Address by Komiyama, Hiroshi
Chairman
Science and Technology in Society *forum* (STS *forum*)
Japan

Komiyama, Hiroshi

Your Majesties, Excellencies, Distinguished Guests, Colleagues, and Friends,

As Chairman of the Science and Technology in Society *forum*, I am honored to declare the opening of our **twenty-second** annual meeting here in Kyoto.
This year is truly historic for the STS *forum*, as we are graced for the first time by the presence of Their Majesties, the **Emperor and Empress** of Japan.

Your Majesties, we are profoundly grateful for the honor of your attendance.

I also thank our sponsors, members, and other supporting organizations for their contributions to the *forum*.

The STS *forum* was founded twenty-two years ago by the late Mr. Koji Omi, to bring together leaders from public, private, and academic areas, to discuss the **lights and shadows** of science and technology from a long-term perspective.

The significance of the *forum* has only grown over time.
As chairman, I feel deeply honored to welcome over **fifteen hundred** leaders to this occasion.
Your presence here reflects our shared commitment to shaping the future of humanity.
Ever since our ancestors migrated out of Africa about two hundred thousand years ago, humankind has spread across the globe, **flourished as a species**, and **developed civilizations** throughout our long history.
Living conditions have improved, though progress was very slow until the

eighteenth century.

Then, two hundred years ago, the **Industrial Revolution** came and changed everything.
The speed of development picked up dramatically, particularly since the start of the twentieth century.
The change was propelled by science and technology.

Human longevity paints a clear picture of our progress: for most of history, the average lifespan was only about twenty-five years. Even at the turn of the twentieth century, it was still thirty-one. Today, the global average exceeds **seventy**, and in many countries, it is over **eighty**.
This is a testament to the success of humanity.

In this long journey, humanity has turned wilderness into farmland for food and mined underground resources for materials and energy. This brought prosperity but also revealed the limited capacity of the Earth.
Our climate is changing in alarming ways: the world is already **one point-two degrees** hotter than pre-industrial levels. Extreme heatwaves, floods, droughts, and wildfires have grown in frequency and severity.
At the same time, **social inequality** is widening, **divisions** are deepening, and **conflicts** persist.
Stability can no longer be taken for granted.

Can we resolve the many issues before us, rebuild a beautiful earth, and ensure a prosperous society? Or will humanity fall into decline after flourishing as a species? We are the ones who will determine our future.

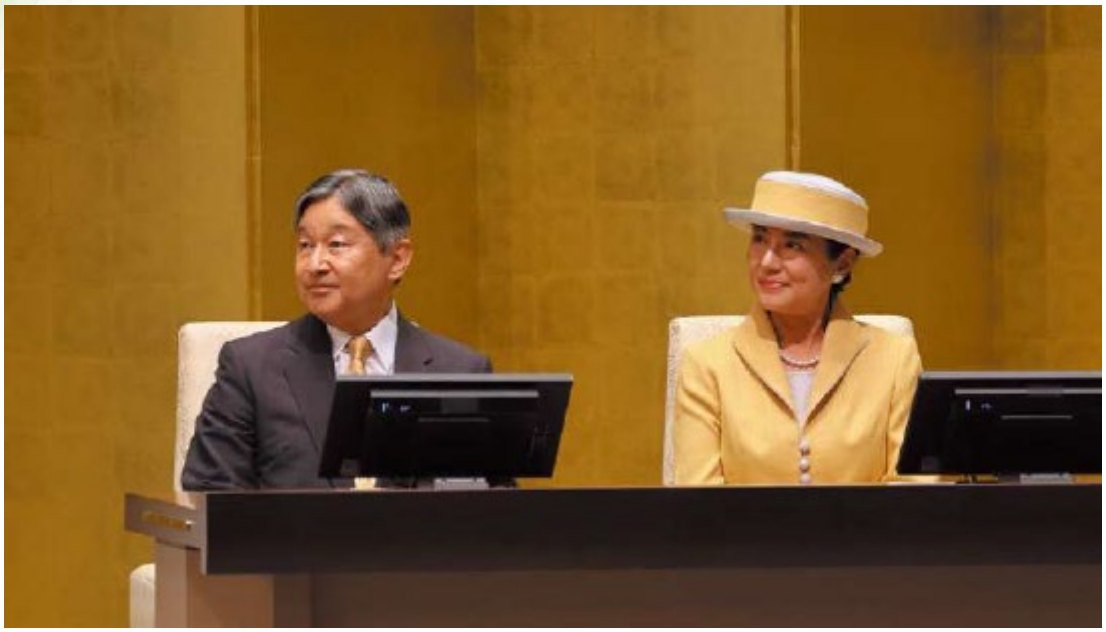
But there is hope.

New foundations for prosperity are emerging: **biomass** from sustainable sources provides an annually renewed flow of material; **renewable energy** delivers a continuous stream of power; and the **urban mine** — not only rare metals but other resources now nearing saturation, like iron, glass, and plastic — is superior to natural mines in terms of both grade and energy efficiency.

Together, these three pillars mark a fundamental shift from a civilization of

extraction to one of **circularity**.

Thus, there is hope.



Their Majesties the Emperor and Empress of Japan

But this shift needs more than technology; it requires **social systems**. The Tokyo 2020 Olympics offers a vivid example: all Olympic medals were made from metals **recovered** from old phones donated by citizens. This proved that with the right social systems, **circularity** works.
It is a reminder that sustainability cannot be separated from society, — the second "S" in STS.

The shift to circularity also means moving from concentration to **decentralization** — toward communities where resources and opportunities are more evenly shared.
Thus, **inequality** and **division** can be avoided.

Another source of hope is the **vast store of knowledge** humanity has accumulated — scientific, technological, tacit, and cultural.

The challenge is its structure.
In my opening address each year at STS, I show a **porcupinefish** as a metaphor for fragmented knowledge: each spine stands apart, as our domains of expertise too often do. Without links, knowledge, as a whole,

cannot function.

If we connect these “spines” and mobilize the right combinations for the right purposes, humanity can move forward. This is where **AI** has a part to play: generative AI can link knowledge across domains at unseen speeds.
That power also brings risks — distorting values and dividing societies if misused.
AI must therefore remain firmly **under human control** — always a servant to human purpose and dignity, never a master.

The very name of this *forum*—Science and Technology in Society—affirms this principle. The STS *forum* has three engagements: first, to harness science and technology **for the public good**; second, to reform society **through dialogue and consensus**; and third, to **use AI** to connect knowledge and speed up solutions.

Together with the three pillars of a circularity — biomass, renewable energy, and the urban mine— these engagements form the base for a sustainable future.

Here, I wish to emphasize the weight of our own endeavors.
There are two sides to science and technology: the power to bring disaster, and, **more importantly**, the power to create a **brighter future**.
Our **collective responsibility** is to find a path to a brighter future—and to act decisively in pursuit of it.

Speaking for myself, stimulated by our continuous discussions at the STS *forum*, I have championed a movement in Japan, striving to achieve **Platinum Society**. This, I define as a sustainable world and a prosperous social model in which all can achieve self-actualization.

Seventeen years ago, we established the Platinum Society Network, bringing together leaders from public, private, and academic areas.

Over the past five years, we have identified five key sectors on this path: forests, renewable energy, health, tourism, and human resource development.
When advanced in concert, these sectors can deliver three outcomes: **self-**

sufficient resources, **lifelong and collective** growth for all, and **local resident investment** in business that supports shared public benefits.
This is Japan's own vision, aligned with the three pillars of a circular civilization and the three engagements of the STS *forum*.

We began launching these initiatives three years ago, one after another. Meanwhile, **AI capabilities grew dramatically**, changing it from promising technology to indispensable and marvelous tool.

We use the same process across the five sectors: **envision** 2050, back-cast to solutions, start with what is feasible now, and scale nationwide.

AI has become the backbone of this process, seeing use in integrating dispersed knowledge, identifying technological, legal, institutional, cultural, and bureaucratic bottlenecks, designing regulations, aligning stakeholders, and prioritizing investments. We have seen it shorten the path from imagination to societal implementation when applied from the outset in our newer initiatives.

This boost is essential, because the challenges we face—from climate change to social division—are worsening **year by year**.
We cannot afford to wait. We must move **faster, together**.
Let us act now—while hope is with us.

And when we return to our home countries and institutions, let us — as leaders from public, private, and academic areas, not only think together but act together. We bear a historic responsibility to ensure that science and technology truly serve humanity. **Let us translate our shared understanding into concrete action** — collaboration, policy design, and investment.
This is why we are here.

Here in Kyoto, over the next three days, we will—as every year at the STS *forum*—take up a broad agenda: resources, energy, water and food, health, inclusion, and governance — examined in light of the latest advances in science and technology.

This year, we planned two special sessions focusing on AI — one, "AI in Twenty-thirty and beyond", and the other, "AI and the Future University."

I look forward to seeing insights from that discussion carried into our other sessions—and carried back to your national initiatives and networks.

In the presence of Their Majesties, with the wisdom gathered in this room, and with our shared commitment to humanity's future, I am confident that we can help lead our civilization toward a brighter, more sustainable path.

We cannot afford to wait. We must move faster—together.
Now, let us begin the STS *forum* 2025.
Thank you.

Address by His Majesty the Emperor of Japan

Excellencies,
Distinguished participants,
ladies and gentlemen,

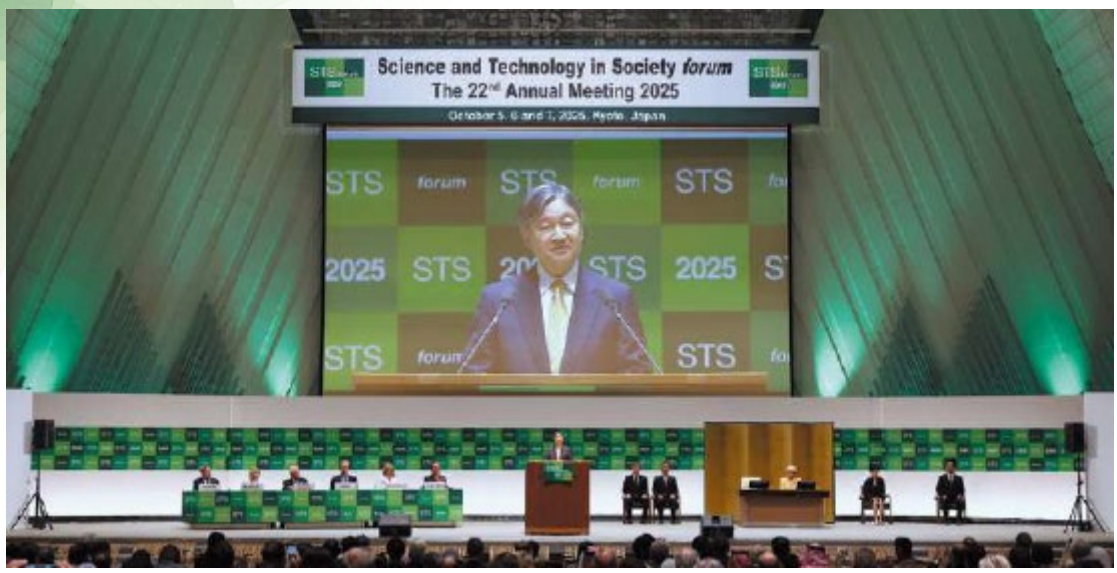
His Majesty the Emperor of Japan

It gives me great pleasure to have this opportunity to join you today, together with the Empress, at the opening ceremony of the 22nd Annual Meeting of the Science and Technology in Society *forum*.

This is the sixth time I have attended the STS *forum* since its founding in 2004. It is of great significance that the STS *forum* has held lively discussions over the last 21 years on various issues related to the "lights and shadows" of science and technology, as well as the sustainability for the future of humankind.
I would like to express my deep respect for all the efforts made by those dedicated to organizing this *forum* as well as those who participated in the previous *forum*s.

I understand that this year's program places a particular emphasis on the evolving field of Artificial Intelligence, or AI. AI is already generating profound innovations across a broad spectrum of fields, including medicine, education, industry, transportation, and even the arts and cultural domains.

At the same time, we are confronted with a host of challenging issues: ethical considerations, the protection of privacy, the impact on employment, and need for transparency in AI-driven decision-making, to name but a few. These are matters that require careful, thoughtful deliberation over a wide range of disciplines and perspectives. There is a need for experts in various fields from all over the world to address these urgent issues by creating interdisciplinary networks.



In thinking of the future of humankind, it is important to discuss these issues, including the environment, energy, food and water, not just 20 or 30 years from now, but from a longer-term perspective, and this goes beyond mere national borders. This is for the sake of everyone living on our planet. Let me express my heartfelt wish that global leaders will continue their efforts to bring their wisdom together and search for the best way to make the most of science and technology for the future of our earth and the sustainable development of humankind.

In conclusion, I sincerely hope that this annual *forum* here in Kyoto will, once again, contribute to the sound advancement of science and technology and the future of humanity.

Thank you very much.

Address by Ishiba, Shigeru
Prime Minister
Government of Japan

Good morning, everyone. I am ISHIBA Shigeru, Prime Minister of Japan. With the honor of their Majesties, the Emperor and Empress in attendance today, I would like to say a few words about the 22nd Annual Meeting of the Science and Technology in Society *forum* (STS *forum*).

The theme of the opening session of this *forum* is "Looking at the World in 2030 and Beyond—The Future of Science and Technology and Humankind." While science and technology can be the "light" that brings hope, they also have the potential to be the "shadow," which creates disparity and anxiety. In order to put the "light" of science and technology to use and prepare for the "shadow," cooperation and responsibility of the international community are essential. The STS *forum* is a venue that nurtures such a network of knowledge and trust. It is my sincere hope that your discussions and interactions will empower us to bring hope to the future society.

In August, Japan hosted the 9th Tokyo International Conference on African Development (TICAD 9), which brought together representatives from 49 countries, including 33 African heads of state. At this important gathering, participants jointly adopted the Yokohama Declaration.
The declaration highlights the critical role of international knowledge exchange, as well as the importance of science and technology diplomacy. In this context, Japan launched an initiative to develop 30,000 AI professionals over the next three years. To ensure shared prosperity across the globe, including Africa, it is essential that we harness the power of science and technology to co-create innovative solutions to common challenges.


Ishiba, Shigeru

With regard to AI, which is the focus of this *forum*, it is crucial to accelerate innovation while mitigating risks. Under the AI Act that was passed in the recent ordinary session of the Diet, Japan will realize its vision of becoming "the

world's most AI-friendly country" and make contributions to the world. Furthermore, we will continuously promote Hiroshima AI Process, which was launched during G7 2023 under Japan's presidency. We will also continue to take a leadership in international rulemaking to advance safe, secure and trustworthy AI.

Currently, at the Expo 2025 Osaka, Kansai, Japan, various visions depicting a future society are being displayed, such as a beating heart created with iPS cells and a society in which humans and robots co-exist, under its theme of "Designing Future Society for Our Lives."
It is my hope that the combination of the discussions at this STS *forum* and the experiences at the Expo will provide the opportunity for realizing the desired future society through science and technology. Thank you for your kind attention.

Address by Zaharieva, Ekaterina
European Commissioner for Startups, Research and Innovation
European Commission
EU

Your Majesty the Emperor, Your Majesty the Empress, Chairman Komiyama, Excellencies, Ladies and Gentlemen,

It is an honor to join you here in Kyoto on behalf of the European Commission.
This year, the Science and Technology in Society *forum* invites us to look ahead at the future of science, technology and humankind.
Looking forward has always guided humanity's search for knowledge, across time and cultures.


Zaharieva, Ekaterina

Here in Japan, this is captured in one of the world's oldest epics, the Tale of Princess Kaguya.[1]
The tale is a story of a woman whose ambition could not be confined on earth.
And whose determination brought her to the moon.
It is a tale of aspiration and determination, the same that drive our innovative efforts.
From Japan's Moonshot Programme to our Horizon Europe.

As we look towards 2030, this spirit of reaching beyond our limits is more important than ever.
Our world faces fragmentation and uncertainties.
Technological competition is rising, even among allies.
Scientific freedom is under pressure worldwide.
In this context, Europe's vision remains unchanged:
Openness and international cooperation must guide the future of science

1 Widely known and celebrated folktale in Japanese culture.

and technology.
We believe that scientific cooperation can build bridges, even in challenging geopolitical times.
Technological partnership is an engine of common prosperity.
This approach allows us to address challenges that are too big to be addressed by any country alone, like global health or sustainable food systems.
But also, to deliver better solutions to our citizens, like more secure and competitive green technologies.
And this is the goal of our cooperation on Hydrogen Safety, for which later today Europe and Japan will sign a memorandum.

This brings me to my second point: partnerships are central in implementing this vision.
This is why our Horizon Europe programme is open to the world, by default.
Participants from 194 countries have applied to Horizon so far.
More than half of our collaborative projects include countries outside of the Union.
And around 40% of the researchers we support through our doctoral and postdoctoral funding are non-European nationals.
Throughout the years we built solid collaborations, including with Japan.
Ten years ago, we adopted an ambitious Joint Vision and a Strategic Partnership in R&I.
Horizon has been supporting Japanese and EU innovators, for example in developing big-data-driven platforms to detect and prevent early health risks.
Or in bringing together researchers and industries to deploy AI solutions in advanced manufacturing.
In short: we showed that even in a fragmented world, trust and partnership work and can deliver results.
And I look forward to strengthening this partnership, with Japan soon joining the family of 20 nations associated to Horizon.
These include global R&I powerhouses from European science leaders like the UK and Norway, top tech and patenting hubs like Canada and South Korea.
But also, emerging innovation actors with unique competitive strengths, like Ukraine or Tunisia. So, I would like to take this opportunity to commend the work of our respective teams, as negotiations approach their final stages.

Association will deepen the links between our researchers and innovators.
It will boost our innovation capacity.
It increases mutual access to global research organizations and cutting-edge infrastructure.
And our innovators clearly recognize this:
Nearly 3 in 4 among them confirm that Horizon strengthens their collaboration with leading R&I powerhouses around the globe.[2]

Vision and partnerships are crucial as we build our tomorrow, but they are not enough.
The future of science and technology **also depends on the resources we dedicate to them, today.**
This is why as European Commission we have proposed to nearly double our resources for research and innovation.
This would bring it to 175 billion euros, or over 30 trillion Japanese yen for the period 2028 to 2034.
We want Horizon to be a global magnet of scientific cooperation in the decade ahead.
And we want our partners to know that you can count on our long-term commitment.
This will enable us to finance even more excellent research and groundbreaking innovation, from the lab to market deployment.
Including the moonshots of tomorrow: from self-driving cars at scale, electric planes, reusable space rockets, fusion energy plants or building the quantum computer of the future.
These are example of new flagship projects that we want to accompany with a novel, comprehensive approach.
From fundamental research to testing and deployment at scale.
With target support and the right funding instruments for each innovation phase.
We look forward to sharing this journey with you.

Excellencies, Ladies and Gentlemen,
To conclude, the future Europe envisions for science and technology is a bright one.
Yet, it is not a given.

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[2] a3aa9b90-15c0-4ea7-b25e-9f4e29cfa740_en

Like Princess Kaguya, we cannot just look at the moon, we must reach it, with determination.
Unlike hers, our journey will not be solitary.
We must travel the path to the future together.
You can count on Europe to be a trusted partner.
Thank to this *forum*, and to all if you, for giving us the chance to reaffirm this commitment.
Arigato!

Address by Varin, Philippe
Chair
International Chamber of Commerce (ICC)
France

Varin, Philippe

Your Majesties, dear Chair Komiyama, distinguished guests, ladies and gentlemen,

It is a profound honor to join this STS *forum*, in the presence of Their Majesties, on behalf of the International Chamber of Commerce and the 45 million companies it represents worldwide.

When we address the future of science and technology, we are not only talking about machines or algorithms. We are speaking about humanity—about the choices we must make to shape the kind of world we want to live in.
Technology is an extension of our imagination, our creativity, and ultimately our values. It rests in our hands.

The future we face will be shaped by forces already visible today. Let me highlight three of them:
- The accelerating power of knowledge
- The pressing challenge of sustainability
- The ongoing revolution in health and medicine

Finally, I will address the urgent ethical and governance questions that will determine whether science serves us—or overwhelms us.

First: The Accelerating Power of Knowledge

For most of history, discoveries advanced slowly. Today, the time between breakthroughs is shrinking at an extraordinary pace—from decoding the human genome to developing vaccines. AI is accelerating this progress even further—helping us design new molecules, optimize energy systems, and

process enormous volumes of data.

This acceleration means that the 21st century will witness multiple revolutions: in biology, in energy, in space exploration, and in digital technologies.

AI is no longer just a tool. It becomes a partner in creativity, diagnostics, and decision-making. Soon, it may become our collaborator in almost every domain of life—and sometimes, a competitor, or worse, an enemy.

This evolution prompts serious questions:
If machines can learn, what will remain uniquely human? How do we preserve creativity, empathy, when algorithms can simulate them? Most importantly, how do we ensure that AI systems reflect our values, rather than amplify our divisions? How can we ensure the benefits of innovation are shared equitably across nations, so progress does not exacerbate inequality?

Second: The Pressing Challenge of Sustainability

Sustainability, above all, is about addressing climate change. This is no longer a distant concern—it is already impacting lives and economies around the globe. In the past decade, extreme weather events linked to climate change have cost the global economy two trillion dollars, affecting two billion people. Insurance premiums rise everywhere, and adaptation becomes a priority.

The good news is that technologies are being developed to mitigate—or even eliminate—greenhouse-gas emissions in key sectors like raw-material production, housing, and transportation. The challenge now lies in funding and scaling these technologies quickly, whilst controlling the huge carbon emissions generated by AI-related activities.

Moreover, nearly half of greenhouse-gas emissions stem from the life cycle of processing materials to supply the needs of the population. Every year, we extract 100 billion tons of materials from the Earth. In the next 30 years, we will extract as much as since the dawn of humanity. We cannot continue

to recycle only 9% of the plastic we produce, use our cars a few percent of the time, or extract significant amounts of raw materials to produce a 130-gram smartphone—with virtually no recycling.

Addressing this requires not only innovation, but also collective intelligence and a willingness to change behaviors. We may have the knowledge to build a sustainable planet—but do we have the will? We have only one Earth, not two.

Third: The Ongoing Revolution in Health and Medicine

AI is helping us extend life expectancy and better treat diseases of aging. Regenerative medicine, bioprinting, and precision therapies are moving us toward a future where we can repair rather than merely treat the body. Brain–machine interfaces will enable human enhancement.

But these advancements raise ethical and social dilemmas: Where do we draw the line between therapy and enhancement? How will we protect sensitive genetic data? How do we ensure equity in a world where some may live to 120 while others lack basic care? And how will we safeguard privacy and security as health data become more extensive and integrated?

Here Comes the Role of Wisdom

Science gives us extraordinary tools, but the future will test our wisdom. Our biggest challenges will not be solved by technology alone, but through a deeper commitment to philosophy, ethics, and dialogue.

Technology mirrors our intent. If we are guided by fear, greed, or domination, it will magnify those forces. But guided by curiosity, compassion, and a sense of shared destiny, our technologies can help us overcome our greatest challenges.

So, what must we do?

First, we must cultivate wisdom alongside knowledge. Education must go

beyond coding and engineering to include ethics, creativity, and civil understanding.

Second, robust political institutions—local, national, and international—should ensure that science serves the common good. But their role is damaged by global fragmentation when collaboration should be a must.

So it is time for the networks of universities to show up, disseminating the best technologies in areas like climate change or circular economy. It is time for the global business institutions like the ICC, that I have the honor to chair, to show up and propose a compact, for revitalizing the global trading system !

Finally, we must not lose sight of the human spirit. Machines may calculate, but only humans can care. Algorithms may predict, but only humans can hope. In the end, the real question is not whether science will change the world. It already has, and it will continue to do so at breathtaking speed. The real question is whether we will shape technology with wisdom, or allow it to shape us blindly.

The future is not a destination waiting to be discovered. It is a decision we are making every single day.

Thank you.

Address by Brabeck-Letmathe, Peter
Chairman of the Board of Directors
Geneva Science and Diplomacy Anticipator (GESDA);
Chairman Emeritus
Nestlé S.A.
Switzerland

Your Majesties,
Mr. Chairman of the STS *forum*,
Madam European Commissioner,
Distinguished colleagues and friends,
Ladies and Gentlemen,

It is a profound honor and joy to be with you once again at this 22nd edition of the STS *forum*.

When His Majesty the Emperor of Japan reminded us just moments ago of the importance of anticipation, I felt a deep resonance. For anticipation is not only about waiting for the future to arrive—it is about preparing ourselves, shaping it, and ensuring it unfolds in a way that reflects the best of human ingenuity and responsibility.

And so we gather here to reflect on a powerful question:
What role will science and technology play in the world of 2030 and beyond?

Brabeck-Letmathe, Peter

This is not a question for the distant horizon. It is a question for now—for how we choose to act, lead, and collaborate in the present.

Learning from the World Expo

At the Geneva Science and Diplomacy Anticipator Foundation—GESDA—we have sought to explore this question not just with experts, but with citizens from all walks of life.

Throughout this year, we have conducted an experiment here in Japan, at the Osaka World Expo, where 28 million visitors are invited to imagine their own future in a world accelerated by science and technology.

Through our Anticipation Portal in the Swiss Pavilion, visitors embark on a journey into the heart of potential breakthroughs. Guided by the insights of more than 2,500 scientists worldwide—50 of them from Japan—they are asked to envision their lives in 5, 10, or 25 years.

They explore five great frontiers:

- Artificial intelligence and the quantum revolution.
- Human augmentation and neurotechnology.
- Eco-regeneration and geo-engineering.
- The interaction of science and diplomacy.
- The very foundations of knowledge.

What have we discovered so far?

The Voice of the Future

Nearly one million visitors have engaged in this journey—90% of them Japanese. Together, they have created over 400,000 visions of the future.

And their voices are clear:

- They are optimistic.
- They believe in health, longevity, and human potential.
- They want science not just to serve them, but to empower them.

They see science as a path to regeneration, to sustainability, and to solving environmental challenges. They do not want to stand by as passive observers. Above all, they want to play an active role in shaping their future.

And when asked what emotion defines their vision, the answer is powerful in its simplicity: joy.

Lessons for Us All

This optimism is not naïve. It reflects a society deeply literate in technology, historically innovative, and ready to embrace progress while keeping human values at the center.

But it also carries a warning for us.

As the signs in Japanese train stations remind us: “Be careful! One train can hide another.”

So it is with science. Four years ago, the world was focused on mRNA vaccines. Then, generative AI appeared like a train out of the fog, transforming everything overnight. And soon, general AI and quantum computing will arrive—perhaps faster than we expect.

The lesson is clear: anticipation must be matched with responsibility.

A Global Perspective

The optimism we see in Japan is not unique. Across Asia, Africa, and Latin America, people are embracing the promise of science. But trust in science—and its recognition in international affairs—remains uneven.

This is why the United Nations’ Pact for the Future, adopted last year, is so important. For the first time, science has been given a central place in the governance of our world. And the Scientific Advisory Board of the UN Secretary-General will help ensure that progress is not only measured in risks, but also in opportunities.

As His Majesty reminded us earlier: We cannot afford to waste time. Science and technology must become the driving forces for the future of our planet, for sustainable development, and for the flourishing of humankind.

Anticipatory Science Diplomacy

At GESDA, we call this anticipatory science diplomacy and leadership.

It means building bridges between the laboratory and society, between discovery and decision, between the future we foresee and the actions we take today.

Our Science Breakthrough Radar is the compass that helps us navigate. It is the tool that enables us to look 5, 10, or 25 years ahead, and then act with clarity and purpose.

But anticipation without action is not enough. That is why we are launching concrete initiatives based on this Radar:

- The Open Quantum Institute, hosted at CERN, to harness quantum science for the UN's Sustainable Development Goals.
- The Global Curriculum for Anticipatory Leadership, to train a new generation of leaders capable of navigating scientific acceleration.
- And at our upcoming Summit in Geneva, the launch of NeuroFutures, a bold initiative to accelerate brain-machine interface therapies that could help millions regain mobility and independence.

A Call to Action

Ladies and gentlemen, what is the message we must take from all this?

That the future is not something that happens to us. It is something we build—together.

Science offers us extraordinary tools. But it is up to us to ensure that they serve humanity, that they expand opportunity, that they create prosperity with inclusion and dignity.

If we act with foresight, if we act with courage, we can ensure that the extraordinary breakthroughs "cooking in the labs" around the world become engines of peace, of justice, of sustainable growth.

This is the leadership the world now needs. Not reactive, but anticipatory. Not fearful, but courageous. Not divided, but united.

Closing

So let us embrace the call of anticipation.
Let us seize the chance to build a future worthy of our children and grandchildren.
Let us ensure that science and technology remain not just the tools of progress, but the instruments of hope, of solidarity, and of joy.

That, Ladies and Gentlemen, is our mission. And that is our opportunity.

Thank you.

Address by McNutt, Marcia
President
National Academy of Sciences (NAS)
U.S.A.

Before we know it, 2030 will be upon us. What sort of S&T enterprise do we want to have at that time?

Allow me to argue here that business-as-usual will not suffice. In the US, the research enterprise was built upon the blueprint that Vannevar Bush released immediately following the second world war in his report: *Science, the Endless Frontier*. Not only was the US research enterprise built upon his vision, but many other nations followed suit, recognizing the essential role of government investment in science to support the health, national security, economic opportunity, and other benefits for their citizens.

Despite the three-quarter century since STEF was written, the overall structure of the research enterprise has evolved to become more international and diverse, and it moves at an accelerated rate compared with the situation in Bush's time.

McNutt, Marcia

Plus there are new pressures on the research system in this century for which I would argue the old way of doing things is not up to the task. More than modest adjustments will be needed, driven by:

1. Public interest in research. Formerly scientists were considered an elite, erudite body that was operating on an almost celestial plane that was beyond the understanding of normal people. Unfortunately, more recently that distance from the public has led to distrust of elites and a concern that science is not operating in the best interests of society.

2. Newfound urgency in addressing issues like climate change, pandemics, public health, environmental sustainability. Scientists no longer exist in Ivory Towers. There is a pressing need for science and engineering to find solutions.

3. Cost. The rate of inflation for research has outstripped budgets and the cost of other important societal imperatives. Consider the difference in the equipment and personnel need for a state-of-the art bioscience lab in the 1970s as compared with today. While technology advances have made so many human endeavors, such as communication and travel, faster, better, and cheaper, we have not made research itself faster, better, and cheaper. Investment in facilities (particle accelerators, telescopes, ships, etc.) to push back the unknown is so costly today that partnerships and international cooperation must be expanded.

Given these drivers, what are the elements of the research enterprise we will need to adjust in near future to remain relevant? Examples are:

1. The academic reward system. It is still too focused on factors like publications, citations, impact factors of journals where the work was published, with insufficient attention to impact of the research, mentoring, communication to non-expert audiences, patents, launching start-ups, research integrity, and public service. We must rise to meet the public's interest in what we do and demonstrate that we indeed work for them.

2. Career paths for students interested in science. Students spend a decade or more post baccalaureate at low wages before achieving a more or less permanent position by their mid-30s. For women who want to have a family, this timeline is unacceptable. In contrast, students who elect to get a master's degree in business can step into 6-figure salaries within two years of their undergraduate degrees. No wonder few young people in the US choose careers in science.

3. Research dissemination. The system for sharing research has certainly taken advantage of the internet such that works are

available worldwide at relatively low cost. But we are experiencing other problems, such as the rise of predatory journals and paper mills, difficulty in finding reviewers for papers, and growing instances of falsified or fabricated research results, much of this bad behavior driven by the research reward system I listed first. Changing the reward system will help, but I doubt it will completely solve the problem. Some of the solutions that are currently being discussed, such as limiting the APCs that journals can charge, could have the impact of making the problem worse by promoting predatory journals at the expense of those that do a good job of reviewing.

4. Transitioning the valley of death. Many research systems are clumsy at transitioning discoveries to new products and services to benefit mankind. I have always felt that the best vector for technology transfer is a student walking out the door of a university and into an industrial research lab, but too many students are being trained only to be clones of their advisors – essentially to do basic research – and don't have the skill set to advance processes to industrial scale, to work in teams, address safety and government approval processes, and interact with consumers. With the majority of science graduates finding employment in industry, we need to better prepare them for these careers.

I honestly do not find these problems insurmountable, and there are some promising examples to follow. But we need to pick up the pace if we are to be ready for 2030.

Address by Horiba, Atsushi
Chairman
Kyoto Chamber of Commerce and Industry;
Chairman & Group CEO
HORIBA, Ltd
Japan

Welcome to Kyoto in this beautiful autumn season.
As a representative of Kyoto citizens, I would like to extend my heartfelt gratitude to all of you. It is a great honor to host the STS *forum* in Kyoto once again this year. I sincerely hope that the warm and enduring relationship between the STS *forum* and Kyoto will continue for many years to come.

I have been engaged in the work of analysis and measurement for a long time. This is a very basic job that needs to be done patiently to see the true nature of things and clarifying challenges. However, when discussing the world beyond 2030, I believe this perspective of "discerning the essence" will become increasingly important.

Here in Kyoto, there are over 1,000 companies that have been in business for more than 100 years. The reason so many companies have overcome various crises and endured is that, even among changing external environments, they have clearly defined their own values and beliefs, and have consistently provided the "HONMAMON"—the genuine article, the top-tier products—that customers truly desire. Sustaining a business requires the wisdom to incorporate new elements into the old.

Horiba, Atsushi

Let me share a story about a startup originating from Kyoto. In recent years, rising sea temperatures have caused a decline in fish species long consumed in Japan within its coastal sea. Climate change is beginning to threaten Japanese food culture. To address this challenge, a startup emerged here in Kyoto, aiming to solve the problem through

aquaculture technology by using genome editing to breed heat-resistant fish varieties. This young researcher understands the “unchangeable essence” of food culture while tackling the challenge of depleting marine resources. He aims to change the “changeable elements”—specifically, how to get fish. This method truly contributes to the happiness of future generations.

No matter how much science and technology advance or how many innovative achievements are created, it is living people who utilize them. Cultures deeply rooted in people cannot be changed overnight. Therefore, I believe science and technology must always walk hand in hand with culture.

In an era where AI makes sophisticated judgments, what should we consider? In an era where robots replace many jobs, what should we do instead? In an era where biotechnology can manipulate life, how far should we evolve?
There are no universally agreed answers to these questions. Precisely because of this, the most crucial skill for navigating the times ahead is the ability to continually engage with “questions without definitive answers.” And I believe that skill is sharpened by encountering HONMAMON cultivated over long ages and rooted as culture.

Our corporate motto is “Joy and Fun” This doesn't simply mean “let's have fun.” It means finding challenges yourself and becoming “absorbed” in solving them. It's a message that the process itself enriches life.
Science and technology will greatly influence humanity's future. Yet, it is each and every one of us who steers that course.

Let us not forget our humanity, continue to ask “Why?”,
and create the future with “Joy and Fun.”

Thank you.