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Abstract

The current generation affects future generations, but not vice versa. This one-way nature of dependence over generations is known to be a main cause for many important problems such as climate change and accumulation of government debts. The occurrence of these problems is characterized by the fact that the current generation tends to choose an action in favor of their benefit without considering future generations, which we call "intergenerational sustainability dilemma (ISD)." This paper designs and implements deliberation experiments of the ISD with a single generation of three people, and examine how the dilemma can be solved. A treatment, "cap of future generations" (capped player), is suggested in which one person in the current generation is asked to be a representative from future without any obligation. We conduct a novel qualitative-deliberative analysis of recorded discussions for 10 minutes of each generation's decision, contributing to the two points. First, we find the conditions under which intergenerational sustainability is enhanced through deliberations. That is, one member in a group voluntarily plays a role of icebreakers for deliberation and/or a capped player is present in a group. We demonstrate that when an icebreaker and/or a capped player are present during deliberation, the group brings more varieties of ideas and viewpoints for the ISD, leading to higher intergenerational sustainability. Second, this research illustrates how a qualitative-deliberative analysis can be usefully amalgamated with economic experiments as a new methodology to reveal human behaviors and preferences in collective-decision making.

Key Words: Intergenerational sustainability; cap of future generations; qualitative-deliberative approach; economic experiments

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Contents

1 Introduction

Many important problems have occurred over several generations such as climate change and government debts. One unique feature of such intergenerational problems is that the current generation affects future generations, but not vice versa. This one-way nature of dependence over generations gives one strong incentive to the current generation. That is, the current generation chooses an action in favor of their benefit, leaving more burdens on future generations and damaging sustainability of societies in the long run, which we call "intergenerational sustainability dilemma (ISD)." If the problems of the ISD becomes more serious, it is claimed that the fundamental sustainability of human societies shall be further compromised (Saijo, 2016).

Market economy and democracy have been widely spread all over the world as the most dominant social regimes. In theory, market economy was expected to have achieved efficiency, while democracy has been believed to be the ideal social regime with freedom of speech and preferences. Unfortunately, people are identified to be very optimistic in nature to overestimate future events in a better way than the reality (Sharot, 2011, Sharot et al., 2011, Sharot, 2012). In particular, Saijo (2016) claims that the "optimistic bias" that interplays with market economy and democracy is the main reason for the occurrence of various ISDs. This paper addresses how ISDs can be solved with a new mechanism even in a democratic (deliberative) setting.

There are only a few researches to examine intergenerational sustainability by employing experimental approach. Sherstyuk et al. (2016) analyze the level of difficulties maintaining dynamic externalities under multiple generations. They find that controlling dynamic externality is more challenging under intergenerational settings, because individuals tend to take more selfish decisions as compared to the non-intergenerational settings. Fischer et al. (2004) show that the existence of "intergenerational links" motivates people to exploit less resources in an intergenerational common pool experiment, and claim an importance of the link to enhance sustainability. Hauser et al. (2014) demonstrate that median voting as an institution promotes intergenerational sustainability in an intergenerational goods game.

Deliberation among people in collective decisions has been studied mainly in the fields of philosophy and political science (Cohen, 1986, Bohman and Rehg, 1997, Rawls, 1993, Chambers, 2003, Niemeyer and Dryzek, 2007). In the last decades, many experimental works have been generated to untangle the

role of deliberations, focusing on different aspects such as socio-demographic backgrounds, culture, communication devices and so on (see, e.g., Steenbergen et al., 2003, Gronlund et al., 2009, Mercier and Landemore, 2012, Klinger and Russmann, 2015, Pedrini, 2015). However, there have been no works that clarify the role of deliberation for intergenerational sustainability, and generally for economic decision making (Mercier and Landemore, 2012).

Intergenerational sustainability has been discussed in relation to justice, ethics and equity (Barry, 1997, Wolf, 2003, 2008). In such literature, there are a wide variety of theories to define what is right and what should be done for future generations, but they do not reach the agreements. The fudamental reason behind this is that the current generation cannot consider how and what future generations hope due to the absence of their voices. In other words, nobody has suggested any mechanism that links the current and future generations in a democratic setting. To overcome this difficulty, we institute a new mechanism that enables the current generation to virtually communicate with future generations, i.e., a "cap of future generations," and implements the new experiments with deliberation to see whether intergenerational sustainability can be enhanced.

Our main idea of a "cap of future generations" comes from the Iroquis Confederacy's Great Law of Peace claiming "in every deliberation, we must consider the impact on the seventh generations from now." To this end, the current generation should imagine and listen to the future generation. To incorporate the voices of future generations in the experiments, we take a deliberative approach in collective-decision process where one individual in a group is asked to be a "deputy (or cap) of future generations" to represent future voice without any coercive obligations. We conduct a novel way of qualitative-deliberative analysis to reveal whether a cap of future generations affects group deliberations and decisions, contributing to the two points. First, we find the conditions under which intergenerational sustainability is enhanced through deliberations. That is, one member in a group voluntarily plays a role of icebreakers for deliberation and/or a capped player is present in a group. With these conditions, the group brings more varieties of ideas and different ways of understanding for the ISDG in deliberations, leading to higher intergenerational sustainability. Second, we illustrate how a qualitative-deliberative analysis can be usefully amalgamated with economic experiments as a new methodology to reveal human behaviors and preferences in collective-decision making.

2 Materials and methods

2.1 Experimental design

A total of 216 undergraduate and graduate students of Kochi University of Technology participated in the experiments. They were randomly divided into 12 sessions, each of which included 18 participants. In each session, the 18 participants were divided into six groups that resemble six successive generations. Each group consists of three subjects, and members in a group are requested to make deliberation and a group decision regarding a resource allocation problem. More specifically, we set up an intergenerational resource allocation problem with a specific focus on the role of deliberation for group decisions. To this end, we use an intergenerational sustainability dilemma game (ISDG) following Kamijo et al. (2016). One session approximately takes two hours.

In the ISDG, a group of three subjects is called a generation and each generation needs to choose between options A and B. By choosing option A, the generation receives a payoff of X, whereas the payoff by choosing option B is $X - 900$. After making the choice between A and B, the generation is asked to split the payoff among the generation members. Each subject's payoff in the ISDG is her generation share of the group payoff plus the initial experimental endowment of 900. For instance, suppose $X = 2700$. The generation earns 2700 experimental money by choosing A, while the generation earns 1800 ($= 2700 - 900$) by choosing B. Consequently, if members of this generation split the payoff equally, each members earns 900 with the group choice A and 600 with the group choice B as the individual share. Each generation is allowed to discuss about the decision between A and B up to 10 minutes. We recorded and wrote their discussions to the sentence for qualitative-deliberative analysis. After the generation decision, the members determine how to split the payoff.

Each experimental session consists of a sequence of 6 generations. Each generation is randomly assigned to the 1st, 2nd, ... and 6th generations, respectively. One generation's decision affects the subsequent generations such that subsequent generations' payoff declines uniformly by 900 when the generation chooses option A, otherwise not. For instance, suppose that $X = 3600$ and the 1st generation chooses A. Then, the 2nd generation will face the game in which she can get 2700 and 1800 by choosing A and B, respectively. However, if the 1st generation chooses B, the next generation can have the same

decision environment as the 1st generation faced. When the 1st generation chooses B, the 2nd generation can have the game in which she can get 3600 and 2700 by choosing A and B, respectively. Following the same rule, the game shall continues for the rest of the subsequent generations in each session. Hence, option B can be considered an intergenerational sustainable option, while option A is an unsustainable choice that compromises intergenerational sustainability.

In each session, the 1st generation starts the ISDG game with $X = 3600$, implying that the 5th and 6th generations may face the game in which options A and B are associated with payoffs of zero and -900, respectively.[1] In addition, we include a treatment of "imaginary future generation" (IFG) for the half of total sessions. In that treatment, we randomly assign a member of one generation to be a representative or an agent for subsequent generations as a "IFG." The subject with a role of the "IFG" is considered to have a "cap of future generations" and called a "capped player." Otherwise, subjects are called "uncapped players." The capped player is just asked to think about not only her own generation but also subsequent generations in decision between options A and B.[2] We introduce this treatment because we are interested in how priming individuals for the future generations can affect the ways of how subjects in a group discuss and how groups make the decisions. In this three-person ISDG game, subjects were paid 2500 yen ($\approx$ USD 20) on an average and 4000 yen ($\approx$ USD 33) at maximum.

2.2 Qualitative-deliberative analysis

Analysis 1: Qualitative coding of arguments

In order to identify the patterns of the shift in players' attitudes and whether they finally support the sustainable option or not, the arguments in deliberations were qualitatively coded following Corbin and Strauss (2014). We focus on uncapped players in our analysis because they are expected to be influenced by the capped player in the generation. The qualitative-deliberative analysis shall determine whether each subject is for or against the sustainable option. It may be true that making arguments for the sustainable option does not simply mean that she is supporting the option. For example, a subject

[1] When the 5th and 6th generations face the game in which options A and B are associated with zero or a negative payoff of -900, the generation members can refund themselves equally from their initial endowment of 900 to make the individual payoff to be at least zero.

[2] The capped player does not have any obligation. Simply, she is asked to think about the decisions.

might make such arguments only as a preliminary remark for drawing his authentic opinions to oppose. However, even if so, coding is still useful for tracking down the contexts of arguments made by each subject and for identifying the status of players at each moment of the group discussions.

Analysis 2: Determination of uncapped players' attitudes

On the basis of Analysis 1, the attitudes of uncapped players toward the sustainable option and the shifts were determined from the transcribed group discussions. In what follows, we describe the definitions of players' status, and then define typology of players with respect to how they change their status throughout the group discussions. The states of players in the group discussions are classified into the following four types.

- **State $\boldsymbol{\varphi}$**: This state refers to the situation where players have not displayed their attitudes regarding which option to support.
- **State $\boldsymbol{A}$** or **$\boldsymbol{a}$**: This state refers to the situation where players have expressed the support for option A (i.e., the unsustainable option).
- **State $\boldsymbol{B}$** or **$\boldsymbol{b}$**: This state refers to the situation where players have expressed the support for option B (i.e., the sustainable option).
- **State $\boldsymbol{Amb}$**: This state refers to the situation where players have expressed their ambivalent positions regarding which option to support.

The distinction between A and a (B and b) is defined as follows: a player is regarded as having moved to state A (B) only if (i) he/she did not follow a specific player in expressing the support of alternative A (B) or (ii) he/she expressed his/her own reason to support alternative A (B). Oppositely, if a player follows other players and expresses that he/she supports A (B) without any reasons, his/her new state will be denoted as a a (b). It should be noted that at the beginning of the group discussions, any players are in state φ. Also, it should be noted that they are either state a, b, A, B or Amb at the end of the discussion.

On the basis of the aforementioned players' states, we classify players into three types according to how they change their own states throughout the group discussions.

Definition 2.1 (Dependent players) *Players of this type start with φ and end with a or b.* ■

Players who are not classified into "dependent players" shall be classified into either of the following two types.

Definition 2.2 (Stable players) *Players of this type start with φ and end with A, during the process of which they do not take states b, B or Amb. Or, they start with φ and end with B, during the process of which they do not take states a, A or Amb. The examples of the change in the status are $\varphi \to A$, $\varphi \to B$, and $\varphi \to a \to A$ where "$\to$" denotes the temporal order of changes.* ■

Definition 2.3 (Unstable players) *Players of this type start with φ and end with A, during the process of which they take the state b, B or Amb. Or, they start with φ and end with B, during the process of which they take the state a, A or Amb. The examples of the change in the status are $\varphi \to A \to B$, $\varphi \to B \to A$, $\varphi \to Amb \to A$, $\varphi \to Amb \to B$ and $\varphi \to a \to B$.* ■

Finally, as we are interested in the role of facilitators for discussion from a neutral standpoint, we define such a person as a neutral icebreaker. It is identified whether a neutral icebreaker appears in each group following this definition:

Definition 2.4 (Neutral icebreaker) *A neutral icebreaker is defined as a person that satisfies all of the three conditions.*

1. *She is the first person to speak something other than greeting words, such as "nice to meet you."*
2. *She plays the role of initiating the group discussion either by (i) making explicit the two options given to the group, (ii) proclaiming the start of the group discussion, or (iii) calling for opinions.*
3. *She is neutral in the sense that he/she does not express his/her own attitude toward the options during the statement as the initiator of the group discussion.* ■

Analysis 3: Quantitative analysis

We summarize and compare the basic statistics of player and group types following the definitions in Analysis 2. We also compute the ratios that a group with and without a capped player (or with and without

a neutral icebreaker) chooses the sustainable option. Next, we run the logistic regression to investigate whether uncapped players are affected by the presence of both (either) a capped player and (or) a neutral icebreaker in groups. For this, we analyze how a total of 70 uncapped players ($= 35$ groups $\times\, 2$ persons) in front of capped players behave differently from 75 uncapped players ($= 25$ groups$\times 3$ persons) without capped players. For this, the logistic regression analysis is applied to the sample comprising of 145 ($= 70 + 75$) uncapped players.

We model the probability that an uncapped player is supportive of the sustainable option (i.e., in states b or B) at the end of the group discussion, and the logistic analysis focuses on whether she is accompanied by a capped player, (ii) whether a neutral icebreaker exists or not in his/her group and (iii) the presence of capped players and icebreakers affect other subjects of uncapped players. Additionally, we consider the previous generation's choice as an independent variable since we expect that it also affects a current generation's discussion and decision. Then, in order to better interpret the association identified above, the ratios of dependent, stable, and unstable players were obtained for each group type (i.e., whether a capped player was included or not and whether a neutral icebreaker appeared or not).

3 Results

A total of 180 undergraduate and graduate students who participated in the experiments were utilized in the analysis, among which 124 were male and 55 were females. Ages of the participants ranged between 18 and 29 (average $= 19.5$). Among the 25 groups without a capped player, the number of groups that chose the sustainable option was 7 ($28\,\%$ and see table 1). On the other hand, among the 35 groups with a capped player, the number was 21 ($60\,\%$ and table 1). The chi-squared test for independence between group choices and group types rejects the null hypothesis at the $1\,\%$ level of statistical significance, meaning that group choices are dependent on group types. In 31 out of the 60 groups ($51.7\,\%$), a neutral icebreaker is identified. The 145 uncapped players ($= 180-35$) were classified into four types according to whether a capped player was allocated and whether an icebreaker appeared in the groups where they played. The numbers of the groups of the four types and the associated group

choices are summarized in table 1.[3]

[Table 1 about here.]

[Table 2 about here.]

The results of the qualitative coding of the arguments are summarized in table 2. A total of 15 concepts were created, and they were classified into three categories: "Reaction to Earlier Generations," "Reason of Not Considering Future Generations," and "Reason of Considering Future Generations." The numbers of concepts are classified into these three categories and table 2 displays three, five and seven examples in each category, respectively. On the basis of the results for the coding of the arguments, the number of different concepts in table 2 that emerge during deliberation of each group was counted, and the types of changes in the attitude of uncapped players were also identified, such as "dependent," "stable" and "unstable players" together with "icebreakers."

[Table 3 about here.]

The number of different concepts in table 2 that emerge during deliberation of each group type is summarized in table 3. Here, deliberation can be considered more effective and influential when more varieties of ideas and concepts are discussed and exchanged within 10 minutes. We can see that NC-NI group (mean $= 1.91$) is lower than any other groups with respect to the number of different concepts discussed during deliberation. This implies that the presence of an icebreaker and/or a capped player increases the variety of concepts discussed in the deliberation. Accordingly, we also summarize the deliberation lengths (minutes) by group types in table 3. Similar to the tendency observed in the number of different concepts, the mean of deliberation lengths in NC-NI groups is lower than in any other groups. Given these results, it appears that the existence of a capped player and/or an icebreaker in a group influences the deliberation in the way that it increases the quality and quantity of the discussion contents.

[3]The first author is mainly in charge of conducting a qualitative-deliberative analysis, while several external coders (who are not in the authorship of this paper) do the same. We have confirmed that the coding outcomes are different from one another within the range of $\pm 10\,\%$, and the statistical analyses that follow in this paper would not qualitatively change by these differences. Note that the first author coded the transcribed contents in a conservative way that statements are coded as "empty" whenever the intention of individual statements is not clear or in-between. The detailed procedures made by the first author are provided as appendices.

[Table 4 about here.]

Table 4 summarizes the composition of players' types per group type. It appears that C-NI, NC-I and C-I groups have more "stable" and less "dependent" types compared to NC-NI group. This implies that more subjects voluntarily express their opinions with logic and reasoning in a consistent manner, and play more active roles without being a follower when their groups have a capped player and/or an icebreaker. To statistically confirm this tendency, we run a chi-squared test of table 4 to test the difference between NC-NI and other three groups (C-NI, NC-I and C-I). The result rejects the null hypothesis that the distributions are identical, implying that the presence of capped players and icebreakers influence individual players' types in deliberation. We further decompose uncapped players' types per group type depending on their support for A or B (table 5). Table 5 shows that the composition of players' types do not differ between options A and B, however, more players support option B when they are in the C-NI, NC-I and C-I groups as compared with NC-NI group. Overall, tables 4 and 5 suggest that the existence of an icebreaker and/or a capped player induces uncapped players to discuss more actively and state their opinions in a coherent manner. Also, it appears that uncapped players in the groups with capped players and icebreakers is more likely to choose option B.

[Table 5 about here.]

To confirm whether uncapped players in the groups with capped players and/or icebreakers have a tendency to choose option B, we run the logistic regression. Table 6 shows the result for explaining the final state of the uncapped player (i.e., "b or B" $= 1$ and "a or A" $= 0$) in terms of the group types. In reference to being in a group without a capped player and without a neutral icebreaker (NC-NI), being in a group with both (C-I) is positively associated with supporting the sustainable option at the $5\,\%$ level of statistical significance, and the odds ratio was 3.39. Being in a group with either a capped player or a neutral icebreaker (C-NI or NC-I) is positively associated at the $1\,\%$ level, and the odds ratios were 2.77 and 2.66, respectively. Finally, as compared to being in a group whose previous group chose the unsustainable option, being in a group whose previous group chose the sustainable option is a positive predictor of supporting the sustainable option at the $1\,\%$ level of significance. Note that this logistic regression analysis was applied to 142 of the 145 uncapped players, because the three players' final status was not determined from the transcriptions of the discussions due to the lack of information.

[Table 6 about here.]

Overall, we find that the presence of capped players and/or an icebreaker enhances the probability that the group chooses a sustainable option. First, the positive influence of capped players can be reasonably explained in terms of the social pressure to conform (see, e.g., Santee and Maslach, 1982). In fact, according to table 5, while the percentage of dependent players who finally supported A is $30\,\%$ in the NC-NI (no capped player and no icebreaker) groups, the number decreased to $3\,\%$ in the C-NI (capped players, but no icebreakers) groups. The similar gap of percentages was observed between NC-NI and C-I groups (i.e. $20\,\%$ and $6\,\%$, respectively). It might also be interpreted that the presence of a capped player succeeds in alleviating the social pressure to conform to the unsustainable players.

On the other hand, the finding that the influence of neutral icebreakers is sustainability-oriented, rather than neutral, is harder to interpret. Some earlier studies aiming at evaluating discourses include respect towards others as a crucial element (Steenbergen et al., 2003, Pedrini, 2015). With this line of researches in mind, it is reasonable to consider that emergence of a neutral icebreaker enhances the quality and quantity of the deliberation, leading to a situation where other members in a group recognize an importance of thinking about the future generations. However, the previous researches do not predict that neutral icebreakers have non-neutral effects. Another possible way of deriving the reason is to focus on the percentage of unstable players who finally supported the unsustainable option. The percentage in the C-I group was $0\,\%$, while it was $15\,\%$ in the C-NI group. It might be that neutral icebreakers prevent the emergence of people who face a dilemma between sustainable and unsustainable options and then end with supporting the unsustainable one, at least in the presence of a capped player. Another experiment with a larger size would determine the reliability of this discussion.

Our research seems to have successfully identified several concepts that could be useful in getting deeper insights about the behaviors of people facing the ISD. First, within the study and practice of social justice, significant concern is paid to remedying injustices suffered by past generations, and is sometimes called “restorative justice” (Golub et al., 2013). Our concept, “willingness to terminate the chain of bad will,” could be useful in understanding the psychological process that the restorative justice works. Second, the present study identifies the concept “risk of unsucceded goodwill” as the hampering factor of choosing the sustainable option. Although the existence of people with such risk had been predicted

by Hauser et al. (2014), the present study seems to be the first to provide an empirical evidence of such existence. Hauser et al. (2014) generalize the concept "conditional cooperators" in the intergenerational context that. This concept is originally proposed by Fischbacher et al. (2001) to describe people who are willing to contribute more to a public good the more others contribute.

Third, the present study identifies another concept that has never been referred to in the literature, to the knowledge of the authors: "Sense of guilt relaxed by earlier generation's decision." This concept refers to a specific generation's relaxed guilty of exploiting future generations when the generation had been exploited by earlier generations. It is important in the future to test the applicability of this concept by checking if statements are observed in the real world or in other experimental settings. Fourth, the present study identifies two concepts that are both sides of a same coin: "Non-negligible cost of considering future generations" and "negligible cost of considering future generations." More interestingly, some groups are found refer both concepts, suggesting that "reframing" occurs in their group discussions. In general, while framing seeks a measure of control over how a communication will be perceived by others, reframing consists of a deliberate attempt to alter someone else's frame (Kaufman and Smith, 1999), and the latter is regarded as a promising tool of conflict management. The finding of the present study suggests the possibility for people in current generations to reach a group decision in favor of future generations, and it is important in the future to characterize conditions under which the sustainable side of the coin dominates the other in the group decision process.

4 Conclusion

This paper has addressed how intergenerational sustainability dilemma (ISD) can be solved with deliberations and imaginary future generations through a new qualitative-deliberative approach, contributing to the two points. First, we find a series of concepts and conditions that emerge as reasons, logic and factors for the current generations to make decisions between sustainable and unsustainable options. More specifically, an importance of icebreakers in deliberation together with imaginary future generations is identified to amplify the quality and quantity of discussions, leading to higher intergenerational sustainability. To the best of our knowledge, this study is the first to demonstrate the importance of such capped players and icebreakers that facilitate the discussions and interplay with others in a group.

Second, this research illustrates how a qualitative-deliberative analysis can be usefully amalgamated with economic experiments as a new methodology to reveal human behaviors and preferences in collective-decision making. Economists have not paid attention to the contents and dynamics of deliberation or even communications in economic decision processes. This research suggests a novel approach and can be considered an important first step to bridge the gap between traditional economic analysis and actual decisions made through deliberations.

The present study has several important limitations. First, the present study traces the status of the players only on the basis of the transcribed voices in the group discussions. Thus, the present study inevitably focuses more on their expressed positions rather than on their actual or authentic ones. It is important in the future to utilize other sources as well, and more precisely to grasp the dynamics of the group discussion. Second, there are a number of dimensions according to which the goodness of deliberation is characterized. The present study considers only a small part of them, such as respect toward groups. We should further consider how/whether other dimensions influence group decisions in the ISD context. Third, although our sample size is not very small, the analysis with larger sample sizes could have better identified the effects of icebreakers and capped players. These caveats notwithstanding, we believe that this study is a first step as an experimental and qualitative-deliberative research to establish the importance of icebreakers as well as imaginary future generations toward intergenerational sustainability.

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List of Tables

Table 1: Number of groups that choose unsustainable and sustainable options for each group type

Group type	Unsustainable option	Sustainable option	Total
No capped player and no neutral icebreaker (NC-NI)	9	2	11
No capped player and a neutral icebreaker (NC-I)	9	5	14
NC-NI & NC-I groups	18	7	25
A capped player and no neutral icebreaker (C-NI)	7	11	18
A capped player and a neutral icebreaker (C-I)	7	10	17
C-NI & C-I groups	14	21	35
Total	32	28	60

Table 2: Created categories and concepts

Category	No.	Concept	Example
Reaction to earlier generation	1	Gratitude to earlier generations	The earlier generations kindly considered us.
	2	Disappointment at earlier generations' decisions	I am disappointed at the earlier generations' decisions. They stick to money for themselves.
	3	Surprise at earlier generations' decisions	Wow! They chose sustainable option A.
Reason not to consider future generations	4	Maximization of the current generations' benefit	I cannot find reasons to consider future generations.
	5	Acceptable disadvantage of future generations	I think there is no problem. They can get at least 900 yen.
	6	Risk of unsucceeded goodwill	Future generations that choose A may ironically say "thank you" to us.
	7	Sense of guilt relaxed by earlier generations' decisions	No problem even if we choose B. Earlier generations did it too.
	8	Non-negligible cost of considering future generations	I know it is just 300 yen, but it matters.
Reason to consider future generations	9	Hope to avoid future generations' disadvantages	I feel terrible for the future generations.
	10	Maximization of the sum of all generations' benefits	The sum of benefits will be larger if every generation chooses B.
	11	Willingness to succeed goodwill	Let us continue choosing sustainable options and consider future generations.
	12	Willingness to terminate the chain of badwill	I would like to change the bad chain of choosing B.
	13	Negligible cost of considering future generations	It is just 300 yen. It does not matter.
	14	Sense of guilt not to consider future generations	Getting benefit by choosing option B means exploitation of money for future generations.
	15	Expectation that goodwill will succeed	I expect that if we choose option B, future generations will do so.

Table 3: Number of different concepts in table 2 that emerge in deliberation of each group and the deliberation length

Group	Number of different concepts		Deliberation length (minutes)	
	Mean	SD	Mean	SD
NC-NI group	1.91	1.70	2.68	2.37
C-NI group	3.17	1.25	5.91	2.65
NC-I group	2.64	1.50	4.17	2.71
C-I group	2.82	1.38	5.80	2.72
Overall	2.72	1.46	4.88	2.86

Table 4: Contingency table of uncapped players by group types and player types

Group	Dependent	Stable	Unstable	Total
NC-NI group	14 (0.42)	16 (0.48)	3 (0.09)	33 (1.00)
C-NI group	2 (0.06)	24 (0.70)	8 (0.24)	34 (1.00)
NC-I group	13 (0.32)	24 (0.59)	4 (0.10)	41 (1.00)
C-I group	5 (0.15)	28 (0.82)	1 (0.03)	34 (1.00)
Total	23 (0.24)	92 (0.65)	16 (0.11)	142 (1.00)

Numbers in brackets indicate the corresponding proportion over player types per group type.

Table 5: Contingency table of final decisions made by uncapped players, group types and player types

Group	Players who finally support A			Players who finally support B			Total
	Dependent	Stable	Unstable	Dependent	Stable	Unstable	
NC-NI group	10 (0.30)	13 (0.39)	3 (0.09)	4 (0.12)	3 (0.09)	0 (0.00)	33 (1.00)
C-NI group	1 (0.03)	12 (0.35)	5 (0.15)	1 (0.03)	12 (0.35)	3 (0.09)	34 (1.00)
NC-I group	8 (0.20)	15 (0.37)	2 (0.05)	5 (0.12)	9 (0.22)	2 (0.05)	41 (1.00)
C-I group	2 (0.06)	14 (0.41)	0 (0.00)	3 (0.09)	14 (0.41)	1 (0.03)	34 (1.00)
Total	21 (0.15)	54 (0.38)	10 (0.07)	12 (0.09)	38 (0.27)	6 (0.04)	142 (1.00)

Numbers in brackets indicate the corresponding proportion over player types per group type.

Table 6: Logistic regression

Independent variable	Coefficient	s.e.[1]	Odds ratio	95 % CI[2]
Previous group's decision (Reference group = Unsustainable option)				
No previous group[3]	0.28	0.48	1.32	[0.52-3.39]
Sustainable option	0.73**	0.44	2.08	[0.88-4.92]
Group type (Reference group = NC-NI group[4])				
C-NI group[5]	1.02**	0.57	2.77	[0.91-8.48]
NC-I group[6]	0.98**	0.55	2.66	[0.91-7.83]
C-I group[7]	1.22*	0.56	3.39	[1.13-10.15]

**significant at 1 % level and *significant at 5 % level.

[1] : Standard errors of estimated coefficients

[2] : Confidence interval of odds ratio

[3] : The 1st generation groups do not have previous groups.

[4] : NC-NI stands for a group in which there are neither capped players nor icebreakers.

[5] : C-NI stands for a group in which a capped player exists, but no neutral icebreakers exist.

[6] : NC-I stands for a group in which no capped players exists, but an neutral icebreaker exists.

[7] : C-I stands for a group in which both a capped player and at least a neutral icebreaker exist.