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Systematic Expansion of Solution Space for Social Innovation: Structured Multiplication Approach to Solve Social Issues

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ABSTRACT

This study is to model expanding systemically and systematically solution space for social innovation. Based upon the system design thinking, this model named as the Structured Multiplication Approach for Solving Social Issues (SMASSI) is structured as workshop-based architecture to enhance participants' creativity by using controlled convergence.

The authors implemented the system design thinking workshop where participants solve their issues on social innovation by structured multiplication approach. By comparing participants' creativity for social innovation, they proved qualitatively and quantitatively the efficacy of this model to enhance creativity of participants with controlled convergence.

KEYWORDS: System thinking; design thinking; workshop; social innovation; controlled convergence.

1. PURPOSE AND CONCEPTUAL DEVELOPMENT

1.1 Purpose

This study is to propose the model to draw a better and multi-faceted solution for complex social problems as the Structured Multiplication Approach for Solving Social Issues (SMASSI), by using the hybrid approach structured with the system design thinking (Maeno et al. [1]) and the controlled convergence (Pugh [2]) as well as to prove its efficacy by social experiment designed as the form of workshop for social innovation.

1.2 Conceptual Developments

System Design Thinking

Since the establishment of the graduate school of System Design and Management, Keio university in 2008, the graduate school to integrate three disciplines of system thinking (S), design thinking (D) and management theories (M) into the hybrid SDM discipline to teach it in an integral way (Yasui et al. [3]), the authors has developed the system design thinking to create innovative solutions systemically and systematically by using innovation loops of three stages; observation, ideation and prototyping (**Fig**.1, Yasui et al. [4]).
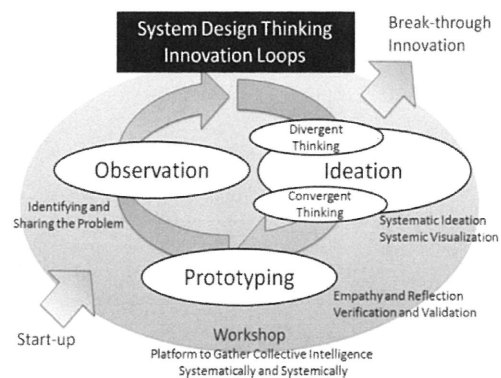

Fig.1. Innovation Loops of System Design Thinking (Adjusted from Yasui et al. 2014: 172, Fig.1)

Furthermore, the authors started the project to model the co-creative workshop-based platform to make innovative policy solutions for social agenda

such as ageing, poverty, urbanization, regional re-vitalization and social inclusion (Yasui [5], Yasui *et al.* [6], Bosch *et al.* [7], Yasui *et al.* [8], and Yasui *et al.* [9]).

Through this development process to design co-creative policy-making platform for social innovation, there emerged two challenges ahead to the authors.

Challenge #1: Multifaceted Problems

The first challenge is the plurality of problems to be solved.

The *conventional approach* of the system design thinking sets the single agenda to be solved so that one solution is created to be optimal for one problem. However, in the local community typically, the social issues to be solved are so 'wicked' (Conklin [10]) that the most effective solution should be produced to address simultaneously to multifaceted problems (Nadler and Chandon [11]).

In this sense, we need to develop the one solution to one problem approach by the conventional system design thinking to something new, the *structured multiplication approach* of the system design thinking, namely, the way for one solution to be produced in addressing for multiple problems. Recently there have been published several studies that proposed successfully the single and the most innovative solution for multiple socio-technological problems by considering in multiplying requirements for expanding the solution spaces from independent and different domains in markets and technological constraints (e.g., Kubo and Baba [12], Takao and Sando [13]).

Challenge #2: Systematic Encounter

The second challenge is the difficulty to design systematically the platform to let many social designers with different social issues encounter in one place. In the conventional thoughts such as the advocacy coalition approach (Sabatier and Jenkins-Smith [14]), the issue groups advocate socially their own issues and interact between them, but little they come across for merging their proposals to one.

However, since 1990s workshops have been used to create innovative solutions for social issues. Workshop refers to interactive learning process among participants, small-group work, and application of new learning (Fleming [15]). Social designers regard a workshop as the well-framed opportunity with small seated groups to generate creative solutions for complex social problems (Will [16]). So we need to take the approach to use a workshop with designated seating frames for gathering social designers with many advocating issues to encounter systematically in one place to seek for the one multi-mighty answer.

Controlled Convergence and Systematic Encounter on System Design Thinking Workshop

In order to develop the new approach to solve multifaceted problems in the society by offering the most effective collective intelligence-driven design, this study extends the conventional approach of system design thinking workshop with the controlled convergence and the systematic encounter workshop to the Structured Multiplication Approach for Solving Social Issues (SMASSI).

The concept of controlled convergence is the core of this multiplication approach. Pugh [2] refers the controlled convergence to multiply good elements of designs on selection criteria into the integrated better design. Pugh concept selection is one of the visualized methods of this approach by a pair comparison, but for this study we applied only the way of thinking of this approach. The example of controlled convergence is raised as the case of new design of tea in **Fig**.2.
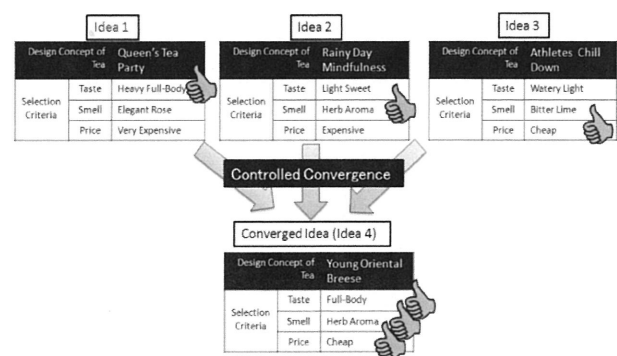

Fig.2. Converged Idea for New Tea Concept Design:
Example of Controlled Convergence

The controlled convergence is unconsciously used in creating the hybrid solution to plural social

problems, and often memorized as common prov-erb as "kill two birds with one stone". The "kill three birds with one stone" approach is listed in **Fig**.3 as the case to create one solution simultane-ously addressing to the social issues of the stressful urban life, the cultivation-abandoned farmlands in rural villages and the aging society.
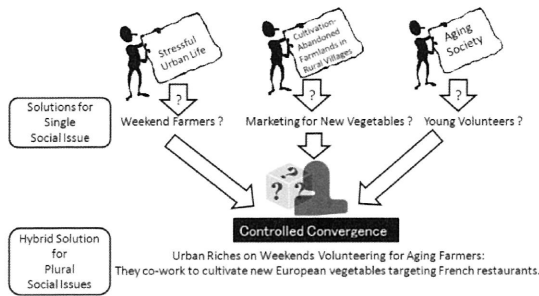

Fig.3. Controlled Total Design:
Converged for Plural Social Issues

The systematic encounter workshop is another driver to expand solution space for social innova-tion. Based upon rich experiences of the system design thinking workshop since 2008, the SMASSI introduces the new process to make workshop par-ticipants holding different social agenda encounter together in one place for workshop.

In the SMASSI, the seats for social designers are pre-designed in accordance with their pre-surveyed agenda. The actual seating arrange-ment in the SMASSI workshop is showed in **Fig**.4.
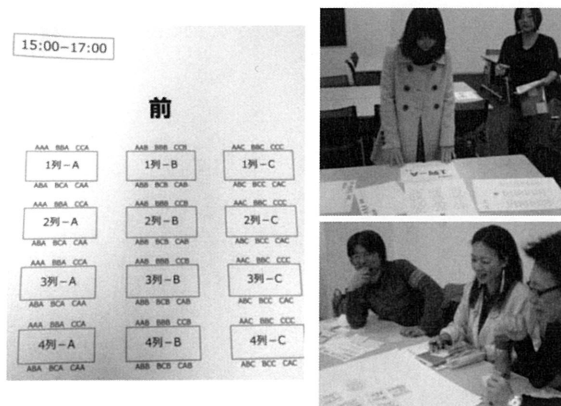

Fig.4. Systematic Encounter Workshop:
Seating Design and Workshop Scenes
(Photo by the authors on November 16th, 2014)

2. SMASSI: ARCHITECTURE

The SMASSI has the five sequential phases same as the system design thinking workshop; a) start-up, b) observation, c) ideation, d) prototyping and e) presentation. The phase c) ideation is further divided into two sub-phases; divergent thinking and convergent thinking.

The SMASSI workshop made no changes as sequences to this conventional innovation cycle. The three new elements of SMASSI are seamlessly incorporated and embedded into five phases of the system design thinking workshop; systematic en-counter to the start-up phase; simultaneous brain-storming with plural social issues; and controlled convergent to the convergent thinking of ideation phase (**Table**.1).

Table 1. Five Phases and Tools of Two Workshops.

Phase	System Design Thinking Workshop	SMASSI Workshop
	Representative Thinking Tools	
a) Start-up	Icebreak	**Systematic encounter*** Icebreak
b) Observa-tion	Ethnography Interview	Ethnography Interview
c-1) Ideation: Divergent Thinking	Brainstorming with one issue	**Simaltaneous Brainstorming with plural issues***
c-2) Ideation: Convergent Thinking	Affinity Diagram	Affinity Diagram **Controlled Convergence***
d) Prototyping	Drawing and Painting 3D Printer Mock-up	Drawing and Painting 3D Printer Mock-up
e) Presenta-tion	Improvised Story Play Storytelling	Improvised Story Play Storytelling

The SMASSI has three major characteristics to expand solution space for multifaceted responses to plural problems.

The first characteristic point is pre-design of seating to ensure systematic encounter. As ex-plained in the previous section, this arrangement is prepared by facilitators of the SMASSI workshop in advance.

The second characteristic point is simultaneous brainstorming with plural social issues. Participants are not engaged in brainstorming with respective social issue with one-by-one, but they are imple-menting all together on the same paper at one time. This tool is expected to stimulate participants' cre-ativity by expanding their in-mind scope for free

association of ideas (**Fig**.5).

The third characteristic point is controlled convergence embedded in the phase c-2) ideation of convergent thinking. As explained in the previous section, this embedded process facilitates to bridges insights from different domains of social issues.
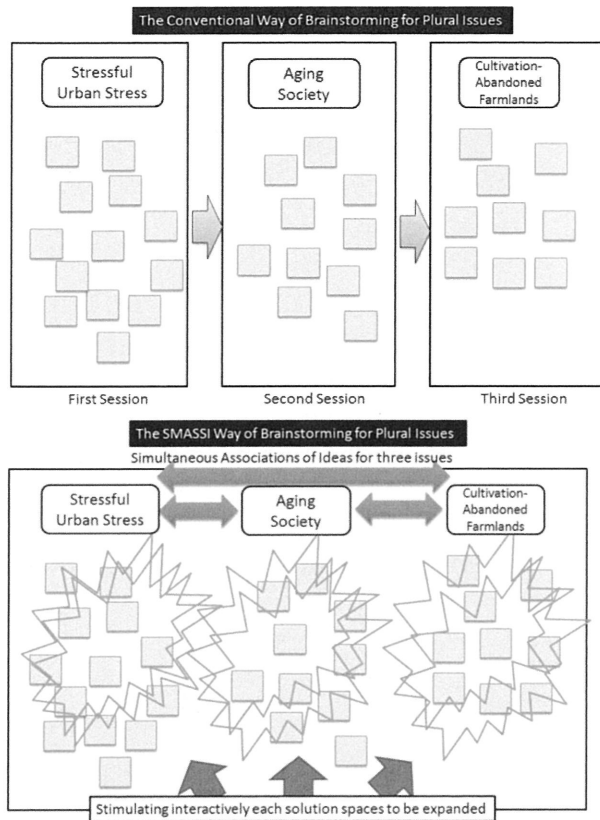

Fig.4. Comparison: Conventional Brainstorming (the Upper) and SMASSI Brainstorming (the Lower)
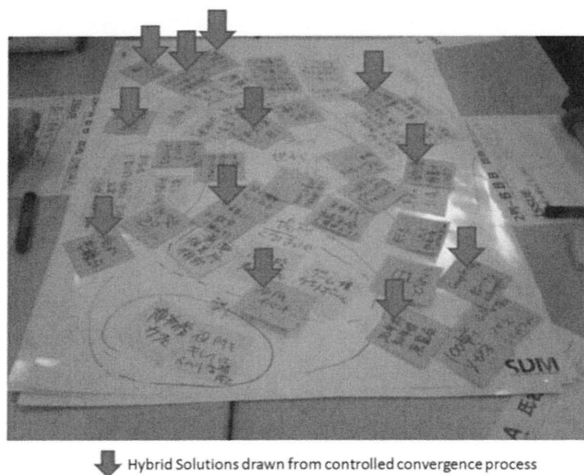

Fig.5. Hybrid Solutions Ideas Drawn from the MASSI Workshop by Controlled Convergence
(Photo by the authors on November 16th, 2014)

3. EVALUATION

3.1 Qualitative Evaluation

The authors conducted two workshops to find collective solution for social problems on November 16th, 2014 to test the efficacy of the SMASSI; one workshop is the conventional system design thinking workshop with the single social problem; another workshop is the SMASSI workshop with three identical social problems.

First of all, nine teams of 6-7 members (N=55) in the SMASSI workshops unanimously stepped all four design processes to reach successfully to each converged innovative solution to satisfy three different social problems. This consequence of the workshop qualitatively proved efficacy of the SMASSI for solving social issues in an integral way.

3.2 Quantitative Evaluation

Workshops-participants joined both workshops and answered the post workshop survey sheets that are translated and put in the Appendix of this paper. Based upon the post-workshop survey, the authors analyzed the efficacy of the SMASSI to enhance the social innovation, compared to the conventional system design thinking.

Two workshops scored the high marks of satisfaction and apprehensibility rates in five point-scale; 4.52 for participants' satisfaction; and 4.40 for participants' apprehensibility. This result can be interpreted that the participants well accepted and understood the SMASSI as the method to find a solution to multifaceted social problems.

T-Value Test

This study implemented the independent T-Test to compare the creativity enhancement effects of two workshop approaches. The authors adopted the five-point scale test of creativity enhancement adjusted from the Torrance Test of Creative Thinking (Torrance [17]) in accordance with the subjective approach of social policy theory (Veehoven [18]).

Test results are shows in **Table** 2. One hand, the conventional system design thinking workshop better performed to help fluency of participants' creativity enhancement; the result was statistically

significant with 1% level. On the other hand, the SMASSI workshop better performed to enhance the emergent properties of creativity increase; the result was statistically significant with 10% level.

Table 2. Independent t-value Test of Two Workshops.

Torrance's Four Elements of Creativity Enhancement	The Conventional System Design Thinking Workshop	The SMASSI Workshop	t-value (with two sides)
Fluency	**4.26**	3.74	**0.0079****
Flexibility	**4.18**	4.00	0.2831
Originality	3.78	**3.86**	0.5424
Emergent Properties	3.66	**3.86**	**0.0959***

**: with 1% significant level statistically satisfied (with two-sides).

*: with 10% significant level statistically satisfied (with two-sides).

The emergent properties of a system represent the systemic characteristics of system, and thus prove how system behaviors as the whole system, not the sum of elements (Jackson [19]). The statistical significance on emergent performance of SMASSI means that this approach is systemically and systematically effective to enhance creativity to social innovation.

Pearson's Correlation Analysis

This study also conducted the Pearson's correlation analysis to compare which of four creativity elements are more correlated in the case of SMASSI compared with the case of system design thinking.

Table 3 is correlation analysis results with the case of system design thinking. **Table** 4 is the correlation analysis results with the case of SMASSI.

Table 3. Pearson's Correlation Coefficients: the conventional system design workshop

Factor	Fluency	Flexibility	Originality	Emergent Properties
Fluency	1	**0.597****	0.338*	**0.616****
Flexibility		1	0.371**	0.409**
Originality			1	**0.687****
Emergent Properties				1

**: with 1% significant level statistically satisfied (with two-sides),

*: with 5% significant level statistically satisfied (with two-sides).

Table 4. Pearson's Correlation Coefficients: the SMASSI workshop

Factor	Fluency	Flexibility	Originality	Emergent Properties
Fluency	1	**0.734****	**0.591****	**0.655****
Flexibility		1	**0.677****	0.483**
Originality			1	**0.709****
Emergent Properties				1

**: with 1% significant level statistically satisfied (with two-sides),

*: with 5% significant level statistically satisfied (with two-sides).

The conventional system design thinking workshop showed significant correlations (here we identified as coefficients > 0.5) with fluency and flexibility (0.597**), fluency and emergent properties (0.616**), and originality and emergent properties (0.687**). This result means that fluency is the key leverage to pop up innovative idea in system design thinking.

Contrastively, the SMASSI workshop showed significant correlations (here we identified as coefficients > 0.5) with four factors of fluency, flexibility, originality, and emergent properties all together (>0.5**) except for flexibility and emergent properties because of slightly less margins (0.483**). The overall result means that all four elements of creativity are equally enhanced as the whole by the SMASSI approach.

4. CONCLUSIONS

4.1 Conclusions

This study modeled the SMASSI, a system design thinking workshop with controlled convergence for expanding solution space for social innovation. The SMASSI has the main characteristics to offer systematically the converged solution space both in physical and philosophical senses as the processed format of workshop.

The authors qualitatively and quantitatively validated efficacy of the SMASSI both in method and outcome. This approach assisted participants' emergent creativity increase for social innovation compared with the conventional system design thinking workshop with the single issue. It also draws better correlation in between four elements of creativity than the single issue workshop.

4.2 Further Research Agenda

The authors will continue to apply the SMASSI for more cases to show its robustness.

At this stage, this model is designed as the architecture for solving social issues, but it may develop to the general method for product and process innovation. The SMASSI needs to be conceptually expanded to reach for other innovation domains in perplexed requirements.

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APPENDIX

Post-Workshop Survey Sheet
Conducted at the workshop site on November 16th, 2014 (Original in Japanese, translated to English)

Answer: five point-scales
(5: very good, 4: good, 3: neutral, 2: poor, 1: very poor)

Q1 (satisfaction): Were you satisfied with the workshop?
A: 5, 4, 3, 2, 1

Q2 (apprehensibility): Did you understand the contents of workshop?
A: 5, 4, 3, 2, 1

Q3 (Creativity Enhancement): By compared with other ideation methods which you experienced in the past, how did you feel with this model particular in these points;

Q3-1 (Fluency): Was it easy to ideate?
Q3-1-1 Workshop with single social issue
A: 5, 4, 3, 2, 1
Q3-1-2 Workshop with three social issues
A: 5, 4, 3, 2, 1

Q3-2 (Flexibility): Was it flexible to ideate?
Q3-2-1 Workshop with single social issue
A: 5, 4, 3, 2, 1
Q3-2-2 Workshop with three social issues
A: 5, 4, 3, 2, 1

Q3-3 (Originality): Did you get original idea?
Q3-3-1 Workshop with single social issue
A: 5, 4, 3, 2, 1
Q3-3-2 Workshop with three social issues
A: 5, 4, 3, 2, 1

Q3-4 (Emergent Properties): Did you get emergence to new idea?
Q3-3-1 Workshop with single social issue
A: 5, 4, 3, 2, 1
Q3-3-2 Workshop with three social issues
A: 5, 4, 3, 2, 1

Q4 (Stage of Innovation): On which stage did you sense shift to innovative idea?

Q4-1: A: Brainstorming, B: Affinity Diagram, C: Controlled Convergence, D: Prototyping and Storytelling, E: Other methods, if any.

Q4-2: Please answer freely what shift to innovative idea you experienced in this workshop.
A. (Free Answer)