

Jun 17th, 12:00 AM

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### Citation

Baek, J., Kim, S., and Pahk, Y. (2016) A sociotechnical framework for the design of collaborative services: diagnosis and conceptualisation, in Lloyd, P. and Bohemia, E. (eds.), *Future Focused Thinking - DRS International Conference 2016*, 27 - 30 June, Brighton, United Kingdom. <https://doi.org/10.21606/drs.2016.203>

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# A sociotechnical framework for the design of collaborative services: diagnosis and conceptualisation

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DOI: 10.21606/drs.2016.203

**Abstract:** This study was motivated by the finding that there is a lack of design knowledge in the area of systems design of collaborative services. This study introduces a framework for developing service design strategies to foster collaborative communities and support social innovation. Based on the sociotechnical systems design, the framework allows designers to conceive the strategies, which belong to the domain of technical system, with an understanding of the social system of an organisation. It aims to achieve a seamless interaction between the social and technical systems of a community, leading to increased impact of social innovations. Social network analysis was used to understand social relations, and a co-design workshop to generate design strategies to foster them. For validation, the framework was applied to a community enterprise in South Korea. The paper discusses the effectiveness of the framework and concludes with its broad implications to the design of socially sustainable services.

**Keywords:** sociotechnical systems, service design, sustainability, social innovation

## 1. Introduction

Collaborative services are defined as the services where final users are actively involved in designing and producing solutions to social problems of their own based on peer-to-peer and collaborative relationships (Jegou & Manzini, 2008). The social forms constructed by these people are called collaborative organisations, and when such forms are bound by the sense of community, they are called collaborative communities (Baek & Manzini, 2012; Manzini, 2015). Collaborative services are social innovations in the sense that their production generates solutions to a wide range of social problems and reinforces social cohesion, thereby creating a positive impact on society (Meroni & Sangiorgi, 2011). By



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definition, collaborative communities exhibit two essential characteristics: the ability to solve their own problems and the relational qualities such as trust and intimacy (Cipolla & Manzini, 2009). These elements can be mutually supportive because the relational qualities are necessary to generate solutions, i.e., collaborative services, and implementation of these solutions can further enrich the relational qualities in return. The interdependency between solutions and relational qualities is coined as the virtuous circle of a collaborative community (Figure 1), and leads to a proposition that a collaborative community is a sociotechnical system (STS) (Baek, Meroni & Manzini, 2015). According to STS studies, a human organisation is an integration of two heterogeneous but mutually supportive systems that can be manipulated to influence the performance of the organisation: a social system in which the members form relationships through activities, and a technical system where they perform a series of tasks related to specific goals (Trist, 1981). These systems are interdependent and their integration leads to higher productivity and wellbeing of an organisation. As a human organisation, a collaborative community too is an STS, and the optimised integration of its social and technical systems leads to higher productivity of collaborative services: In the social system there are people and their relationships, and in the technical one there are communal activities that transform community resources into desired values (e.g. trust, conviviality). People and their relationships are an essential resource to organise and implement communal activities, and these activities in return lead to reinforcing the relationships of the participants. This mutually supportive interaction of social and technical systems increases the productivity of collaborative services (Baek & Manzini, 2012; Baek, Meroni & Manzini, 2015).

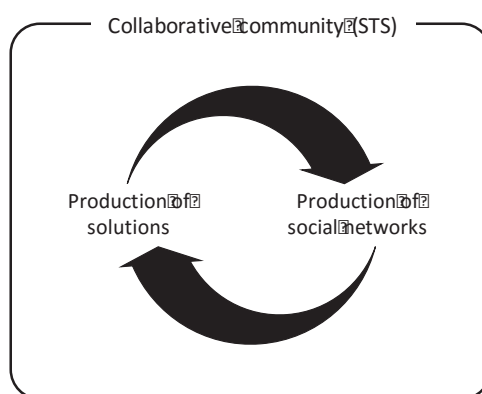


Figure 1 A virtuous circle of collaborative community

While existing service design literature focuses on the design of technical system (e.g. design of service concepts, processes and interfaces), that of social system (e.g. fostering social relationships in the direction relevant to design goals through design interventions) has been relatively undermined. It is partly due to the view that human relations are known to be contingent and spontaneous in nature, and hence cannot be anticipated or designed (Cipolla, 2008; Luhmann, 1995 in Fischer & Herrmann, 2011). Service encounters, which occur when people interact and exchange values, are hence the subject to be designed for

(Meroni & Sangiorgi, 2011; Manzini, 2015). This stochastic view is contrasted by a more deterministic one which considers service encounters as the subject to be planned and designed (Snelders et al., 2014)<sup>1</sup>. Without leaning to the deterministic view, we argue that the social system can be analysed, designed for, and assessed with appropriate sociotechnical interventions. This argument is supported by several social network studies: Sociotechnical interventions transform social networks of a virtual community (Haythornthwaite, 2002), foster trust within a local community (Kavanaugh, 1999), and enhance social capital such as interpersonal contacts, participation and community commitment (Wellman et al., 2001); social network analysis is used as a means to evaluate the effectiveness of community development (Ennis & West, 2012), sense of community (Gruzd, Wellman & Takhteyev, 2011), community resilience (Akama, Chaplin & Fairbrother, 2014; Baek, Meroni & Manzini, 2015), or sustainability of social-ecological systems (Gonzales & Parrots, 2012). According to the virtuous circle of a collaborative community, the design of technical system would then benefit from the understanding of social system. We hence address the following questions: (1) How do we diagnose the social system of a collaborative community? (2) What are the implications of the diagnostics to the design of collaborative services and of socially sustainable services in general? To address these questions, a framework to diagnose a collaborative community and form design strategies was devised. It was then applied to an empirical research for validation.

This study is a sequel to an earlier work which proposes a collaborative service design process from sociotechnical systems perspective (Baek, Meroni & Manzini, 2015). We argued that collaborative services are the technical system of a collaborative community, and can be designed based on the understanding of the social system state. The social system state is in turn influenced by the implementation of the technical system. The design process is iterative and comprises four phases: (1) analysis, (2) design, (3) implementation, and (4) evaluation. During the analysis and design phases, the social system is analysed and its qualities are reflected on the design of the technical system. During the implementation phase, the technical system is implemented and influences the the social system state. In the evaluation, the effectiveness of the technical system is validated by assessing changes in the social system. The framework in this paper becomes an analytic module of the design process, and used during the analysis and evaluation phases to understand the existing social system state and evaluate the effectiveness of the technical system respectively.

## **2. Methodology**

The framework employs the notion of collaborative encounters, social network analysis, and co-design in the construction of methodology. They are relevant to the aim of the framework because collaborative encounters provide a perspective of observing collaborative communities while social network analysis offers a strategy to investigate their

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<sup>1</sup> Snelders et al. note that the deterministic view is built on service research literature predating service design field such where services are treated as a predefined process (for instance, Shostack, 1977 and Ramaswami, 1996 in Secomandi & Snelders, 2011).

collaborative network structure from a system's perspective, and co-design engages communities and designers in conceiving design strategies to address the problems derived from the analysis.

### 1.1. Framework design

Collaboration takes place when people encounter and exchange resources with an aim to create shared values, and collaborative encounters are an act of people meeting and interacting in order to do something they recognise as a value (Manzini, 2015). They are the core of collaborative services, and also a viewpoint of observing collaborative communities with the focus on the act of collaboration. While collaborative encounters vary in their contexts and results, commonalities exist in terms of the participant involvement and quality of interactions on which they are based. The former is further classified into active involvement and collaborative involvement, and the latter into social tie strength and relational intensity (ibid). These four commonalities are the variables to describe various types of collaborative encounters. These variables were reviewed for the possibility of applying social network analysis, which entailed finding relevant attributes and metrics for each variable, translating the variables into measurable metrics, collecting and analysing the data, and interpreting the data to understand their implications to collaborative encounters. The relevant social network attributes were identified through an internal discussion and literature reviews. As a result, collaborative involvement and social tie strength were matched with 'collaboration' and 'tie strength' respectively. On the other hand, we were not able to find the attributes that can be the indicators for active involvement and relational intensity. They were thus analysed qualitatively based on the information gathered from an interview and a co-design workshop.

- *Collaborative involvement* is the degree to which the participants collaborate during an encounter. Collaboration in this context has the qualities of socially constructive and open, and is distinguished from collaboration "that can produce destructive results to others" such as mafias or terrorist groups (Sennett, 2012 in Manzini, 2015: 100). It is represented as the function of cooperative attitudes and openness to innovations within an organisation. The degree of collaboration is categorised as high and low. People with high degree of collaboration tend to work jointly on a mission while those with low degree of collaboration choose to compete. In between are disengaged people who participate in neither collaboration nor competition.
- *Social tie strength* is the aggregate strength of interpersonal ties that participants establish in a collaborative encounter, and it determines the characteristics of relationships within a community such as stability over time or openness towards outside world. Based on the strength, interpersonal ties are classified as strong, weak, and absent (Granovetter, 1973). Strong ties arguably take decades to be formed while weak ties are formed more quickly. Tie strength has another implication connected to the previous variable, which

is the potential of innovation diffusion within an organisation. Described as the strength of weak ties (ibid), weak ties play a critical role in connecting an organisation to outside world, thereby allowing innovations to diffuse. On the other hand, innovations in an organisation whose relationships are mostly strong tend to be self-contained.

Configuration of collaborative encounters can be described on a two-dimensional space – social tie strength and collaborative involvement in axes (Figure 2).

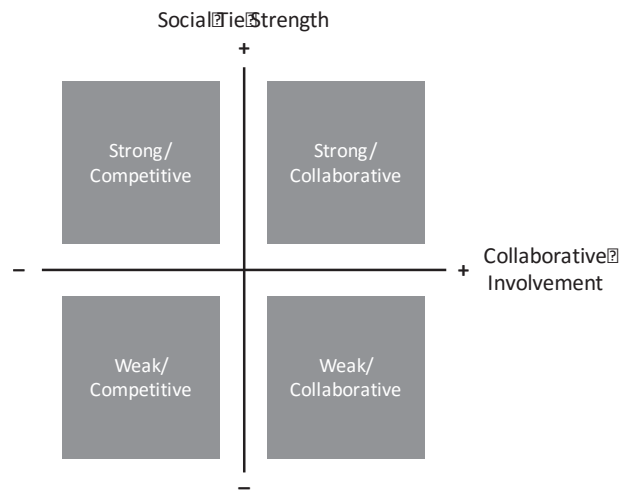


Figure 2 The framework of collaborative encounter

Previous social network studies measure collaboration by defining the notion of collaboration, and introducing the metrics and their measurement (Moody, 2001; Newman, 2001; Godly, Barron & Sharma, 2011; Schoen et al., 2014). For instance, Newman investigated the scientific collaboration by analysing the connections among scientists in the bibliographic databases based on the assumption that co-authorship of scientific publications is a scientific collaboration. The network characteristics associated with collaboration include distance, fragmentation, betweenness, number of collaborators, the giant component, strength of collaboration among others. For this study, we selected three metrics relevant to the small size and locality of the subjects under investigation: network density, betweenness centrality, degree centrality, and network centralisation. In defining the nature of collaboration, we considered any relations formed in the process of implementing a collaborative service. This assumption was necessary since not all relations formed within a collaborative community were collaborative. Therefore, existing relations prior to the collaborative service or those not associated with the endeavour was excluded from the dataset.

Social tie strength is an aggregate strength of interpersonal ties that exist in a collaborative network, and can be measured by calculating the proportion of strong and weak ties within a network. According to Granovetter (1973), the tie strength can be measured in combination of the amount of time, the emotional intensity, the intimacy (mutual

confiding), and the reciprocal services which characterise the tie. To estimate the tie strength, we adopted a method proposed by Ennis and West (2012) who required people to describe their relationship with another person in terms of ‘close friend or family’ (a strong tie), or not (a weak tie). We asked the participants to describe their interpersonal relationships formed through business in terms of ‘intimate’, ‘close’, ‘acquainted’, and ‘not related’. ‘Intimate’ and ‘close’ were considered as strong ties, ‘acquaintance’ as weak ones, and ‘no relationship’ as absent.

Table 1. Attributes of collaborative services and related metrics in SNA from the literature

Attribute	Metrics	Reference
<b>Collaborative involvement</b>	Network density, betweenness centrality, degree centrality, network centralisation	Moody, 2001; Newman, 2001; Godly, Barron & Sharma, 2011; Schoen et al., 2014
<b>Social tie strength</b>	Tie strength	Granovetter, 1973; Ennis and West, 2012; Manzini, 2015

In integrating social network analysis into the design process, we followed the framework to design collaborative services from an earlier study (Baek, Meroni & Manzini, 2015). While this framework is introduced in the context of community resilience, it was developed under consideration for the wider context of designing for sustainable services. The framework follows the process of (1) defining the scope of system under investigation, (2) analysing the system state, (3) diagnosing problems, and (4) forming goals and strategies.

### 1.2. Framework application

For validation, the framework was applied to a community enterprise called Neighbouring Farmers (NF) in the district of Ulsan Buk-gu, South Korea. As an organisation owned and controlled by a community and such that undertakes business on behalf of the community, a community enterprise is an exemplary organisation to deliver collaborative services. NF is one of seven community enterprises in the district, and it was chosen because it is relatively young, one year old at the time of investigation, and growing so that the social network dynamic is more visible than others. In defining the system scope, the target system and the boundary of its social and technical dimensions are identified. Since we aimed to understand the social system of a collaborative community, the boundary of target system was defined as community members engaged in a collaborative service. It includes employees, producers, consumers, local government, and other partners participating in the operation of NF.

During the system state analysis, social network data representing the aspects of social system under investigation were collected and interpreted. We analysed and compared the social network data at two points in time, before and after the implementation of a collaborative service (September 2013 and August 2014 respectively), to identify how the technical system influenced the social system over time. The pre-service network was

identified retroactively by inquiring the community network at the time of launching the business<sup>1</sup>, and the post-service network at the time of investigation. The data were collected from the community members using a survey followed by an interview (Table 2). The questionnaires were devised to identify the nature of collaborative encounters based on the previous studies in the use of SNA in community development and qualitative and quantitative approaches to social network analysis (Emmel & Clark, 2009; Ennis & West, 2012; Baek, Meroni & Manzini, 2015) The survey was the primary source of information about social network structure while the interview provided supplementary data including the nature and background of the relationships and clarification of doubtful issues. During the interview, the data were reviewed, doubtful issues clarified (e.g. why are certain people and relationships missing in the network?), and notable changes in the networks discussed. The results led to the visualisation of collaborative networks at two different junctures, i.e., before and after the implementation of the collaborative service. The data were analysed using UCINET 6 and Netdraw, which are SNA software that provide numerical and visual descriptions of network features respectively (Borgatti, Everett & Freeman, 2002).

Interpretation of the data led to problem diagnosis and goal forming. The problems are defined as the characteristics of social networks that potentially inhibit the production of collaborative services. This step was conducted by the project team consisting of design researchers knowledgeable about network theories. The results were fed into a co-design workshop where the community enterprises sat together and discussed how to enhance the social system through design interventions. The workshop consisted of an introduction, SNA review, sharing problems and goals, strategy building, and wrap-up. The overall process lasted for 150 minutes. In the introduction, the purpose of the workshop was presented with the notion of virtuous circle. To help the participants' understanding, a case study of scaling up a social innovation through the virtuous circle was provided. Next, the design goal based on the problem diagnosis was shared and discussed. SNA results were presented by comparing the social networks of each enterprise at two different junctures and between the enterprises. The participants then identified and discussed the strengths and weaknesses of their social and technical systems, which became the input for generating goals and strategies.

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<sup>1</sup> The retroactive method was used because the data to be obtained occurred before this research started.



Table 2. Survey questionnaire

Section	Queries
Personal information	Name, occupation, home address, period of residence, role in the community enterprise, period of participation
Company information	Company name, date founded, representative director, number of employees when founded and now, products/service, sales
Stakeholder information	Stakeholder name, relationship, satisfaction of collaboration
Social network information	Name, gender, role in the community enterprise, tie strength, age, home address, minority group (yes or no)

### 3. Context of study

NF was launched in 2013 with an aim to revitalise a local community in Dalgok Village, Ulsan confronted with socioeconomic challenges. Once a thriving clan, the village has decayed in the process of urbanisation and industrialisation over the past decades. It is now mostly inhabited by elders as young people left the village for jobs. The residents are mostly small and medium-sized agricultural producers who are loosing ground in the globalised and industrialised agriculture. NF believes that they need a new model of production and distribution that are more competitive, more attractive, and closer to customers, i.e., low-impact farming and direct sales. It thus practices community-supported agriculture (CSA) with a group of producers in the village. CSA is an alternative, and potentially sustainable, economic model of producing and distributing agricultural products. It typically works as consumers make a contract with local producers and pay at the onset of the farming season for a share of the anticipated harvest. In return, they periodically receive shares of seasonal vegetables and farm products. Its main service is the delivery of locally produced vegetables and other farm products to neighbouring consumers. The products include seasonal vegetables, fruits, mushrooms, abalone, tofu, eggs, and dried seafood. In addition, it also runs farm visit and camping programs on demand (Figure 3).



Figure 3. Food box (a) and farm visit program (b) by Neighbouring Farmers

### 3 Results

#### 3.1. Social network analysis

From the time of launch (September 2013) to that of investigation (August 2014), NF's collaborative network has grown in size with more members and relationships. The size grew from 19 to 30 as more producers joined the initiative. More members implies increased possibility of collaboration, and in fact, the number of relationships also increased from 6 to 69. It also means a greater variety of products and services NF could offer. In terms of the composition of stakeholders, the network remains the consortium of the employees (E), producers (P), consumers (c), and the district government (G) (Figure 4 & 5).

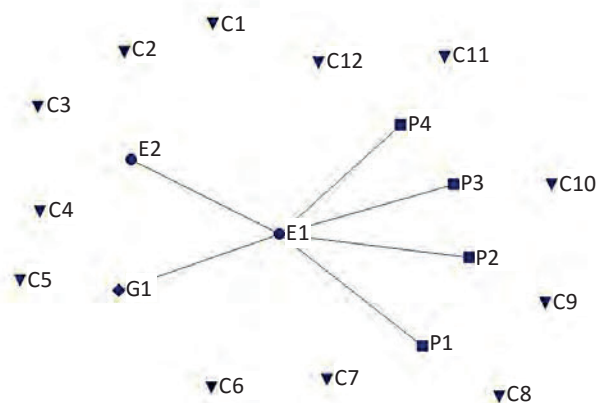


Figure 4. Collaborative network before CSA (C: consumers, P: producers, E: employees)

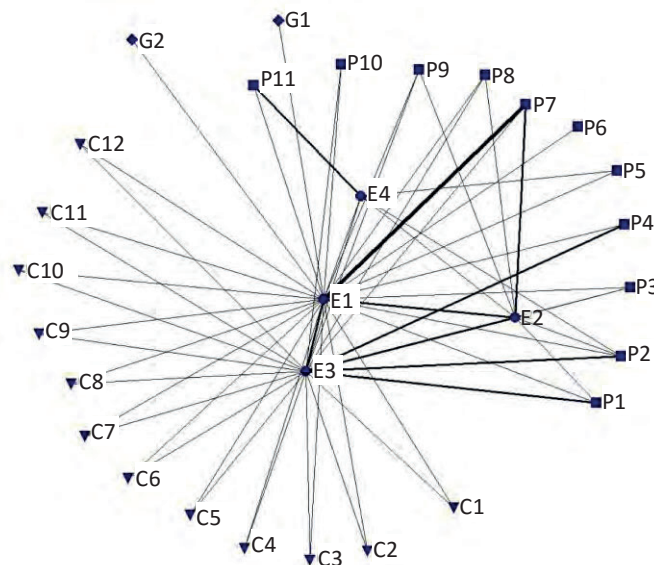


Figure 5. Collaborative network after CSA (C: consumers, P: producers, E: employees)

With the overall network remaining highly centralised, collaboration increased mostly between NF and the customers/producers. Network density, the number of ties divided by

the number of possible ties, means how densely are the nodes connected. It increased from 0.11 to 0.49, driven by and confined to the relationship forming between the employees and two sets of people, i.e., customers and producers. At the centre of the before-CSA network was the founder (E1) with the highest betweenness centrality of all nodes, which is quantified as the number of times an actor acts as a bridge along the shortest path between two other actors. It indicates that he has a large influence on communication and the transfer of goods. After CSA was initiated, E3, a staff in charge of distributing the food box, emerged as one of foci of the network. Throughout the project, the network maintained the centralised structure, which reflects a lack of autonomy and collaboration within the organisation and inefficient resource management. The mean number of collaborators, represented by degree centrality, has tripled from 1.00 to 3.06, implying an increase in involvement. There was a significant increase in the overall network centralisation, from 9.8 to 58.46, indicating that the organisational structure became more centralised to E1 and E3 (Table 3).

Table 3. The summary of the analysis of NF’s collaborative network

Attribute	Metrics	Before	After
Network size	Total number of members	19	30
	Total number of relationships	6	63
Collaboration	Network Density	0.11	0.49
	Betweenness centrality of founder	15.00	241.83
	Degree centrality (no. of collaborators)	1.00	3.06
	Network centralisation index (%)	9.80	58.46
Social tie strength	Mean tie strength	0.21	0.50

The social network of NF is dominated by weak ties. In the beginning, the social tie strength was 0.21<sup>1</sup> with only weak relationships. As the community grew, the tie strength increased to 0.50. The proportion of weak ties increased from 21% to 36%, and that of strong ties increased from 0% to 6.9% (Figure 6). An in-depth look at the development of the participants’ relationships reveals that the strengthened relationships, i.e., weak ties into strong ones, are confined to those among the employees and between the employees and the producers (Figure 5). Quite the contrary, those within or between the farmer and consumer groups were not at all fostered. It is also noteworthy that the change of tie strength was mainly driven by the increase of weak ties, which is explained by the new relationships NF established with its producers and consumers. The fact that they are weak and coincide with the exchange route of goods raises a doubt whether they are the

<sup>1</sup> Social tie strength is the mean strength of existent ties. The strength of existent ties, which are categorised in four types, is quantified as follows: not related: 0, acquainted: 1, close: 2, intimate: 3.

inevitable consequence of business transactions, as found in typical business environment, or the result of social cohesion.

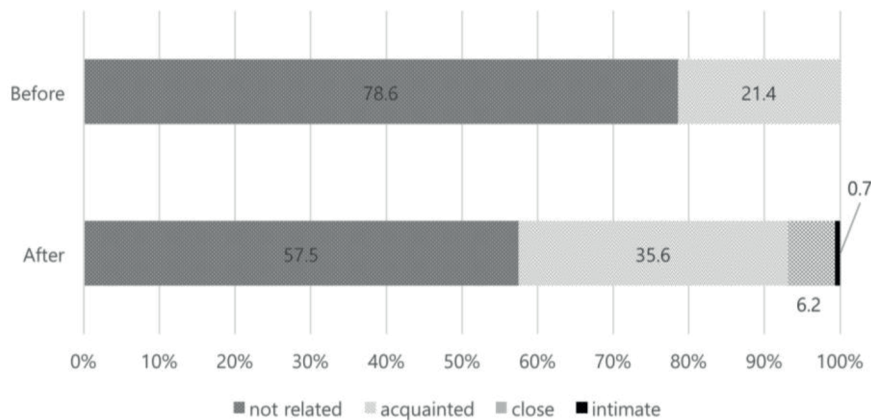


Figure 6. Change of social tie strength

### 3.3. Problem diagnosis

Based on the analysis, characteristics of NF’s collaborative network that hinder, or can hinder, the production of collaborative services were identified as problems. Firstly, the level of collaborative involvement of the producers is low. The collaborative network thus heavily relies on the commitment and sacrifice of the founder. Without a certain level of autonomy and teamwork, the founder is likely to be overburdened with workload, and causes inefficiency in collaboration. It also means that the community is highly vulnerable because a removal of the leader would lead to the dysfunction of the entire network. Moreover, a lack of collaborative involvement among the producers can be a barrier to the operation of services that require combined efforts. Behind these problems is the weak sense of community in the Dalgok Village manifested by the pervasive distrust and selfishness.

Second, relationships among consumers are inactive. This is problematic from social innovation point of view because the driving force of CSA is missing on the consumer side. From business perspective, it means the lost opportunity to take full advantage of early adopters. Early adopters are important not only as a test bed for new services but also a marketing resource. Given a persistent and effective relationship building, they can create a bandwagon effect and generate a momentum for business expansion. This is particularly important to NF because it has an urgent need to increase sales volume in order to maintain partnerships with the producers. The current scale renders the business an insignificant revenue stream to the producers.

Third, there is no relationship between producers and customers. There is no indication, at least in terms of the social relations, that producers and consumers are part of the collaborative community. The producers and consumers participate in the supply chain, yet lack opportunities that foster their relationship forming during service operation which is essential in community building. Positing that a community enterprise is an organisation “run by a community as well as for a community” (locality, accessed in October 13th, 2015:

<http://locality.org.uk/our-work/community-enterprise/what-is/>), NF is not a fully-functional community enterprise because it is run for a community but not by a community. Likewise, it is an incomplete CSA because it lacks the social function of creating relationships of solidarity between the farms and the subscribers (Feagan & Henderson, 2009).

Lastly, NF has few external relationships, which keeps the social innovation contained and reduces its social impact. External connections also enhance community resilience by increasing the chance of receiving supports from outside in the times of difficulty. For instance, there are already seven other community enterprises running in the North District and some have practiced CSA in the past. Communication with these companies would allow NF to learn from their success and failure.

In conclusion, NF makes little contribution to building a community. If it continues to function as such, it is unlikely to have any communities formed or fostered as the result of purposeful activities, which is a significant loss to the community enterprise incubation program. This problem may be approached from two directions: The first approach to strengthen the social capital of the Dalgok Community where the producers are rooted in; the second approach is to organise and empower consumer groups which support local agriculture.

### *3.4. Design*

The design goal was thus set to foster the relationships within and across the producer and customer groups both quality and quantity-wise, and to create missing links between the company and the outside world to amplify its socioeconomic impacts. In the next step, the diagnostics was brought to the co-design workshop with the stakeholders for discussion and strategy building. These strategies ranged from sales, marketing, design, and partnerships.

20. The participants had a demand to diversify the distribution channels, expecting that it would increase the access to target customers and stabilise the firms' sales. They proposed a farm store connected with the ongoing farm visits. They also wanted a retail store to sell their products in the urban area which it could not afford, and thus proposed a collective retail store (a small department store) and joint branding for all community enterprises in the district together. Through this joint effort, the participating firms could share the costs of advertising, renting a place, and selling while increasing the product diversity.
- In marketing, the participants wanted to utilise information communication technologies (ICTs) such as social network services and online media more effectively and efficiently to promote their products and services. The demand particularly lied in reducing the costs of developing and maintaining the marketing activities. A suggested idea was a joint online platform and store for introducing the community enterprises in the district and their products and services.

- The participants also shared the need for design resources. They looked for opportunities to work with designers in the locality, particularly in packaging, graphic, and character designs. Suggested ideas included a collaboration with the neighbouring universities to procure design resources from students in the forms of volunteer work, bartering, or profit-sharing. Their understanding of and interests in design value tended to be limited to tangible and physical attributes which have immediate perceived changes in product quality and consequently reactions in the market.
- In line with the design goals, the participants were encouraged to brainstorm ideas that stimulate mutual support and partnerships among the community business companies in the district. They reported that interactions at the executive level already existed in the form of occasional and friendly gatherings. The purpose of gatherings was to share the difficulties and distresses in business, and in doing so gain empathy or find solutions. The participants were guided to design strategies to address such difficulties through mutual reciprocity. A suggested idea was an after-school program organised by NF for the children of working mothers in other community enterprises in the region.

#### **4. Discussion**

Co-design is the process of bridging the gap between user needs and designers' intention, and this process is not necessarily without conflicts. In co-designing sustainable solutions at systems level, a continuous tension was observed between the design team and the participants who had different views on what the problems and solutions are. The participants tended to focus on urgent business issues, possibly due to the increasing pressure from the government on the economic performance of community enterprises. They often generated solutions that lack entrepreneurship and self-sufficiency. For instance, the ideas of collective retail store or collaboration with local design schools were dependent on pro bono services by local stakeholders. These solutions also convey the participants' lack of systems thinking, i.e., ability to think beyond their individual interests and have a holistic understanding of the system, which together with transformational nature of the workshop created a dissonance between the participants and designers in building strategies. The role of designers in this case was not only a facilitator but also a transformer with an aim to reshape the collaborative network with design interventions. Their role thus included steering the workshop towards the formulation of long-term, socioeconomic, and empowering strategies. On the contrary, the participants anticipated from the workshop immediate solutions to what they perceived as urgent issues, i.e., increasing profits in the short term. Some participants found the workshop irrelevant and the outcomes unsuited to their business. It is speculated that the dissonance between the designers and participants is partly because the design problems were defined not from stakeholder needs but from the systems state. The participants hence did not perceive the problems as problematic nor the

solutions as relevant. To conclude, it was and remains as a challenge to co-design sustainable solutions that address communal or societal needs without compromising the needs of participating actors. A lesson from our empirical study is that to bridge the disconnect between the system goal and those of individuals, an effort to align them is necessary and it could begin as early as the problem diagnosis phase. To set a viable goal, it is essential that the design team and the participants reach a consensus between on what the problems are at systems level and how they relate to individual needs. This process may require negotiation and persuasion if the design team has a different set of priorities from the participants.

In presenting the notion of collaborative encounter constituted of four sets of variables, Manzini (2015) argues that successful social innovations, ones that spread and generate social impacts, achieve the balance of opposing characteristics. In other words, configuration of collaborative encounters in the design of collaborative services should aim for the balance between strong and weak ties, relational and formalised interactions, collaborative and individual activities, and active and passive involvement. However, the recipe of balancing the opposing qualities is difficult to articulate, and remains as an open question to be explored. Until now, the nature of balance is abstract such as that between body and soul or yin and yang rather than concrete. The act of balancing is to recover the characteristics submerged by the contrasting ones “to the detriment of deeper human dimension” based on the understanding of the nature of encounters (ibid: 103).

While the sociotechnical framework was devised in the context of collaborative services, its application extends to any organisations which can benefit from increased customer interactions in service production processes. Active participation of customers in service production, also called customer process, is a basic element constituting a service (Edvardsson & Olsson, 1996). Customer process has become increasingly important in recent years with the rise of sharing economy or collaborative consumption (Lessig, 2008; Botsman & Rogers, 2010). Sharing services such as Airbnb, Uber, or TaskRabbit are distinguished from commercial ones in that they create social, environmental, and economic values through more efficient distribution of resources, i.e., sharing. At their origins are the social innovations conceived by people who “rediscovered the power of doing things together” in the era of extreme individualisation (Manzini, 2015: 86; Penn & Wihbey, 2015). However, a closer look at the trajectory of some of the widespread sharing services reveals that the true meaning of networking and collaboration which is at the core of their predecessors has dissipated in the process of commercialisation. For instance, CouchSurfing, a non-for-profit initiative of sharing houses for travellers, aims to foster cultural exchange and mutual respect among users envisioning a world connected by travel (CouchSurfing, 2015). However, the vision and functionality of reinforcing social capital are no more found in Airbnb, a commercial version for sharing lodging. It remains a question to be explored whether there is a common pattern behind the consolidation of social innovations. It is only noted here that such a concern raises the potential contribution of this framework to service design: the meaning of relationships at systems level is becoming increasingly relevant to

competitiveness and sustainability of services, and thus needs to be intentionally and thoughtfully approached at the early phase of design process. The sociotechnical framework provides designers with a means to explore the social dimension of customer process. It also integrates the generation of relational values into service conception by articulating the interaction between the social system and service concept. In the framework, problems diagnosis leads to the identification of social systems needs (needs in the sense that changes are necessary for the transition towards a desired state), which become the opportunities for new service development.

## **5. Conclusion**

Recently, an increasing number of social innovations and businesses have adopted collaboration as a means to achieve social and economic values. While human encounters including collaboration are difficult to predict or control due to their contingency and spontaneity, design interventions combined with an understanding of social relations can facilitate their transformation by creating favourable conditions. This paper is an effort to develop such an intervention in the context of community-driven social innovations. We noted that collaborative communities are a sociotechnical system in which people's relationships and technical solutions develop interdependently. We also noted that existing design interventions tend to focus on developing technical solutions while research on fostering social networks is few. We thus proposed a sociotechnical framework to conceive the technical solutions based on the understanding of the social networks with an aim to foster collaborative communities. The framework employs the collaborative encounters and social network analysis to understand the social system. It is useful for diagnosing the social system with quantifiable metrics. It informs designers about the current state and desired state in terms of the configuration of collaborative encounters. It also supports their embodiment by providing design opportunities related to specific aspects of collaborative encounters. Although the framework was devised in the context of collaborative services, it is applicable to any services which may benefit from customer engagement and collaboration. This paper contributes to design for social innovation and sustainable services at two different levels: (1) at the theoretical level by introducing a systemic approach to understanding and designing for the social system of services; and (2) at the methodical level by proposing a framework and tools to analyse specific attributes of interpersonal encounters and interpret their social impacts.

**Acknowledgments:** This study was funded by the the Ministry of the Trade, Industry & Energy on the 'Promotion of Special Design-Technology Convergence Graduate School' (N0000973) of the Korea Institute of Design Promotion, and District office of Ulsan Buk-gu, South Korea. The authors thank the community enterprises in Ulsan for their collaboration.



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