Designing Public Policy by Structural Shift Ideation: Modelling and Validation through the Case of Revitalizing Decaying Local Shopping Malls

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Abstract. This paper proposes the Structural Shift Ideation (SSI) and explores its potential to change the way in designing public policy. The SSI is a system engineering methodology developed by the Graduate School of System Design and Management, Keio University. The SSI shifts structure of a system in question to ideate systematically and systemically innovation of the system.

This paper firstly illustrates basic features and functions of the SSI. Secondly, it explains its apparatus to shift previously narrow-defined pursposes, functions, and components of a social system in question, and then to expand the conceptual solution space for problem that the system may have. Thirdly and finally, the authors validate quantitatively the efficacy of SSI through its application to the case of revitalizing decaying local shopping malls in rural areas of Japan, which have recently become a big social issue of that country.

INTRODUCTION: QUEST FOR PUBLIC POLICY INNOVATION

Problem

Making public policy is the participatory process in design perspectives toward to a social problem (Bryson *et al*. 2013). So social design perspective is a key view to propose a public policy (Linder and Peters 1984; 1987; 1991). The more perplexed and the more inter-connected social systems in recent years have emerged as harder obstacles against effectiveness of these traditional methods (Coklin 2005; Yasui 2011), the more articulated and structured methodology in designing public policy for those systems is in need (Yasui *et al*. forthcoming). Nontheless, policy experts engaged in social design traditionally relied upon analytic and process-oriented methods with their tacit knowledge shared only within them when they crafted public policy, thus that policy went with less effective way.

Social design recently became one of central area for public policy (UNESCO 2007). Social design is so closely associated with social and industrial innovations (Brown 2009). So that most of industrialized countries set their growth policy designs as primary arsenals to tackle with policy agenda on the economic growth and social well-being (Aghion 2012; Roper *et al*. 2012).

Not a few governements are in quest of new methodology to systematically and systemically ideate innovation of social system. This paper is to apply the Structural Shift Ideation (SSI), a system engineering methodology developed through the study conducted by the Graduate School of System Design and Management, Keio University since 2008, to bring destructive innovation (Christensen *et al*. 2006) to a social system in question through crafting public policy in participatory way.

Workshop-Based Methodologies for Social Design

Since 1990s, there have been proposed many workshop-based methodologies for social design. There are two different approaches among the proposed methodologies; the dialogue-orieted approach and the process-oriented approach. The dialogue-oriented approach values to properly include all stakeholders of the issue and to engage them with enough time in dialogues for their accomodation (Checkland and Scholes 1990). On the contrary, the process-based approach highlights to make stakeholders proceed with the preset stages for properly identifying requirements to solve a problem of socio-technical system

(Jones and Maiden 2004; Maté and Silva 2004).

As for the dialogue-oriented approach, Brown and Isaacs (2005) headed for introducing workshop under the name of the Whole System Approach to promote social change. The methodology of Deliverative Democracy (Gutmann and Thompson 2004) coined workshop as participatory decision-making process on political arena. The Consensus Conference, *aka* the Citizen's Panel, is another way to enhance dialogues among different groups of stakeholders for social design, usually between policy experts and ordinary citizens (Grundahl 1995). The Future Center Movement, born in the Continental Europe, have also diffused to other continents as future-oriented and problem-solving platfom for social innovation and entrepreneurship (Dvir *et al*. 2006).

The Evolutionary Learning Laboratory (Bosch *et al*. 2012) repersents the process-based approach for social design. That methodology guides stakeholders with the processes for solving complexity in a social system by the participatory systems analysis and to structure the system to identify leverage points for their systemic interventions.

The SSI integrates the above two approaches by simultaneously embedding dialogue for accomodation and process control for creating concrete solutions. In that sense, the SSI is a hybrid workshop-based methodology to systematically and systemically create innovative design for the society.

METHODOLOGY: STRUCTURAL SHIFT IDEATION

Basic Features and Functions of the SSI

The SSI is a system engineering methodology to shift structure of a system in question to ideate systematically and systemically innovation of the system. It has participatory knowledge-management platform as workshop-based project. This participatory platform ensures systemicity for all stakeholders who join in the workshop.

Indeation is a thinking loop that have three stages (see Figure 1). The first stage is fieldwork or ethnography (Brown 2009) for identifying the issue and sharing it among stakeholders of the social system in question. Then a thinker proceed to the ideation stage. Ideation has two types; the divergent thinking and convergent thinking (Guilford 1967). In this second stage the divergent thinking comes first and the convergent thinking follows it. The third statge is prototyping to share empathy and refection among stakeholders and to verify and validate it. Social designers trail repeatedly this loop of ideation under the 'fail-fast' principle (Stanford d.School 2010) until they finally reach to satisfactory idea for innovation. This loop of ideation is also known as the 'Aha, Whoops, and Eureka!' process for innovation (Kelly and Litterman 2002).

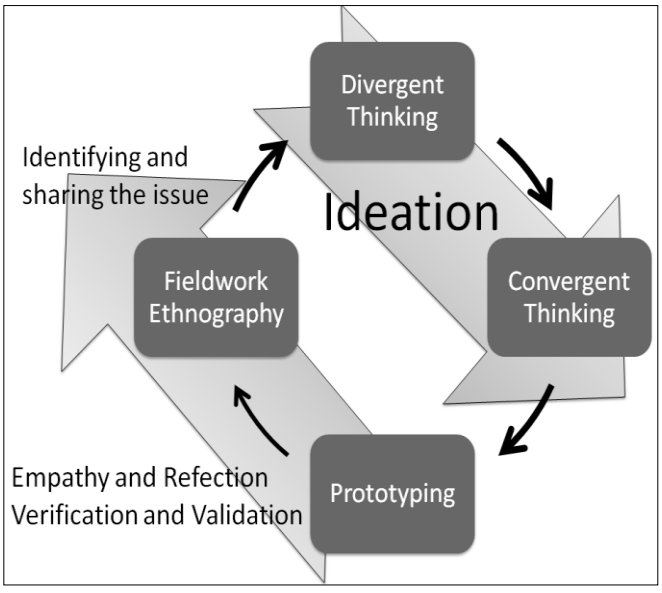

Figure 1. Ideation Loop for Innovation

Innovative thinking methodologies have rich history. There has emerged several milestone efforts to draw up a list of innovative thinking for social design during these two decades. Those milestones are diversified in many disciplines including the study on the organizational theory (e.g., Holman *et al*. 2009), the design thinking theory (e.g., Stanford d.School 2010; Kumar 2012), the creativity theory (e.g., Parnes and Harding 1962; Leeuwen and Terhrue 2010; Mesquita 2011), and the problem-solving theory (e.g., Proctor 1999).

The SSI synthesizes the heritage of those innovative thinking methodologies and stresses the role of structuring a system for destructive innovation. Systems engineering defines the structure of a system as all the parts that it comprises and the relationships among the system. The SSI strengthens structuring efforts of the ideation stage where participants join in the workshop with tools for systematic ideation and systemic visualization for structured improvisation (Miner *et al*. 2001:329) as the planned serendipity (Mirvis 1998:590) (see Figure 2).

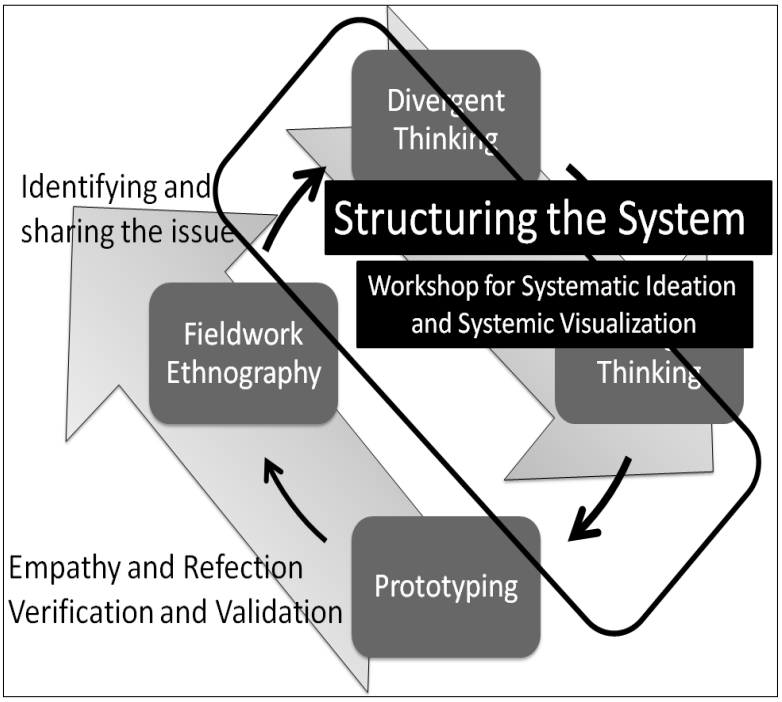

Figure 2. SSI Loop for Innovation

By structuring a system, the system engineers share a list of all the elements that comprise the system for visualization, then how the elements are interconnected, and what portion of the total system behavior is carried out by each element (Oliver *et al*. 1997:11; Jackson, Hitchins, and Eisner 2010:41). This definition of elements actually contains purpose, function and component of a system. In the SSI structuring the system possesses the key role to visualize purpose, function and component of the targeted system and make them ready for shift by ideation.

Phases of the SSI

The SSI enables workshop participants to ideate innovative solutions with the 'out-of-box' thinking. The four preset phases of SSI let stakeholders' collective intelligence flow smoothly in the workshop to an optimal 'out-of-box' solution. The four phases are; a. identifying the system's elements and and listing them; b. structuring the identified elements of the system as the purpose-function-component configuration of the system; c. ideating by shifting new elements of purposes, functions or components, d. making a new configuration of purpose-function-component to create new prototypes (see Table 1).

Table 1. Four Stages of the SSI

Phase	Name	Contents
a.	Identification	Identifying the system's elements and listing them.
b.	Structuring	Structuring the identified elements of the system as the purpose-function-component configuration of the system.
c.	Shifting	Ideating by shifting new elements of purposes, functions or components.
d.	Configuring	Making a new configuration of purpose-function-component to create new prototypes.

The SSI structures elements of the system into three layers; purpose, function and component of a system. The SSI describes a system as one or plural configuration(s) of elements on these three layers. In the stage c., workshop participants ideates new elements on each layer in various methods by shifting the original elements which they had identified in the previous stage.

The SSI is the systems approach to emphasize shifting system elements and configuring them for new system structure. Jackson (2010:29-31) raised standard procedure of the systems approach in ten stages. Table 2 is the table to show how ten stages of the systems approach corresponds to four phases of the SSI. It shows both shifting and configuring phases are new to the conventional systems approach so that the SSI is equipped with innovative ideation mechanism.

Table 2. System Approach's Ten Stages and SSI's Four Phases

System Approach (Jackson 2010)	Structural Shift Ideation
● Identification of systems elements ● Subdivision of elements into smaller elements	a. Identification
● Grouping of elements ● Identification of system boundary ● Identification of the function of each element ● Analysis of the interactions among elements ● Identification of the system environment ● Identification of emergent characteristicsof the system ● Systhesis of the system ● Verification and validation of the system	b. Structuring
(New to SSI)	c. Shifting
(New to SSI)	d. Configuring

Source: Left Half Part Adapted from Jackson (2010:29) Table 2.3.

Figure 3 illustrates the innovation process of the SSI for a public library as the simplest example. The conventional library set wisdom as purpose, reading as function, and books as compoments (the upper case of Figure 3). By shifing each elements of three layers, new configurations of elements emerges to new ideas of library. If a new configuration comes with healing as purpose, sleeping as function, and tables and chairs as compoments, the new prototype library is for a sleeper's oasis (the middle case of Figure 3). If a new configuration comes with coziness as purpose, talking as function, and couch as compoments, another new prototype for a library comes out for the retired's favorite (the lower case of Figure 3).

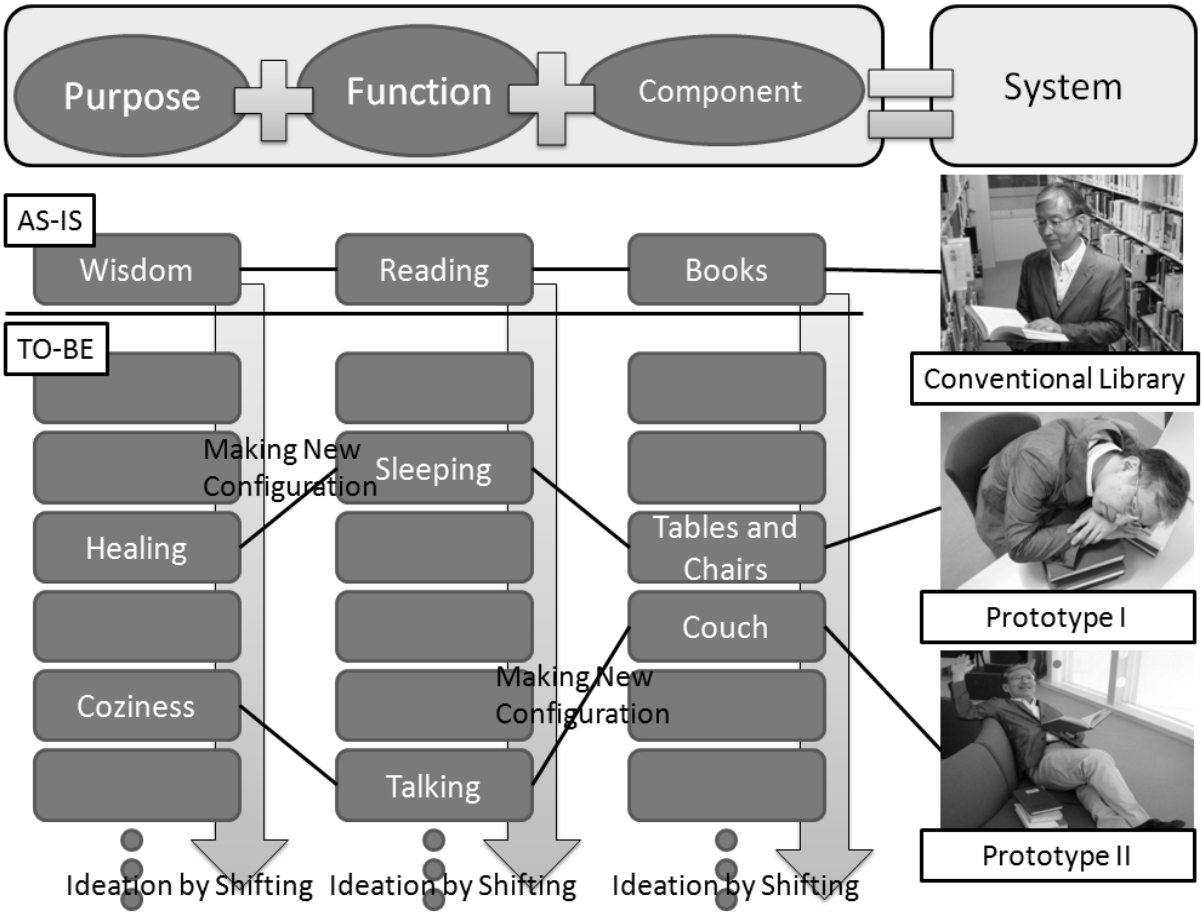

Figure 3. SSI Example: Innovating a Public Library

The SSI helps system engineers in systemically identifying hidden elements and structuring them with purpose-function-component layers with systematic proccesses. Thus it is particularly effective to make innovation of social system. Social system is mostly intangible and invisible so that hardly can system stakeholders visualize the structure and the boundary of the system (Maier and Rechtin 2009:125-136; Yasui 2011). By applying the SSI to social system innovation, stakeholders are able to make structural change happens in the system without omissions and leakages of elements.

Ideation by Shifing

Ths SSI is designed to allow significant freedom to select ideation methods. Workshop participants apply any ideation methods suitable to the characterstics of the social system by their choices. They structure their shared view on the system that they target. Then they spread their ideas for innovation with any combination of the divergent thinking and the convergent thinking as ideation by shifting. Ideation by shifting start with a chained assocciation of ideas created by any combination of the free association methods (e.g., brainstorming, brainwriting method) or the forced association methods (e.g., scenerio graph, TRIZ method). Then the convergent process follows by using the convergent thinking (e.g., affinity diagram, PERT method, fishbone method) to select new ideas emerged in the divergent process and make them a new configuration for appearing new system structure.

The most frequently used sequence of the shifting phase is a trail of brainstorming, affinity diagram or dual-axes diagram to shift elements.

Figure 4 is one example featuring the personal life design of certain researcher of the structured shifts with brainstorming and affinity diagram. By the affinity diagram he draws the new dimension of his life for the academic future. In this diagram he illusrated elements of purpose, function and conpoment all together as a single diagram.

Figure 5 is another example of the shifting phase with the structured positionings of the American

cereals on dual-axes diagram and searching the strategic shift along with the blue ocean strategy (Chan Kim and Manborgne 2005). Figure 5 is the diagram targeting elements only on the component layer to intend the innnovation of component level.

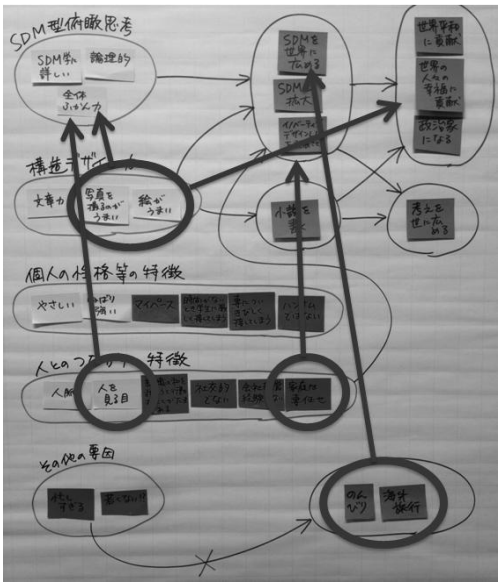

Figure 4. The SSI Structured Shifting with Brainstorming and Affinity Diagram

Source: Adpated from Keio SDM Lecture Slides for the Design Project on May 1, 2013

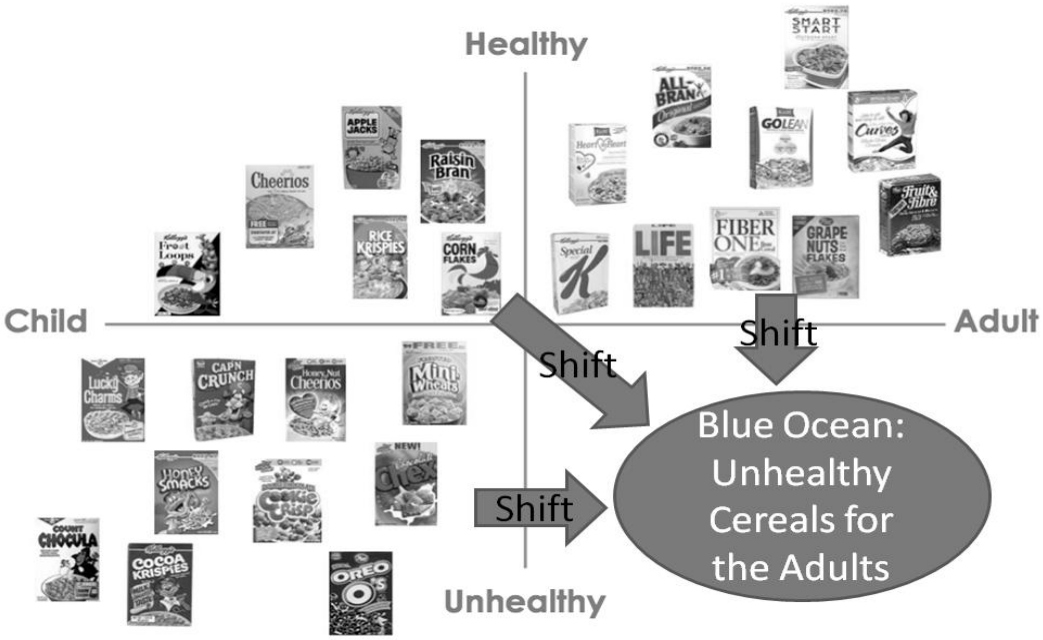

Figure 5. The SSI Structured Shifting with Brainstorming and Dual-Axes Diagram

Source: Adapted from Keio SDM Lecture Slides for the Design Project on May 1, 2013

Figure 6. shows the inductive use of SSI in the context of entrepreneurship study. Mr. Sakichi Toyoda, a founder of Toyoda Industries Corporation. Sakichi, a successful corporate owner of the company producing automative weaving machines in 1920s, was inspired by the success of Ford Motors in the United States. In 1937 he launched a new company that produced an automobile by ideation by shifting from the weaving machine system. Sakichi's innovative minds are well respected and made the seeds of Toyota Motor Corporation's corporate cultures (Liker 2004). Figure 6 illusrates historical SSI application to the founder of the Japanese car giant.

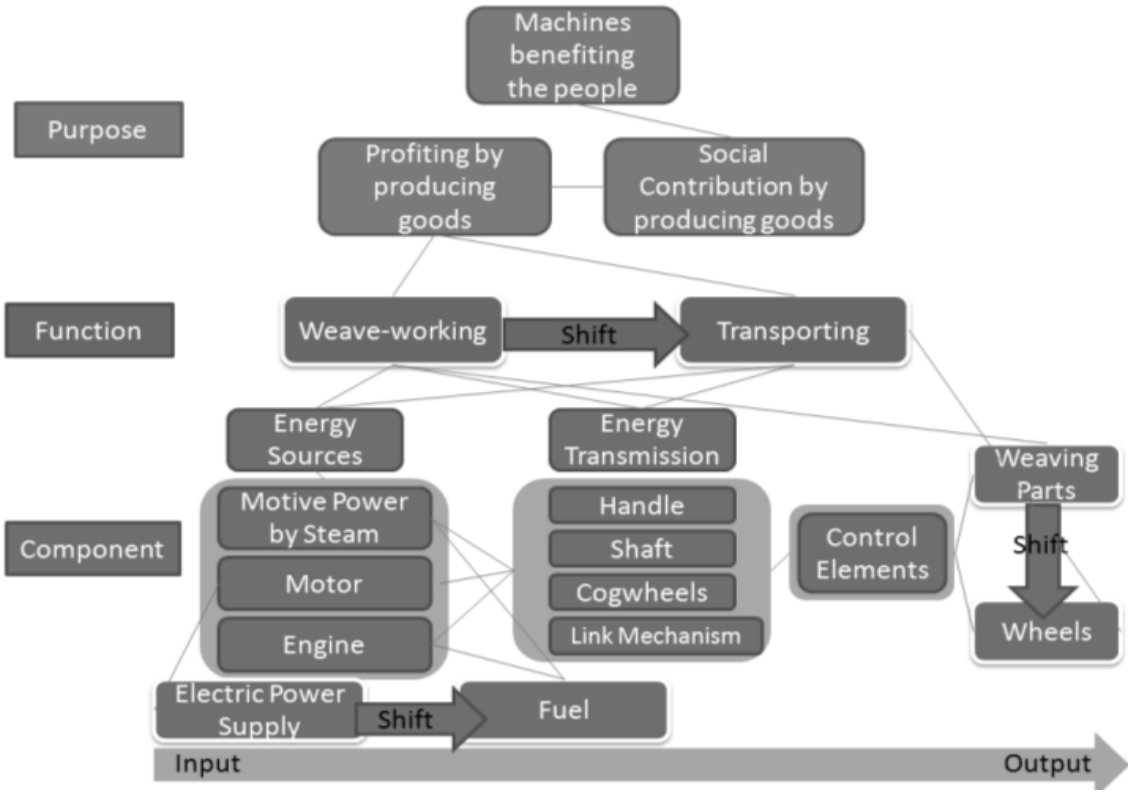

Figure 6. SSI Shift: From Toyota Weaving Machines to Toyota Motors

CASE STUDY: SSI TO DESIGN PUBLIC POLICY

SSI Workshop for Verification and Validation

In order to empirically verify and validate the efficacy of the SSI when it is applied to designing public policy for social design, the authors held the SSI workshop on March 3, 2013 at the Keio University Hiyoshi Campus, Yokohama, Japan. The theme of the workshop was the 'policy design to change social system'. Sixty participants joined in he workshop and all succesfully completed the workshop of three hours. Table 3 lists the information on workshop participants' attributions.

Table 3. Attributions of the SSI Workshop Participants (March 3, 2013)

Gender	Male: 35, Female: 15, N/A: 10
Age	10-19 years-old: 1, 20-29 years-old: 8, 30-39 years-old: 22, 40-49 years-old: 10, 50-59 years-old: 7, 60-69 years-old: 2, 70-79 years old: 1, N/A: 9
Social Status	Student: 2, Company Employee: 38, Self-Employed: 5, Other: 4, N/A:11

Sixty workhop participants divided into ten teams of six members. The case that they chose was the problem of decaying local shopping malls (LSMs) in Japan and creating innovative policy ideas beyond the conventional rural development policy implemented by the Japanese Government for more than three decades. Revitalizing decaying LSMs in rural areas of Japan have recently become a big social issue of that country (Yasui *et al*. 2011). It is one of central public policy areas where residents expect 'out-of-box' thinking brought into the policy formulation process that conventional policy currently gained few remarkable achievements to stop LSMs decaying.

Workshop participants as teams used brainstorming to identify critical issues of decaying LSMs. Then they freely associated elements of LSMs which they hit as idea (see Figure 7). All teams raised more than 35 elements per table about the social system of LSMs that they consider as examples. After the identification phase, they structured the LSM system to visualize and share among the team members by categorizing and mapping identified elements into three layers; purpose, function and component of the

LSM system which they consider.

On the shifting stage, they commenced association of new ideas from considering to write on the work sheet the conventional configuration of the LSM system. Most teams set satisfying daily needs (purpose) – buying (function) – customer, shopper and goods (component) as the conventional configuration of the LSM system. Participants then proceeded to ideation by shifting. They did brainstorming to pop up new elements and grouping them by affinity diagram to formulate innovative elements on each layers (purpose, function and component) respecitvely (see Figure 8). Based upon outputs of these three brainstorming and affinity diagram, they selected one new configuration of three layered elements to innovate the LSM system.

Fugure 7. The SSI Workshop: Identification Phase
(Photo by the Authors, March 3, 2013 at Hiyoshi)

Figure 8. The SSI Workshop: Structuring Phase
(Photo by the Authors, March 3, 2013 at Hiyoshi)

By using the SSI, all teams successfully reached to innovative ideas that they recognized them as 'out-of-box' thinkings (see Figure 9). For example, one goup raised an idea of the LSM system for a platform to let local residents exchange at the human level, the configuration satisfying gathering happiness (purpose) – exchanging for human -centered (functiontion) – customer, shopper and the unemployed persons (component).

Finally all the teams expressed their innovation for the LSM system on the playback theater (Salas 1983; Kintigh 1998) according to the method of story-telling (Brown *et al*. 2005; Godin 2005). All teams completed to perform on the improvisation theater their innovative system of LSMs. Figure 10 shows the playback theater performed by the team that proposed the LSM system as a platform to let local residents exchange at the human level.

Fugure 9. The SSI Workshop: Shifting & Configuring
(Photo by the Authors, March 3, 2013 at Hiyoshi)

Figure 10. The SSI Workshop: Playback Theater
(Photo by the Authors, March 3, 2013 at Hiyoshi)

EVALUATION: T-TEST, CORRELATION, FACTOR ANALYSIS OF SSI WORKSHOP

The authors conducted the post-workshop poll and collected sixty answer sheets from workshop participants. Appendix is the list of questions asked to the workshop participants in the poll and translated into Engllish.

Some may think that it is better to show the actual results of the SSI workshop including the result of structuring phase and the results of shifting and configuring phase rather than show the results of post-workshop poll in order to show the effectiveness of the SSI. However, this paper adopts the subjective approach to prove the effectiveness of the SSI by asking workshop participants for their subjective satisfaction, rather than the objective approach to show the quality of workshop outputs.

The subjective approach mainly considers 'soft' matters such as satisfaction while the objective approch focus upon measuring 'hard' facts such as income in dollars (Veenhoven 2002: 33). The satisfaction and other subjective factors matter to evaluate the effectiveness of SSI, in parallel with as the main stream of the current well-being studies adopt the subjective approach to evaluate individual happiness (e.g., Heller *et al*. 2004; Kahneman *et al*. 2006).

t-Test

Table 4 shows the averages of workshop evaluations. Answers were made with 5 degree scale (5=Very Good, 4=Good, 3=Neutral, 2=Poor, 1=Very Poor) on each item, and all averages went far better beyond the neutral (Neutral=3). All averages are statistically significant and satisfy the 1% significance level.

Table 4. Independent t-Test to the Median (M=3)

Question #	N	Average	Standard Deviation	Significant Probability
1-1. Satisfaction to the Workshop	58	4.55	.502	.000
1-2. Understadability of the Workshop	60	4.55	.502	.000
2-1. Method Evaluation: Understandability	59	4.39	.588	.000
2-2 Method Evaluation: Usability	59	3.85	.738	.000
2-3 Method Evaluation: Efficacy	59	3.78	.721	.000
3-1 Output Evaluation: Feasibility	56	3.89	.802	.000
3-2 Output Evaluation: Originality	57	3.88	.781	.000
3-3 Output Evaluation: Efficacy	55	3.67	.747	.000
4-1 Useful for Systematic Thinking	57	4.35	.582	.000
4-2 Useful for Systemic Thinking	57	4.21	.750	.000

Correlation Analysis

The authors also implemented the correlation analysis among variables of the method evaluations and the output evaluations. Table 5 shows the Pearson's correlation coefficients of evaluation items and their statistical significances.

Table 5. Evaluation Items: Pearson's Correlation Coefficients and Statistical Significances

	2-1	2-2	2-3	3-1	3-2	3-3
2-1. Method Evaluation: Understandability	1	.457**	.410**	.246	.366**	.349**
2-2 Method Evaluation: Usability	.457**	1	.616**	.367**	.278*	.537**

2-3 Method Evaluation: Efficacy	.410**	.616**	1	.440**	.466**	.507**
3-1 Output Evaluation: Feasibility	.246	.367**	.440**	1	.156	.374**
3-2 Output Evaluation: Originality	.366**	.278*	.466**	.156	1	.506**
3-3 Output Evaluation: Efficacy	.349**	.537**	.507**	.374**	.506**	1

Note: **1% level significance (two-sided) satisfied, *5% level significant level (two-sided) satisfied.

The correlation analysis showed that the method usability highly correlated with the method efficacy and the output efficacy, respectively (>.500). The method efficacy had also high correlation with the output efficacy (>.500). The output originality highly correlated with the output efficacy (>.500). This result indicates that the workshop participants are satisfied with SSI's efficacy both in method and in output, and that the SSI efficacy is deeply associated with the method usability and the output originality.

Factor Analysis

The authors then implemented the factor analysis to examine factors affecting the workshop satisfaction, understandability and the sense of usefulness felt by the workshop participants. Table 6 is the factor matrix for the analysis by the varimax rotation associated with the Kaiser normalization.

Table 6. Factor Matrix after Rotation

	Factor #1 (workshop factor)	Factor #2 (structure factor)
1-1. Workshop Satisfaction	.656	.068
1-2. Workshop Understandability	.563	.138
4-1 Systematic Usefulness	.305	.790
4-2 systemic Usefulness	.027	.806

Note: Facor extracted by the major factor method. Varimax rotation (R=3) with the Kaiser normalization.

The factor analysis identified two factors affecting the workshop satisfaction, understandability and usefulness. Two factors extracted from the analysis are independent, and they express different contents.

Factor #1 is associated with the workshop itself. Workshop participants felt the value of SSI from the SSI workshop itself. Accordingly, the authors named Factor #1 as the workshop factor.

Factor #2 is associated with usefulness of the SSI as the thinking method. Workshop participants felt the value of SSI because it is useful both for systematic and systemic thinking simultaneously. This result indicates that SSI is valued since the SSI is well structured to formulate phases in systematic and systemic thinkings for innovation. Thus, the authors maned Factor #2 as the structure factor.

DISCUSSION

The results of evaluation supports the proposition that the SSI is effective in creating innovative ideas for public policy. In particular, high satisfaction and understandability ratio of the SSI workshop comes from the participatory design of the SSI, which involves stakeholders to concurrent creation of public policy in the local policy platforms.

Both the method evaluations and output evaluations gained high scores after the SSI workshop. The SSI efficacy is well appreciated in correlation with the method usability and the output originality. In this sense, the validation of SSI relies on its usability in process to create something innovative.

According to the factor analysis, the two major factors supporting the SSI are workshop-based and structred in systematic and systemic. This validates that the SSI well balances two requirements of the public policy platform for social design; the dialogue-oriented approach and the process-oriented approach. The workshop-based factor corresponds to the dialogue-oriented approach; the structred in systematic and systemic factor corresponds to the process-oriented approach.

CONCLUSION

This paper showed the basic features and functions of the SII. The SII has structured platform with workshop in shifing and configuring of elements in accordance with three layers (purpose, function and component) of a system in question.

This paper verified quantitatively the efficacy of SSI in social design. The SSI performed well in the workshop to design public policy. The SSI showed quantitatively the efficacy both in method and in output. The designed structure of SSI contributed to the method usability and the output originality.

FURTHER RESEARCH AGENDA

This paper illustrated the basic features and functions of SSI, and it showed the effcacy for social design with the view from public policy. It is expected that further research will reach to other areas where innovative designs are in need.

Another research agenda is to generalize the SSI for the meta-methodology for innovation. The SSI has potential to integrate methodologies for innovation among diversified disciplines. The SSI may interpret various innovation theories at the same conceptual architecture of system.

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APPENDIX

Questions asked in the post-workshop poll (English translation, conducted on March 3, 2013)

		Answer (5 degrees)
Q1: On workshop design		
Q1-1	How are you satisfied with the workshop ?	5. 4. 3. 2.1.
Q1-2	How do you understand the SSI ?	5. 4. 3. 2. 1.
Q2: Evaluation on the SSI as method compared with other methods		
Q2-1	Did you understand easier ? (understandability)	5. 4. 3. 2. 1.
Q2-2	Did you use better ? (usability)	5. 4. 3. 2. 1.
Q2-3	Did you get better outcome ? (efficacy)	5. 4. 3. 2. 1.
Q3: Evaluation on the SSI as output compared with other methods		

Q3-1	Did you get the output more feasible ? (feasibility)	5. 4. 3. 2. 1.
Q3-2	Did you get the output more original and creative ? (originality)	5. 4. 3. 2. 1.
Q3-3	Did you get the output effiective ? (efficacy)	5. 4. 3. 2. 1.
Q4 : Evaluation on the SSI of how it will change your way of thinking compared with other methods		
Q4-1	More useful to think in systematic manner ? (Systematic Thinking)	5. 4. 3. 2. 1.
Q4-2	More useful to think in systemic manner ? (Systemic Thinking)	5. 4. 3. 2. 1.

Note: Answer 5=Very Good, 4=Good, 3=Newtral, 2=Poor, 1=Very Poor

BIOGRAPHY

Toshiyuki Yasui earned his BA in International Relations from University of Tokyo in 1985, and immediately joined in the Ministry of Finance of Japan. During his distinguish services for the Japanese Government for more than 25 years, he experienced various key posts in the Ministry of Finance and the Financial Services Agency. In March 2011, he earned his Ph.D in Arts and Science from International Christian University, Tokyo. He teaches social systems theories and policy design methodology, and has lectures for Graduate School of System Design and Management at Keio University as Guest Professor and National Graduate Institute for Policy Studies as Visiting Professor. He was awarded twice (2010 and 2011) the Best Paper Award of theYear from the Japan Society of Competitive Intelligence as well as the Best Paper Award of the 2012 Annual Journal from the Japan Creativity Society.

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Takashi Maeno has been a Professor since 2008, and currently he is the Dean of Graduate School of System Design and Management, Keio University. He received his BS in 1984 and his MS in Mechanical Engineering in 1986 from the Tokyo Institute of Technology, Tokyo, Japan. From 1986 to 1995, he worked for Canon, Inc., in Tokyo, Japan. He received his Ph.D in Mechanical Engineering from the Tokyo Institute of Technology, Tokyo, Japan, in 1993. From 1995 to 2008, he was with the Department of Mechanical Engineering of the Faculty of Science and Technology at Keio University, Yokohama, Japan. He was a visiting industrial fellow at the University of California, Berkeley, from 1990 to 1992 and a visiting professor at Harvard University in 2001.