# Simulation and Gaming as Tools for Designing a Community Currency System

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Since the 2000s, many types of community currencies (CCs) have been issued and utilized in Japan (Nishibe 2013), some of which have encountered problems with sustainability. Yamazaki (2013) reported that about 60% of CCs in Japan were terminated or suspended because of a circulation failure within certain areas. Nishibe (2013) pointed out that CCs in Japan encounter many types of problems: funding, making people understand a CC, and designing a CC system for various types of stakeholders. Practitioners are of the opinion that it is necessary to create a common understanding, among many different stakeholders, of the goals for introducing a CC (Nishibe 2013).

In order to resolve these problems, it is necessary to set up a platform where many types of people can use CCs and reflect their trading situation. We consider that the gaming simulation is suitable for learning how to use a CC as well as for designing how to introduce a CC into communities (Yoshida 2012, 2013; Yoshida and Kobayashi 2014). Gaming simulation is "a hybrid form, involving the performance of game activities in simulated contexts" (Greenblat 1988, 15). Through gaming simulation, we can behave under "an operating model of central features of elements of a real or proposed system, process, or environment" (*ibid*, 14). Some researchers have used

gaming simulation to investigate the conditions for the circulation of CCs (Hayashi and Yosano 2008). These studies pointed out that the economic divide within a community affects the circulation of a CC. However, as CC issuers cannot operate this condition, it is difficult to apply these studies for designing a CC system. We develop a gaming simulation for searching the operable conditions that affect the circulation of a CC.
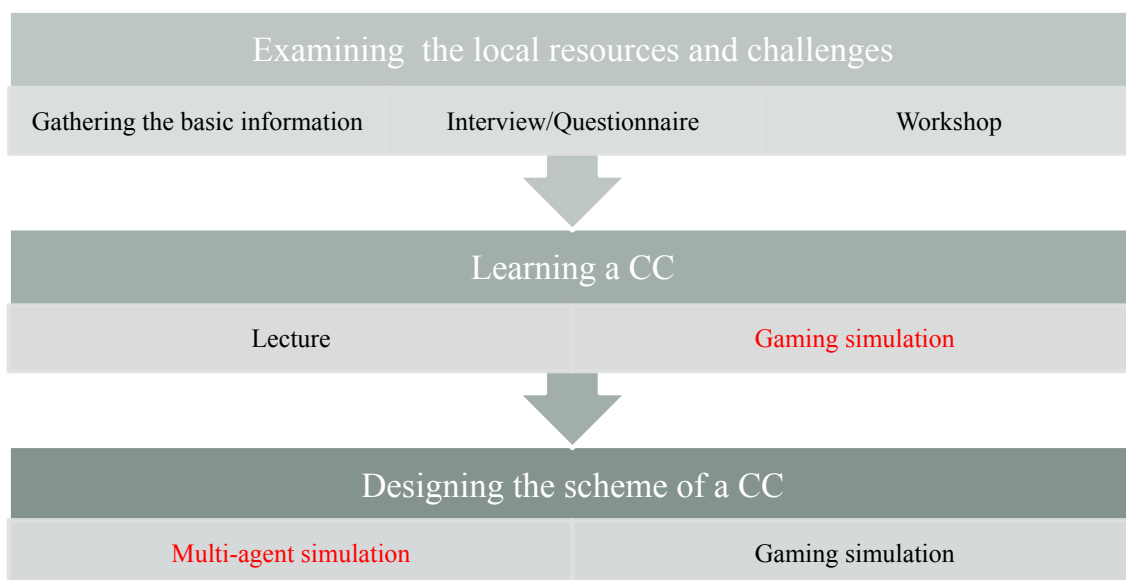
As of date, we have developed and practiced a gaming simulation, the Community Currency Game (CCG), in Nagaoka, Kitami, Iide, Tsubata, and Nomi, the Japanese towns that have planned to introduce a CC. To construct a CC system based on these results, we use computer simulation. Computer simulation is suitable for analyzing the mechanism of circulating a CC (the conditions for circulation, factors that promote circulation, etc.) (Kobayashi et al. 2012, Kobayashi et al. 2013). We have developed the computer simulation model and analyzed these conditions in Nagaoka.

In this study, we consider the effectiveness of simulation and gaming as tools for creating a common understanding of the goals of a CC system, and for exploring some possible scenarios that might result from the introduction of CC.

**Design of the process of introducing a CC**

In this study, we designed the process of introducing a CC (Yoshida 2013), which has three phases (fig. 1). Firstly, we examine the resources and challenges in the town. Concretely, we gather the basic information of the town (e.g. population, the number of households, income level, and major industries) and reveal the local resources and challenges through the interview and questionnaire. Additionally, we share these data and information among the local residents throughout the workshop.

Secondly, we arrange a learning session for local residents, where we present some precedents and explain the basic characteristics of a CC. Following this session, we help the local residents practice the gaming simulation, as can learn how to use a CC and discuss the cost and benefit of introducing a CC in the town. Through the discussion, they share their opinions on introducing a CC. Lastly, we design the scheme of a CC with the leaders of the town. By using a multi-agent simulation, we can verify whether the scheme of a CC works. In addition, by reflecting upon the results of the simulation of the gaming simulation, various types of stakeholders can take part in the process of the design.

| Examining the local resources and challenges | | |
|---|---|---|
| Gathering the basic information | Interview/Questionnaire | Workshop |

| Learning a CC | |
|---|---|
| Lecture | Gaming simulation |

| Designing the scheme of a CC | |
|---|---|
| Multi-agent simulation | Gaming simulation |

**Fig. 1 The process of introducing a CC**

In what follows, we examine the effectiveness of gaming as a tool of learning a CC and of simulation as a tool of designing the scheme of a CC.

**Gaming simulation**

We created a gaming simulation and tested it with residents of a town that intends to introduce a CC. The CCG is a face-to-face, analog game. The purpose of the game is to learn how to use CC and to promote a common understanding among various types of stakeholders of our goal by introducing a CC.

The main rules of the game are as follows (Yoshida and Kobayashi 2014):

- Determine some types of residents in the town (employee, student, etc.); each participant is assigned one of these roles. Further, each role has trading record sheets (fig. 2).

- Participants buy goods and services according to the dice. They must choose a shop inside or outside the town. The prices of goods and services inside the town are higher than those outside.

- Participants are faced with some problem (snow removal, etc.), the nature of which is determined by the dice. Other participants can volunteer to help them and if they do, their income from outside the town reduces by ten percent on their next turn as a cost of volunteer work. In these situations, they choose to pursue either their own

interest or the public interest.

- The game consists of two phases. The first phase has two turns; during this phase, the participants trade only with legal tender (yen). The second phase consists of three turns; during this phase, the participants trade with legal tender and CC. In this phase, participants decide the proportion of CC to be used to pay the selling price of goods traded. Participants also decide whether to receive CC for volunteer services rendered.

| trading record: before introducing a CC | | | |
|---|---|---|---|
| ( )turn | | | |
| employee | | | |
| | dice(1) | item/sales outlet | volunteer |
| purchase | 1 | Home electrical appliances / outside the town — Delicatessen / supermarket/outside the town — Private teacher / student | |
| | 2 | Bicycle / outside the town — Pancake / restaurant/outside the town — Vegetable / supermarket/outside the town | |
| | 3 | Clothes / general store/outside the town — Stay / Japanese-style inn — Curry / restaurant | Taking pets for a walk / student |
| | 4 | Delicatessen / supermarket/outside the town — Hot spring / Japanese-style inn — Chinaware / pottery/outside the town | Harvest experience / farmer |
| | 5 | Spice / outside the town — Rice / supermarket/outside the town — Delicatessen / supermarket/outside the town | Learnig how to cook a curry / restaurant |
| | 6 | Clothes / general store/outside the town — Daily goods / general store — China dish / pottery | Babysitter / student |
| sale | | | |
| item | | amount | |
| full-time job(10000 yen) | | | |
| volunteer | | | |
| menu | | amount | |
| house cleaning | | | |

| income from outside the town | dice(2) | income | amout of volunteering in previous turn | balance |
|---|---|---|---|---|
| | 1,2 | 0 yen | | |
| | 3,4 | 6000 yen | Did you get a volunteer in previous turn? | |
| | 5,6 | 12000 yen | Yes   No | yen |

| trading record: after introducing a CC | | | |
|---|---|---|---|
| ( )turn | | | |
| emploee | | | |
| | dice(1) | item/sales outlet | volunteer |
| purchase | 1 | Home electrical appliances / outside the town — Delicatessen / supermarket/outside the town — Private teacher / student | |
| | 2 | Bicycle / outside the town — Pancake / restaurant/outside the town — Vegetable / supermarket/outside the town | |
| | 3 | Clothes / general store/outside the town — Stay / Japanese-style inn — Curry / restaurant | Taking pets for a walk / student |
| | 4 | Delicatessen / supermarket/outside the town — Hot spring / Japanese-style inn — Chinaware / pottery/outside the town | Regional vitalization |
| | 5 | Spice / outside the town — Rice / supermarket/outside the town — Delicatessen / supermarket/outside the town | Learnig how to cook a curry / restaurant |
| | 6 | Clothes / general store/outside the town — Daily goods / general store — China dish / pottery | Regional vitalization |
| sale | | | |
| item | CC receipt rule | | amount |
| full-time job | 10000 yen=( ) yen +( ) S | | |
| volunteer | | | |
| menu | CC receipt rule | | amount |
| house cleaning | 0S   500S   1000S | | |
| regional vitalization | 0S   500S   1000S | | |

| income from outside the town | dice(2) | income | amout of volunteering in previous turn | balance |
|---|---|---|---|---|
| | 1,2 | 0円 | | |
| | 3,4 | 6000円 | Did you get a volunteer in previous turn? | |
| | 5,6 | 12000円 | Yes   No | yen |

**Fig. 2 Trading record sheet**

To the participants, we explained that this town has two big problems: one is the decline of the local economy and another is the decrease in mutual aid. We make participants think for solutions to resolve these problems. As per the game setting, the more the participants use CC, the easier they resolve these problems.

We studied two types of changes in the game (fig. 3). Firstly, we studied the changes in behavior of the participants who were using the CC. In particular, we focused on the changes of purchasing and volunteering when CC was introduced. Secondly, we studied the changes in their understanding of and attitude to CC because of their experience with the game. We gathered the survey data about an attitude toward

money and community-oriented values through pre- and post-game questionnaires, and analyzed the responses. We focused particularly on the participants' cognitive social capital and their visions of money (Kobayashi et al. 2013). In this game, we had two debriefings. The goal of the first debriefing is for the participants to share the experience in the CCG. Here, each role announced their final balance of legal tender and CC. Then, the participants discussed their experiences in the CCG and their understanding of CC. After the first debriefing, we analyzed the results of the game (trade history and pre- and post- questionnaire). In the second debriefing, we fed back these results to the participants. After sharing the behavior in the game, the participants discussed the scheme of CC suitable for their town and how to introduce CC in it. The goal of the second debriefing is to share the visions that introduce CC into their town.
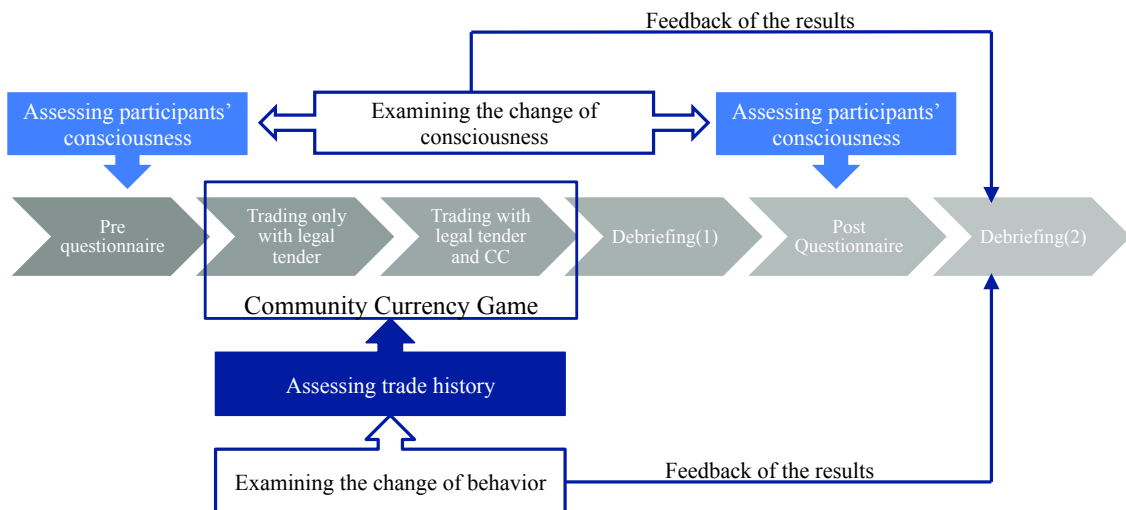


**Fig. 3 Procedure of CCG**

**Computer simulation**

We constructed a computer simulation model based on CCG to identify the factors that promote the circulation of CC (Kobayashi et al. 2012). In this model, each resident agent in the town probabilistically selects a purchasing store from three areas: inside the town, outside the town (near), outside the town (far)
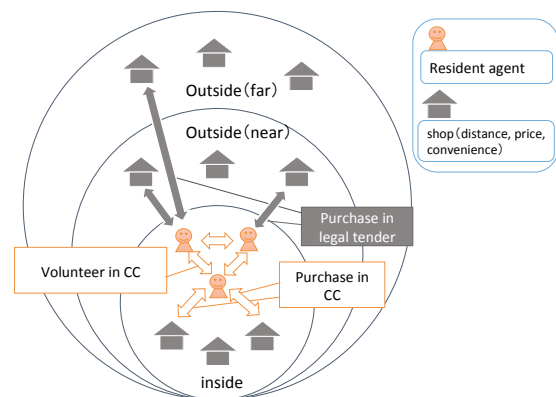


**Fig. 4 Area model**

(fig. 4). Their selections are according to the following five factors (probabilities): the habitual use of CC, the habitual use of legal tender, community-oriented value, the evaluation of stores, and the balance of CC. The probabilities of these factors for each agent can change depending on the agent's purchasing behavior.

Each shop has three elements: distance, price, and convenience. In this model, we set these elements as follows:

- Distance: inside < outside (near) < outside (far)
- Price: inside = outside (near) = outside (far)
- Convenience: inside > outside (near) = outside (far)

Under simulation conditions, we controlled three parameters: the premium rate of the CC, the proportion of the CC in salaries, and the propriety of volunteers with CC. We observed a change in the purchase rate of the area within town. Firstly, we focused on the premium rate of the CC because a high premium rate tends to increase the velocity of circulation of CC and enhance the effect of economic revitalization. Secondly, we focused on the proportion of the CC. The proportion of the CC paid as salaries may control stagnation of CC in stores, and may promote the use of CC. Lastly, we focused on the propriety of volunteers with CC because Nishibe (2008) indicated that CC connects people in a distribution network of CC and not only by the commercial use of CC. We have analyzed the condition of promoting the circulation of CC with the computer simulation model in Nagaoka.

**Results of simulation and gaming**

**Gaming simulation**

The trading history of the CCG showed that the proportion of items bought in the town and the rate of volunteering increased with the use of a CC. In addition, from the pre- and post-game questionnaires, we found that the participants' attitudes towards the diversity of money were positively affected by the CCG and that they understood the meaning of the network formed by a CC. In the debriefing session, the participants realized that using CC promotes transactions in their community (Yoshida and Kobayashi 2014).

In addition, we found that the changes of the behavior of the participants and the consciousness in this game depend on the customs of participants' community and the consciousness of the participant. For instance, in some gaming, participants helped each
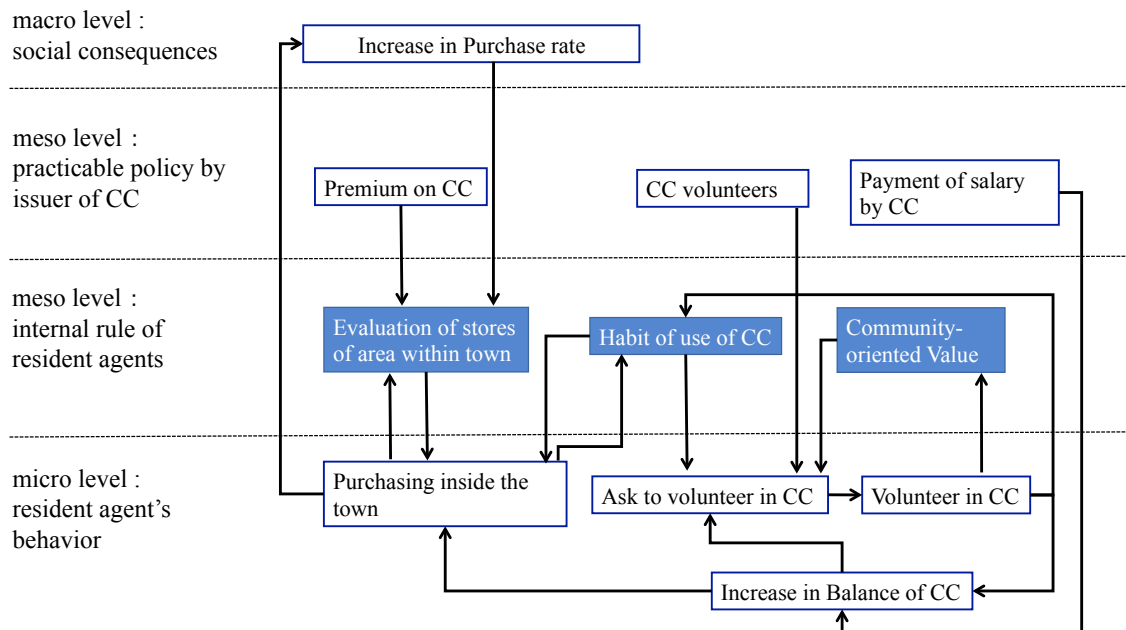
other without CC both before and after introducing CC because many participants have high reciprocity; the rate of volunteering is high. Moreover, we found that participants' image of CC is formed by their actual experiences in the game. For instance, for the wealthy role, as cash inflow exceeds the cash outflow, participants positively receive CC when the role sells items and willingly take on a volunteer. These participants tend to form positive image of CC.

We have incorporated a feedback system to the game. For instance, by virtue of receiving a CC by selling the item, the participant promotes to buy items inside the town and to pay volunteers a CC. Therefore, the more the CC circulates, the more the local economy and community activities connect, and vice versa. We confirmed that the gaming simulation results in interaction among many types of participants under these situations and through the debriefing, the participants can share other experiences. Through the CCG, we can provide the platform where many types of people can use CCs and share their recognition about CCs. This is the basis of the design of CC.

**Computer simulation**

In the simulation, the purchase rate of the area within town increased with the three parameters: the premium rate of CC, the proportion of the CC in salaries, and the propriety of volunteers with CC. However, the mechanism of increasing the purchase rate of the area within town is different (fig. 5).

The purchase rate of the area within town increases with the premium rate. In this case, evaluations of the stores inside the area increased since they offer discounts according to the premium rate of the CC. If the resident agent purchase inside the town, the evaluation of stores of area within town increase. Therefore, this policy stimulates the local economy. However, the cost of CC issuer increased by virtue of the premium. Therefore, this policy is not sustainable.

macro level :
social consequences

Increase in Purchase rate

meso level :
practicable policy by
issuer of CC

Premium on CC      CC volunteers      Payment of salary by CC

meso level :
internal rule of
resident agents

Evaluation of stores of area within town    Habit of use of CC    Community-oriented Value

micro level :
resident agent's
behavior

Purchasing inside the town    Ask to volunteer in CC    Volunteer in CC

Increase in Balance of CC

**Fig. 5 Causal loop of the purchase rate increase**

On the other hand, the other policies, where the resident agents' salaries were paid with CC and the resident paid volunteers with CC, are sustainable. However these policies do not stimulate to purchase inside the town directly. The purchase rate of the area within town gradually increases with the ratio of the CC in salaries. By paying salaries with CC, the balance of CC increases and the stores in the area within town are more likely to be chosen. In addition, the probability of the habitual use of CC also increases. Moreover, in the case where the resident paid volunteers with CC, the purchase rate of goods in the area within town increases compared to the case without CC volunteers. The choice probability according to the community-oriented value also increases since the community-oriented values of resident agents develop by providing volunteers. Moreover, since some people receive CC through their volunteer work, the balance of CC also increases. As a result, the resident agents have a greater opportunity to choose stores in the area within town. Furthermore, the occurrence probability of volunteers increases according to the habitual use of CC, the community-oriented values, and the balance of CC.

**Implications and discussion**

By using a CCG, participants can experience the interactions that can emerge in a community where CC circulates. Further, participants can discuss their experiences in the debriefing session. Participants can also use gaming to create common goals for CC among many different stakeholders. We confirmed that the gaming simulation has an effect on sharing the recognition of a community where CC circulate and on forming the goals for CC. However, the gaming simulation is not suitable for setting the scheme of CC because in the game, the rules of CC are settled in advance. Furthermore, because the number of participants and trading is a small, we cannot observe the actual transactions among the residents and the actual changes in the community through the game.

On the other hand, the computer simulation has an advantage to set the scheme of circulating a CC. We can identify the factors that promote the circulation of CC in the town. The computer simulation can show the most effective scenario where CC circulates and the practicable policy for the issuer of CC. The hybrid of simulation and gaming allows us to inform people about CCs, and to involve many different stakeholders in the design of a CC.

There are some limitations to our study. Firstly, it is important to secure the validity of the results of simulation and gaming. In particular, the CCG has a high degree of freedom of behavior. Therefore, the results of gaming depend on the characteristics of participants and on the facilitation of the game. Thus, we must approach debriefing very carefully. In that case, we must explain that the interactions of the game represent what happens in their town if a CC is introduced.

Secondly, we must construct the relationships among residents, leaders, and scholars when we use simulation and gaming as a design tool. Further, it is important to share the goals and methods of introducing a CC as well as the limits of achievement of simulation and gaming.

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