Engaging Customers’ Experience through C2C Interaction in Value Co-creation Process: Agent Based Simulation

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Few studies have been carried out with the specific aim of looking at customer-to-customer (C2C) interaction, as opposed to the co-creation of the experience. There are C2C literature on empirical case studies and conceptual methods, but one approach is to identify and explore a wider range of C2C-driven services in terms of customers’ interaction. In this research we use the framework of agent-based modeling and simulation in process model of value co-creation which engages the customers’ experience. In the model, through co-experience customers and providers, who have different internal model at first, by mutual understanding with each other may share and co-define their common internal model. In order to achieve this purpose in a realistic context, we take as a typical example Airline selection problem in Indonesia. We define concept of C2C network of interaction, i.e., face-to-face (physical space) and social media (virtual space). Furthermore, we introduce the number of customers who know the reputation of provider. We measure learning efficiency to create value with the provider in value co-creation process by using simulation and empirical methods.

Keywords: value co-creation, customer-to-customer (C2C) interaction, co-experience, co-definition, customers’ community, agent-based modeling and simulation.

1. Introduction

Fundamentally, in a view of service dominant (S-D) logic, value co-creation resides in the notion of value-in-use (Vargo and Lusch 2004). The meaning of value co-creation as value-in-use is relational and reciprocal, and based on perceptions and experiences as captured in the idea that the customers is always co-creator of value (Vargo and Lusch 2008d). Gronroos and Ravald (2011) suggest that to better understand value co-creation, it is essential to further analyze customers’ roles as value co-creator.
To address this, and to further explore customers’ active roles in the value co-creation process, the concept can be considered from the perspectives as value-in-use, and the provider-customer co-creation relationship. The literature on value co-creation has mostly taken a firm centric view; where value is jointly co-created through customer-provider interaction (Boyle 2007; Payne, Storbacka, & Frow 2008; Prahalad & Ramaswamy 2000). Relatively little attention has been paid to services where C2C is one of the main sources of value co-creation.

Few studies have been carried out with the specific aim of looking at customer-to-customer (C2C) interaction, as opposed to the co-creation of the experience. However, more recently, studies have introduced a customer centric view by exploring the co-creation process through customer-to-customer (C2C) networks of interaction or ‘customer community’ (Cova & Salle 2008; Rowley, Kupiec-Teahan, & Leeming 2007). These studies on C2C literature are empirical case studies and conceptual methods, but one approach is to identify and explore a wider range of C2C-driven services in terms of customers’ interaction more dynamic is needed.

In this research we use conceptual framework for agent-based modeling and simulation in process model of value co-creation (Novani and Kijima 2012). In this framework, there are three entities: empirical data collection, model and simulation. Model is a process description which implemented in simulation, and by which we can reproduce the evolution of empirical data and simulation as a tool to verify and validate the model. On the other hand, in the model of value co-creation, through co-experience of customers and providers, who have different internal model at first, by mutual understanding about the service with each other may share and co-define their common internal model.

The main purpose of this research is to investigate which kind of styles of customer-to-customer interaction (C2C), i.e., face-to-face (physical space) and social media (virtual space) is efficient for customers to learn the providers in Airline service selection problem. In this research, we introduce number of customers who know reputation of providers. We measure learning efficiency, i.e., distance between the average of internal models of the customers and that of the provider.

2. Customer-to-customer (C2C) Interaction Driven Service in Value Co-creation

In this present research, we focus on co-created value which reflects the level of perceived value created in the customer’s mind arising from interactive with actors, which is generated in focal service experiences (Vargo and Lusch 2008a; Gummesson et al. 2010; Mele and Spena 2010). We emphasize that co-creation is when customers contribute to the value creation of provider and their offerings.
Such services have been referred to as C2C-driven services and shapers of C2C (Nicholls 2007; Baron et al. 2007). Contributions in this area include a number of case studies where C2C is portrayed as one of the main sources of value co-creation. Heskett (1983) shows how Shouldice Hospital carefully structures interaction between customers so as to create value. There is a need for further investigation of C2C-driven services.

2.1. C2C: Network of Interaction

The concept of co-creation is focus on interactions. Co-creation may take place in the context of customer communities. In this research we categorize two types of interactions, i.e., face-to-face (physical space) and social media (virtual space) community.

Fan clubs, interest clubs may constitute customers which interact on face-to-face. In fact, there is evidence that supports the claim those alternative “physical space”. Customers with similar interests gather into communities to fulfill their demands for information, belonging, entertainment, and even financial benefits. They form a community to exchange the information, share the experience and build the relationships. Based on a range of different variables, like group size, levels of interest and social status, they can affect customer behavior and provider’s interaction with the customers.

One context in which there has been more discussion of customers’ interaction is virtual environment (Armstrong and Hagel 1996). With the Internet revolution changing everyday life and interaction, it was only natural to see the emergence of social media or “virtual space”. Great example is the community of Weightwatchers. A member of this community is able to engage experience of C2C in value co-creation process based on sharing information among customers.

3. Method

In this research we use conceptual framework for agent-based modeling and simulation (Gao and Freeh 2003). There are three entities of this framework, i.e., empirical data collection, model and simulation.

3.1. Empirical Data Collection

Data collection is an essential component to conducting research. Data collection is a complicated and hard task. This research discusses data collection from two types, i.e., interviews and questionnaires.

3.1.1. Qualitative Research Method: In-depth Interview

It was decided to use in-depth interviewing as the main method to collect the data for the study since an interpretative approach was adopted for the investigation. The central concern of the interpretative research understands human experiences at a holistic level. We take as a typical example service system of Airline selection problem in Indonesia. We choose Garuda Indonesia, since Garuda Indonesian Airlines leads the best
service quality in Indonesia. Garuda Indonesia won the best international Airlines award for January 2012 from Roy Morgan Research. According to Roy Morgan, Garuda received 91 percent satisfaction rate from 3943 respondents surveyed in January.

The award is the latest accolade for Garuda. The Airline won a four star rating from research company Skytrax in 2010. Skytrax also named Garuda as the world’s most improved Airline at the 2010 world Airline Awards in Hamburg, Germany. Garuda also won Asia’s leading service quality Airline by the Center for Asia Pacific Aviation (CAPA) in 2010.

We did in-depth interviews with the Vice President of Strategic Marketing of Garuda Indonesia Airline. The interviews were conducted with an average duration of 45 to 75 minutes at Jakarta. The main aim of conducting interview is to derive internal model from provider’s perspective.

Based on the interview, we recognize Garuda provide two types of service orientation, that is, high-oriented and price-oriented service. High-oriented service is defined as top class service (full service), which is provided by the Garuda to guarantee “Just in time”, reliability, quality, frequent flyer programs and price-oriented service is defined as service offered by low fare and low cost Airlines, such as Citi link, that is, no entertainment, no flight meal, etc.

We collect data based on in-depth interview from providers’ perspective, which assume each customer has different value system; in other words, he/she has a subjective internal model. Then, we use hypergame as a framework, where a subjective game is represented by an internal model to describe mutual understanding process of customers and providers very naturally.

Based on the interviews results, the provider, Garuda Indonesia, believes that customers have three expectation levels, i.e., low (L), middle (M) and high expectation (H). It also describes the provider has two strategies, i.e., high-oriented service (H) and price-oriented service (L). Figure 1 shows Garuda Indonesia’s internal model as high-oriented service provider.

![Fig 1. Provider’s Internal Model](image)

### 3.1.2. Quantitative Research Methods: Questionnaires

On the other hand, we collect questionnaires data from customers who use Airline service which related to the investigator. This data is used to validate our simulation result. The main aim of the questionnaire is to obtain data from experienced customers who use an Airline, how they got the information from others by using such kind of interaction types say, face-to-face (physical space) or social media (virtual space).
3.1.2.1. Sampling Techniques

In this research we want to know the percentage of customers who use Airline by using interaction through face-to-face (physical space) and social media (virtual space). In this case, if the population you would to ask to be bigger than 100 million people then it is obvious that making an interview requires big efforts. In this situation, for economic reasons, it will be convenient to interview a certain part of the population, a sample.

In this research we use stratified sampling since it is good as or better than random samples, but it require fairly detailed advance knowledge of the population characteristics. Before doing the sampling, the population is divided into characteristic, i.e., customers who use Airline and educated customers. Population of this research is 30% college educated in Indonesia, and then 30% of the sample is randomly selected from the college-educated population.

Questionnaires were sent to Indonesian students, i.e., Computer University, Business School of Management ITB, and Indonesian student at Tokyo Institute of Technology. The characteristic of samples is student who used Indonesian Airline. Researcher was constructing the questionnaires by online. By two weeks, we received questionnaires from 116 customers. Completed questionnaires were received from 90 individuals. Twenty-six questionnaires were not valid due to the various reasons such as not completed fill in. Therefore, an overall response rate of 77.5% was achieved.

Table 1. Sample Demography

<table>
<thead>
<tr>
<th></th>
<th>Count</th>
<th>Column (%)</th>
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<tbody>
<tr>
<td>Age</td>
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<tr>
<td>20 or younger</td>
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<td>1.11%</td>
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<tr>
<td>21-30</td>
<td>60</td>
<td>66.67%</td>
</tr>
<tr>
<td>31-40</td>
<td>23</td>
<td>25.56%</td>
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<tr>
<td>41 or older</td>
<td>6</td>
<td>6.67%</td>
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<tr>
<td>Gender</td>
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</tr>
<tr>
<td>Male</td>
<td>56</td>
<td>62.22%</td>
</tr>
<tr>
<td>Female</td>
<td>34</td>
<td>37.78%</td>
</tr>
<tr>
<td>Educational Background</td>
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<tr>
<td>Undergraduate Degree</td>
<td>65</td>
<td>72.22%</td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>25</td>
<td>27.78%</td>
</tr>
</tbody>
</table>

3.1. Hypotheses

In order to investigate how interaction type of C2C influences their learning process, we measure the learning efficiency, i.e., the distance between the average of internal models of the customers and that of the provider. The smallest distance the highest learning efficiency.

We pose four hypotheses as follows:

H1: If customers have similarity in terms of attributes (e.g., education background, lifestyle, wealthiest) with others, then face-to-face is efficient to create value with the providers.

H2: If customers are dissimilar in terms of attributes (e.g., education background, lifestyle, wealthiest) with others, then social media is efficient to create value with the providers.

H3: If quite many customers in our community know well provider’s reputation then face-to-face is efficient to create value with the providers.

H4: If few customers in our community
know provider’s reputation then social media is efficient to create the value with the providers.

3.2. Agent-based Modeling and Simulation

In this research, we propose network of interaction styles for customer-to-customer (C2C) and use the concept of adaptive learning in service system process.

3.2.1. Network of Interaction in Process Model of Value Co-creation

In this research, we define two types of interaction (Novani and Kijima 2012) in which all the customers interact each other in the same way:

1. Face-to-face or physical space

In this interaction, all customers interact on face-to-face basis only with their family, relatives and/or friends. Customers with similar interests gather into communities. We may suppose diversity of the interaction partners is relatively low that it is reasonable to suppose that all the internal models are quite similar to each other. Hence, we assume the population of customers is relatively small and for any two customers $i$ and $j$ in the community, we have:

$$d(M_i, M_j) < \text{threshold}$$

where, $M_i$ and $M_j$ represent $i$'s and $j$'s internal model, respectively.

To argue how customers share their internal model in the phases of co-experience and co-definition process, we now introduce a basic framework of hypergame analysis (Novani and Kijima 2012). The network of customers in service process is portrayed in Figure 3.

![Fig 3. Face-to-face Interaction in Process Model of Value Co-creation](image)

The other assumption is at least one of the customers in the community happens to understand the provider’s preference correctly. Formally, there is $i^* \in C$ such that

$$\pi_j(s, t) = \pi_j(s, t^*)$$

for any $s \in S_{i^*} = S_{i, j}$ and $t \in S_{j, i^*} = S_{j}$

We define distance between two internal models by:

$$d(A, B) = \sum_{k=1}^{3} \sum_{l=1}^{4} |a_{kl} - b_{kl}|,$$

where $A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \end{bmatrix}$ and $B = \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} \\ b_{21} & b_{22} & b_{23} & b_{24} \\ b_{31} & b_{32} & b_{33} & b_{34} \end{bmatrix}$
2. **Social Media or virtual space**

In this interaction, all customers interacts each other by using virtual space, i.e., social media. In this case, the population is so large (we assume 1000 customers) that we can reasonably assume at least one customer identifies the provider’s preference correctly. The network of customers is portrayed in Figure 4.

![Fig 3. Social Media Interaction in Process Model of Value Co-creation](image)

3.2.2. **Learning Process**

We adopt the learning procedures by using genetic algorithm (Goldberg 1989) to examine the process of learning to describe how customers are improving their knowledge through the interaction among them. Genetic algorithm is suitable because it provides a method to reorganize knowledge according to the experience and to improve the performance (Dawid 1996). The interaction among the customers and provider is portrayed by Figure 4.

![Fig 4. Adaptive Learning Model of Interaction among Customers and Provider](image)

We describe the adaptation process of the customers as follows:

- For each customer $i \in C$, let us denote internal model at the $t^{th}$ iteration by $M_i^t$.
- At the initial condition, customers’ internal model will be generated randomly.
- At iteration, each customer $i \in C$ uses his/her internal model to play with provider. Therefore, there are $n$ interactions between the two, customers and providers at each iteration; where $n$ is the number of the customers.
- By considering the information, customer $i$ evaluates and revises the internal model from $M_i^t$ to $M_i^{t+1}$ for the $(t+1)^{th}$ iteration.
- Customers interact among themselves to get some information about the provider.
- Each customer chooses an action based on his/her rule and his/her internal model or information about the others responses so far.
- By repeating interactions and revisions again and again, the population may be dominated by a better internal model.
A better internal model is defined as one getting a higher performance for the customers when Nash equilibrium is implemented.

As a result of learning, customers may share a common internal model.

The following is the learning procedure which consists of three stages:

1. **Stage 1: Initialization**

   We generate randomly an initial population of \( n \) internal models, each of which is associated with a customer in the group. Each internal model is encoded as a chromosome.

   a. **Generation of Initial Population**

      For the purpose of this research, the way we generate the initial internal model should depend on the interaction style.

      1. Face-to-face community, i.e., generating internal model of customers randomly but they are quite similar to each others.

      2. Social media community, i.e., generating randomly internal models of customer in the large society.

   b. **Encoding**

      We encode the customers’ internal model as a chromosome. Chromosomes represent information about the customers’ value.

2. **Stage 2: Action Choice**

   An action choice of customers and provider is based on his/her current internal model and decision rule adopted by him/her. We will use two kinds of decision rules, its subjective Nash Equilibrium \( (N_i) \) and random action.

   a. If there is no subjective \( N_i \) action in his/her game, \( i \in C \) adopts random action.

   b. If there is only one subjective \( N_i \) action in his/her game, \( i \in C \) adopt it.

   c. Otherwise, if more than one subjective \( N_i \), \( i \in C \) select one randomly and adopts it.

3. **Stage 3: Update**

   Each customer revises the current population of internal models by genetic algorithm procedures as follows:

   a. **Fitness Evaluation**

      Calculate a fitness score of each internal model in the current population by a fitness function. The fitness function maps his/her internal model into \([0,1]\).

   b. **Breeding Process**

      Repeat the procedure until \( n \) children (or \( n \) new internal models) are produced from the current internal models.

      1. **Selection**

         Selection is to choose an internal model, called parent from the \( n \) internal models, when each customer begins to revise his/her internal model.

      2. **Crossover**

         After doing selection, each customer begins to create children
by crossover or reproduction depending on crossover probability $p_c$.

### 3.3. Simulation Design

We now conduct an agent-based simulation based on the preparation above. We call iteration of the simulation procedure as generation. The entire set of generations is called a run. We define the threshold as a limit point of distance between the internal model of customer and that of provider to measure the similarity between them. That is, if the distance is less than the threshold, we may say these matrixes are similar. The parameters for the simulation are portrayed in Table 2.

Table 2. Definition of Parameter

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Numbers</th>
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</thead>
<tbody>
<tr>
<td>Number of customers in social media Community</td>
<td>1500</td>
</tr>
<tr>
<td>Number of customers in face-to-face Community</td>
<td>150</td>
</tr>
<tr>
<td>Maximum generations number</td>
<td>100</td>
</tr>
<tr>
<td>Maximum runs number</td>
<td>100</td>
</tr>
<tr>
<td>Probability of Crossover</td>
<td>0.7</td>
</tr>
<tr>
<td>Threshold</td>
<td>8</td>
</tr>
</tbody>
</table>

### 4. Results

#### 4.1. Respondents’ Background

Our respondent from the questionnaires result have experience using Airline service. The experience of respondents who used Airline ranged from one to forth per year with an average experience of twice per year. Most respondents had a significant amount of experience and so the results should reflect expert behavior.

#### 4.2 Simulation and Empirical Result

In this section we compare between simulation and empirical to investigate how customer-to-customer interaction (C2C) styles influences their learning process through hypotheses. We define learning efficiency, i.e., measuring the distance between the average of internal models of the customers and that of the provider. The smaller distance the highest learning efficiency of interaction styles in service system process.

#### 4.2.3. Hypothesis 1

In this hypothesis, we investigate if quite many customers know the reputation of provider to create the value. In the simulation, we assume number of customers who knows the provider correctly is 20% in the community.
Fig 5a. Learning Efficiency from simulation result if quite many customers know the provider’s reputation well

If many customers know the reputation of provider in the community

Fig 5b. Learning Efficiency from empirical result if quite many customers know the provider’s reputation well

The distance can approach to zero faster in face-to-face interaction from simulation result. The same result we found from empirical research that 70% customers said face-to-face interaction is efficient if quite many customers know the provider’s reputation in the community.

4.2.4. Hypothesis 2

We now investigate if no customers know the reputation of provider to create the value. For the purpose of simulation, we assume number of customers who knows the provider correctly is 1% in the community.

Fig 6a. Learning Efficiency from simulation result if few customers know the provider’s reputation well

If few customers know the reputation of provider in the community

Fig 6b. Learning Efficiency from empirical result if few customers know the provider’s reputation well

From both of result, social media interaction is more efficient than face-to-face interaction if no customers know the reputation of provider in the community. The distance can approach to zero which shown by simulation. On the other hand, based on the empirical result, it found that 77% customers said social media is efficient if few customers know the reputation of provider in the community.

5. Conclusion and Discussion

Most of the research in value co-creation is just only using conceptual method or empirical methods. In contrast, this research try to use the framework of agent-based model and simulation approach by using empirical data collection, simulation and validation
using the data. The benefits of agent-based modeling and simulation over other modeling techniques can capture the dynamic interactions of customers in service system process and provides a natural description of a service system.

We investigated which kind of network styles of customer-to-customer interaction (C2C) by introducing number of customers who know the reputation of provider to create value. Face-to-face is efficient if in our community there are quite many customers know the reputation of provider. On the other hand, social media is efficient if in our community there is no customers know the reputation of provider. Customers have different background with others such as demography, education or lifestyle and they will interact in a “public” way and this is customer-to-customer interaction (C2C).

In summary, based on the empirical result, 61% of customers said that both of interaction style, i.e., physical space (face-to-face) and virtual space (social media) is important on C2C interaction to create value which depends on the community. We found that 84% customers use face-to-face interaction as efficient way if they have similarity in service attribute in the community and 70% customers said if quite a many friend, family or relatives know the reputation of provider in the community. On the other hand, 80% of customers use social media interaction as efficient way if they are dissimilar in service attributes and 77% customers said if few customers know the reputation of provider in the community.

References


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