Section 2: Science and Policy Interaction

2−1 Lecture Prof. Michael Norton
Science and policy interaction during Covid pandemic in the U.K.

When I spoke with Matsumura-san about how the government and scientists were dealing with each other, the topic of countermeasures against Covid (a new coronavirus) came up.

Regarding the Covid countermeasure, it was not a success story in the UK because of the high mortality rate, but there has been progress. Let me tell you about it.

Three years ago, at the beginning of the pandemic, I saw scenes like this almost every night on British television.

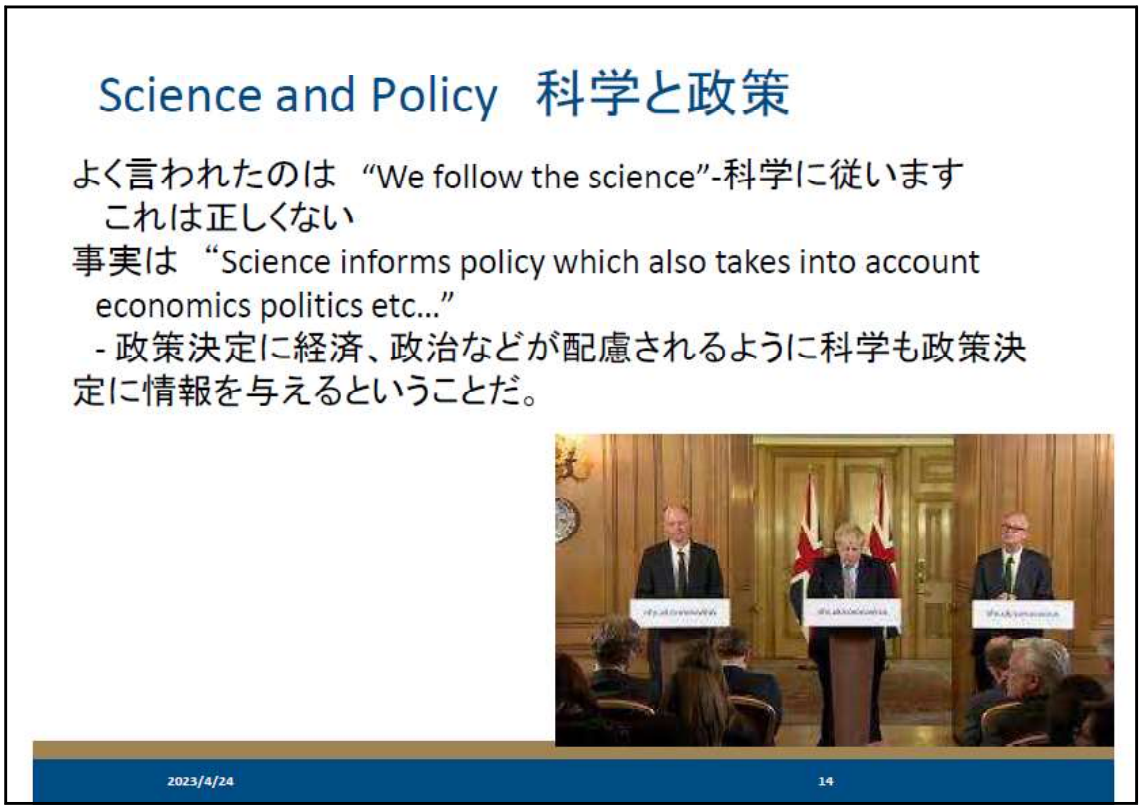
In the middle is the Prime Minister (The Rt Hon Boris Johnson) and on the left is the Chief Medical Officer (Prof. Chris Whitty), a medical science specialist. On the right is the Government Chief Scientist (Sir Patrick Vallance FRS). They were always on TV explaining Covid's Trends of the Day, Statistics of the Day, Conclusions of the Day and Regulations of the Day etc.

The purpose of this was to show that the government's mandate was to follow science. But it is inherently incorrect to say that the government follows science. Policy is essentially the responsibility of governments, not scientists.

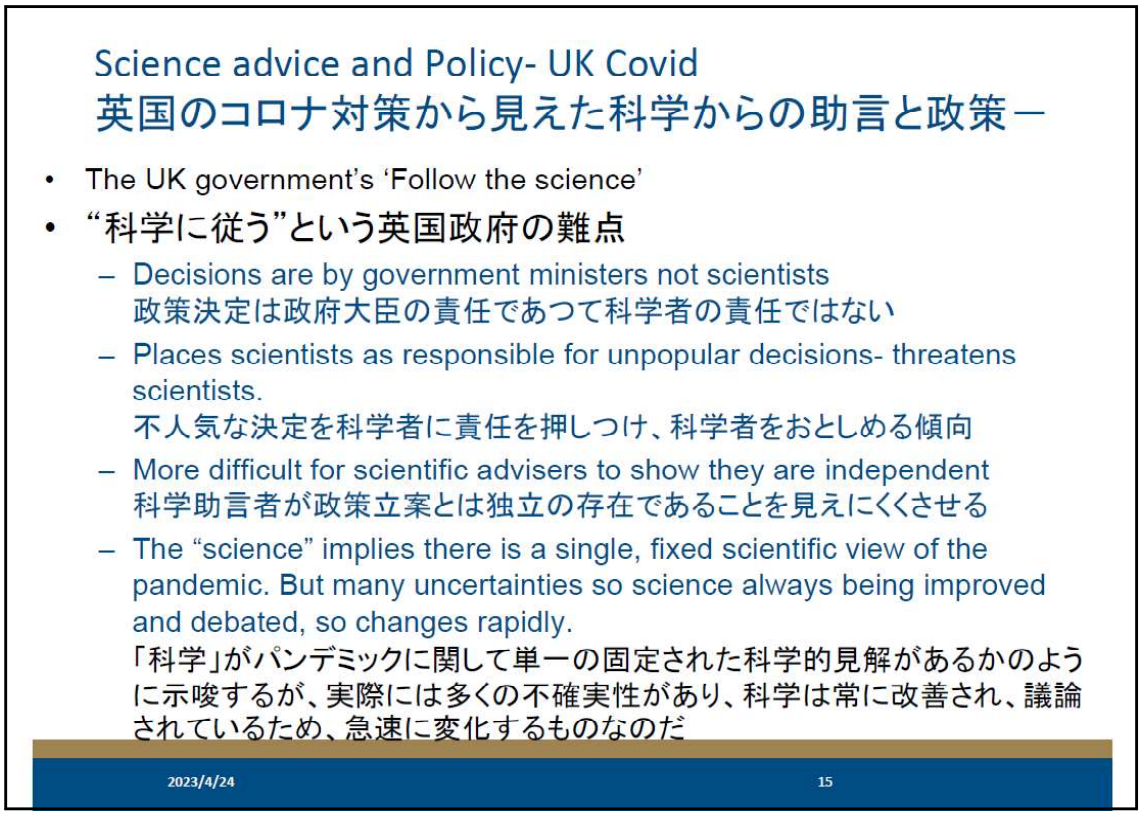
Even though scientists use their knowledge of medical science, infectious diseases and many other fields to give advice, the government decides on policy based on economic considerations, the reaction of the public, the interests of the public and many other things.

But almost every day, even in parliamentary conversations, the British government has said 'we will follow the science'.

Slide 2-1-1. Science and Policy



Slide 2-1-2. Science and Policy-UK Covid



This was a problem. The British government almost used scientists as a shield.

As a result, they said that it was the scientists' fault in the press, including newspapers, that unpopular regulations such as lockdowns were made. This resulted in undesirable effects, such as scientists being abused and harassed.

In the midst of all this, a case occurred where an important scientist was bullied in the media. It was an undesirable appearance.

Science does not always draw one conclusion. Especially when there is a lot of new information, new interpretations arise, data are added every day and conclusions change.

Scientific conclusions change because there is always debate among scientists.

As it is a new virus, there is little data to start with. With each new data, the conclusions change more and more.

In the beginning, hand-to-hand contact was said dangerous. But it was stressed that masks were not effective. But actually it was different. Hand-to-hand was less risky. The mask was significant. So scientific conclusions change.

Politicians have to be cautious about science as well.

Slide 2-1-3. Setting an example!

Also in the case of the UK, the British Prime Minister was a bit rash.

The Prime Minister was holding hands with everyone, even though he was advised not to hold hands at that time.

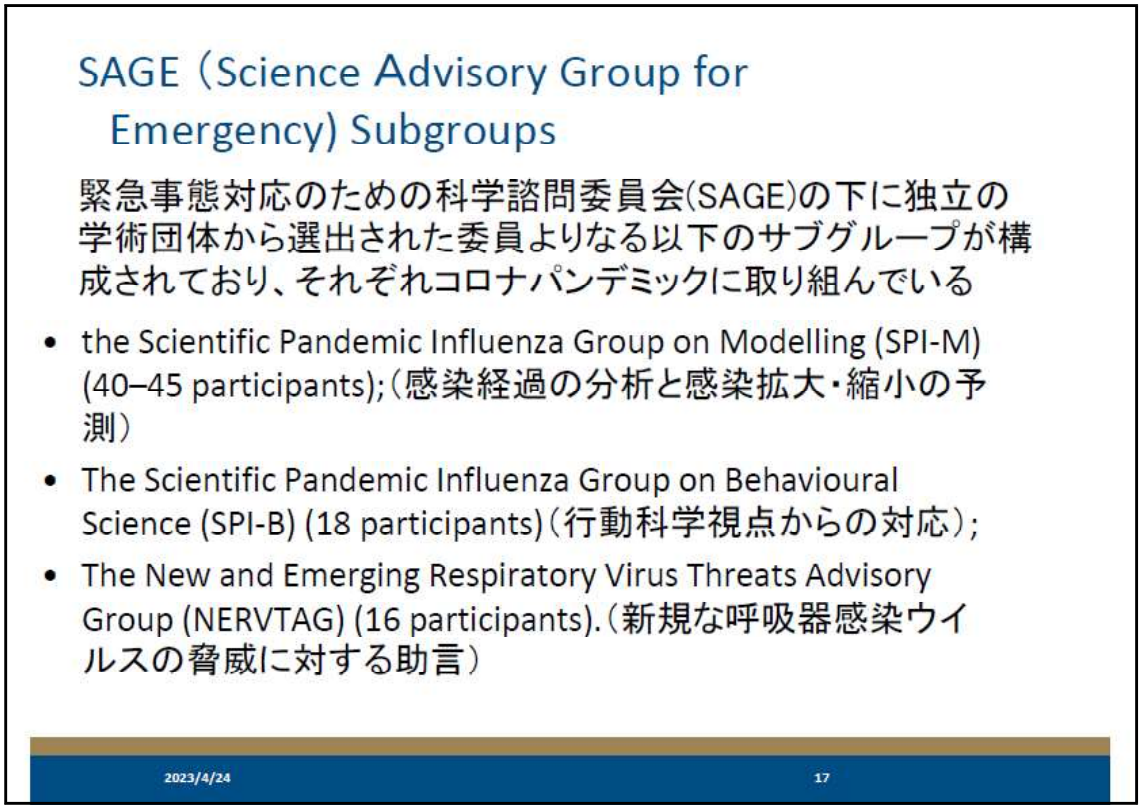
To convey the meaning that I am fine. To create the image that I am fine and that there is nothing to worry about.

As a result, many people were made to think that the threat of Covid could be ignored.

But a few weeks after this picture, the Prime Minister was infected and almost died.

After that, his attitude became more serious.

Slide 2-1-4. SAGE (Science Advisory Group for Emergency)



Scientific advice is given by a bit complex organization. It consists of three expert committees drawn from independent scientific bodies under the Scientific Advisory Board for Emergency Response （SAGE).

The first is an expert committee for analysing the course of influenza transmission and predicting the spread of infection, consisting of more than 40 members.

The second is to predict what will happen in our lives in the event of a pandemic. For example, if there is a lockdown, will citizens avoid or protect themselves?

The third is to advise on how to deal with the threat of a pandemic, including the development of a vaccine. This group decided to distribute vaccines to the elderly first.

This structure was generally created by appointing a lot of scientists to make the best advice.

Slides 2-1-5. Scientists do criticize.

Scientists can participate in advising the government but not be bound by it and protect their independence.

One example is this psychologist Prof. Stephen Reicher, who wrote a number of newspaper articles criticizing the government. This headline would be very hard to imagine in Japan.

Lying buffoon means 'lying idiot'. It is saying that our Prime Minister is a lying, stupid person.

But Professor Reicher is still in office in good standing.

He also says that the failure of Covid is not the fault of the public, but of the government, which is deregulating after a year of infection, and that the government is playing a dangerous game. He warned that although Covid had become less dangerous, it was still dangerous.

Slides 2-1-6. And also comment

Another well-known scientist is Prof. Devi Sridhar, Professor at the University of Scotland.

Almost every week she sends comments to newspapers. She is not so critical in her case, but has always written articles to inform the public about important knowledge, information.

She wrote this article when statistics showed that over 200,000 people had died in the UK, and on what have we learnt from these mistakes. She also wrote articles on general health.

In Conclusion, during the Covid pandemic, British scientists were able to participate in a truly multifaceted way.

We took part in making government policy.

They participated in teaching the media.

They also took part in communicating important information to the public.

The public's reputation for British scientists was enhanced by these appearances.

Host:

Thank you very much, Prof. Norton. I am glad to hear about the achievement of scientists in such a complex situation as the Covid pandemic in the UK. It has been pointed out that in Japan, there have been occasions when the Government has made its own decisions while continuing to say that it is subject to the Expert Groups, and that this has left problems regarding the nature of the relationship between the two sides.

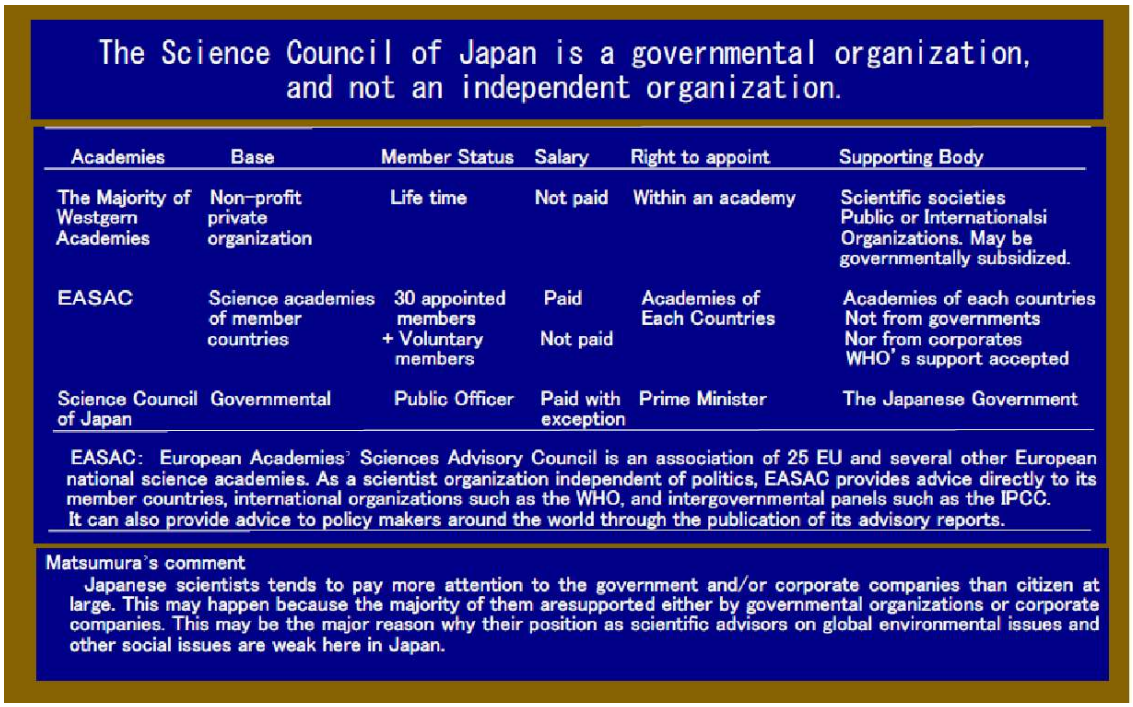
In contrast to EASAC's consistent stance of being independent of politics but advising on policy, there may have been situations where experts were deeply involved in policy making, making it difficult to see the responsibility that policy makers are supposed to bear.

This is by no means the end of the pandemic. I will end this section with a reminder that there are high hopes for how we can prepare for the future.

Before we move on to the discussion, I would like to show you a slide that I have prepared for your reference in order to compare the relationship between science and politics in the UK and Japan.

2-2 Comments from Host
UK-Japan comparison in the interaction

Slide 2-2-1 Comparison of EASAC and Science Counsil of Japan



What organization in Japan would be that provides advises on policy from the standpoint of scientific academies? In other words, is there an organization like EASAC in Japan?

To the above question, I thought that The Japan Academy is the representing science academy and the Science Council of Japan is the representing advisory body. The table compares the two.

From what I heard from Prof. Norton, I understand that EASAC does not receive any financial support from the government or a business corporate, although it does receive a grant from WHO, and thus it is basically an independent body supported by the national science academies in Europe. It has a core of about 30 paid members and many other scientists who volunteer their time. The main task of EASAC seems to be to respond to the consultations issued by the EU, but there are not that many, and in fact much of the policy advice is also sent to international organizations, etc., and a lot of it is published on the internet. So it is available to policy makers and citizens all over the world.

My knowledge on the Science Council of Japan (SCJ) is very limited, except that it is a governmental organization as has been established by a Japanese law (for English translation of which is at https://www.japaneselawtranslation.go.jp/ja/laws/view/4327).

I noted that SCJ issues reports on global warming, as EASAC does. A cross search of the 'Science Council of Japan' with 'Transformative Change' has given a single note of a meeting announcement of Institute for Global Environmental Strategies (IGES). So far no reports on this subject appear to be presented by SCJ on internet.

2-3 Discussion and Q&A for Section 2

Host

To my regret, I have little knowledge of the Science Council of Japan (SCJ), and I did not know even that it is a government organization before I studied it for this meeting.

From what the SCJ law describes, I understand that SCJ is expected to play an important role in the fair distribution of national budget in the field of science and technology.

Discussant A.
From outside the Science Council of Japan

As far as the Science Council of Japan is concerned, it is an organization that lives in a world that has nothing to do with the general public.

I have no idea what the Science Council of Japan does or what kind of activities it engages in. But it has several divisions. So there is philosophy division, natural science division, and so on, and there are committee members for each, and so on, and so on.

Now it's in the news that the government is involved in selecting the members of the Science Council, but people don't know about it from the beginning, so they don't understand it even if there is news.

Discussant B.
From inside the Science Council of Japan

The Science Council of Japan is under the jurisdiction of the Prime Minister, so in that sense it can be called a government organization. In addition, the budget is given by the government and the clerical work is done by people seconded from the Ministry of Education, Culture, Sports, Science and Technology. On the other hand, however, the Science Council of Japan is a special organization operating independently of the government. The recent major issue of whether the Prime Minister ultimately approves or disapproves the membership of the Science Council has to do with the fact that it is such a special organization. At the root of this issue is the cooperative relationship between science and policy, and I believe it is important to consider the role of science in human society in order to settle on the nature of this cooperative relationship.

I used to be an associate member of the Science Council, so I know a little bit about what the Council has done. If you look at the website of the Science Council, you will find many reports. Each of them was made painstakingly after several meetings by some members and associate members of the Science Council, and anyone can read them and download them. Among them, some reports are answers to questions from the government, and others are recommendations to the government. And here you can see examples of cooperation between the Science Council and the government. Unfortunately, not many people see these reports. In a way, I think they are poorly advertised.

Host

Prof. Norton, I wonder if you have any advice here for the Japanese scientific community, while you are in an active and influential council like EASAC.

Prof. Norton.

EASAC is a European-focused organisation. For the UK, the equivalent organisation to the Japanese Science Council is the Royal Society.

A division of the Royal Society looks at how science can contribute to government policy.

Sometimes the government asks the Royal Society to analyze this issue. But often it's the other way round, where we analyse an issue and submit advice to the government on an important scientific issue that is part of current UK policy.

In other words, we submit scientific advice both at the request of the government and on our own initiative.

The Royal Society's activities over the past ten years or so have included the formation of a committee of scientific experts, with volunteer participants, ranging from about 20 to 30 people, who meet every summer to discuss the issues.

Host

Thank you very much. The Royal Society responds to the consultation from the UK Government. The Royal Society calls itself as Royal, but to my knowledge it's actually an independent organization, and thus their advice may be as independent as the one from EASAC.

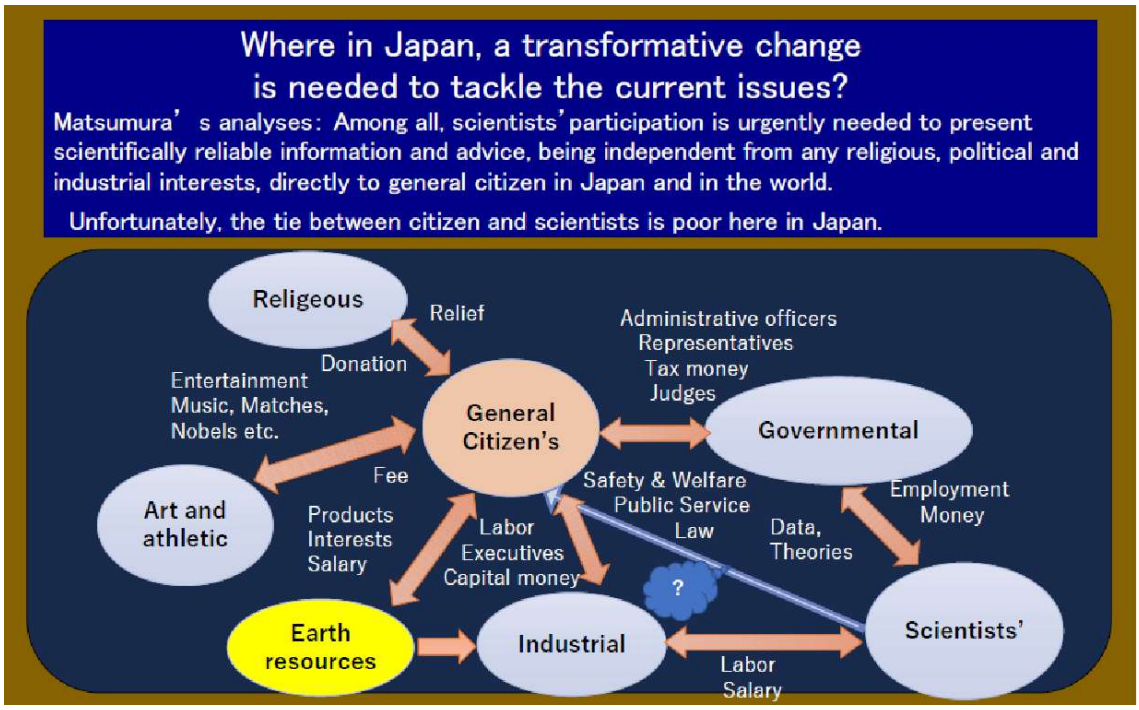
Time is running out, so we will move on to the next session.

Section 3: Social ties between citizens and scientists

Proposal Host speaker (Toshi Matsumura)
An idea to strengthen ties between citizens and scientists

As the EASAC report mentions, it is urgently needed to advance public awareness of citizens to the current situation of global climate change and biodiversity crisis. Here I would like to present a proposal to advance ties between citizens and scientists.

Slide 3-1 Can scientific people conpose a stakeholder in the society?
An imaginary figure



First of all please give your attention to social status of scientists. I will talk about Japanese case but the same may be true in many other countries, too.

The term stakeholder is used to mean power relations among people.

My naive understanding of major stakeholders in the society is shown in the above diagram (Slide 3-1). Here in this diagram, the circle of citizens does not mean a stakeholder, but whole people from which a part of people may belong to one or other stakeholders.

Every one of businesses', private owners', religious organizations' and the government's stakeholders has a direct dual way interaction with citizens.

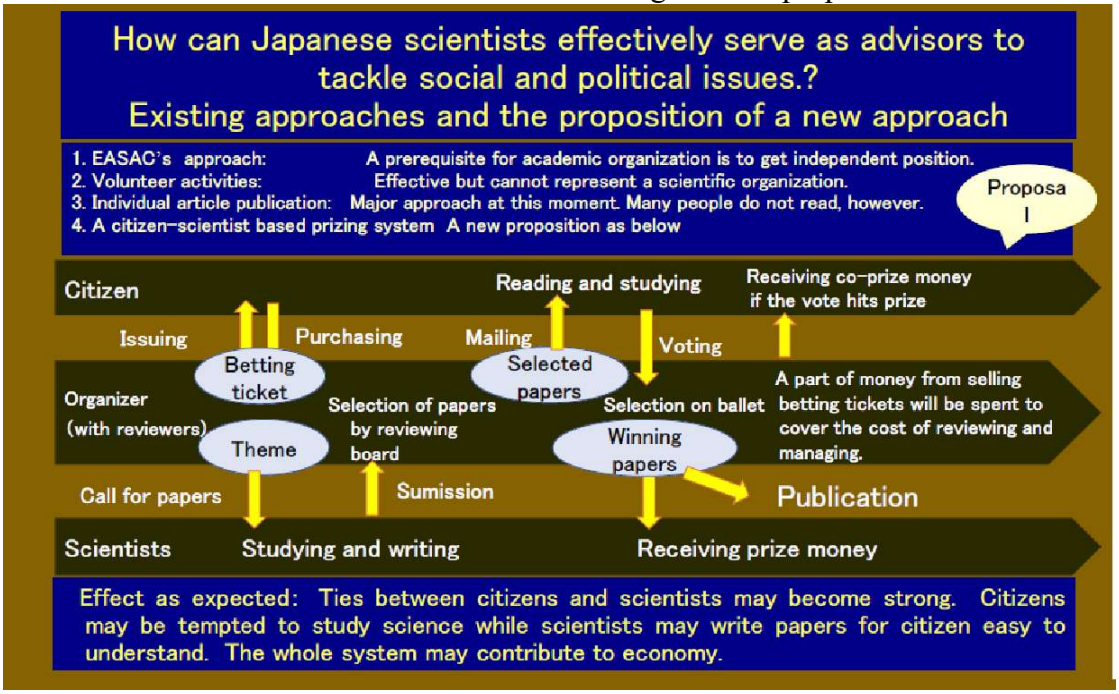
To the government, for example, citizens pay taxes and provide human resources such as judges, deputies and civil servants. Governments, on the other hand, provide citizens with public conveniences such as welfare, safety and roads.

The stakeholders of business corporates, religious organizations, and private owners, are respectively paid by citizens to provide a variety of goods and services in return, and thus in respective dual way interactions. Here, I intend to include musicians, athletes, writers and independent shops into the stakeholder of private owners.

It appears to me that scientists have few direct links with citizens. Most scientists exist as employees of some kind of organizations, such as a government or a company. In other words, it seems to me that scientists do not, or only very weakly, compose a stakeholder with a direct dual link to citizens, in Japan. One may think of the interaction through the mass media, such as TV science programs, but this is not a direct interaction between citizens and scientists.

Noting that the above-mentioned interactions between stakeholders and citizens involve the exchange of money, I propose a prize system in which scientists submit their papers and citizens who read the papers vote on them. The essential framework and procedure of the prize system may be shown in the slide 3-2 and described as below:

Slide 3-2. What can citizens and scientists do together. A proposal.



(1) First of all, a promoter of the prize system is to be be established.

The key here is for the promoter to invite capable editorial members with a strong peer reviewing committee. Critical evaluation of candidate papers is essential. Any non-scientific, low quality, or copy-paste papers should be rejected while those with creative and genuine idea for solving current problems at issue should highly be appreciated.

(2) Applicants write papers while the promoter sell voting tickets

Scientific and citizen-friendly papers are invited for submission to a race. There could be a subject for each race. A submission can come from anyone, as long as the paper is of sufficiently scientific quality to pass peer review. On the other hand, the promoter sells voting tickets to the public. One can get only one voting ticket for a race.

(3) The promoter selects papers and releases selected papers to ticket holders.

Once papers have been submitted, the promoter select candidate papers by its reviewing committee, and offers a set of candidate papers, about ten papers for example, to each of ticket holders.

4) Voting and ranking.

Citizens who have bought tickets read the papers, write the names of the authors they have chosen on their tickets and send them to the promoter. The promoter tallies the results and announces the rankings.

(5) Distribution of prizes.

From the results of the voting, both the entrants and the citizens who voted for them win prizes. To make the prize money more attractive, a multiple system could be used, as in horse racing. Also, donations for prize money may be welcome.

(6) Effect.

Both citizens and scientists can use the prize money as a platform for friendly competition. Citizens will try hard to learn science and win prize money, and scientists will make effort to write papers that are easy to understand for the public, thus creating a link.

The above is the general outline of one idea, it would probably need to be worked out in more details. I am sure there are many other possibilities, but here is one idea.

(A proposal drafted by Toshiharu Matsumura, Hascross)

3-2 Comments for Section 3

Discussant A.

As to Matsumura's proposal, it seems to be quite difficult in the social sciences, but I think there is potential in the natural sciences.

Especially when we think about climate issues, energy, thermodynamics and so on, we can't talk about them unless we talk about them based on science. I would be very grateful if there were teachers who could contribute in this way.

It's no good if they write for a book that will sell, so in that respect, it's a peer-reviewed journal. I think that's good.

How to make it suitable for children is also an important point, isn't it?

Matsumura

We have to find a body, a promoter.

Discussant A.

It might be difficult to find out a promoter with social and economic support. I don't think it's easy to set it up in a difficult area, but if one think of current climate issue, I think there may be possibilities in relation to fuel industries etc.

Section 4: Post-conference information and comments

4-1 Environmental impact indicators from Prof. Norton

In his email after the meeting, Prof. Norton informed us that the global greenhouse gas emissions and the projected marginal future greenhouse gas emissions allowed to keep the temperature increase below a certain level (carbon budget) are calculated and updated annually, and that the source of the basic data etc. for this purpose is as follows:

(1) The Global Carbon Budget 2022.
Earth System Science Data (ESSD) 14(2022)4811
https://essd.copernicus.org/articles/14/1917/2022

(2) The Global Carbon Project.
The Global Carbon Project provides analysis data on global and regional anthropogenic emissions of greenhouse gases, including CO2, and their absorption by nature.
https://www.globalcarbonproject.org/

(3) Mauna Loa Observatory.
Data on the concentration of greenhouse gases such as CO2 in the air since the 1950s.
https://gml.noaa.gov/ccgg/trends/

4-2 Additional comments from Discussant A

Activities aimed at reducing CO_2 emissions by society as a whole (the nation) have been underway for about 30 years, but nothing has been accomplished beyond discussion. It is unlikely that they will continue to do so in the future. Opposition is strong and society is unlikely to change.

Meanwhile, individual energy waste is also intense. In the face of global warming, we are faced with the question of whether we can reduce CO_2 generation (energy consumption) at our own will. Even this, we see it as extremely difficult.

When the war in Ukraine made it impossible to import LNG, instead of reducing energy use, coal consumption increased.

Coal consumption increased from about 6 billion tons per year until 2021 to about 8 billion tons in 2022. We see it as extremely difficult to change the way we live, our consumption of cars, smartphones, fashion, travel, food, etc.

However, if we do not change, temperatures will rise, sea levels will rise, and we will face catastrophe. It is a serious question: which will we take?

4-3 Environmental impact indices of personal life from Toshi Matsumura (the host of this meeting)

(i) Macroscopic and microscopic perspectives

Prof. Norton indicated the location of various source data to assess impact on the global environment.

There was a complete set of globally standardized data on various national and global climate change indicators, such as fossil fuel consumption, emissions from agriculture, emissions of carbon dioxide other environmentally hazardous substances from wildfires, and the amount absorbed by forests.

To my understanding, there is no doubt in that EASAC's analysis and recommendations are based on the analysis of these global data, and are scientifically sound.

However, in the meeting, we were not able to fully discuss these indicators with Mr A and Mr B, who asked how they relate to their personal lives.

Both Mr. A and Mr. B were interested in the microscopic perspective of global warming as an accumulation of indices given to individual products and services at the individual level, rather than the macroscopic perspective of global warming.

Therefore, after the meeting, I tried some additional investigation for insights into what kind of analysis has been done on microscopic perspectives. For details, we may require a separate discussion, but the main points of the paths investigated and my personal considerations may be described as supplementary materials for your information.

(ii) Environmental impact indices for individual activities

Various indices have been proposed to quantify the environmental impact of personal activities, mong them, the carbon footprint (CFP) index appears to be quite widely used. This index expresses the amount of greenhouse gases emitted before a product (or service) is sold, expressed in terms of CO_2 equivalents (tCO_2eq or $KgCO_2eq$ (tons or kilograms of carbon dioxide equivalent. (Ref to Wikipedia for a brief explanation).

Furthermore, in the context of an individual's daily life, a CFP value can be set for each of the goods and services that he or she pays for, so that by adding up the CFP values for one year, it is possible to determine how much of an impact his or her life has on global warming over the course of a year.

Of course, each CFP value can also be calculated for a single company or a single country, so I have studied this indicator as briefly described in below in the hope that it will provide with a consistent and easy-to-understand indicator from micro to macro level.

(iii) How to determine a carbon footprint (CFP) value

If an individual wants to accumulate CFP values arising from his or her own life, it will first be necessary to determine the CFP values for individual products and services.

In Japan, a guideline has been issued by the Ministry of the Environment (Guidelines for the Calculation of Total Greenhouse Gas Emissions, Mar 2017) indicating that CFP values are to be calculated on the basis of coefficients called global warming potentials for various chemical substances, electricity, fuel, etc.

Therefore, even if the same category of product, for example a loaf of bread, is produced, the raw materials and the elemental CFP values generated in the production process will differ depending on the country of production and the production method.

In practice, it seems that a CFP value is calculated in each company for each of its products, and is labelled on each product.

Some application programs and service companies are found that can help us doing such calculations. For example, we found the MIELECO service from Wastebox, which helps calculate the CFP values associated with the manufacture of products and services, and the Carbon Footprint Communication Program, which is an online service (https://www.cfp-japan.jp/sitemap/index.html).

However, these services are aimed at manufacturers and distributors, and I have not so far found any publications aimed at the general public, such as a publication listing the CFP values of daily necessities.

In cross searches with the Consumer Affairs Agency and the Science Council of Japan for carbon footprints, I have not been able to find any material on the subject.

So, if an individual wants to calculate the CFP value of the goods and services he or she has used in a year, what can he or she do in the current situation?

I found that there are some foreign service programs on Internet. There, if you input such data as what kind of car you drive (petrol or diesel, what displacement, etc.) and how much you drive per month, or how much electricity or gas etc. etc., you can get a rough estimate of the annual or monthly CFP per individual. However, with this kind of service, people living in Japan may not be able to get a correct reference value.

When I looked for similar Internet services in Japanese, I found a Japanese organisation called Code for Japan that released a personal CFP visualisation program called "Jibun-goto Planet". This application program also seems to aim at companies and local governments rather than individuals, but future development may be expected.

iv) Role of the CFP value as a micro-scopic environmental impact index

As for the purpose of calculating the CFP value, the above-mentioned Ministry of the Environment guideline clearly states that the government requires all public entities and companies to submit their data in order for the government to calculate the annual greenhouse gas emissions for Japan as a whole.

Here, it would not be necessary for the CFP values to be for individual products, but only for individual entities.

Meanwhile, the Environment and Economy Office of the Ministry of Economy, Trade and Industry (METI) has established a study group on the calculation and verification of CFP values.

Table 4-3-1 Annual CFP values by use (Kg-CO_2 equivalent) per household:

Usages	Annual CFP value
private cars	1,574.3
lighting and household appliances	1,565.7
hot water	744.7
heating	618.6
total including others	5,202.9 $KgCO_2eq$

Data for year 2006 from JCCCA (https://www.jccca.org/content/view/1048/789)

A report entitled 'Carbon Footprint Report' was issued by this study group in March this year, which clearly states that the purpose of the report is to maintain and strengthen the international competitiveness of Japanese industry.

Further investigation revealed that METI had designated more than 400 products in multiple domains, including foods, clothing and printing-related products etc., for which CFP values should be calculated, and published calculated figures for some fourty of these products. This report was written in English (Carbon Footprint of Products Guidebook, 2009-2011) and I understood that the Ministry is aware of that the calculation of CFP is an export measure.

In other words, the information that citizens seek for, as Mr A and Mr B do, namely an index to estimate the extent to which the products and services that individuals purchase in their daily lives impose a burden on global warming, has originally been conceived with the aim of the CFP value. But the CFP value appears to be used in other directions.

Despite the fact that CFP values were originally designed to play such a role, as far as I am aware, few CFP values are actively provided to the public in Japan.

(v) CFP values on personal basis.

In an easy search for publicized CFP estimates on personal bases, a set of annual CFP values by use per average Japanese household was found in the Japanese version of Wikipedia (as checked on 20230411) as cited in Table 4-3-1.

In the above table, data are not on personal basis, but on per household basis. An additional search of JCCCA (the Japan Centre for Climate Change Actions) revealed estimates of CO_2 emissions from households on per capita bases over time in Japan, as exemplified in Table 4-3-2 in the next page.

For further data on estimated annual CO_2 emissions by individual besides JCCCA, I found that the Institute for Global Environmental Strategies（IGES), the National Institute for Environmental Studies, the White Paper on Land, Infrastructure, Transport, and Tourism, the Global Environmental Strategies Institute, and a research group at the University of Tokyo reported relevant figures. They are shown from item 4) to 7) in Table 4-3-3 in the following page.

Table 4-3-2 Annual CFP values by use (Kg-CO_2 equivalent) per capita: Data for 2015 and 2017

Usages	2015	2017
Powers (including those for lighting and household appliances)	724	696
Private cars	664	692
Heating	317	334
Hot water supply	274	285
Total including others	2,063	2,054 $KgCO_2eq$

Since the two sets of data from the JCCCA in Table 4-3-2 do not fluctuate much between years 2015 and 2017, I thought that those usage items shown there in this table may give hints for us to get a general idea of personal emission.

Obviously, the total emission per capita as shown in item 3) of this table is larger than the cumulative CFP values of individual emission estimates in items 4) to 7). This is because the total emission in item 3) includes those CFPs as emitted for public utilities by the government and some other public organizations.

It may be noticeable here, however, that the figures for items 4) to 7) for per capita household emissions varied widely from report to report.

Among them, the one from JCCAA in item 6), i.e. 2 ton, contains only those emissions from direct energy consumption, such as electricity, gas or petrol, but does not include emissions brought about from purchasing bread, meat, services etc.

The MLITT White Paper as cited in item 4) mentions that household emission comprises 60% of the total emissions of Japan. We have not been able to confirm the reliability of the 60% ratio, since the breakdown of the public part of the total CFP value of Japan has not been publicized so far.

I am not sure why the estimated value of household emission from IGES as shown in item 5) is so high as 7.6 ton, and I am afraid if I misunderstood something.

In the publicized data of the University of Tokyo's Group study, CFP values are given on a monthly basis and the data are graphed. So here in this comparison, the figures in the graph are converted manually to an annual numerical value as shown in item 7).

From the above comparative study, at least the following may be said;

First, the CFP values from the JCCAA in item 6) can be distinguished from others since the JCCAA values are ag gregated in a range different from others.

Among the remaining items 4), 5) and 7), the University of Tokyo's Group study in item 7) may probably be the most reliable, since it is an independent academic group, and the data are based on direct surveys, and publicized in a high quality journal (Long Y, et al. Urban Sustainability 3; 3-19 (2023).)

In any case, to improve the reliability and applicability of per capita household emission data in Japan, we may need to expand investigation and scrutinization of publicized information further.

Table 4-3-3 Basic numerical values to assess the effect of personal housefold CO_2 emmission on global warming

Items	2015	2017
1) Total emissions of all environmentally hazardous gases in Japan	1,322 Megaton	1,292 Megaton
2) Population of Japan	127.095 Million	126.706 Million
3) Allocation of total emissions to single person	10.40 ton(100%)	10.20 ton(100%)
4) Household emission per capita as estimated in the MLITT White Paper 2020	6.24 ton(60%)	6.12 ton(60%)
5) IGES's estimatation of per capita household emission		7.6 ton(75%)
6)JCCCA's estimation of per capita household emission	2.06 ton(~ 20%)	2.05 ton(~ 20%)
7) Univ Tokyo Group's estimation of per capita household emission	~ 3.7 ton	~ 3.7 ton

1) Ministry of the Environment FY2020 preliminary figures
2) From the census
3) Figures from 1) divided by 2)
4) White Paper on Land, Infrastructure, Transport and Tourism 2020 estimates
(Value calculated as 60% of the value in 3)
5) https://www.iges.or.jp/en/pub/15-lifestyle/ja
'75%' is an estimated value when the value in 3) is set as 100%.
6) From the JCCCA table of "CO_2 emissions from households (per capita)" over time.
'~20%' is an estimated value when the value in 3) is set as 100%.
7) Long Y, et al. Urban Sustainability 3; 3-19 (2023)
'~36%' is an estimated value when the value in 3) is set as 100%.

(vi) Proposed answers to Mr A and Mr B

With the data obtained so far, it may be possible to present a hint to the question of Mr A, who asks how much would halving the emissions of private cars contribute to the global environment.

According to the JCCCA data, the annual CFP for a household owning a private car is some 1,600kg CO_2 per household. So, halving the emission of a private car would save about 800 kg CO_2 equivalent per household.

The average Japanese household has about 2.6 members, indicating that there are some 49 million households in Japan. If all these households halve their private car emissions, the CFP that can be reduced is 39,000,000tons. This is about 3% of Japan's total CFP of 1,300,000,000 tons.

My proposed answer to Mr A and Mr B here is therefore that reducing car size to the half contributes significantly to reduce the national CFP reduction, and that personal monitoring of CFPs in daily life is highly appreciated.

However, there may be opinions in other directions, too; Let me ask another question how much we can save with this displacement of a car. Here, I do not go into details of car expence analyses but just postulate a rough idea of an annual saving of some 300,000 yen, on the bases of my personal estimation for the maintance cost of a compact car which may be something around 700,000 yen per year including the cost for periodical car renewal.

If this is the case, the total reduction for all 49 million households would be 14.7 trillion yen every year. Since the Japan's total GDP is some 550 trillion yen, this would mean a reduction in national GDP of around 2.6%.

This rough calculation may suggest that the effect of downsizing car to the half on national GDP reduction is similar in the order to that on the country's CFP reduction, and may further suggest that few government would ever suggest people to do this, but would be eager to maintain peoples car expense while try hard to reduce carbon emission separately without reducing the car size.

From citizens' viewpoint, on the other hand, they would certainly imagine effective ways to spend the money saved by reducing the car size. In other words, without the citizens' voluntary choice, the government may not give any suggestion that may result in GDP reduction. What are your thoughts on this?

(vii) Prospects for the future:
Transformative change or incremental change?

If an increase in GDP is essential for economic sustainability, can we lower the CFP without decreasing it and bring it down to zero-emission, i.e. zero CFP?

The current view of the IPCC and EASAC, as I understand, is that it is difficult to do so, and that transformative change, including the introduction of an economic indicator to replace GDP, is necessary.

By the way, looking at the past and present trend in Japan, things appear to have ended up with a series of incremental changes only. Data show that, at least in this direction, Japan has succeeded in more than doubling its GDP over the last decade with little increase in CFP (White Paper on Environment, Sound Material-Cycle Society and Biodiversity, Ministry of the Environment, 2012).

This can be attributed to the invention of hybrid vehicles, LEDs, carbon fibre and lithium-ion batteries, as leading technologies to reduce carbon emission.

The government's current efforts to fortify nuclear power plants and ammonia power generation technology, seem to me as being only a temporary measure, rather than a long-term solution. It should be noted here that an atomic energy plant may not be regarded as a permanent carbon-emission free energy source in Japan, not only because of their risk at natural disasters, but also because of their risk as a negative weapon to defend the country.

While any governments including the Japanese one, as well as UN agencies and experts, have not been able to provide sufficient answers to the question of what constitutes transformative change, I feel that we should not neglect incremental change and, on the other hand, seek concrete measures for transformative change from the citizens, who are the last and biggest repository of genuine ideas.

In this supplementary survey and analysis for this meeting, I did not mention the public works portion of our country's total CFP. It would be difficult for individual citizens to tackle this part. I hope that an organization such as the Science Council of Japan will conduct a rigorous survey and analysis and publish the results.

Although this supplementary survey could not touch other specific issues such as how much CFP value could be reduced by reducing plastic bags, I felt that quantitative analysis from a microscopic viewpoint is very valuable as well as from a macroscopic viewpoint.

So much for the discussion of future prospects at this round-table discussion, I invite everyone to try out new challenges and proposals, whether incremental or transformative. I would also like to make an attempt.

My thanks are to Dr. Nobuaki Hori for his advice on this additional research.

4-4 Ammonia as a fuel substance: Comments from Host

(1) Evaluation as a carrier medium for energy

To the comments and the question of Ms C who was concerned about the Japanese Government's plan of using ammonia for energy source., Prof. Norton pointed out that ammonia is being looked at for energy transport in Europe.

Apparently, ammonia has not received much attention as a key energy substance in Europe, but in Japan. Why?

After a brief survery, I frequetly noted attention on ammonia with its capability as a hydrogen transporter, but that its global production capacity is small and the current production method releases considerable CO_2, which has a non-negligible environmental impact.

(2) Technical measures against NOx formation.

With regard to the questioner's suspicion that nitrogen oxides, which have a significant environmental impact, are released during the combustion of ammonia, it was reported that the problem has been solved technically.

The optimal conditions for reacting ammonia so that the product remains water (H_2O) and nitrogen gas (N_2) when burning ammonia (in a coal-fired furnace burning 20% ammonia mixture) have been established (Harasaburo (2015-2019) Study on ammonia use in existing thermal power plants, report of the Central Research Institute of Electric Power Industry)

(3) Assessment of ammonia development as a general-purpose heat source.

From a layman's point of view, I imagine that some attention might be focused on ammonia with its possible advantage of utilizing it without major changes to current fossil fuel-based facilities such as thermal power plants and blast furnaces.

Japan's current development target appears for ammonia to supply 20% of the fuel used in power generation, etc..

So the remaining 80% will continue to depend on fossil fuels. This may mean ammonia production to be used only for a short term as a bridge technology.

(4) For a long-term general-purpose heat sources that can replace fossil fuels.

From a conversation with Prof. Norton during break time, he commented that wind and solar power are insufficient to solve Japan's energy problems and that nuclear power is definitely needed to reduce the load on fossil fuels.

I understand that Japanese people are generally regarded as being too much sensitive against its use with historical reasons. However, I feel that there are some other lines of difficulty using neclear energy as a long term energy source. One of major difficulties with it, to my understanding, is that it can be a powerful negative nuclear weapon. Having a nuclear plant means having a negative nuclear bomb as a target of just an ordinary missle attack at a time of emergency. We may need further studies to seek for a long term energy source in Japan.

Here, I wonder why geothermal power generation has not attracted much attention in Japan. Japan ranks third in the world in terms of geothermal power generation capacity, but its utilisation ranks much lower. I am aware that there are problems with existing industries such as the spa industry and the remote location of the country, but these are not comparable to the problems faced by fossil fuels and nuclear power, and I think they can be solved through careful political efforts.

Concluding remarks

Flood, drought and pandemic. The government of a country is not always ready to be confronted with such disasters. Many countries tend to slip down into a chaotic condition, where the government may try to maintain social order disregarding people's daily life, may take it first to maintain economy so that people can get tomorrow's bread, or may try to overcome fear with prayer.

In the midst of such chaos, however, there are citizens who calmly try to draw up countermeasures with scientific mind to know nature.

I myself will never forget the memory that, in an early day of Covid pandemic, a guest of our shop came and presented us beautifully handmade cloth masks together with non-woven peaces of air filter. It was the time when people were complaining about the lack of masks, and the Japanese government was hurrying to import a large number of masks which were found out of standard later.

I understand that the most famous Covid vaccine so effective in saving human life in the world came from an independent biotechnology company that jumped into vaccine development on the day when the DNA sequence of the Covid virus was publicized.

If my memory is correct, for some period of time since the Covid invasion to Japan, the Japanese Governmental notion on vaccine had been something like, 'We are considering vaccine development carefully, hearing experts' opinions.'

A similar situation may appear to exist now for global environmental issues. Each country sends representatives to an international convention to develop measures, which are then brought back to the home country for implementation. The countries may try to respond like in a slowmotion picture, such as one cycle for every two years, while global climate change goes on and on.

A recent report from such an international body notes that the problem is unlikely to be solved by the methods that have been built up so far. To do something about it, we need a 'transformative change', meaning a change that will transform the system itself. Someone. Please do something about it. It seems to say.

EASAC, a group of just 30 or so scientists on academic society bases, made one proposal, which the international convention promptly adopted. It seems like that a seed of such change does not always come from a government-based heavy organization, like in the case of Corona vaccine development.

It seems to say that we must also pay attention to the possibility of change coming from individuals or groups of persons in the city. Here, the names may be remembered of Syukuro Manabe who first successfully proposed a simulation model for global climate change, and Kohei Saito who is trying to draw a model of future sustainable society recently as Prof. Norton mentioned.

We would like to thank Prof. Michael Norton and all those who have taken part in this small science café discussion meeting and engaged in serious discussion.

Toshiharu Matsumura, Host of this discussion meeting and the editor of meeting record