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Future Design for Sustainable Nature and Societies

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Future Design for Sustainable Nature and Societies

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Abstract: Let us create a society for future generations, but how can we do that? *Future Design* (FD), introduced in 2015 in Japan, is a new approach to addressing this question by formulation of new theories, verifying them through experiments, and then practicing them in real communities, municipalities, and private companies. FD is "the design and implementation of social systems that activate participants' *futurability*. Futurability refers to "the possibility that the present generation will put the interests of the future generations ahead of its own." However, the society in which we live today based upon markets and democracy is one that suppresses our futurability. For this reason, FD concerns with designing a society where people can change their behavior by activating their own futurability. It seems that we have focused only on making our generation better that we have been making *future failures* that likely cause excessive burden for future generations. Such examples are disruption of carbon cycle, nitrogen cycle, phosphorus cycle, and so on, and then the concept of Imaginary Future Person (IFP) is introduced to cope with myopia and optimism of human beings. Think about flying to the future, becoming an IFP, imagining the future society, and giving advice to the present from the future. This system works quite well in laboratory and field experiments. It also works well in real cities and towns and several examples are introduced.

1. Introduction

Let us create a society for future generations, but how can we do that? "Future Design (FD)", introduced in 2015 in Japan, is a new approach to addressing this question by formulation of new theories, verifying them through experiments, and then practicing them in real communities, municipalities, and private companies [1, 2]. In a nutshell, FD is the design and implementation of social systems that activate participants' *futurability* [3]. First, let us look at the framework of FD and what role the concept of futurability plays in it.

The science and technology that we have developed have begun to threaten our own

survival [4-8]. The social mechanisms that are supposed to control them, the market and democracy, are not only failing but are also complicit in them. For example, the Glasgow Climate Pact [9], combined with increased ambition and action from countries, means that 1.5C above pre-industrial levels by the end of the century is realized, but it will only be possible with concerted and immediate global efforts. However, a few weeks later to the Pact, developed countries demanded that oil-producing countries should increase their supply of crude oil as the price had risen and then release their own oil reserves. The implicit assumption behind it means that we humans will continue to take our existing standard of living for granted and even enjoy a better life. If we do not change the way we live and the way our society works, it is most likely that our future is very much in jeopardy. Nevertheless, the modern society always seems to be postponing the necessary changes to address climate change for example We need to respond to them immediately.

FD's proposal is radical and clear [10]. The first part of the proposal pertains to the following problems: we take decisions after discussions or deliberations, but since future generations cannot participate in them, how can we take decisions for the benefit of future generations? In other words, no matter how much we talk about problems and agree that changes are necessary, there is no fundamental solution because no such results are obtained which appear to benefit future generations. The absence of future generations in discussions or deliberations is untenable, and we may seem to have hit a dead end here. However, FD proposes a change in thinking here. The key to this proposal is the concept of *futurability*.

Futurability refers to "the possibility that the present generation will put the interests of the future generations ahead of its own." It is argued that we already possess this potential. For example, it is universally observed across cultures, times, and places, that parents give priority to the interests of their children even at the expense of their own. The idea of futurability posits that the same is true not only for one's own children or descendants, but also for future generations that may not be related by blood. The first proposal of FD is to change the way we think, and to acknowledge that we humans have futurability.

But if that is the case, how can we explain our current situation? If we had futurability, wouldn't we be facing the same difficulties we are facing today? Where did we go wrong? With respect to this point, FD provides "the design and implementation of social systems that enable people to demonstrate their futurability." Our futurability can only be realized if the society allows for its realization to the fullest. The society in which we live today is one that suppresses our futurability. Based on this understanding, I present the second part of the proposal that explains the framework of FD. This proposal pertains to creation of

such a society in which people can realize their futurability. It is not enough for us to simply call for a change in behavior. FD concerns with designing a society where people can change their behavior by activating their own futurability.

2. What have we been doing?

First, let us consider what "we" have been doing for some time now. By "We" we are referring to human beings. It seems that we have focused only on making our generation better that we have been making *future failures* that likely cause excessive burden for the future generations [1, 3].

More than 120 years ago, in 1898, the theme of Sir William Crookes' address to the President of the British Association for the Advancement of Science was food crisis [11]. He said that "England and all civilized nations stand in deadly peril of not having enough to eat" [12]. Using a variety of data, he showed that many people were likely to die of starvation around 1930. Many in the audience must have been surprised, as they must have expected that he would talk about physics or chemistry, in which he specialized. At that time, the European countries were importing guano (a thick accumulation of seabird droppings over a long period of time) and Chilean nitrites (naturally occurring sodium nitrate, $NaNO_3$) from South America to be used as fertilizers, but these were beginning to run out. To avoid a food crisis, he called for the production of ammonia (NH_3) by reacting atmospheric nitrogen with hydrogen found in water or fossil fuels because nitrogen fertilizer can be made from ammonia.

His call was answered by Fritz Haber and Carl Bosch of Germany [11]. Haber used fossil fuels to create high-temperature, high-pressure conditions and, by using a variety of catalysts, reacted nitrogen and hydrogen to produce ammonia, which he sold the process to the chemical company BASF. It was Bosch, who oversaw nitrogen research at BASF, and who implemented the technology for industrial mass production based on this process. In 1911, he succeeded in producing more than two tons of ammonia in a single day. In 1913, he built the first commercial ammonia plant in Oppau and succeeded in large scale production of marketable ammonia. The meaning of "marketable" is important, simply because a successful process at an experimental laboratory will not be shared or disseminated throughout the world if it is not marketed or sold. Nitric acid and its compounds made from ammonia can also be used as explosives, but in 1921, a huge explosion occurred at the Oppau plant, killing 509 people and leaving 160 missing [13]. people may also remember that in 2020, there was a massive explosion in Beirut. It was ammonium nitrate (NH_4NO_3) that exploded. After the Second World War, the production of ammonia accelerated rapidly [14]. It spurred the production of nitrogen fertilizer rather

than explosives.

In 1944, Norman Borlaug started to cultivate wheat in Mexico based on Norin Ten (wheat No. 10) developed by Gonjiro Inazuka in 1935, and succeeded in production of wheat, the yield being multiple times higher [15, 16]. In the 1960s (1965-1966) he is reported to have sent 60,000 tons of high-yielding wheat seeds to India and Pakistan (18,000 tons to India in 1966 and 42,000 tons to Pakistan in 1967), that were facing a famine at that time, and thus saved them from this crisis. This was a part of the "Green Revolution". The point was not to send wheat that could be eaten immediately, but to send wheat as "seed". Wheat needs sufficient amount of fertilizer to grow. On March 29, 1967, Borlaugh made the following statement regarding India. "I wish I were now a member of India's Congress; I would stand up out-of-order every few minutes and shout in a loud voice: What India needs now is fertilizer, fertilizer, fertilizer, credit, credit, credit, and fair prices, fair prices, fair prices!" ([15]). The argument is that the government and banks "lend" money to the farmers, with which the farmers buy "fertilizer," and the government buys the harvest at a "fair price," which is much higher than the market price. Of the three important issues, "fertilizer" was the first issue which he decided to emphasize. In fact, it was the nitrogen fertilizer produced by the Haber-Bosch process that supported Borlaug's "Green Revolution," as in 1961, ammonia production was 10 million tons, but by 2020, it had increased tenfold to 106 million tons [17].

Increased grain yields can produce three main effects. First is the short-term effect. Increase in the amount of essential grains can help alleviate hunger, but increase in production does not necessarily lead to increased revenue. This is because grains have limited consumption. Therefore, surplus grain can be made available with the same labor input as before. This can facilitate urbanization (i.e., the movement of people from non-urban areas to urban areas). The second short and medium-term effect is that some of the excess grain is used for livestock production to meet the demand for meat from people who want a better diet [21]. Global meat production increased more than four times between 1965 and 2020. A third, more long-term effect is population growth: the population increased from 2.94 billion in 1961 to 7.8 billion in 2020, which shows an increase of about 2.4 times. After the war, with the accelerated production of nitrogenous fertilizers by the Haber-Bosch process, the number of people eating food grown with organic fertilizers and those eating food grown with nitrogen fertilizers using the Haber-Bosch method are almost equal by 2020 [18]. In other words, Half of our bodies would be dependent on the Haber-Bosch method, and the other half on organic fertilizers. Then, if it were not for the Haber-Bosch method, our population might not be as large as it is today and, therefore, our greenhouse gas emissions might be much lower.

Our goal of a better life does not include only food. We want more comfortable living, more spacious homes with air conditioning and heating, and better-performing appliances. There is also the desire to move, to go where we want to go. In order to fulfill these needs, we have started using large amounts of energy for transportation of people and goods. Greenhouse gas emissions, mainly resulting from the burning of fossil fuels, have also accelerated to a vast extent, leaving climate change to future generations. The carbon cycle is not the only thing that has undergone dramatic change. The large amount of reactive nitrogen (nitrogen compounds other than N_2) produced by the Haber-Bosch process has caused environmental problems everywhere, including air pollution, climate change, water pollution, ozone depletion, and eutrophication of water bodies, greatly accelerating the nitrogen cycle and leaving a negative legacy for the future generations. However, the importance is not widely recognized. It is still not clear how much the cost of the damage by reactive nitrogen is, but according to the United Nations Environment Programme (UNEP), the global cost was about US$ 340 billion to 3,400 billion annually at the beginning of this century [19]. Furthermore, it seems that the phosphorus cycle, biodiversity, etc., have exceeded the tipping point beyond which they cannot be recovered [4].

Haber and Bosch were awarded the Nobel Prize in Chemistry and Borlaug the Nobel Peace Prize. They must have thought that it was "justice" to increase the production of chemical fertilizers and use them to produce more food for the hungry. While scientists and engineers were moving forward to pursue their own agendas without a second thought, they may not have given enough thought to the social impact of their achievements and the probable impact on the future generations. This is not to say that I am proposing a social system that diminishes the creativity of scientists and engineers, but I want them to be as active as they want to be. However, the way in which they use their achievements is an issue for to be considered by the society as a whole. That is, we have not designed a social system to answer this issue. We reap enormous benefits by influencing elemental-level cycles, such as the carbon cycle and the nitrogen cycle, but whether we realize it or not, there are threats associated with them, especially when we consider that these threats extend beyond time and space to future generations.

Next, let us revisit the two pillars of our society (i.e., market and democracy) [1, 3, 20, 21]. The Haber-Bosch process was a great commercial success, but the criterion for success was whether the product could be sold in the market. However, while the market is an excellent mechanism for realizing people's immediate desires, it is not an appropriate mechanism for allocating resources in a way that takes future generations into account. Unfortunately, future generations are unable to express their will in the current market. On the other

hand, democracy based on liberty and equality, especially indirect democracy based on elections, which was born from the idea of social contract by Hobbes, Locke, and Rousseau to escape "the struggle of all against all", has not been able to overcome the myopic effect created by science and the market. Democracy is "a system that realizes the interests of the people living today," not "a system that incorporates future generations." If a person seeking candidature for the mayor in your community shouted, "No fossil fuel vehicles, no chemical fertilizers for future generations," he or she would not be elected. Science, markets, and democracy are the three basic pillars of our society, but in this way, the very structure of science, markets, and democracy can threaten the survival of humans.

3. Why do future failures occur?

The three basic pillars of our society are science, market, and democracy, but it seems that the very mechanisms of science, market, and democracy will lead to future failures that would burden the future generations. Since the Industrial Revolution, especially from the middle of the 20th century to the present century, we have come to understand that future failures will burden future generations not only in certain regions but also globally, for hundreds of years, and even for hundred thousand years as far as nuclear issues are concerned [7]. But even we being aware of this, it seems to be a difficult issue to deal with. The fundamental nature of human beings, which has evolved over a long period of time, perhaps over ten thousand years, will not change easily just because the current generation has become a burden for the future generations across time and space. Next, I would like to introduce the framework of FD, which discusses the measures which we can adopt to change the structure of society based on the above discussed factors.

Over the past century or so, why have we continued to make future failures that are likely to burden future generations? Researchers in a variety of fields, including psychology and neuroscience, have examined a number of human traits and explored the relationships among them, but let us look at the three human traits as proposed by the neuroscientist Sapolsky [22]. The first is that our senses respond relatively to changes rather than to absolute quantities. For example, we react to a sudden darkening or a loud noise. This is a trait that enhances our own survivability, and if we think of it as seeking a place where there is no change (like the height of a mountain, where your gain or loss is the height of a mountain, you would aim for the summit where the gradient is almost gone, rather than staying on the steepest part), then relativity appears as the principle of short-term optimality. The second is impulsivity or myopia. It is difficult for humans to resist eating a delicious food item placed in front of them. Thirdly, humans are social, with multiple people working together to dominate other animals. The optimism of another neuroscientist, Sharot, adds on to this [23]. It is quite possible that we have evolved in such

a way that we forget the bad things of the past, to seek pleasure in the present, and to think optimistically about the future. In fact, the question is ”Weren't science, markets, and democracy born out of these traits?”

Next, let us look at the Industrial Revolution, which had laid the foundation for our current society [24]. We are currently experiencing a major change in society itself with COVID-19, but let us go back to the Black Death in the mid-14th century. The population that was reduced by the Black Death was about 100 million out of the world's population of 450 million at that time, especially in England, where the population was reduced by almost half in three years starting from 1348, and the population decline seems to have continued for a hundred years. The decline in population led to an increase in the value of labor, especially in England, which witnessed a large rise in wages. A declining population led to a reduced demand for grain, which in turn led to urbanization, as some of the agricultural workers migrated to the cities. Population growth in urban areas led to an increase in the price of wood, which was a source of energy in the cities. Coal, which happened to be readily available, plentiful, and inexpensive, was sought as an energy source. And it was the steam engine that replaced expensive laborers to pump the water from the coal mines. It was precisely this shift from organic energy to fossil energy that led to the "Industrial Revolution" and since then we have seen various innovations.

These innovations provided a feedback that not only reinforced human relativity and myopia but also optimism. This in turn has led to a desire to innovate to make things a little more convenient and easier. In addition, markets and democracy will surely lead to further efficiency and globalization. This chain of feedback reinforces our relativity, myopia, and optimism, and gives rise to a society that aims for endless growth despite various “future failures”.

If this is the case, then reforms in social institutions themselves should have been a major issue in the first half of the 21st century [1]. However, the various disciplines of social science, which should be the engine of institutional reform, are fixed with regard to individual paradigms and have not found an answer as to how we should reform our institutions for a sustainable future. Let us suppose that society is a three-dimensional object like a pumpkin. Political science uses the sword of *power*, psychology uses the sword of *emotion*, sociology uses the sword of *norms*, and economics uses the sword of *incentives* to cut and analyze society. The cuts of the two disciplines become a line, with very little in common. Furthermore, three or more cuts have only one point at best, and cannot be used to analyze society as a three-dimensional object. Despite this, the current mainstream approach is to understand human behavior, devise social systems based on this

understanding, and solve various problems by coordinating and synthesizing the knowledge of individual fields such as humanities and natural sciences in addition to each field of social science [25].

FD takes the "exact opposite position" to this [1, 3]. Conventional (social) science assumes that people's way of thinking does not change easily, and has been concerned with what happens within the existing social structure (upper left in Fig. 1). On the other hand, the field of mechanism design from the latter half of the 20th century to the present has considered the design of social mechanisms, that is, the design of mechanisms that achieve efficiency and fairness by making them variables, although people's thinking is a given (upper right of Fig. 1). On the other hand, although the social mechanism itself is a given, the role of behavioral economics is to lead to behavioral changes rather than changes in people's way of thinking through small innovations. Future Earth, the Inter-governmental Panel on Climate Change (IPCC), and the Sustainable Development Goals (SDGs), which use social change as a keyword, do not target the social system itself, but rather, they aim to change people's behavior by using the social system as a given (bottom left of Figure 1).

		Social Institution	
		Fixed	Variable
People's way of thinking	Fixed	Traditional (Social) Science	Mechanism Design
	Variable	Behavioral Economics, Future Earth, IPCC, SDGs	Future Design

Figure 1: People's way of thinking and Social institutions

However, human thinking (trait) is supposed to be transformed by social institutions and their feedback. In other words, democracy and the market itself, as social systems, shape the way we think. We are in the midst of experiencing a major transformation in our behavior and thinking as a response to COVID-19 pandemic, although it is not a social institution. In other words, our behavior as well as thinking will change. Therefore, in order to avoid future failures and to build a sustainable society, we need to design a social mechanism that will transform our way of thinking. It can be done by utilizing the knowledge of various sciences to verify how the designed mechanism changes people's way of thinking (lower right in Fig. 1). This is the starting point of FD.

Many people would agree that in case enough food is not available, parents feel happy to reduce their own consumption and give it to children to satisfy their dietary needs. Is it

possible to extend this to future generations who are not directly related to you? Therefore, *futurability* is exhibited if "a person experiences an increase in happiness because of deciding and acting to forego current benefits in order to enrich future generations" [1 , 3]. FD aims at designing a social mechanism to activate futurability as well as determining as to how and where it should be activated [3]. In other words, FD refers to design of a mechanism that activates futurability that could not be realized due to the existing market and democracy, and to aid in reconstruction of the market and democracy by changing the perception of the bearers of the market and democracy.

Let me give you a recent, clear example. It seems that many countries have agreed to reduce methane emissions at COP26 of the Framework Convention on Climate Change. Under the current social system, there are many proposals on improving cattle feed, analyzing the genes of cattle that burp less, and on producing such kind of cattle. On the other hand, the Nitrogen Use Efficiency (NUE) of livestock farming (the amount of nitrogen that remains in the meat after 100 nitrogen inputs as fertilizer) is about 6, which is very poor [26]. The reactive nitrogen that is not a part of the edible meat is released into the environment and causes various adverse effects. It might be better to improve the NUE of livestock production here too. However, behind these examples is the implicit assumption that people will still eat beef in the same way they have being eating it, and if we use the FD system, people may start to question whether beef can be eaten at all. I don't mean to debate upon whether it is right or wrong in eating beef here, but the goal of FD is to change the way people think. Even if we are rational agents from the perspective of economics, we can build up a macro model that maintains a sustainable society if we believe in futurability and can hence build a society that nurtures it [27].

How then should we think about the achievements of "science"? Haber, Bosch, Borlaug, and others are Nobel laureates, but they did not think about the impact of their achievements on future generations. Leaving the fruits of science to the market can lead to future failures. For example, the inexpensive, sturdy plastic bag with a handle seems to be the invention of the Swedish engineer Sten Gustaf Thulin, who was granted a patent in 1962 [28]. It should have been easy to imagine that the plastic bag would become trash after use and end up in rivers and oceans. Moreover, it does not decompose easily. At that time, if the market and democracy had incorporated a social mechanism to avoid future failures, rather than just immediate convenience, the "now" of 60 years later might have been different. Our goal is to design a social mechanism that activates this kind of futurability.

Iroquois is the source of ideas for FD research [2, 3]. Native Americans formed a confederation of five or six tribes and called this confederacy "Iroquois". When they took

important decisions, they took them by pretending themselves to be people seven generations from now. The founders of the United States, George Washington and Benjamin Franklin, learned federalism from attending Iroquois' meetings and used it to unite the 13 colonies. On the bicentennial of the U.S. Constitution, the Senate and House of Representatives issued a joint resolution thanking the Iroquois for their contributions [29]. However, while federalism remained in the U.S. Constitution, the idea of "seven generations" did not.

4. Experiments and Practices

In order to confirm the effectiveness of FD, laboratory and field experiments were conducted using human participants, as well as practices in several cities and towns that were started based on the results of the experiments.

Inspired by the mechanism of the Iroquois which can be adapted to make decisions in the present on behalf of the future seven generations, researchers at the Osaka University asked students to assume roles of people belonging to the future generations in the class, slipping forward in time to the future without changing their age. We started a discussion experiment on the future of energy, nuclear power and so on. Although it was not a well-controlled experiment, we noticed that when we introduced imaginary future people, they maintained their perspective on the future and discussed both the present and the future from a bird's eye view.

This classroom trial was the trigger that we started laboratory experiments. The first one was Kamijo et al. [30] and they created a new intergenerational sustainability dilemma game (Intergenerational Sustainability Dilemma Game, ISDG) instead of the prisoner's dilemma game that is often used in environmental issues such as climate change. Let me summarize the experiment in Kamijo et al. Three participants representing each generation interacted with each other for a maximum of 10 minutes and were asked to choose between A ($36) or B ($27). They were then asked to think about how they would divide the money among the three. If it were just this, they would choose A, but we added a condition here. If they chose $36, then A and B of the next generation would have $9 less money. In other words, A would be $27 and B would be $18 for the second generation. On the other hand, if the first generation chooses B ($27), then the money available to the second generation would not decrease. In other words, the second generation would have $36 for A and $27 for B. Even under these conditions, people who only care about their own interests choose A. They repeated at least five generations.

Next, Kamijo et al. [30] conducted another experiment under the same conditions, but with

a slight change. The idea was to randomly select one of the three participants to negotiate with the other two on behalf of the future generation. They called this participant the "Imaginary Future Person" (IFP).

Let us summarize the results. When the first experiment was repeated five times, out of 25 groups (generations), 7 groups (28%) chose B; when the IFP experiment was repeated seven times, out of 35 groups, 21 groups (60%) chose B, which showed that the second (IFP) experiment was more effective than the first experiment. We continued ISDG's experiments for several years, but each time we re-designed the experimental settings. For example, in an experiment conducted in Bangladesh, when all the three participants assumed roles of IFPs, 85% of the groups chose B [31]. In Nepal, we attempted to confirm the effectiveness of the *accountability* mechanism that leaves the reasons for decision-making not only on the present generation but also on the future generations [32]. In this study, 85% of the groups chose B. In other words, when we make decisions, if we must leave the reasons for our decisions to present and future generations, it will be difficult to make decisions that are advantageous only to ourselves.

Past design can also be useful [33, 34]. This is a method of giving advice to people in the past about events that happened in the past from the current perspective. The past cannot be changed by giving advice to the people of the past, but the people of today are the future generation from the perspective of the people of the past. Past design is a preparatory exercise for FD. In other words, when you replace the present with the future and the past with the present in past design, you are an IFP advising decisions now from the future.

Let us consider an event which happened in the past, say 30 years ago, when CDs replaced vinyl records. At that time, there must have been various visions of the future of music and music industry, for example, the decline music industry because CDs made it easy to copy music. One of these visions must have led to the present. On the other hand, one is sure that some of the advice you would give to the past people would be based on visions that people back then could not have imagined, such as music being distributed over the Internet and records being reevaluated.

Now consider a time travel. Think about flying to, say, the year 2050, becoming an IFP, imagining about the society of 2050, and giving advice to the present from 2050. The world in 2050 may be an altogether new world that you could have never imagined if you were thinking about it currently. In other words, it may be a world that did not appear at all while imagining about the future from the current called *forcasting*. Moreover, if we send

an advice from 2050 to the present, the vision based on that the advice may be something that the people of today have never imagined. In other words, it may be a vision pertaining to the future that cannot be obtained by imagining about a future vision from now and then *backcasting* from the vision to the current [35].

However, we have yet to discover effective methods other than imagining about the future, the accountability mechanism, and past design. Demeny voting, which gives children the right to vote, hardly works in experiments [36, 37], and John Rawls' veil of ignorance does not work either in an experiment [38]. On the other hand, field experiments have confirmed that the effects of IFPs differ greatly between urban and non-urban areas in Bangladesh [39], and that IFPs are effective for financial sustainability [34, 40], that rural Indonesians think about the harvest in the following year and beyond, but fishermen in fishing villages concentrate on the immediate catch [41], that energy choices vary widely by region in Beijing [42], and the effectiveness of approval mechanisms in resolving social dilemmas [43, 44].

FD aims for the wellbeing or happiness of the current generation as well as wellbeing or happiness of future generations. The happiness we are talking about here is the happiness after the current generation exhibits futurability. In other words, the basis of happiness may be different before and after activation of futurability. By doing this, we may or may not foster growth of economy. In other words, we are not aiming for de-growth or anti-growth, but for the happiness of current and future generations. Of course, this may or may not disrupt the circulation of certain elements such as carbon, nitrogen, phosphorus and so on. If it does, the goal is to design a society that considers the acceptable degree of disturbance for the current and the future generations. Researches have also begun to provide a philosophical basis for such a view [10, 45].

In Japan, FD practices in various cities and towns began, firstly in Yahaba Town in Iwate Prefecture [46]. The Cabinet Office requested each city and town in Japan to develop a "long-term vision" for the year 2060, and Yahaba created a part of it with the help of its citizens who became IFPs. At that time, the content of the proposal for the current policies was completely different between the current group, which considered the future from the present perspective, and the future group, which considered the present from the future perspective. The current group substituted current issues, such as free medical care for children, for future issues, while the future group proposed a new transportation system of the town and parks based on "The Night of Milky Way Train" that is a beautiful friendship story by Kenji Miyazwa who was a novelist and poet fo children literature. In fact, the people in Yahaba shared that the starting station of the Milky Way Train was located at the

top of Nansho Mountain, as Kenji often climbed the mountain in Yahaba. In addition to this, when the FD was used for a residents' workshop organized to discuss the water service, which is becoming difficult to maintain, the residents themselves proposed raising the water price, and Yahaba town decided to raise the rates by 6% from 2018. There was almost no opposition from the residents' side. After observing these workshops, Shozo Takahashi, the mayor of Yahaba Town, declared the town to be a FD Town in his fiscal 2018 policy speech and established the Future Strategy Office in the town in April 2019, and in FY2020, the Future Strategy Office worked with the residents to develop the Town's Comprehensive Future Plan using the FD methodology. Of all the proposals for the plan, 83% of the proposals came from future designers, or IFPs. Not only the structure of Yahaba Town is changing but also the way of thinking of its residents.

The Shinshu University FD team is collaborating with the city of Matsumoto to hold FD sessions to discuss the reconstruction of the city hall [47]. In a normal discussion, current dissatisfactions or desires tend to be the basic demands to the reconstruction, such as an increase in the number of contact points, an expansion of the parking lot, or a floor with a good view of Matsumoto Castle, but none of these requests were made by the people who became IFPs and examined the situation. IFPs judged that these requests were unnecessary due to the declining population of Matsumoto City and the development of AI and automatic driving, and rather proposed a compact and networked government building.

In Uji City at Kyoto Prefecture, FD was also used to discuss the ways which can be adopted to think about the future of the community, and 80% of the participants in the session formed a citizens' group, FD Uji, and began participating in policy making with the local government. When we interviewed members of FD Uji, we found that their mindset had changed [48]. Furthermore, Uji City is employing FD in their staff training.

In addition, FD sessions were conducted in Kyoto Prefecture (sewage system), Saijo City (infrastructure), Maibara City (vacant houses), Odawara City (environmental energy), Hida-Takayama area (medical system), and Kizugawa City (reform of city administration itself) and so on.

In March 2021, countries other than Japan, for example, the Jan van Eyck Academie in the Netherlands invited two vice chairpersons of the IPCC to participate in a three-day Intergovernmental Panel on Art and Climate [49]. In addition, Generation Politics (YoungMinds.Amsterdam) in the Netherlands has started practicing FD. In addition, INRIA (French National Institute of Informatics and Automatic Control) is implementing

FD on food. Despite the small size, a network of researchers and practitioners from various fields in the Netherlands, France, the UK, and Switzerland is being created. In addition, the researchers in Europe have just started pursuing FD research [50].

What we have learned in our FD practice from 2015 to 2021 is that when we discuss from "now" to "future", it is difficult to come up with ideas to solve problems because our feet are tied up in the "now" and the participants' thoughts are directed in different directions. On the other hand, if the participants jump to the "future" and envision future society, and then think about what should be done "now," they start to propose original and creative ideas. In addition, the IFP is able to view future with a bird's eye viewing not only the present but also the future from a high position, and it is known that conflicts among the participants are less likely to occur. Furthermore, it seems that once people have activated their futurability, they will not easily return to their previous state.

5. The Future of FD

As we can see from looking back to COP26, the discussion from "now" to "future" seems to be caught up in “now” or the present. At the regional level, it is gradually becoming clear that FD can prove useful in coordinating stakeholders who are facing different directions, but whether FD is effective at the trans-regional level is not yet understood. In the last few years, experiments have begun to mix ammonia as a fuel in thermal power plants in Japan. This is because ammonia does not produce carbon dioxide when it is burned. On the other hand, reactive nitrogen is emitted on burning ammonia. Furthermore, the demand for large amounts of ammonia for burning may crowd out the production of nitrogen fertilizer and, ultimately, food. We are about launch "FD of Ammonia Combustion," in which we ask various stakeholders to imagine themselves as part of "future" generation and consider the design of current policies from their perspective. We plan to conduct FD sessions on various projects from a similar perspective.

Even though we are talking about a region, only a small percentage of people in the region can participate in the FD. We are well aware of the criticism that "validity" may not be fulfilled. For this reason, we are considering the possibility of having everyone in a municipality experience FD.

The FD itself costs almost nothing. Therefore, we are planning to conduct various field experiments to ensure happiness of people living in developing countries. We are planning to test the effects of FD on food diversity, indoor air pollution, and groundwater contaminated with arsenic by randomly selecting a large number of households and comparing them in Bangladesh. The diet of the Bangladeshis mainly includes grains.

Eating a balanced diet including diverse kinds of food may help in maintaining good health and in increasing one's life. In addition, it is quite normal to cook food indoors using wood, but this seems to have adverse effects on one's health due to pollution caused by PM2.5. In the 1980s, the World Bank, WHO, JICA, and other organizations encouraged the developing countries, including Bangladesh, to drink groundwater pumped up by tube-wells rather than from rivers or rainwater, and this practice spread throughout the region. However, the groundwater contained arsenic, and even today there are 60 million people drinking water that does not meet the WHO standards. With these FD results, we are considering new policy recommendations not only for Bangladesh but also for many other developing countries.

The development of methods and mechanisms other than IFP and the accountability mechanism is also a major issue. Although this is an unexplored area, we are attempting to formulate theories based on the results of experiments conducted on human subjects and to apply them in policy formulation.

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