). As such non-measurable Social Innovations are difficult to defend due to the lack of clarity over success measurements. The measurability of such social benefits is important to design because it justifies the quality of the design process, as laid out in the brief. These delivered social benefits are non-financial, often qualitative, and sometimes difficult to quantify. In the example of the Child Happiness Index (see UNICEF Innocenti Research Centre, 2007), it would be easy to provide arguments on what components define child happiness, and ultimately what the eventual measurement would mean in terms of social realities. It would also be in terms of how it relates to other more definable measures of unhappiness (e.g. recorded numbers of self-harm). Another key aspect of measuring Social Innovation is the individual and social attitudes towards the benefits themselves. Social behavior has always been difficult to predict largely for the issue that people have beliefs and opinions towards outcomes and the utility of these outcomes, even when they are not financial.

It is obvious that financial benefits are easy to measure because they are quantifiable and as such objectively agreeable by the majority of people within the system. On the other hand, social benefits are often qualitative, often making the interpretation of their benefits difficult to agree objectively and by a majority. When they are quantitative, these measures are also difficult to agree in terms of how beneficial they are to the society. As an example, many people have no interest in the concept of saving the environment because their subjectively more trustworthy set of opinions and beliefs may suggest that the environment does not need saving. As such, the measurement of the benefits may be more complicated than the delivery of the benefits. And those social issues that do exist within society may be obfuscated largely due to conflicts of opinions such as different interest groups having different beliefs and priorities. In addition, social problems may often have unquantifiable economic costs making them difficult to prioritize within a political and economic context. This manuscript has pointed out the relevance to measure the impact of a Social Innovation. It is therefore important that design methods oriented to enhance Social Innovation consider how to measure their successes.

FUTURE RESEARCH DIRECTIONS

The steps of the DfSI method have been introduced in some detail allowing other designers to readily adopt and use it. It is understood, however, that the given descriptions may not answer all the designers' questions that they may have when implementing it. The authors are, thus, developing supporting tools to implement the method and in particular are focusing upon the ecology model as a generative idea tool. Designers can then consider the different levels of the ecology model within a design challenge.

This will allow them to propose ideas that can become design opportunities. The tool aims to introduce ideas for each level based upon a particular design challenge, and in this way further studies will aim to facilitate the implementation of the method.

Thus, further research can also define the skills or benefits that designers will gain when addressing Social Innovation. For instance, it has been identified that designers' skills can be enhanced through the development of DfSI projects having some typical issues, e.g. considering users as active agents, considering the impact of the context, managing the ambiguity and uncertainty within the context, and stimulating research for design (Ortíz Nicolás, 2016).

Another relevant future discussion concerns the identified commonalities between the Fuzzy Front End for Social and Economic Innovation in a greater context. These include information gathering, the problem solver is similar in both cases as a financial market full of consumers is essentially a different type of social system, albeit one with mainly economic innovations. In social systems, the choice of methods is more likely to be more specific to social issues, for example delivering the common good.

Social innovation has acknowledged the role that design may have on its development in at least two areas: creativity and the development of solutions, e.g. an artefact, service (Grimm, Fox, Baines, & Albertson, 2013; Van der Have & Rubalcaba, 2016). It is up to designers to insert their discipline in a broader context, i.e. Social Innovation. This insertion may be a perfect environment to stimulate inter- and multidisciplinary work, a long desired dream to design (see Papanek, 1985).

CONCLUSION

The DfSI method aims to enhance the capacity of both designers and users to act to current social challenges. The results of this research indicate that the DfSI method shows potential to frame social challenges and deliver solutions that aim to tackle those challenges. In a similar line, the ecology model is a useful tool that supports design decisions. In Social Innovation, the context is incredibly important and any tool that helps the designer, or indeed innovator, to understand the context and situation will be improving the efficiency of the process.

Many Social Innovation challenges are wicked problems, thus existing that deal with this type of problems in Economic Innovation may be relevant to consider in Social Innovation.

Social Innovation can benefit from Industrial Design and vice versa; designers can develop particular skills when undertaking this type of projects, e.g. Trans-disciplinary work. It may also be a clear action to create solutions that surpass the oriented market ones.

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KEY TERMS AND DEFINITIONS

Design Brief: A document that provides a direction and scope to the task being completed; ranging from “open and ambiguous” to “closed and specific”.

Design for Social Innovation: Design approach that aims to enhance the common good.

Design Method: A particular approach to address a design task. In a way it guides designers to generate solutions.

Ecology Model: Scalable theory of the context that deconstruct it on four systems: micro-, exo-, meso-, and macrosystem.

Fuzzy Front End (FFE) of Innovation: Work that is performed before the organization has begun to take the idea seriously; this is both in terms of resources and management attention.

Social Innovation: Type of innovation that aims to enhance the common good.

Wicked Problem: A multifactorial challenge where it is difficult to define its cause, and commonly experienced as design problems.