



# Changes in perception and the effects of personal attributes in decision-making as imaginary future generations: evidence from participatory environmental planning

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## Abstract

We conducted a Future Design deliberation workshop on the theme of the “3rd Environmental Master Plan” of Suita City, Osaka Prefecture over four sessions in 2019, with the participation of both city residents and officials of the city government. To condition the deliberations of participants, we adopted the method of Imaginary Future Generations (IFGs) and analyzed its impact on their future vision of the city in 2050, policy options needed to shape that future, and changes in their perceptions. We also investigated how the adoption of IFGs affects the relationships between personal attributes and the changes in their perception. The results of variance analysis and multiple linear regression analysis based on data from the deliberations and questionnaire surveys of participants revealed the following: (1) the content and quality of the 2050 vision of society and policy options conceived from the perspective of the IFGs significantly differed from those conceived from the perspective of the current generations; (2) IFGs heightened certain perceptions, such as “a sense of crisis about the future” and “a shared recognition of goals that are desirable for society as a whole”; and (3) although the degree of “critical thinking”, as a disposition of individuals, influences the heightening of perceptions in decision-making from the perspective of the current generations, when IFGs is adopted, the degree of “critical thinking” seems to be no longer a factor in heightening these perceptions. These findings could be useful for designing mechanisms to facilitate sustainable decision-making that considers the interests of future generations.

**Keywords** Imaginary future generations · Critical thinking · Perception change · Participatory environmental planning · Personal attributes

## Introduction

Various sustainability problems, such as climate change and resource depletion, are increasingly threatening the foundations of humanity (Rockström et al. 2009; Komiyama and

Takeuchi 2006; Kates et al. 2001). These are long-term challenges, which involve intergenerational conflicts of interest. While governmental plans have aimed at the decarbonization of energy systems and at resource recycling at both the national and local levels, these issues are not necessarily viewed as intergenerational in an explicit manner. A new approach is necessary to cope with such long-term intergenerational issues.

There have been numerous efforts and much research involving stakeholders to envision sustainable futures and to resolve such environmental and sustainability problems by means of scenario planning and backcasting approaches (Höfer and Madlener 2020; Nikolakis 2020; Pereverza et al. 2019; Kishita et al. 2016; Reed et al. 2013; van der Voorn et al. 2012; Robinson et al. 2011; Mander et al. 2008). Further, various foresight and future research methods have been proposed to cope with future issues (Popper 2008; Magruk 2011; Inayatullah 1998). Strategic scenario

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methods to acquire the capacities of futures literacy have also been discussed (Miller 2007). However, the benefits and preferences of future generations, with an aim to reconcile intergenerational conflicts and trade-offs, have rarely been considered explicitly in such methods and approaches (Kuroda et al. 2021; Hara et al. 2019). Essentially, long-term issues such as these should not be considered only from the perspective of the current generations; rather, they should instead be considered from a long-term perspective, with an examination of the impacts on and benefits to future generations (Saijo 2020; Hara et al. 2019).

In recent years, the concept of Future Design, which is the design and praxis of social systems to succeed a sustainable society to future generations by overcoming intergenerational conflicts, has been increasingly studied and practiced (Saijo 2015, 2020; Hara et al. 2019; Hara 2016). A person exhibits futurability when he or she experiences an increase in happiness as a result of deciding and acting to forego current gains to enrich future generations, and Future Design is the design and praxis of a society generating futurability to cope with intergenerational conflicts (Saijo 2018). An important focus of research on Future Design has been the question of how to design social systems to generate “futurability”, to facilitate decision-making and actions that consider the preferences of future generations. Extant social systems, such as markets and democracy, serve to meet the needs of the current generations, but they are incapable of incorporating the interests of future generations (Saijo 2020). It is therefore difficult to adequately address long-term intergenerational challenges using conventional approaches that are based on these existing social systems. This point is clearly illustrated by the various problems that human beings encounter. On the issue of climate change, for example, global greenhouse gas emissions have continued rising (IPCC 2014), despite the wide range of research, technological developments, and policy initiatives that have been conducted to date. It seems that there are still major hurdles to the social transformation that is needed to establish a carbon-neutral society.

The issues addressed in this study are related to energy and resource management at the local government level. These are long-term challenges in the sense that the local planning needed to address these issues requires vision design and policy planning from a long-term perspective in a way that incorporates the perspective of future generations.

Future Design has increasingly been the focus of considerable research and implementation, and social systems and mechanisms have been investigated to facilitate decision-making that considers the preferences of future generations. One particularly promising approach that has been proposed is that of Imaginary Future Generations (IFGs), which have been proven to be useful to activate futurability. They are the stakeholders tasked

with representing and speaking for the benefit of future generations, putting themselves in the shoes of future generations.

Through experiments, field experiments and practices, the IFGs approach has been demonstrated to be effective for real-world decision-making and vision design as it avoids shortsighted decision-making and instead promotes reconciling intergenerational conflicts (Kamijo et al. 2017, 2021; Saijo 2020; Hara et al. 2019). For example, it has been shown that the decisions and visions of groups tasked with representing a future generation in decision-making processes are more innovative than those of groups that look at issues from the standpoint of the current generations (Hara et al. 2019). Other studies have shown that considering the benefits to future generations makes it possible to propose measures necessary for sustainability that could potentially impose a burden on the current generations (Uwasu et al. 2020), and when the perspectives of both the current and future generations are considered, judgments and decisions can be made from a more holistic perspective (Hara et al. 2021; Nakagawa et al. 2017). Other studies addressed the relationships between personal attributes and dispositions, and the acquisition of future perspectives (Nakagawa et al. 2019; Kuroda et al. 2021; Hiromitsu et al. 2021; Hara et al. 2015; Nishimura et al. 2020). Nakagawa et al. (2019) reported that higher levels of critical thinking or generativity are more likely to facilitate future-oriented choices. Hiromitsu et al. (2021) argued that cognitive aspects of interpersonal reactivity are useful for defending the interests of future generations.

Even with these studies, no study has analyzed how the perceptions and dispositions of participants in a real-world, local government policy-planning deliberation process relate to the adoption of a future generations perspective. In addition to the IFGs approach, various methods for stimulating identification as IFGs are possible, but no studies have analyzed how the different types of treatments using IFGs relate to people’s perceptions, personal attributes, and dispositions. Clarifying these relationships may yield valuable suggestions and information about the design of social mechanisms that can generate “futurability” in people and support sustainable decision-making and actions that consider future generations.

For this study, we conducted a workshop (deliberation experiments) over four sessions in Suita City, Osaka Prefecture in Japan, in 2019. The workshop was part of the city government’s policy planning process relating to the formulation of its “3rd Environmental Master Plan”. Both ordinary residents and city officials participated in the deliberations, which focused on three themes: “energy”, “resource recycling”, and “cross-sectional priority themes”. In the workshop, participants were asked to formulate a vision of the city’s future in 2050, both from the perspective

of the current generations and the perspective of IFGs, and to propose the policy options that were needed to shape those future visions. In addition to analyzing the effects of adopting the IFGs' perspective, we examined the relationship between futurability and personal attributes. More specifically, using data obtained from the discussion sessions and from questionnaire surveys of participants of the workshop, we examined the following questions: (1) Does the adoption of IFGs change the future vision or policy proposals by participants compared to when they examine issues from the perspective of the current generations? (2) How does the adoption of IFGs change the perception of participants? (3) How does the adoption of IFGs affect the relationships between personal attributes and dispositions of participants and changes in their perception? By clarifying these points, we aim to examine the effectiveness of adopting IFGs in the real policy design processes, along with presenting the discussion results of the workshop. Note that "perceptions" in this study are (1) perceptions about the relationship between current and future generations; (2) perceptions and assessments relating to Suita City; and (3) perceptions about important points when formulating visions and policies. "Personal attributes and dispositions" include critical thinking, generativity, scientific literacy, social value orientation, and personal attributes (i.e., gender, age, occupation, family structure, number of years living in the same residence, residence type, and income). Details are explained in "[Questionnaire analysis](#)".

By shedding light on the relationships among personal attributes, dispositions, and the "futurability" of human beings, this study will yield knowledge that is useful for the design of social mechanisms that facilitate sustainable decision-making and action in ways that consider the perspective of future generations.

## Methods

### Framework of the deliberation experiments (workshop)

Suita City is a bedroom community with a population of approximately 370,000 located in the northern district of Osaka Prefecture. Before the practice presented in this study, there had been virtually no participatory planning for environmental and relevant issues in the city, except for the process of the so-called "public comments system." When a city government or other local government body is formulating important policies or promoting administrative plans, a "public comments system" is a mechanism for publicly disclosing a draft version of the proposal to the residents of the municipality and then reflecting the opinions and information received from residents in the policymaking

or planning process. The system is often adopted in the processes of public policy and planning at the local governmental level in Japan. However, actual participatory planning in public policy, which invites local citizens to participate, is still very limited in Japan.

Over four sessions in 2019, we conducted a workshop on the theme of the city's 3rd Environmental Master Plan, which the city government was in the process of researching and formulating. Both ordinary residents and city officials participated in the workshop.

Through a process of public solicitation at the city hall, we extended an open invitation to city residents to apply to participate in the workshop. As a result, applications from 24 citizens were accepted. Four officials involved in environmental administration and water services at the city hall also joined, resulting in a total of 28 participants. Of these 28 participants, 17 were men and 11 were women, ranging in age from their 20s to 80s. The 24 citizens were divided into five groups that were selected to reflect an even balance in ages and genders. Including one group composed of the city officials, there were six groups in total. Throughout the four workshop sessions, the group members remained the same.

The workshops were conducted on March 30, 2019 (Session 1), April 13, 2019 (Session 2), June 23, 2019 (Session 3), and August 31, 2019 (Session 4). Each session lasted approximately 3 h. The themes for discussion in the workshops were the three pillars of the city's environmental master plan: (1) energy systems for a low-carbon society; (2) resource recycling; and (3) cross-sectional priority themes (especially themes relating to fostering environmental awareness). Each group was tasked with discussing one of these three themes.

The discussion themes were assigned to groups as follows. Two groups discussed energy systems (hereafter referred to as "Energy A" and "Energy B"), two groups discussed resource recycling ("Recycling A" and "Recycling B"), and two groups discussed cross-sectional priority themes ("Cross-section A" and "Cross-section B"). The group made up of city officials was group "Cross-section B," while the citizens were all divided among the other five groups (i.e., "Energy A", "Energy B", "Recycling A", "Recycling B", and "Cross-section A").

The mission of the workshop participants was firstly to (1) envision and examine the state of Suita City in 2050 and then, in accordance with their theme, to (2) formulate measures and policy options for adoption in the city's 3rd Environmental Master Plan for the 8-year period from 2020 to 2028.

## Designing discussion processes

In accordance with the research objectives, we designed the discussion contents and processes for the four workshop sessions as follows.

In Session 1, groups discussed their themes from the perspective of the current generations, but in Sessions 2–4, they had to engage in discussion from the perspective of IFGs. We designed the workshop this way to enable us to observe how the shift of perspective from the current to future generations changed the decision-making of the groups. In designing the discussion processes for Sessions 2–4 in particular, we applied findings from earlier Future Design studies to generate “futurability” among participants. Specifically, we referred to Hara et al. (2021), who used the mechanism to shift the perspective within individuals from current generations to future generations in deliberations. In addition, we referred to the method shown in Nakagawa et al. (2019) to obtain a retrospective perspective. Table 1 shows a summary of the discussions held at each session. The following explains the details of each treatment and the contents of each session.

- Session 1: Envisioning the society of 2050 and assessing policies (as current generations)

In Session 1 of the workshop (March 30), the participants formulated a future vision for Suita City in 2050 from the perspective of the current generations. Based on the future vision, they then discussed and assessed a draft of the city’s environmental master plan. Firstly, Suita City officials provided the participants with basic information and data relating to the group’s discussion theme, e.g., about city population trends and environmental conditions. The city officials also presented their thoughts on the city’s policies through to 2028 relating to “energy”, “recycling”, and “cross section”, which were the three basic themes of

the city’s environmental master plan. After receiving this information, each group discussed its imagined vision of Suita City in 2050. The discussions focused most heavily on the following three aspects of the city: the state of the city, infrastructure, and industry; the state of the environment; and the state of human life (lifestyle and work style).

After sharing their visions of the city’s future in 2050, the groups assessed a draft of the city’s environmental master plan and the measures (policy options) that should be considered in accordance with the vision and discussed policy options to be considered. Discussion focused on the points of agreement with the city’s current policies, points that need to be improved or revised, and new measures and perspectives that need to be added.

- Session 2: (1) assessment of past policies, (2) envisioning the society of 2050 and assessing policies (as IFGs)

In the first half of Session 2 (April 13), the groups reviewed the environmental policies that Suita City implemented in the past and they analyzed and assessed the past policies from the perspective of the current year, 2019. More specifically, they looked at three of the city’s past waste management policies as case studies—(1) subsidies for food waste composting equipment (introduced in 1991); (2) five-category separated waste collection (introduced in 1992); and (3) use of colorless and semi-transparent garbage bags (introduced in 2004)—and they analyzed them in the light of their particular theme. Firstly, a city official (not one of the workshop participants) provided some background on the introduction of these policies at the time, along with an outline of the policies, and the results and outcomes of their implementation, including specific data. After receiving this information, each group was asked to assess these past policies from the perspective of the current generations in the form of a message to the city officials involved in drafting the policy at the time. We applied this method while referring to previous studies such as that of

**Table 1** Flow of deliberation and contents of each session at workshop

	Date	Content
Session 1	March 30, 2019 (current generation perspective)	Receive information about the city and the 3rd Environmental master plan Envision the state of Suita City in 2050 Evaluate and review a draft outline of the environmental master plan and policies
Session 2	April 13 (analysis of past policy) (IFGs perspective)	Evaluate the past waste management policies Envision the state of Suita City in 2050 as IFGs Review policy ideas that should have been considered (and implemented) as environmental plans and policies in 2019
Session 3	June 23 (IFGs perspective)	Create a past timeline (roadmap) from 2019 to 2050 as IFGs Based on the past timeline, review the policy ideas that should have been considered (implemented) in 2019 and identify priority policies
Session 4	August 31 (IFGs perspective)	Formulate final proposals for 2019 as IFGs (finalize images of Suita City in 2050 and priority policies)

Nakagawa et al. (2019), assuming that formatting the process in this way helps participants to acquire the perspective of future generations. This process can be a good step for the next process of obtaining the perspective of IFGs, as explained below.

In the second half of Session 2, the groups began to hold discussions from the perspective of IFGs. Firstly, one of the authors explained the meaning and importance of thinking from the perspective of IFGs, followed by the projection of a visual presentation (picture-story show) (Nakagawa and Saijo 2021) which summarizes the experiences of people who had previously participated in discussions as representatives of IFGs (Hara et al. 2019). After the presentation, all of the participants discussed their topics from the perspective of IFGs in 2050. Participants were advised to imagine traveling 30 years in time to 2050, without aging at all, and living as a citizen in Suita City. From that perspective, the participants were then asked to describe in detail the society of Suita City (specifically, industrial activities, lifestyle, social systems, and urban infrastructure), as well as environmental conditions in the city in 2050. Finally, based on their group's shared images of Suita City in 2050, the participants looked back in time to the past society of 2019 and discussed the policies that should have been considered or adopted by the city officials who formulated the environmental master plan in 2019.

- Session 3: creating a past timeline up to 2050 (as IFGs)

Maintaining the perspective of IFGs in 2050 from Session 2, in Session 3 (June 23), the participants created a past timeline (past roadmap) connecting the images of the 2050 society that they depicted in Session 2 back to the society of 2020, which is the starting year of the 3rd Environmental Master Plan. In accordance with their timeline, they then reconsidered the policies that should have been addressed in 2019. Each group started by reviewing its discussion about the policies proposed and shared in Session 2. Assuming that these policies were reflected and implemented in some way in the 3rd Environmental Master Plan, the groups then created a past timeline from 2020 to 2050 from the perspective of IFGs in 2050. In their discussions about creating the past timeline, the groups were asked to assign particular importance to two points: (1) How was the city's current environmental situation (energy, recycling, and cross section) achieved between 2020, when the policies were first considered, and their current time period of 2050 as IFGs? (2) To achieve the environmental conditions of 2050, what challenges arose and how were these challenges overcome? Through the above discussion process, the participants worked to reconsider and revise the policies that the city should have considered in 2019.

- Session 4: selection of final policy proposals (as IFGs)

In the final session, Session 4 (August 31), continuing from the perspective of IFGs, the groups worked to formulate a message for the citizens and officials of Suita City in 2019. More specifically, each group wrote descriptive summaries of the social and environmental conditions of Suita City in 2050 and selected three particularly important policies or initiatives that Suita City citizens and officials should consider implementing after 2019, along with the reasons for their choices. Their "Images of Suita City in 2050" and "Priority measures to be considered" were presented in the form of a message from the future. Finally, the groups offered their assessment and advice about the draft (revised) version of the environmental master plan that was being considered by Suita City in 2019 from the standpoint of IFGs.

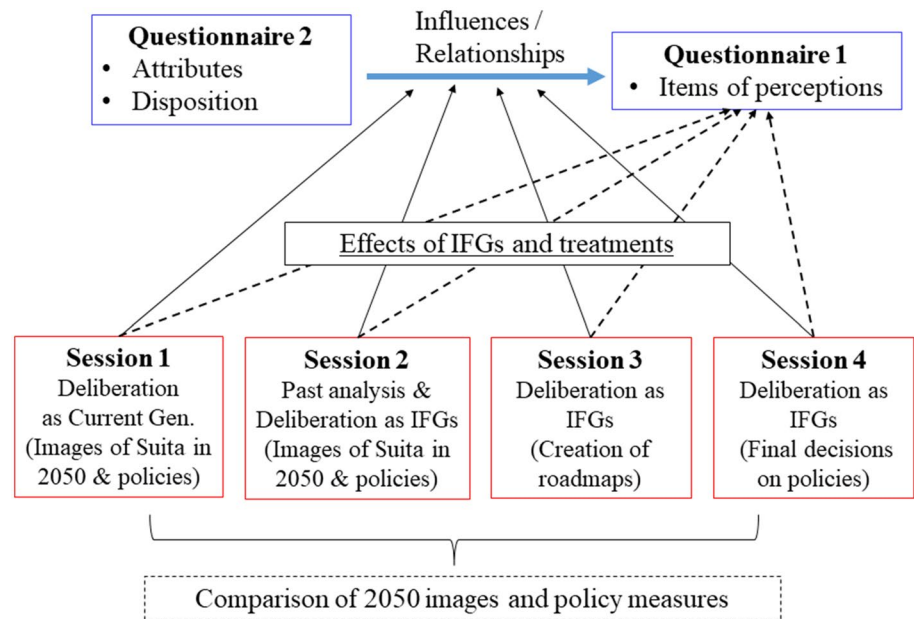
The contents and results of the four discussion sessions are described later. As explained above, the contents of the discussion in Session 1, from the perspective of the current generations, and the topics of the discussion in the second half of Session 2, from the perspective of IFGs, were the same, i.e., (1) the images of society (Suita City) in 2050 and (2) the policies and measures that should have been considered in 2019. This means that decision-making and discussion contents can be compared depending on the different perspectives (i.e., those of the current generations and IFGs) and thus it is possible to clarify the effects of adopting IFGs. The subsequent discussions in Sessions 3 and 4 were both conducted from the perspective of IFGs, but a different treatment to that employed in Session 2 was applied. In Session 3, instead of examining the societies of 2050 and 2020 as a cross section of a particular era, participants worked to connect the two points in time by creating a past timeline, which gives the participants a clearer sense of the time dimension. In Session 4, to arrive at a final conclusion, each group engaged in a decision-making and consensus-building exercise, to select the three most important items from their proposed policy measures in the previous Sessions. Thus, in each of Sessions 2, 3, and 4, the groups engaged in different tasks (treatments) from the perspective of IFGs.

## Questionnaire analysis

### Questionnaire

In this study, we conducted a questionnaire analysis to determine whether the participants changed their perception and thinking over the course of the discussions and treatments explained earlier. We prepared two kinds of questionnaires, Questionnaire (1) (Appendix 1), which was administered to all participants after each of the four workshop sessions,

**Fig. 1** Framework of study and relationships of each analysis



and Questionnaire (2) (Appendix 2), which was used to understand the personal attributes and dispositions of the participants. The questionnaires were originally presented to participants in Japanese. Appendices 1 and 2 are translated versions prepared for this manuscript. Figure 1 describes the framework of analysis employed in this study. We first investigated how the introduction of IFGs and relevant treatment in each session influenced the perception of participants (Questionnaire (1)). Assuming that the perception is related with personal attributes and dispositions (Questionnaire (2)), we also delved into how the adoption of IFGs and the associated treatment could influence the relationships. In doing so, we aimed to study the effects and roles of IFGs as a new social system to generate futurability (see Fig. 1).

For Questionnaire (1), we applied a questionnaire form implemented by Hara et al. (2021), which consists of 35 questions in total, under three main headings: (1) perceptions about the relationship between current and future generations; (2) perceptions and assessments relating to Suita City; and (3) perception about important points when formulating visions and policies. The questions under headings 1 and 2 were answered by rating the level of agreement with various items on a five-point scale (1 = Disagree, 2 = Somewhat disagree, 3 = No opinion, 4 = Somewhat agree, 5 = Agree), while Question 3 was answered by rating the level of importance of items on a scale of 1 to 5 (1 = Not important, 2 = Not very important, 3 = No opinion, 4 = Important, 5 = Very important).

The participants were asked to answer Questionnaire (2) at home after Session 1 of the workshop. In this questionnaire, modified from Kuroda et al. (2021) and Hara et al. (2021), we asked participants to answer questions to enable us to

assess their critical thinking disposition (Hirayama and Kusumi 2004), generativity (McAdams and de St. Aubin 1992), scientific literacy (Okamoto 2008), social value orientation (Van Lange, et al. 2007), and personal attributes (gender, age, occupation, family structure, number of years living in the same residence, residence type, and income). The number of questions in the questionnaire was limited to avoid burdening the respondents. To assess critical thinking, we asked 13 questions about “awareness for logical thinking” and from the Generative Behavior Checklist we included 40 items, excluding dummy items.

Critical thinking is reflective thinking that consciously examines one’s reasoning process, focused on deciding what to believe, assert, and act upon (Ennis 1987). It allows one to consider things from multiple perspectives and with appropriate criteria, rather than judging them subjectively. Respondents were asked to indicate their level of agreement with various statements on a 5-point scale (1 = Disagree, 2 = Somewhat disagree, 3 = No opinion, 4 = Somewhat agree, 5 = Agree).

Generativity is defined as a concern for nurturing, teaching, and guiding the next generation by generating things and outcomes that promote continuity from one generation to another (McAdams and de St. Aubin 1992). For this study, we used the Generative Behavior Checklist (GBC) to measure generative behaviors, including creating, maintaining, and offering to others, in ways that mutually benefit subsequent and emergent commitments. Of the 50 items in the original GBC, 10 “filler items” were removed and the remaining 40 items were used in this study. Respondents

were asked how frequently they performed certain behaviors on a 3-point scale (0=Never, 1=Once, 2=Twice or more).

According to Miller (1998), scientific literacy is defined as the ability to read and write about scientific and technological matters, including practical things like reading product labels and repairing cars, as well as reading newspapers and magazines and understanding scientific vocabulary and scientific concepts well enough to understand the nature of opposing arguments. The questionnaire used in this study was developed by referring to a questionnaire used previously in social research on the citizens' scientific literacy by the Japanese government (Okamoto 2008).

The concept of social value orientation (SVO) classifies people's preferences regarding outcomes for themselves relative to outcomes for others, based on the assumption that individuals vary in terms of the weight that they attach to other people relative to themselves. In this study, we used Van Lange et al.'s (2007) triple-dominance measure of social values, which classifies people's preferences as being prosocial, individualistic, or competitive.

Although previous studies have analyzed how individuals' dispositions, such as generativity and critical thinking, relate to the generation of "futurability" (Nakagawa et al. 2019; Hiromitsu et al. 2021), in this study, we paid particular attention to the relationship between personal attributes and dispositions and different forms of treatment, such as creating a timeline of the past and selecting policies after adopting the IFGs approach.

### Statistical analysis

In this study, firstly with Questionnaire (1), we conducted a one-factor analysis of variance (ANOVA; between-subjects distribution) with the work produced at each session treated as an independent variable, to investigate whether the perceptions of participants could be changed by the treatment at each workshop session.

Next, based on Questionnaire (2), we conducted a multiple regression analysis to examine whether the personal attributes and dispositions of the participants impacted their weightings of values and perceptions. In particular, we investigated how personal attributes and dispositions (evaluated by Questionnaire (2)) influenced changes in the participants' perceptions about the items listed in Questionnaire (1), at each session. By doing so, we aim to delve into how adoption of IFGs and each treatment influenced the relationship between personal attributes and dispositions and changes in the participants' perceptions (Fig. 1).

Multiple regression analysis of all items shown in Appendix 1 was performed to examine how people's

personal attributes and dispositions relate to these perceptions. All of the items in Questionnaire (1) were used as objective variables to examine how the perceptions of participants were affected by their personal attributes and dispositions. The explanatory variables were critical thinking, generativity, scientific literacy, and social value orientation (SVO) as dispositions, and gender, age, occupation (each occupation was used as a dummy variable), household size (number of members), number of years in the same residence, residence type (each type of residence was used as a dummy variable), and household income as personal attributes. The variables were selected using a stepwise method.

## Results

### Session discussion results

#### Comparison of results from Session 1 and Session 2

The results of the discussions in Session 1, from the perspective of the current generations, and the discussions at Session 2, from the perspective of IFGs, are described in Appendix 3. The detailed contents of the discussions of each group are given in Appendix 4. Taking the example of "Energy A", the group emphasized visualization and education of the effectiveness of greenhouse gas emission reductions to raise public awareness, the implementation of enjoyable events, and the need for subsidies and eco-tax cuts as economic incentives as measures to be taken after 2019 when they discussed this topic in Session 1. On the other hand, the group's proposals of measures in Session 2 as IFGs included ambitious targets for renewable energy, the creation of a budgetary framework for the future that is not shortsighted (approx. 5% of funds) for measures to address environmental challenges to enable the public to understand them, and the need for training events and education to eliminate disparities. Thus, discussion results of policy measures were very different from those of the case of Session 1.

Likewise, as described in Appendix 3, there was a clear and significant difference in the quality of proposals regarding the participants' images of society (Suita City) in 2050 and the measures that should be adopted in 2020 between those generated by the discussion from the perspective of the current generations (Session 1) and those from the perspective of IFGs (Session 2). We argue that the differences of discussion results were derived from the effects of adopting IFGs, in that futurability was activated and new perspectives and normative values were obtained. This is consistent with previous studies (Hara et al. 2019).

**Table 2** Images of Suita City in 2050 and three high-priority policies, proposed by IFGs

## Description of Suita City in 2050

**Energy A:** Suita City, as of 2050, runs on 100% renewable energy and consumes 70% less energy. Self-driving cars declined since 2040 and have now almost disappeared. An air transportation network has been developed. Old roadways are now green belts, with abundant nature. Although life has become very convenient, there is less communication between people in the community (with people other than family members). This has become a social problem

**Energy B:** in 2050, Suita City has become an environmentally friendly place to live, with no more vacant houses or lots, and abundant green spaces and places for community activities. Disaster-resistant buildings with solar panels are the norm, and the city's population continues to grow as its living environment improves. Suita City has been successful in changing the attitude of individuals and in encouraging them to create a better environment. Energy self-sufficiency is over 75%, so each household is able to supply its energy needs without difficulty

**Recycling A:** in Suita City in 2050, cars fly in the sky, so there are no traffic jams. AI takes care of daily healthcare and the initial diagnosis of illnesses is handled by AI, so medical care is inexpensive. Work styles have also changed. With the support of robots, humans can focus on creative work. Human interaction has increased, but disparities have developed in the community. The style of education has also changed. People can now learn anywhere and anytime. After much effort, garbage has been reduced to zero

**Recycling B:** in 2050, Suita City is a zero-waste “advanced SDGs city.” Goods are transported by drones and flying cars. It is a center of human activity, but the city's greenery is decreasing and there is increasingly less interaction among people

**Cross-section A:** in 2050, Suita City is the No. 1 municipality in the Kansai region for environmental satisfaction. It offers advanced transportation and self-driving vehicles. It has a high recycling rate and a high level of low-energy housing. There are more foreign residents. Thanks to AI and unmanned community buses, the city has far lower labor costs. The plastic recycling rate is high. Exporting garbage abroad is not acceptable., (double-paned windows, AI-based air conditioners)

**Cross-section B:** in 2050, Suita City is a clean, green, and comfortable city, thanks to the widespread use of EVs, the greening of walls when buildings are rebuilt, especially in the Osaka area, far fewer air conditioners are in use. As a result of environmental education programs at elementary schools and in the form of public seminars that have been systematically organized since 2019, Suita City has become a city of strong environmental initiatives that has attracted the attention of children, parents, and companies, with a growing number of jobs related to the environment. Suita City has also collaborated with other cities

## Three high-priority policies that should be adopted from 2020 and reasons for the proposal

**Energy A**

Contents (1): building a renewable energy system that also considers disposal methods

Reasons (1): we are satisfied with the current state of 100% renewable energy, but when building a renewable energy system, it is essential to consider the final disposal method and replacement

Contents (2): collaboration with neighboring municipalities

Reasons (2): to achieve 100% renewable energy, for example, without wind and biomass in mountainous municipalities

Contents (3): create a system to nurture the “spiritual richness” that has been lost

Reasons (3): due to the use of AI, interpersonal communication has declined, and although it is convenient, the current environment is lacking in human spirit. It is therefore necessary to increase interactions with nature and animals, and intergenerational interactions, by making the best use of enriched green spaces

**Energy B**

Contents (1): measures to improve waste reuse

Reasons (1): because reusing waste energy in all households will not only raise public awareness, but also greatly increase energy self-sufficiency. Such measures will lead to physical reduction in the quantity of garbage generated

Contents (2): improve environmental education

Reasons (2): thoroughly changing the awareness of individuals will facilitate changes in ordinances related to the conversion garbage into energy. Government and citizens can work together to promote measures, thereby creating an ideal environmental cycle

Contents (3): measures to address the problem of vacant land and houses

Reasons (3): this will reduce the amount of waste and garbage due to the abandonment of vacant land and housing. A steady and persistent approach by the government will eventually lead to a solution. Resolving the issue of vacant land and housing will facilitate inflows of people from other municipalities and lead to the creation of a more attractive environment



**Table 2** (continued)

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Three high-priority policies that should be adopted from 2020 and reasons for the proposal

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**Recycling A**

Contents (1): establish clear basic policies and measures for realizing a better 2050

Reasons (1): above all, it is important to set goals for the future and establish a path to reach them

Contents (2): provide education and raise awareness about the environment

Reasons (2): in 2019, there were many technical and institutional solutions to waste separation and recycling issues, but they could not be realized due to a lack of public awareness and knowledge. It is therefore necessary to incorporate environmental classes into school education and actively disseminate information to companies and organizations

Contents (3): R&D to realize zero waste

Reasons (3): it is essential to partner with universities and research institutes on research to develop biodegradable plastics and automatic garbage sorting systems, and other technologies that were not available in 2019

**Recycling B**

Contents (1): fee-based garbage disposal system

Reasons (1): to reduce waste by using the revenue earned from the fee-based garbage disposal system to fund research on the environment and waste management by universities and companies. Achieving recycling

Contents (2): education and awareness of the SDGs

Reasons (2): to deepen understanding of fee-based garbage disposal system, etc.

Contents (3): new rules for drones and flying cars

Reasons (3): to reduce the burden of road maintenance and achieve an efficient, low-waste environment through fuel reduction, etc.

**Cross-section A**

Contents (1): land improvement

Reasons (1): roads, living environment (drainage, utility poles)

Contents (2): exchange (locations)

Reasons (2): distribute and share information on social networking sites. Create more children's playgrounds and places for people to interact

Contents (3): recycling

Reasons (3): increase the number of sorting categories ⇒ separate plastics, etc. Charge for garbage bags

**Cross-section B**

Contents (1): designing the environment together with citizens

Reasons (1): by providing environmental education to young generations and exchanging opinions with citizens who are interested in the environment, generate a synergistic effect to raise environmental awareness and create policies in conjunction with citizens

Contents (2): collaborating with other cities and trying to establish committees

Reasons (2): to enable access to information from other cities and to enable the implementation of a wide range of measures

Contents (3): create institutions related to the environment

Reasons (3): to accelerate environmental improvements, involve companies, and increase the scale of projects. Also, guidelines are necessary for real-world implementation

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**Characteristics of key policies raised by IFGs**

Table 2 summarizes the “Images of Suita City in 2050” and the “Three high-priority policies that should be adopted from 2020” proposed by each group as IFGs at the end of their discussions in Session 4.

Although the proposals of the six groups share some common elements with the policies they came up with in Session 1 (from the perspective of the current generations), on the whole, the contents are fundamentally different. The proposals formulated from the perspective of IFGs are characterized by the following two points.

**(1) Proposal of new institutions and systems**

One of the characteristics is the proposal of all new institutions and systems. For example, the “fee-based garbage

disposal system” proposed by Recycling B as IFGs is a new idea that might represent an excessively high hurdle for the current generations. This group’s proposal is not an extension of the existing waste management policy; it is a new system that assumes that the revenue from fees is used to fund research on the environment and waste management measures by universities and companies.

Recycling B proposed “new rules for drones and flying cars” for the purpose of reducing the burden of maintaining roads and creating a more efficient and less wasteful environment by reducing fuel consumption. Another characteristic of the group’s recommendation was the proposal of adopting new, unprecedented systems, to reduce resource and energy use and promote waste reduction. The tendency of proposing new institutions and systems as IFGs is consistent with previous studies, such as Hara et al. (2019).

## (2) Proposals from a long-term, “big picture” view

Another important feature is holistic proposals. Energy A raised the issue of “collaboration with neighboring municipalities”, while Cross-section B proposed “collaborating with other cities and trying to establish committees”. These proposals suggest that the groups felt that instead of having individual municipalities act alone, it is necessary to promote consideration from a more comprehensive standpoint, in order to achieve more humane universal social goals.

Energy A’s proposal for “building a renewable energy system that also considers disposal methods” was characterized by a view that proposals to build renewable energy systems should consider not only the issues of the individual energy systems, but also the problems of final disposal methods and secondary issues. This is the kind of idea and view that is obtained by adopting the perspective of 2050 to formulate a concrete image of future challenges. Energy B’s suggestion to develop “measures to address the problem of vacant land and houses” also indicates that the group considered energy issues from a comprehensive perspective, rather than as an isolated local problem.

Recycling A’s proposal for “R&D to realize zero waste” is not so much about how to deal with generated waste (e.g., treatment, management, and recycling), but rather, how to promote R&D in collaboration with universities, and other institutions. This too can be seen as the result of selecting policies from a long-term perspective rather than a short-term one.

### **Analysis of variance (ANOVA): perceptual changes due to treatments**

Appendix 5 shows the results of a one-factor ANOVA (between-subjects distribution) based on data obtained from the questionnaires. Based on Appendix 5, we summarize the essential points as follows.

#### **Items indicating significant differences between Sessions 1 and 2**

In Session 2, after participants were instructed to envision the society of 2050 as IFGs and send a message with policy proposals to Suita City officials in 2019, scores for item Q1-17 “In today’s discussion, I thought about things from the perspective of a person living in the present day” decreased. Conversely, scores for item Q1-18 “In today’s discussion, I thought about things from the perspective of a future generation” increased. This means that the participants consciously abandoned the perspective of a person

living today and acquired the perspective of a person living in the future, indicating that the treatment was successful.

In terms of the perceptual changes generated in participants, significant differences were observed in two items. After the participants were instructed to send a message with policy proposals to city officials in 2019, as IFGs, the level of agreement with item Q1-3 “The policies talked about in the discussion will help foster environmental awareness among Suita’s citizens” increased. In addition, responses to questions about what they prioritized in their discussion show that the participants assigned greater importance to item Q3-7 “Reducing anxiety about what could occur in future” than when they considered issues from the perspective of the present day.

#### **Items indicating significant differences between Sessions 1 and 3**

In Session 3, continuing to maintain the perspective of IFGs in 2050, the participants created a past timeline (roadmap) connecting the society of 2050 back to the society of 2020, for the purpose of re-assessing the policies that should have been considered in 2019. Once again, the level of agreement with item Q1-17 “In today’s discussion, I thought about things from the perspective of a person living in the present day” decreased, while agreement with item Q1-18 “In today’s discussion, I thought about things from the perspective of a future generation” increased. Therefore, the treatment can be regarded as successful.

In terms of changes in perceptions, for each of three items—Q1-2 “The policies talked about in the discussion will lead to the formation of a social system that will manage Suita City’s resources”, Q1-3 “The policies talked about in the discussion will help foster environmental awareness among Suita’s citizens”, and Q1-4 “Failure to implement the policies talked about in the discussion will lead to a serious crisis”—the mean score (level of agreement) was higher in Session 3 compared to Session 1. In addition, responses to questions about what they prioritized in their discussion show that the participants assigned more importance to items Q3-5 “These measures could bring about an ideal future” and Q3-7 “Reducing anxiety about what could occur in future” in Session 3 than in Session 1.

#### **Items indicating significant differences between Sessions 1 and 4**

In Session 4, each group was instructed to select the most essential policies and send a message to the policy planners in 2019, including the group’s image of society in 2050 and three high-priority policies, as formulated from the standpoint of IFGs. Again, the level of agreement with item Q1-17 “In today’s discussion, I thought about things

from the perspective of a person living in the present day” decreased, while agreement with item Q1-18 “In today’s discussion, I thought about things from the perspective of a future generation” increased, indicating that the treatment was successful.

Compared to Session 1, each of the following perceptions of participants were stronger in Session 4: items Q1-1 “The policies talked about in the discussion will lead to the realization of a low-carbon society in Suita City that conserves limited energy resources”, Q1-2 “The policies talked about in the discussion will lead to the formation of a social system that will manage Suita City’s resources”, Q1-3 “The policies talked about in the discussion will help foster environmental awareness among Suita’s citizens”, Q1-4 “Failure to implement the policies talked about in the discussion will lead to a serious crisis”, Q1-14 “The members of my group debated goals that seemed desirable for society as a whole”, Q1-15 “The members of my group shared goals that seemed desirable for society as a whole”, and Q2-8 “Suita City will be a comfortable place to live in 2050”. This session was the most focused on selecting and proposing specific policies from the perspective of IFGs in 2050, which may be why we see greater awareness of policy issues relating to energy, resource recycling, and cross section here. We also found that, in this discussion, items Q3-1 “Living an affluent lifestyle” and Q3-7 “Reducing anxiety about what could occur in future” were assigned more importance in Session 4 than in Session 1.

As shown above, in Session 4, the participants felt more strongly that Q2-8 “Suita City will be a comfortable place to live in 2050” compared to Session 1, indicating a change in their perception of Suita City. In the workshop, no change was observed in affection for Suita City or the intention to live in Suita City, so this was the only item in which a change in perception of Suita City was observed. Two items, Q1-14 “The members of my group debated goals that seemed desirable for society as a whole” and Q1-15 “The members of my group shared goals that seemed desirable for society as a whole”, were the only ones for which a significant change in the level of agreement (compared to Session 1) was observed in Session 4. The mean score was already high, i.e.,  $\geq 4$ , but it increased even more in Session 4. However, we cannot exclude the possibility that this effect was due to the deepening of mutual understanding among the group members that arose from repeated discussions in the same group. We can assume that changes in Session 4 are the result of the treatment of getting participants to make recommendations to the policy planners of 2019 as IFGs in 2050. Nevertheless, in future studies we will need to examine, in detail, the extent to which the influence of repeated sessions contributes to the success of treatments.

## Multiple regression analysis

The results of our multiple regression analysis are shown in Appendix 6. The following results are the most important findings from the analysis. The details of each individual analysis for items and implications are summarized in Appendix 7. With the below results, we highlight the three points as commonly observed trends and implications that are particularly important because of their commonality.

### (1) Effects of “Critical Thinking” under the scheme of IFGs

In Session 1, when multiple items, Q1-4, Q1-5, Q1-6, Q1-8, Q1-9, Q1-14, Q1-15, Q1-16, Q1-18, and Q3-8, were considered from the perspective of the current generations, we observed that the higher the level of critical thinking among participants, the more important do these perceptual items tend to be. However, in the second and subsequent workshop sessions, when the IFGs’ perspective was adopted, the influence of critical thinking tended to disappear (Appendix 6). Given that the average scores of these items tended to increase after Session 2 when the IFGs approach was adopted, it appears that the adoption of IFGs may strengthen these perceptions, independently of the individual characteristic of critical thinking. For example, for items Q1-4, Q1-5, Q1-6, Q1-8, and Q1-9, individuals with a higher propensity for critical thinking were more likely to feel a sense of crisis, responsibility, and expectation in Session 1; however, from Session 2 onward, the influence of critical thinking was no longer observable. Since the mean ratings of these items increased from Session 2 onward, compared with Session 1, it is possible that most participants came to feel a sense of crisis, responsibility, and expectation, regardless of their critical thinking level.

Further, for item Q1-17 “In today’s discussion, I thought about things from the perspective of a person living in the present day”, those with lower critical thinking scores tended to agree with this statement in Session 1, but the effects of critical thinking disappeared after Session 2 when the IFGs approach was adopted. These results clearly indicate an effect of adopting IFGs. Note that similar tendencies were observed for some items on the personal dispositions of generativity and SVO.

### (2) Effects of types of treatment under the IFGs approach

In Session 2 and subsequent sessions, after the IFGs approach was introduced, analysis results suggest that the influence and effect of personal attributes can vary depending on the treatment and work contents. In other words, even when IFGs is adopted, the influence of these personal attributes may vary depending on the type of

treatment and the form of discussion for decision-making. In particular, specific features were observed in the treatment of Session 3 in which participants created past roadmaps connecting the society of 2050 back to the society of 2020. For example, the effects of personal attributes surfaced in Session 3 for items Q1-2, Q1-9, Q1-15, and Q3-5 (see Appendix 6). However, more detailed study is required to clarify this point.

### (3) Influence of residence type on perception changes

Analysis results suggest that detached house owners are less likely to develop stronger perceptions about the items listed in the questionnaire, regardless of the perspective (current or future generations). In other words, it is possible that living arrangements or residence type may nurture the perceptions of empathy for future generations in some way. This seems to suggest a certain limitation in terms of fostering an awareness of these items. For example, with item Q1-4 in Sessions 2 and 3; with item Q1-5 in Sessions 1 and 4; with item Q1-6 in Sessions 2 and 3; with item Q1-18 in Sessions 2, 3, and 4; with item Q2-2 in Sessions 1 to 4; with item Q2-3 in Sessions 1, 2, and 4; with item Q2-5 in Sessions 1 and 3; with item Q3-2 in Sessions 2 and 3; with item Q3-5 in Sessions 1–3; with item Q3-6 in Session 3 and 4; with item Q3-7 in Sessions 1, 2, and 3; and with item Q3-8 in Sessions 1, 3, and 4, we observed that individuals who live in detached houses (owners) tended not to think in accordance with the items. The number of participants in this study was limited, so to understand this tendency more clearly, it is necessary to accumulate more case studies.

## Discussion

### Reflection of the results

The discussion results and arguments presented in "[Session discussion results](#)" are consistent with the points identified in previous studies as being characteristic of discussions from the perspective of IFGs. For example, studies have shown that the perspective of IFGs is to give rise to new ideas, that it enables the proposal of measures that may be burdensome to the current generations, and that it facilitates decisions from a comprehensive ("big picture") perspective or shared perspectives of the current generations and IFGs (Hara et al. 2021; Nakagawa et al. 2017). However, in these previous practices of Future Design, the discussions were characterized by a high degree of freedom and a lack of administrative constraints. In this study, on the other hand, even in discussions within the framework of administrative planning, the same characteristics are present, suggesting that the adoption of the IFGs approach is at least partially

effective for tackling issues that require sustainability and issues that require the coordination of interests of the current and future generations.

The ANOVA in "[Analysis of variance \(ANOVA\): perceptual changes due to treatments](#)" demonstrated that there was a significant difference in the responses of participants between Session 1, when they evaluated the master plan from the perspective of the present day, and the other sessions, when they examined issues and made decisions as IFGs. The level of agreement with item Q1-3 "The policies talked about in the discussion will help foster environmental awareness among Suita's citizens" was higher in each of Sessions 2, 3, and 4 compared to Session 1, suggesting that this item is easily influenced by the future perspective. We also found that with each session, there were an increasing number of items for which the level of agreement differed from that in Session 1. In the questions about discussion perspectives, we saw that two items, Q1-17 "In today's discussion, I thought about things from the perspective of a person living in the present day" and Q1-18 "In today's discussion, I thought about things from the perspective of a future generation", were the only ones for which there was any observed difference in agreement between Sessions 1 and 2. However, in Sessions 3 and 4, differences (compared to Session 1) were observed in four and nine items, respectively.

Notably, no significant differences were found between any of Sessions 2, 3, and 4. This indicates that the various observed perceptual changes occur in the shift from considering things from the perspective of the current generations to considering things from the perspective of IFGs, and that the impacts on the perception changes with the different treatments applied after the future perspective is acquired are smaller than the shifts between Session 1 (current generations) and Session 2 (IFGs). This is a new insight that could be obtained from this study, unlike previous studies, such as Hara et al. (2021), which did not delve into the impacts of different treatments on perception changes after IFGs is adopted. However, in this workshop, we did not apply the treatments of Sessions 3 and 4 to discussions from the perspective of the current generations, so we cannot make a rigorous comparison. This is therefore a subject for further investigation.

The results of a multiple regression analysis in "[Multiple regression analysis](#)" revealed one of the most important findings of this study. When considering future visions and policies from the perspective of the current generations, individuals with a high level of critical thinking tended to show more importance to items, such as "a sense of crisis about the future", "a sense of responsibility as the current generations", and "a shared recognition of goals that are desirable for society as a whole". However, the influence of critical thinking seemingly disappeared after Session

2, when IFGs was adopted. This fact demonstrates the effects of adopting the IFGs' perspective in deliberation and decision-making. Based on the findings of “[Analysis of variance \(ANOVA\): perceptual changes due to treatments](#)” and “[Multiple regression analysis](#)”, the adoption of the IFGs approach could function to enhance the perceptions of these items in individuals, regardless of the level of critical thinking as a disposition. This is a new finding not addressed in previous studies that delved into the relationship between personal attributes and futurability, such as those by Nakagawa et al. (2019), Kuroda et al. (2021) and Hiromitsu et al. (2021). For example, Nakagawa et al. (2019) showed that those with a high degree of critical thinking or generativity are more likely to select future-oriented options. Our results show, for the first time, that it would be possible to increase empathy about future generations by introducing the IFGs approach, regardless of the level of critical thinking.

### Summary of main findings

In summary, data from group discussions and questionnaire surveys of participants revealed the following. Firstly, data from group discussions clearly showed that the adoption of IFGs approach significantly changed the contents of the policies proposed or supported by participants. When participants discussed issues as IFGs, they were more likely to propose new, unprecedented institutions and systems and measures framed from a long-term and comprehensive perspective, in marked contrast with thinking and decision-making tendencies when discussions were held from the perspective of the current generations.

Next, the results of an ANOVA clearly showed that adopting IFGs can bring about clear changes in perceptions of intergenerational problems and in assessments of Suita City, and furthermore, that applying the IFGs approach to decision-making processes and discussions gives rise to significant differences in perceptions, depending on the specific treatment and work contents. As examples, perceptions of (1) the need to eliminate uncertainties about the future, (2) a sense of crisis about the future, and (3) a shared recognition of social goals for the future were all clearly enhanced when the IFGs approach was combined with other tasks. These attitudes are extremely important for decision-making and consensus building, as well as for resolving long-term issues. The fact that these attitudes were strengthened suggests that the “futurability” of participants was activated.

The results of a multiple regression analysis yielded the following three notable points. First, when examining future visions and policies to be implemented from the perspective of the current generations, individuals with a high level of critical thinking (as a disposition) tended

to assign more importance to several items, including “a sense of crisis about the future”, “a sense of responsibility as the current generations”, and “a shared recognition of goals that are desirable for society as a whole”. However, for many of the items as discussed in “[Multiple regression analysis](#)”, the impact of critical thinking tended to disappear from Session 2 onward, when IFGs was introduced. These findings suggest that adopting the IFGs approach can strengthen the perceptions of a sense of crisis, responsibility, and expectation, regardless of individuals' levels of critical thinking.

Second, even in Sessions 2–4, even after IFGs was adopted, the influence and effects of personal attributes and dispositions changed, depending on the treatment and work contents. In particular, specific characteristics were observed in Session 3 when participants were dedicated to discussing past roadmaps connecting the society of 2050 back to the society of 2020. It is possible that this type of treatment enables participants to activate the perception of time framework more clearly. This finding indicates that the types of treatment and work contents in decision-making could be determining factors affecting the perception of individuals, even when the IFGs approach was adopted. It is important to accumulate knowledge as to what types of treatments work effectively to generate empathy for the future generations after the perspective of future generations is adopted.

Third, owners of detached houses were less likely to develop a stronger perception of various items in the questionnaire, regardless of whether they adopted the current generations' or IFGs' perspective, suggesting that factors like residence type and living environment may influence the effectiveness of adopting Future Design. It is therefore necessary to examine the possibility that there are spurious correlations involving the number of years in the same residence, annual household income, relational mobility, social capital, and risk forecasting (e.g., expectation of losing assets due to a natural disaster or the like). In apartment complexes, there are many opportunities for people to meet others in their surroundings on a regular basis, and it is quite possible that neighbors are expected to get to know each other and cooperate.

### Conclusions

In this study, we conducted a workshop in which both residents and city government officials of Suita City examined the 3rd Environmental Master Plan, a key policy document of the city. Groups of participants formulated a vision (image) of the city in 2050 and proposed policies that should be implemented in the near-term to realize the vision, both from the perspective of the current generations and

from the perspective of IFGs in 2050. The results revealed the following: (1) the images of society in 2050 and policy options considered from the perspective of the IFGs were significantly different from those considered from the perspective of the current generations; (2) adoption of IFGs could heighten certain perceptions, such as “a sense of crisis about the future” and “a shared recognition of goals that are desirable for society as a whole”; and (3) although the degree of “critical thinking”, as a disposition of individuals, appears to influence the heightening of these perceptions when considering from the perspective of the current generations, if the IFGs approach is adopted, the degree of “critical thinking” is seemingly no longer a factor in heightening the perceptions. The results and implications of this study can serve as valuable information for the creation of a mechanism for supporting sustainable decision-making that considers the interests of future generations.

Topics for further research include the following. Above all, since the number of participants in these discussions was limited to 28, we need to increase the number of case studies and sample sizes to obtain more robust results, particularly in terms of the statistical analysis. In addition, in line with previous studies, we limited the number of questions on critical thinking and generativity, but there is still a need to examine the effects of items not tested in this study, so this is another matter for subsequent investigations. We hope to clarify all these points as we accumulate further case studies.

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**Data availability** The authors confirm that all data generated or analyzed during the present study are included in this article and its appendices.

## Declarations

**Conflict of interest** The authors have no competing interests to declare that are relevant to the content of this article.

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