Learning to Collaborate:
The impact of the Commons Systems in Building Collaborative Capacity through Enhanced Social Learning

International Political Economy (Case Study)
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Abstract

The commons systems or common pool resource systems have been described as the institutions for collective action which can deal with social dilemmas as an alternative to the market and hierarchical institutions. The paper attempts to examine whether commons systems actually facilitate collaborative capacity through a comparatively analysis of the outcomes of an experimental game played by the commons group and non-commons group. Also, it intends to illustrate how institutions of collaboration emerge and evolve through observational analysis of the process and result of the experimental game.

The results of the experimental game demonstrate that individuals of the commons group were able to initiate collaboration from the very beginning even in a new environment compared to the individuals who are not familiar with collaborative regime of the commons system. The determining factors of their capacity to initiate and develop collaboration were: 1) their perception on the game (zero-sum or non-zero-sum); 2) the existence of pooled resources; 3) the extent of the interactions (the level of deliberation and collective experiments).

Based on both quantitative and qualitative analysis on the outcomes of the experimental game, the paper argues that the commons systems do improve collaborative capacity of individual actors involved in the community through social learning. The commons systems facilitate social learning required for not only improving collaboration, but also initiating collaboration through a particular kind of social learning called triple-loop or transformative learning.

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Keywords
The Commons Systems, Social Learning, Collaboration, Collaborative Capacity, Deliberation, Collective Experiment

1. Introduction
In recent decades, some scholars started to take collaboration seriously. Among them, Ostrom analyzed multiple cases of collaborative resource governance systems across the world and came up with institutional design principles of the collaborative systems or the common-pool resource systems as she named. In recognition of the role of collaboration in dealing with the problem of social dilemmas in which people cannot realize social optimal and instead end up choosing less optimal options, she emphasized the institutional aspects calling the commons systems for institutions for collective action (Ostrom, 1990). The commons systems are defined as the

collaborative resource governance systems (Ibid). The examples of the commons systems ranges from communal grasslands, community forests, to a community restaurant in urban areas and diverse forms of cooperatives through which a group of individuals collectively produce, manage, and consume certain kinds of resources.

In both theoretical and empirical way, many studies found out that the Commons or Common-Pool Resource systems can be an alternative to the market or hierarchical resource governance regime by dealing with social dilemmas with collective actions or collaboration (Ostrom, 1990; Wade, 1994; Gibson et al. eds., 2000; Agrawal and Ostrom, 2001; Ostrom and Nagendra, 2006). For this reason, the commons systems are interchangeably called as "institutions for collective action" Yet, questions remain. Do the commons systems actually facilitate individuals' capacity to collaborative so that they can collaborate better than the individuals who are not involved in the commons systems? If collaboration is of evolutionary and complex property, how collaboration or the institutions of collaboration emerges and evolves?

So far, no study compared the collaborative capacity of the commons group and the non-commons group though an experimental game. Also, studies involving experimental games did not focus on the emergence and evolution of the institutions for collaboration and collaborative capacity because of the absence of communicative interaction in the game settings, and very restricted control of the players in terms of changing game dynamics and thus results. Hence, the paper attempts to examine the impact of the commons systems on collaborative capacity through an experimental game. Also, it intends to analyze how the institutions for collaboration or collaborative regime emerge and evolve through the experimental game.

In this paper, cooperation is differentiated from collaboration in order to avoid confusion with the narrowly defined cooperation used in game theory literature. Although the terms like cooperation and collective actions are conventionally used in the commons literatures as well including Ostrom's work as the result of the relationships enabling people to overcome social dilemmas for mutually beneficial outcomes (see Ostrom, 1990, 1998, 2003).

2. Framework
2.1. Methods/ Approach
In this paper, a dependent variable is collaborative capacity and independent variables are the familiarity with the collaborative regime of the commons systems and absence of it. The independent variables are represented by two different subject groups - commons group and non-commons group. Regarding the concept of institutions, the paper follows North's definition which identifies institutions as "the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction" (North, 1990, p 3).

For the comparative analysis on collaborative capacity depending on the independent variables, the paper uses the first hand data produced by an experimental game because data gathered from experimental settings give researchers a greater degree of confidence compared to a simple conventional observational analysis. However, as it is an experimental game, it shall be differentiated from "pure experiments". The data analysis involves some observational aspect based on the video recordings of the game sessions.

In this sense, the experimental game can be categorized as mixed experimental-observational design. The collaborative capacity is evaluated by both quantitative and qualitative outcomes. For simplicity, the main criteria for evaluation would be the quantitative outcome which is the amount of payoff of the group per person. Yet, the emergence and development of collaboration in relation with social learning would be carefully analyzed based on interactions and behaviors of the participants recorded on video tapes.

2.2. Background
Collaboration

One of the most cited works on collaboration (Gray, 1989), defines collaboration as a process through which actors with different perspectives "can constructively explore their differences and search for solutions that go beyond their own limited visions of what is possible (emphasis added)" (p 5). A more recent definitions refer collaboration as "an approach to solving complex problems in which a diverse group of autonomous stakeholders deliberate to build consensus and develop networks for translating consensus into results" (Margerum, 2011, p 6). The list of key components of collaboration can be summarized as below

1) interdependence,
2) shared purpose of making positive changes,
3) explicit but voluntary membership,
4) organization or group forms (both formal and informal),
5) collective decision making,
6) constructive appropriation of the differences,
7) interactive processes (deliberative processes emphasized)
8) mutual accountability (both in terms of burden and power) with the understanding on the nature of collaboration as an *emergent process*
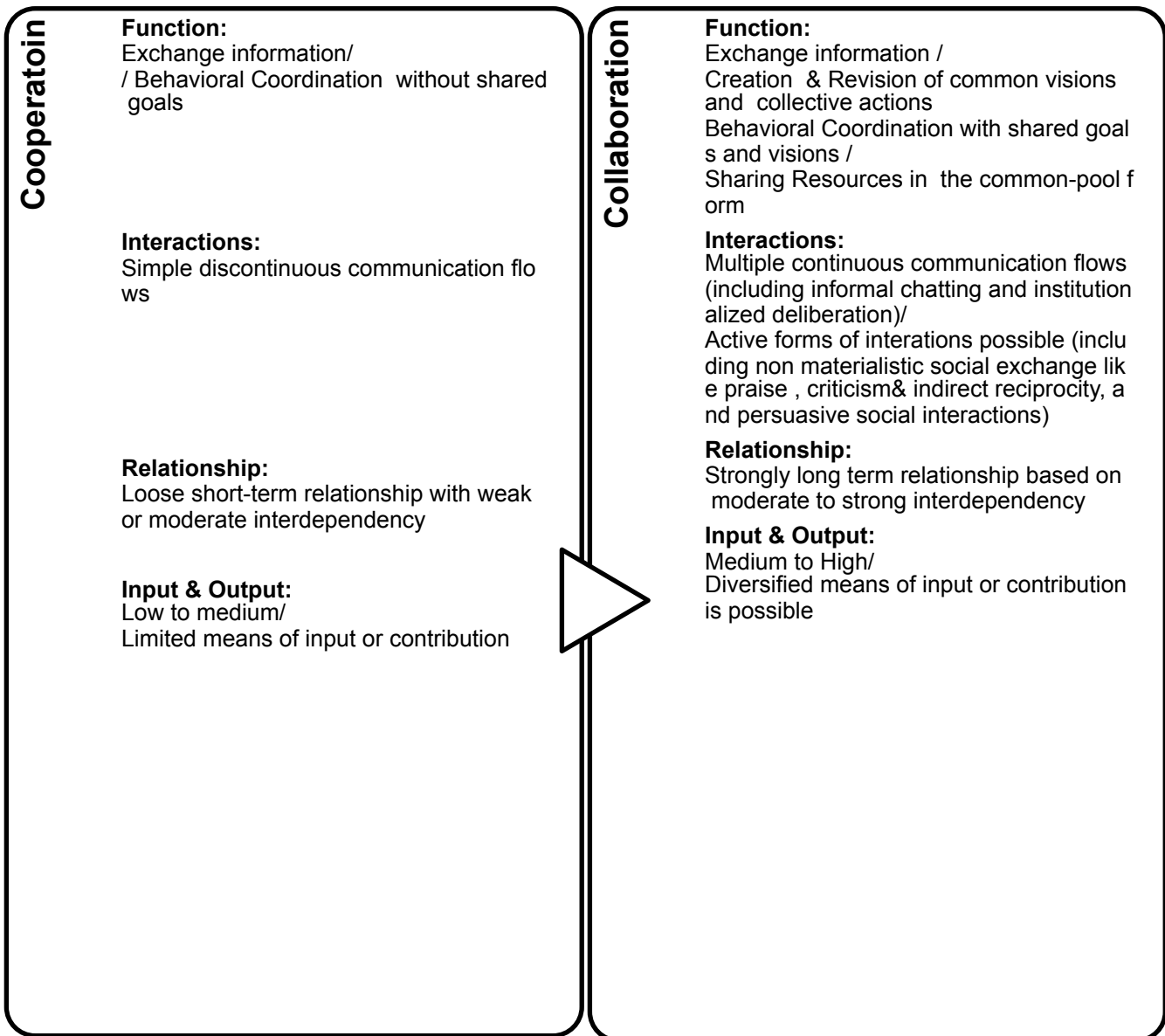9) networks

(Gray 1989; Robert and Bradely, 1991; Margerum 2011).

They are different as collaboration involves deeper level of interaction, integration, commitment, and complexity (Melaville & Blank, 1991; Mattessich & Monsey, 1992; Himmelman 1996).

The additional emphasis made by Margerum on 'deliberative process' as a tool to ensure consensus and' networks' to realize the collectively made decisions (2011, p 7) gives a better representation of the contemporary context thus more applicability to the commons systems. These accounts of collaboration reflect collaboration's procedural nature, transformative purpose, and relational facet based on social interactions.

Although the term is often misused and overused without much discretion often interchangeably with the term cooperation, many scholars specialized in collaboration distinguishes it from cooperation as the former involves deeper level of interaction, integration, commitment, and complexity (Melaville & Blank, 1991; Mattessich & Monsey, 1992; Himmelman 1996).

Figure 1   Cooperation and Collaboration

Cooperatoin	**Collaboration**
Function: Exchange information/ / Behavioral Coordination without shared goals	**Function:** Exchange information / Creation & Revision of common visions and collective actions Behavioral Coordination with shared goals and visions / Sharing Resources in the common-pool form
Interactions: Simple discontinuous communication flows	**Interactions:** Multiple continuous communication flows (including informal chatting and institutionalized deliberation)/ Active forms of interations possible (including non materialistic social exchange like praise , criticism& indirect reciprocity, and persuasive social interactions)
Relationship: Loose short-term relationship with weak or moderate interdependency	**Relationship:** Strongly long term relationship based on moderate to strong interdependency
Input & Output: Low to medium/ Limited means of input or contribution	**Input & Output:** Medium to High/ Diversified means of input or contribution is possible

* Adapted from Himmelman 2002

From Table 1, one can notice that collaboration does require more than smart tactics and skills as cooperation does. On one hand, cooperation, especially in the way it is used in the game theories, would allow agents to coordinate their behaviors even if they have different goals or visions as the cooperative behavioral pattern is based on short term transactions or deals. Although such cooperative deals can be repeated and sustained for some time, the depth of relations, interactions, and commitment involved for such repeated cooperation is still not as extensive as those for collaboration. For instance, if the players are homo economicus they may share an incentive of maximizing their personal benefit or utility in the given situation instead of sharing a more other-regarding incentive of maximizing their collective utility in the social sphere.

On the other hand, collaboration requires creating common goal, visions, resources, and identity. Furthermore, collaboration requires a paradigm change before it can take place. A paradigm change refers to the change in underlying norms, and world views involving transformative social learning. Due to such differences, collaborative process necessitates certain institutional frameworks to enable and sustain it in the face of social and ecological disturbances. In other words, both enabling and improving collaboration requires learning and repetitive experiences through social interactions. This is why for collaborative systems like the commons institutions and institutional design have been one of the focal issues.

3. Experimental Game

A simple experimental game was carried out for comparative analysis the collaborative capacity of two different groups of people who have been engaged in the commons systems on a long term and those who are unfamiliar with the commons systems. Specifically, the experimental game was played by a group of graduate students who are not extensively engaging in the commons systems, and a group of citizens who have been active members of the urban commons systems at least for 5 years in Seoul. The data resulted from the experimental game played by these two different groups shall be helpful in illustrating the role of the commons systems in facilitating collaborative capacity through social learning.

Given that collaboration is an interactive and emergent process, the experimental game is designed in a way the interactive and emergent aspects can be also analyzed. To begin with, in the game, the decisions made by participants are designed to resemble the decision making process in real life by enabling interactions to a greater extent , and various communicative actions so that individual players would have more influence and power in regard with the game dynamics and results.

The limit of the conventional game theory related experiments is that their game settings do not allow interactions to a meaningful extent for simplicity. In many cases, players communicate whether they will cooperate or not in 'yes' or 'no' form in a given condition or term over which they do not have a control or influence to change the game structure and dynamics. Moreover, to analyze the emergent property of the collaboration, the whole process is recorded on a video tape and qualitative outcomes were carefully analyzed. By integrating the process related and qualitative data gained from observation will allow better understanding on the emergence and evolution of collaboration by social learning.

3.1. Game Settings
- Experimental Factor:

Treat factor: The characteristics of the group

Two groups with different familiarity with the commons systems played the same experimental game separately. A group of people with high familiarity to the commons systems or collaborative institutions is categorized as the commons group, while the ones without such familiarity are sorted as the non-commons group.

Confounders: The rest of game settings

The same game settings were applied to both groups except the minor difference in the number of players (The commons group had 15 participants whereas the non-commons group had 16 participants).

- Subject Groups

1) The commons group: A group of people from different grass-root community organizations in Seoul who have been actively engaged in such commons systems at least for 5 years.
2) The non-commons group: A group of graduate students from the same department who have not been engaged in the commons systems more than one year.

- Number of Participant

1) The commons group: 3 groups with 5 people in each group (15 people participants in

total)
2) The non-commons group: 4 groups with 4 people in each group (16 people participants in total)

- Number of Rounds per Game: 3 rounds
- Duration: 35 minutes or so (5 minutes per round)
- Game Rules
1) Participants who manage to make someone (including her or himself) stand in front or behind of their chairs through communication can get $ 100 per person. No irrational or violent measures such as threatening are allowed.
(Standing in front or behind of one's own chair would get the person $ 100 - the same amount the person can get when she or he make other players stand in front or behind her or his chair. For instance, if a person succeeds to make 2 other players stand in front of the person's chair, and stand behind one's own chair, the person would get $ 300 as the person would have 3 people standing in front or behind the person's chair including oneself)

2) Except changing the location of table and chairs, any creative trials are allowed and encouraged

3) Each group should report the resulted process & outcome briefly to other groups after each round

3.2. Results
3.2-a. Expected Results
   Based on the hypotheses of this paper, it is expected that the commons group will have a higher group pay-off compared to the non-commons group. Also it is expected that the non-commons group will display highly self-regarding attitudes and come up with efficient or aggressive strategies in to maximize their individual outcomes instead of collective outcomes of their groups. It was further assumed that the non-commons group will set competitive games as the basis of institutions and legitimatization to enable individuals who are "the fittest" to earn more than others.

3.2-b. Actual Results

- Quantitative Outcomes

1) Non-commons Group   (per person)

Pay-off	Group1	Group2	Group3	Group4
Round 1	100	100	100	100
Round 2	100	100	100	100
Round 3	100	200	100	100

2) Commons Group   (per person)

Pay-off	Group1	Group2	Group3

Round 1	200	100	100
Round 2	500	200	500
Round 3	500	500	500

-Qualitative Outcomes

Analysis of the process of the game based on the recorded tapes revealed several significant differences between the two groups in terms of interaction and pooling resources.

1) Non-commons Group

<Pooling Resources>

No group succeeded or attempted to pool resources.
No individual suggested pooling resources to create a common pool.

<Interaction>

The majority were passively engaged in interactions.
Only a few tried to engage others for a group dialogue.

2) Commons Group

<Pooling Resources>

From the first round, every sub-group pooled their resources creating a common fund.
Multiple players suggested pooling the money from the beginning.

<Interaction>

The majority showed proactive attitude in terms of interacting with each other. They actively engaged themselves in communicative actions to the extent to have a deliberation regarding the strategies to maximize the collective group pay-off and how to use the collective fund. Also, along with the deliberative process, they collectively carried out experiments or trials to examine suggested strategies.
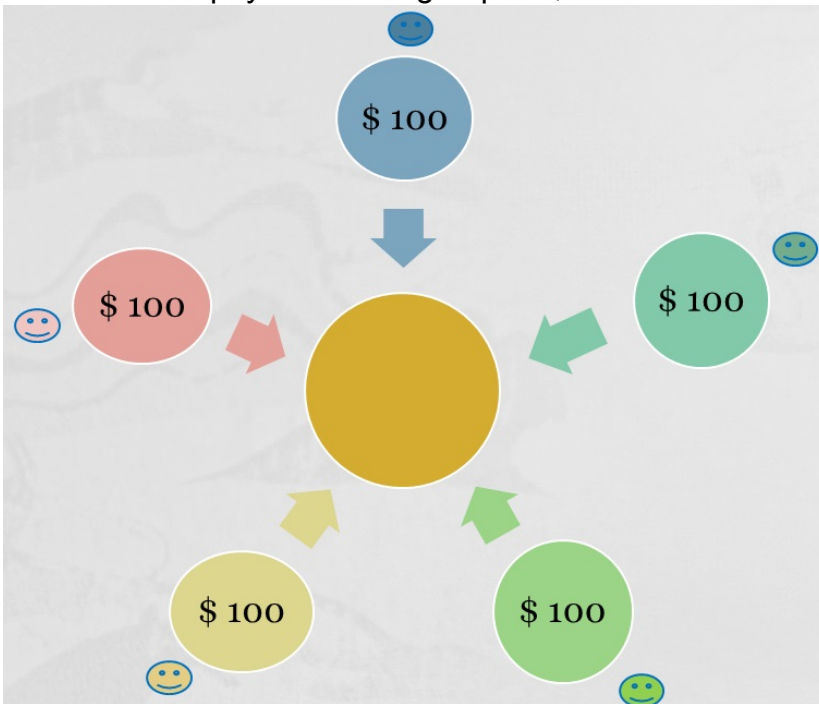
3.3. Data Analysis
- Categorization of the Outcomes (in the case of 5 participants and $ 100 pay-off per person)

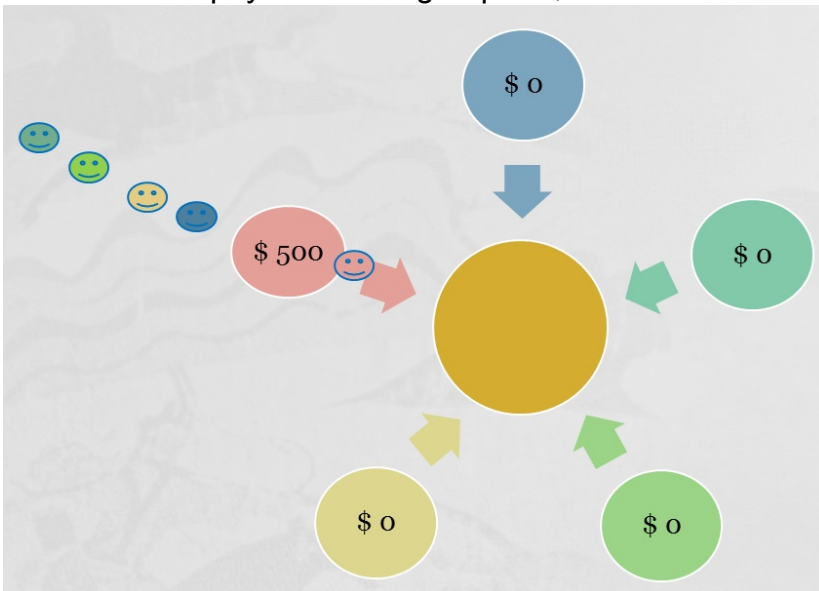# 1) The non-commons group

1-A. Homo-economicus Paradigm
: The total payoff of the group = $ 500
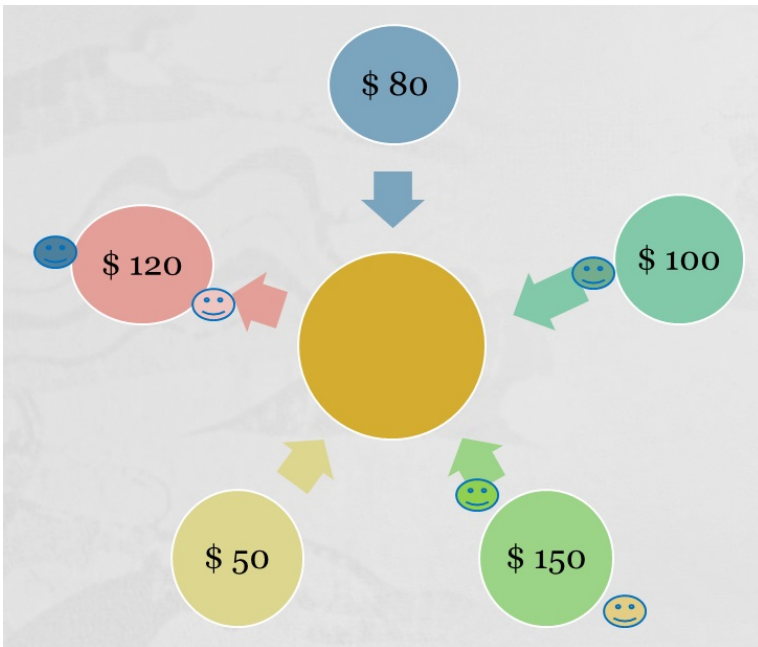

1-B. Leadership-based Cooperative Paradigm
– Pretty Social Homo-economicus Version
: The total payoff of the group = $ 500

## 1-C. Transactional Cooperative Paradigm – Social Homo-economicus Version
: The total payoff of the group = $ 500

1-D. Transactional Cooperative Paradigm – Strategic Social Homo-economicus Version

: The total payoff of the group = $ 1,000

Each individual earns $ 200 by standing in front of their own chair and counting the other person who is standing on the opposite side towards them
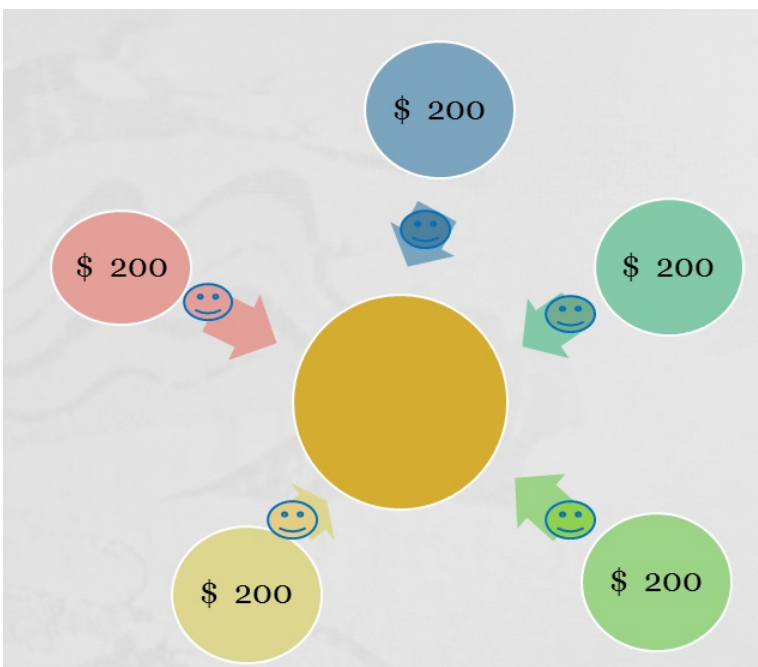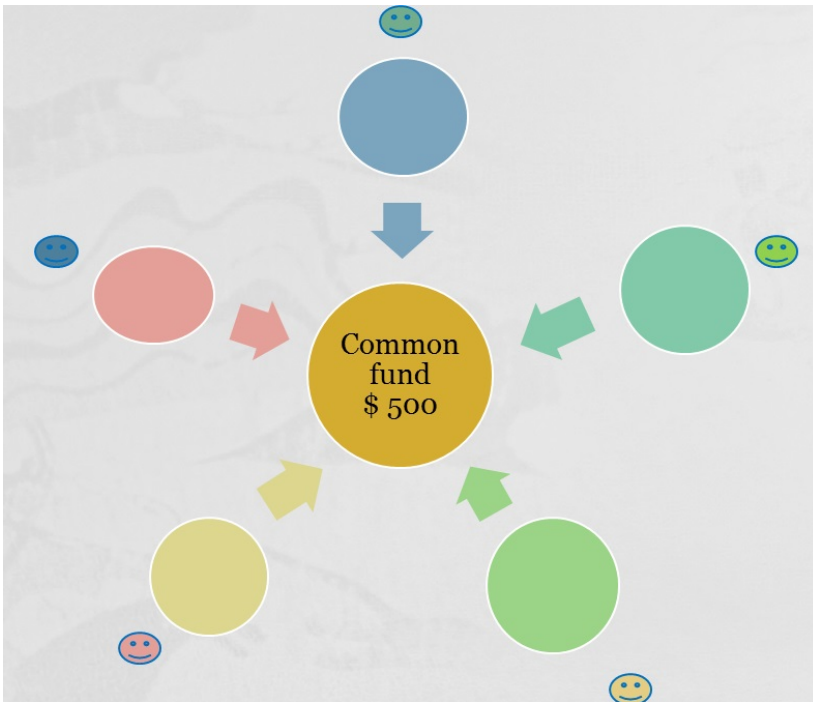

2) The Commons Group
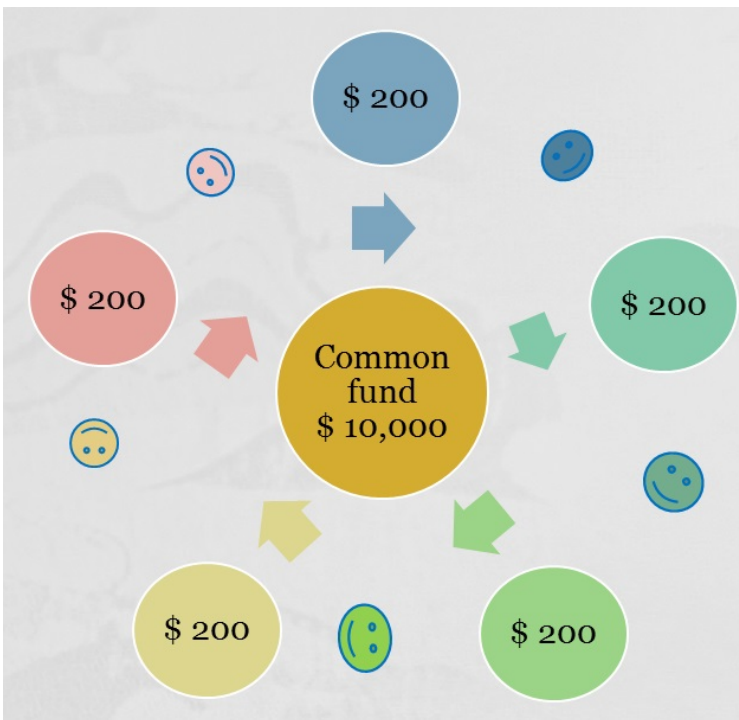## 2-A. Collaborative Paradigm - Initial Version

: The total payoff of the group = $ 500

In Collaborative Paradigm, more extensive informal institutional building and interactions can be observed (e.g. the creation of a common fund)

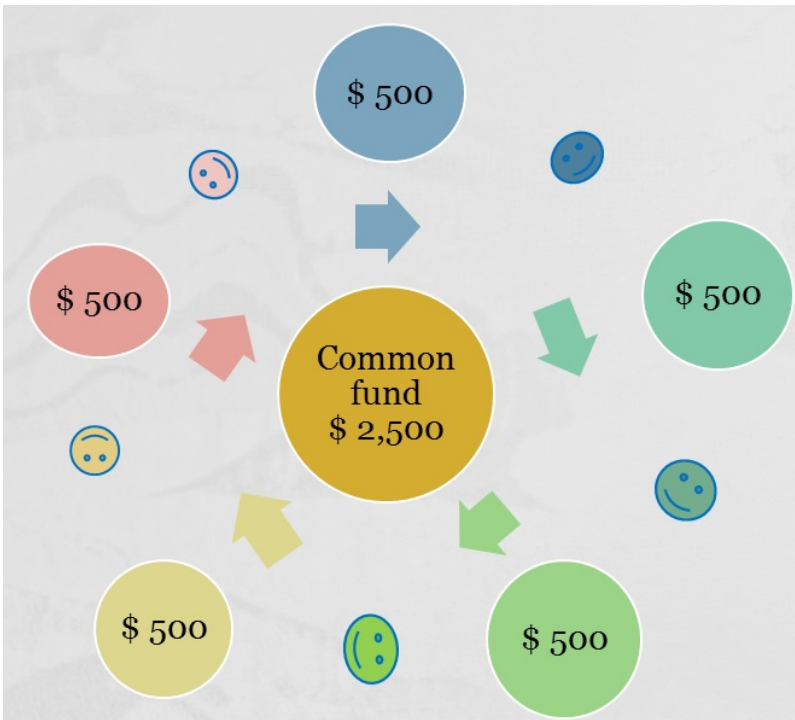## 2-B. Collaborative Paradigm – Simple Circle Version
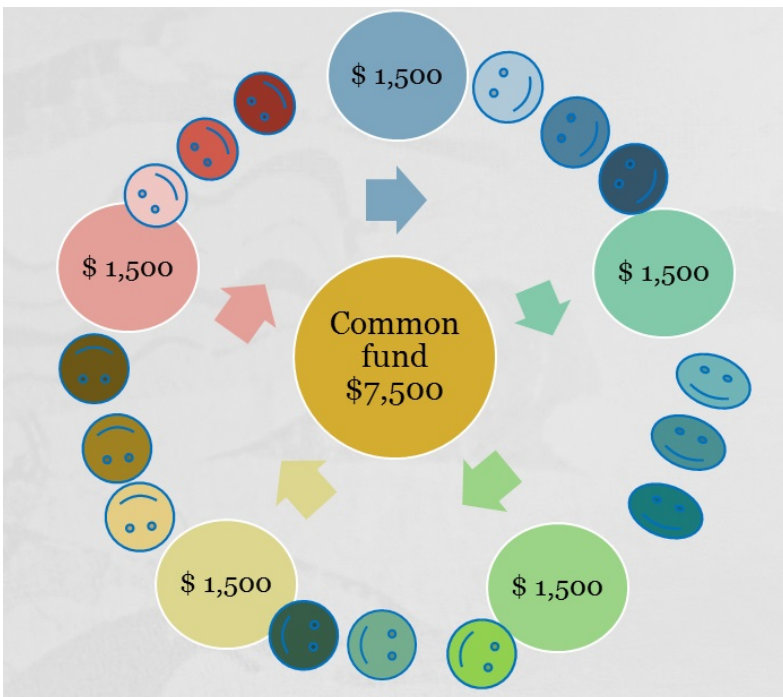: The total payoff of the group = $ 1,000

2-C. Collaborative Paradigm – Extended Circle Version
: The total payoff of the group = $ 2,500

In this extended circle version, people play the game more creatively by counting all other members in the circle as standing behind their chair allowing $ 500 payoff for each.
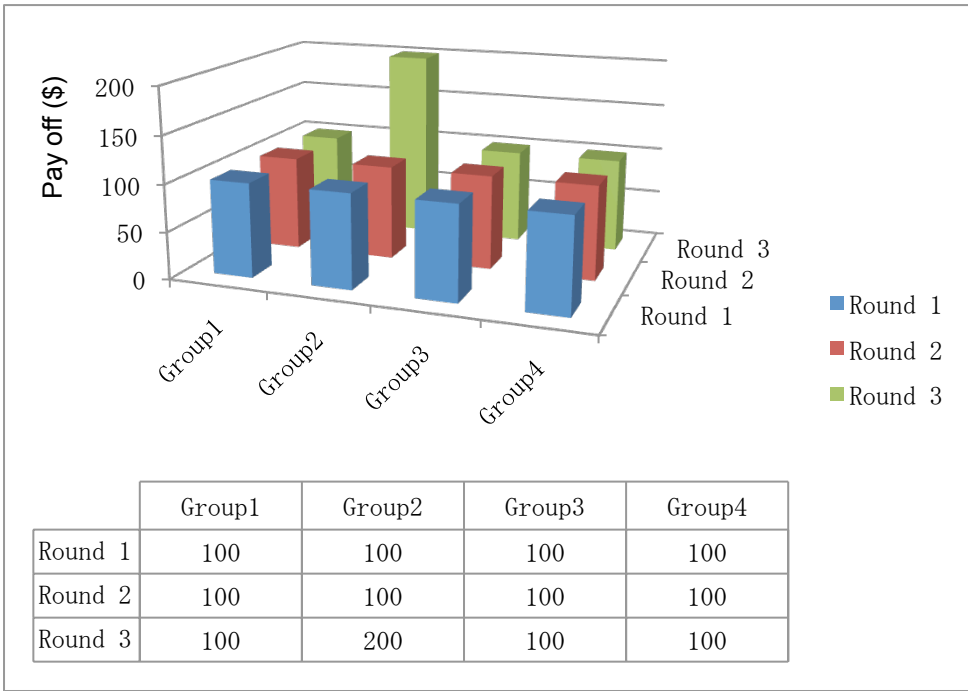
2-D. Collaborative Paradigm –Extended Network Circle Version
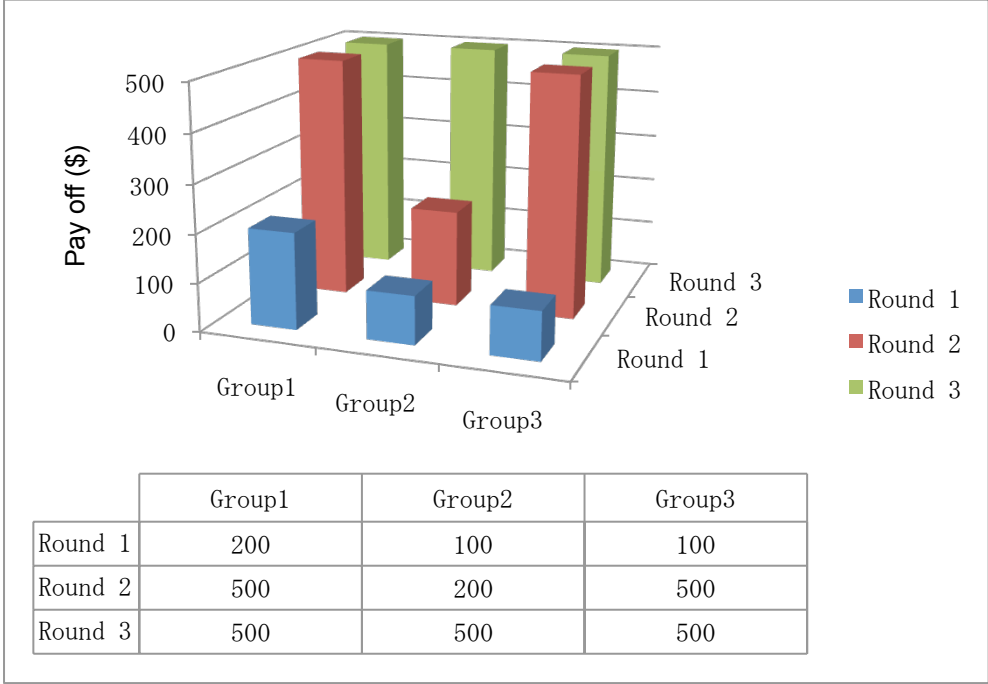 : The total payoff of the group = $ 7,500

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- The Comparison of the total pay-off per group and individual in each round

Graph 1 The Group Pay-off per capita of the Non-commons Group

	Group1	Group2	Group3	Group4
Round 1	100	100	100	100
Round 2	100	100	100	100
Round 3	100	200	100	100

Graph 2 The Group Pay-off per capita of the Commons Group

	Group1	Group2	Group3
Round 1	200	100	100
Round 2	500	200	500
Round 3	500	500	500

Graph 3 The Comparison of the Pay-off per capita of the entire group

	Round 1	Round 2	Round 3
■ Non-commons	100	100	125
■ Commons	133.3333	400	500
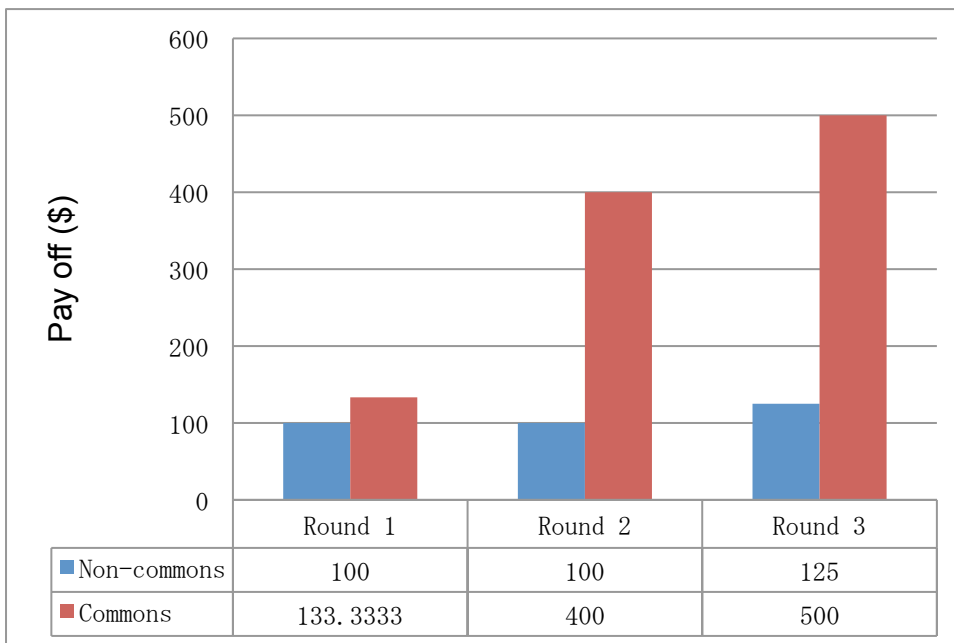
In the case of the non-commons group, despite the variations of individual pay-off distribution, the average pay-off of sub-groups per person were same ($ 100) for all sub groups in the first and second round. Only in the last round, one sub-group (Group 2) managed to double the amount showing the strategic social homo-economicus behaviors of the transactional cooperative paradigm as categorized by the paper. Every player earned $ 200 as they all stood in front of one's own chair and but at the same time each was standing in front of the other person who is standing diagonally across each of them. Hence, the sub-group does not show the collaborative paradigm in which resources are pooled, but the sub-group showed smart cooperative behaviors (or strategic social homo-economicus behaviors – Category 1-D).

Although qualitative results of the commons group were considerably distinguishable from that of the non-commons group, the quantitative result for the first round was not so different from its counterpart. The sub-groups of the commons group displayed just slightly higher outcome in the first round – $ 200 for one sub-group and $ 100 for the rest two groups.

Nevertheless, it is important to notice that the result of $ 200 appeared from the very first round whereas the non-commons group only saw it appearing in the last round. Furthermore, in the second round, the commons group was able to produce much higher outcomes: $ 200 for one sub-group and $ 500 for two sub-groups. All the sub-groups reached $ 500 in the last round. The important difference between the commons and the non-commons group is that, the former not only produced the higher pay-off but also increased the pay-off more dramatically through three rounds.

Another unexpected outcome was that participants from the non-commons group did not display selfish or competitive behaviors as initially assumed. In fact, they were very concerned with their social positions and relationships. Instead of establishing competitive game settings within each sub-group and let "the fittest" members to win more rewards, they choose to both economically and socially rational behavior patterns which is categorized as strategic social homo-economicus pattern. In this sense, the data does not

support the expectation that the commons group would produce much higher group outcomes whereas the non-commons group to produce better individual outcomes.

Why the commons group was able to achieve much better group outcome compared to the non-commons group even when individuals of the non-commons group showed other-regarding behaviors instead of Machiavellian behaviors, and outcomes of the two groups were not so different from each other in the first round. A careful analysis of the process illustrates that three factors were responsible for significantly different eventual outcomes of the two groups: 1) their perception on the game (zero-sum or non-zero-sum); 2) the existence of pooled resources; 3) the extent of the interactions (the level of deliberation and collective experiments).

Three determining factors of Social learning for starting and developing Collaboration

Unfortunately, extensive and through deliberation could not take place among both groups due to the time restraint of the experimental game. Nonetheless, there were significant differences between two groups regarding deliberation.

In the case of the non-commons group, during the game, few people were actively engaged in communication, but the communicative interactions did not evolve into deliberation due to the lack of motivation, relational capital, and most importantly, the common framework for understanding or basis for joint action. In the absence of such elements, the non-commons groups perceived the game as *the zero-sum game* creating winners and losers. Thus, social interactions with other players meant either gain or loss compared to the amount of pay-off they can get by standing in front or behind their own chair.

In this light, extensive interactions regarding the pay-off could be considered as something unnecessary and to be avoided especially given the short period time (5 minutes) to interact per round. Two comments made by the non-commons group players during the group report session reflect this kind of perception clearly - "We decided to stay where we are as we can get the reward without moving and other hassles"; "I was hesitant to make a move as I did not want to take others to gain more pay-off". It echoes the conclusion of the recent studies on human decision-making and behavior that humans, in general, tend to cooperate with others as they are motivated by social preferences (Bowles and Gintis, 2011). Yet, the non-commons group participants could be only cooperators not collaborators to each other.

On the other hand, the people of the commons group, who are actively engaged in the commons systems, were able to set the initial collaborative framework by suggesting the collective fund for their group. This would not have been possible if they were unable to see the game as a *non zero-sum game* from the very beginning.

As the non-commons group did, the commons group lacked the relational capital when they started the game as the non-commons group did, since they were members of different communities or the commons systems. Some of them were acquaintances and

most of them were meeting each other for the first time. However, when the game started people quickly introduced themselves to build the relations based on which they can have more active social interactions. As the game proceeds, they were able to deliberate as a group on possible options to increase the pooled resources (collective money) within the collaborative framework. Furthermore, from the second round, all groups were discussing the usage of the commons fund.

Even more interesting behavior pattern was the expansion of collaboration to the entire group creating one big group encompassing the all three sub-groups (refer to the 2-D. Collaborative Paradigm –Extended Network Circle Version from the result category part). The process of expanding collaboration occurred through expanded boundary of deliberation and collective experiment. In the third round, as they realized that there are no rules prohibiting interactions between sub-groups, sub-groups started to interact with each other and forming a big one group with a bigger common fund. In fact, there was an attempt to form a bigger group earlier in the second round by few individuals, but it did not work out as they needed more time to communicate their ideas to others through deliberation. In the last round, they could establish the communicative rationality on forming a bigger group for bigger common fund which could increase the possibility and power of the collective monetary resource through deliberation within and among sub-groups.

Compared to the non-commons group, the commons group showed greater motivation, relational capital, and the common framework for understanding and basis for joint action as they continued the group deliberative process. It is possible that besides their experiences and familiarity with the commons systems, the fact that they were aware that others are from the community organizations sharing similarly collaborative framework and experiences, also played a role in rapid. Due to these reasons, compared to its counterpart, the commons group displayed more active and extensive deliberation enabling them to learn faster to collaborate better.

By pooling the money, the groups managed to engage every player in the collective thinking and experimenting process. Players were more proactive in trying to maximize the group pay-off with creative measures not only through deliberation but also actual experiments. They actually tried the suggested options with their members to communicate the options by demonstrating them and examine the real outcome of the options. The experimental collective actions were useful in developing new options through collective contemplation based on the experimental demonstration, and also in persuading other members by effectively communicating the options. Thanks to the activated deliberation and collective experiment, the commons group were able to learn faster and better to collaborate and how to collaborate better. As you can from Figure 6, the resulted outcome by the commons group after each round increases much more rapidly than that of the non-commons group.

4. Social Learning and Collaborative Capacity through the Collaborative Interaction Framework of the Commons

Collaboration and social learning is the key factors for capacity building. Collaborative frameworks facilitate *social learning* via collaborative engagements among individuals. In other

words, collaborative institutional framework structures social interactions so that substantial social learning can take place. For this reason, essential elements of collaboration seem to reflect the necessary conditions for social learning.

By definition, social learning is a change in understanding beyond individual level allowing social changes through interactions across social networks (Keen et al., 2005; Reed et al., 2010) through "collective *action* and *reflection* … among different individuals and groups" (Keen et al., 2005, p 4, emphasis added). It "occurs when people engage one another, sharing diverse perspectives and experiences to develop *a common framework of understanding and basis for joint action*" (Schusler et al., 2003, p311, emphasis added). These definitions implicate that social learning requires collaborative interactions to produce positive social changes through joint action and reflection. In this regard, it is possible to identify the commons as social learning systems as they develop a common framework for understanding and decision making through collaborative engagements.

Regarding the depth and scope of social learning, there are three different kinds including single-loop, double-loop learning (Agrys and Schon, 1978), and triple-loop learning (Flood and Romm's 1996; King and Jiggins, 2002; Diduck, 2004; Keen et al., 2005). Single-loop learning enables incremental improvement by reflection of the relationship between certain outcomes and actions. Double loop learning refers to a learning process through which you are able to revisit and revise underlying assumptions in the sense of cause–effect relationships (Argyris and Scho¨n, 1978), whereas triple loop learning enables you to "reconsider underlying values, beliefs, and world views, if assumptions within a world view do not hold anymore." (Pahl-Wostl, 2009).

Consequently, the specific social learning resulting in positive transformation shall have characteristics of triple-loop or experiential learning process. Since the emergence of collaboration or institutions for collaboration also demands experiential learning since it requires the revision of perceptions, values, beliefs of people to see the given situation as a non-zero sum game and potential of collaboration beyond the cloud of uncertainty.

Figure 2 Single-loop, Double-loop, and Triple-loop learning

(Hargrove, 2003)
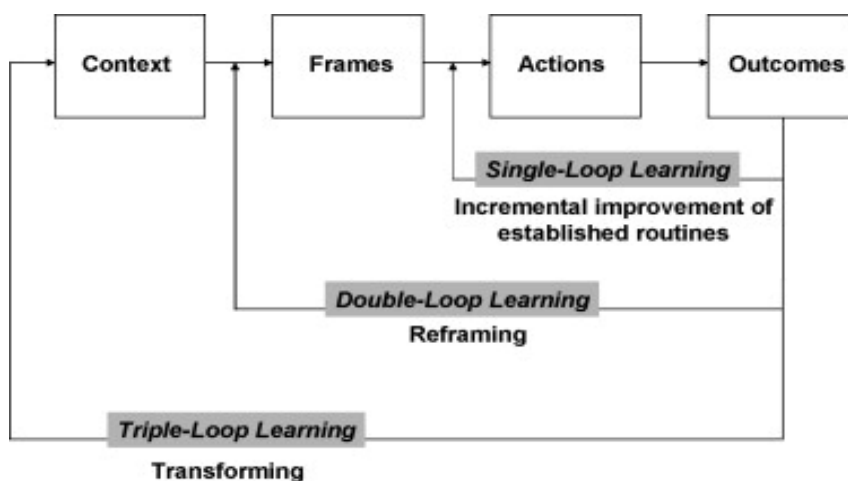
For self-governing or self-organizing collaborative systems like the commons, enhanced social learning through collective action and reflection enables further development of

collaborative capacity of the systems. In illustrating this point, the concept of "the communities of practice" is useful. The capacity of social learning units or "the communities of practice" develop based on 1) members bounded by the jointly formed understanding of the group identity in terms of vision and function, and accountability of individuals in terms of both responsibility and rights; 2) proactive participation of members in establishing the learning units through collective engagement; 3) the common pool of resources (Wenger, 2000). It reconfirms that the collaborative interactions, pooling resources and involving individuals in collaborative activities, is an indispensable component of social learning. Consequently, the more social learning take place in the communities of practice, the better they become in collaborating.

As substantial "interaction and communication" among individuals is the key to social learning (Röling and Wagemakers 1998, p 65), facilitating social learning involves indentifying desirable forms of interaction and communication. As discussed earlier, if the collaborative framework is the integral component of social learning, what kind of specific forms of interactions are desirable in the collaborative framework? Two kinds of social interactions can be suggested: 1) deliberation and 2) experimental collective action based on theoretical explanations on the means of social learning and overcoming social dilemmas.

As collaboration is a mechanism to overcome social dilemmas creating social optimal requiring social learning process, collaborative capacity of the commons necessitates continuous social learning. Considering that, "collective *action* and *reflection*" of different actors (Keen et al., 2005, p 4) enabling social learning shall be the desirable forms of social interactions in developing collaborative capacity of the commons. Furthermore, "the two ways out from social dilemmas" suggested by Ostrom: 1) communication and collective action; 2) innovation and collective action (1998, p 6), also suggest the deliberation and experiment as the desirable social interactions in collaborative capacity building as deliberation is a specific form of communication allowing reflection and collaborative experiments is a kind of collective action that enables innovation. From the results of an experimental game as well, the commons groups showed clearly showed much more active engagements in terms of deliberation and collective experiments.

Some scholars in the field of social learning emphasize the value of experiments in learning. Kolb emphasized the necessity of "creating adequate conditions to link experiences, reflection, and experimentation" among individuals or groups (1984). Diduck and his colleagues assert that what renders learning is an eagerness to experiment along with a risk taking tendency, political and institutional frameworks conducive to learning, alteration of worldview and synthesis of knowledge (2005). In addition, as was briefly mentioned earlier, the social learning of the commons can be explained from the perspective of the "community of practice". By definition, community of practice is a joint social entity with communal resources developed by members who share the understanding of the community's purpose and member's mutual accountability to each other, and develop the community through mutual engagement (Wenger 1998). As communities of practice provide a chance to develop competence through an experience of direct participation, they play the role of critical social units of learning (Wenger 2000). Applying the concept of communities of practice, the commons offers the chance to enhance the capacity by participation and experience in the form of decentralized collective experiments.

Furthermore, in the complex socio-political systems of the current era, "multiparty collaboration embedded in a specific context and leading to specific outcomes" enables social

learning extensive enough to change system structures and dynamics (Pahl-Wostl et al. 2007, 3). In this sense, decentralized arenas associated with sub-units of the commons can facilitate social learning profound enough to revise preexisting frames and even transform the cognitive context by changing system structure and dynamics.

The transformation of system structure and dynamics by triple-loop learning illustrates the shift from cognitive context of social dilemma to that of social collaboration through the evolution of collaboration in which "individuals temporarily caught in a social-dilemma structure are likely to invest resources to innovate and change the structure itself in order to improve joint outcomes" (Ostrom 1998, 8). In such a condition, learning that enables transformation occurs through a "continuous trial-and-error process until a rule system is evolved that participants consider yields substantial net benefits" (Ibid).

5. Implications

After all, the commons group showed not only higher group pay-offs but also more activated deliberation and collective experiments. Such qualitative differences allowed the commons group to experience a greater level of social learning and collaboration. The commons group showed a stronger ability in pooling resources as not only they were able pool resources right from the beginning, but also they pooled increasingly more resources after each round by coming up with creative strategies and expanding the network of collaboration through deliberative process and collective experiments. Such results implicates that the commons systems can make people learn to collaborate and do it better by establishing and developing collaborative institutions.

Furthermore, triple-loop or experiential learning the specific kind of social learning required for people to become collaborators to begin with. In other words, transformability through triple-loop or experiential learning is a precondition to initiate a collaborative regime or institutions for collective actions/collaboration. Unfortunately, social learning and collaborative capacity building are not fully appreciated and studies in the commons study. Hence, if we are to expand the concept of commons to include the commons systems, new principles relevant to social learning and collaborative capacity building such as deliberation and experimenting collective action shall be added to the original 8 principles of institutional conditions for long-lasting self-organizing CPRs (for the detailed explanation refer to Ostrom, 1990). Specific principles or conditions appropriate for the purpose can be the interesting topic for future studies.

6. Conclusion
All in all, by qualitative and quantitative analysis of the outcomes of an experimental game, the paper found out that the commons systems do contribute to the development of collaborative capacity of individuals through social learning. Although, the difference of initial outcome between the two groups was not significant and the non-commons group was other-regarding enough, the eventual outcomes of the two groups were substantially. The comparative analysis of the results illustrated that the commons group produced better group outcomes by establishing collaborative institutions from the very beginning and learned faster to collaborate better than the non-commons group. The determining factors of the different level of collaborative capacity and social learning were 1) their perception on the game (zero-sum or non-zero-sum); 2) the existence of pooled

resources; 3) the extent of the interactions (the level of deliberation and collective experiments).

Regarding emergence and evolution of institutions of collaboration, social learning played a critical role. Triple loop learning is particularly relevant type of social learning for the emergence of institutions of collaboration and for its evolution social learning in general (including all three types of social leaning - aka. single- double-, triple-loop) through reflective and experimental collaborative engagements.

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