

This is the world we envision  
as we stand at the chasm of potential,  
on the path to well-being  
for all humankind.

We relish the thousand failures  
that push us through the darkness  
in search of that elusive solution.  
The dream we share knows no boundaries.  
We advance together.

Our unfeared minds resist the stereotype,  
refute the pre-established,  
and embrace the unconventional.

for we see an alternate future.

An alternate  
future  
Out of reach,  
beyond belief,  
unimaginable,  
unknown.



Tokyo Tech

## Development of Tokyo Tech's Designated National University Corporation proposal

Kazuya Masu  
President  
National University Corporation,  
Tokyo Institute of Technology

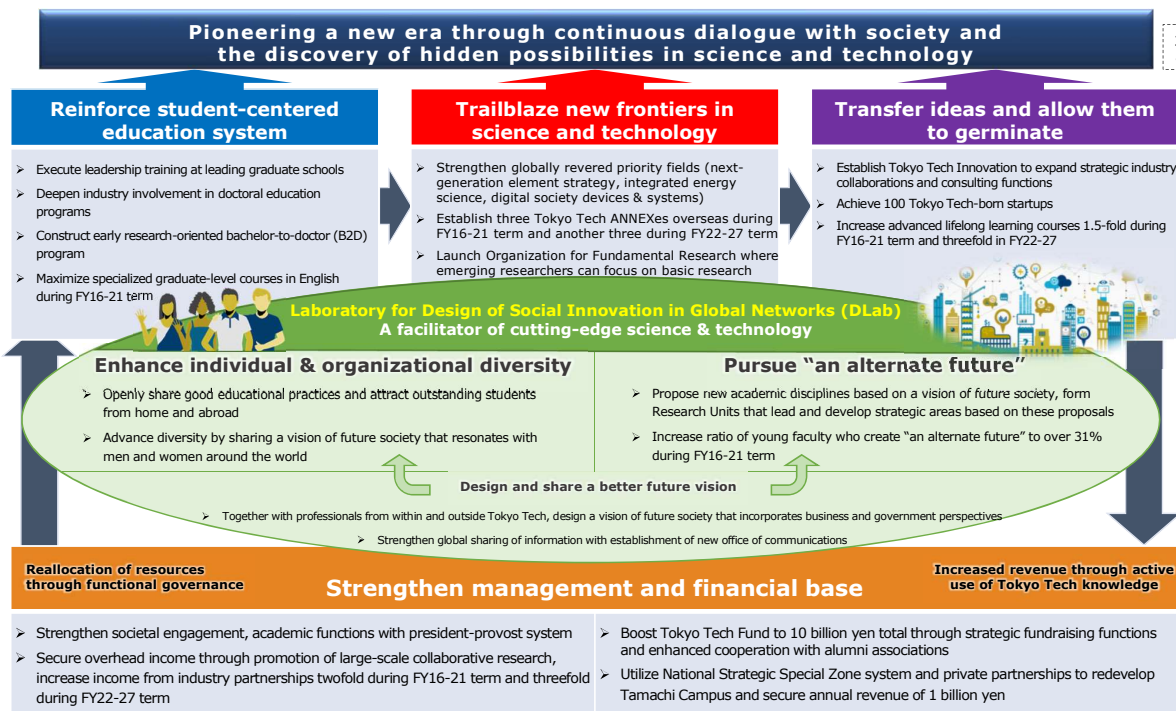
January 19, 2022  
National University Corporation Evaluation Committee,  
Designated National University Corporation Subcommittee Hearing

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### Outline of Designated National University Corporation proposal, Tokyo Institute of Technology (March 2018)



Tokyo Tech



3rd term: FY16-FY21  
4th term: FY22-FY27

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# Continuous virtuous cycle in motion:

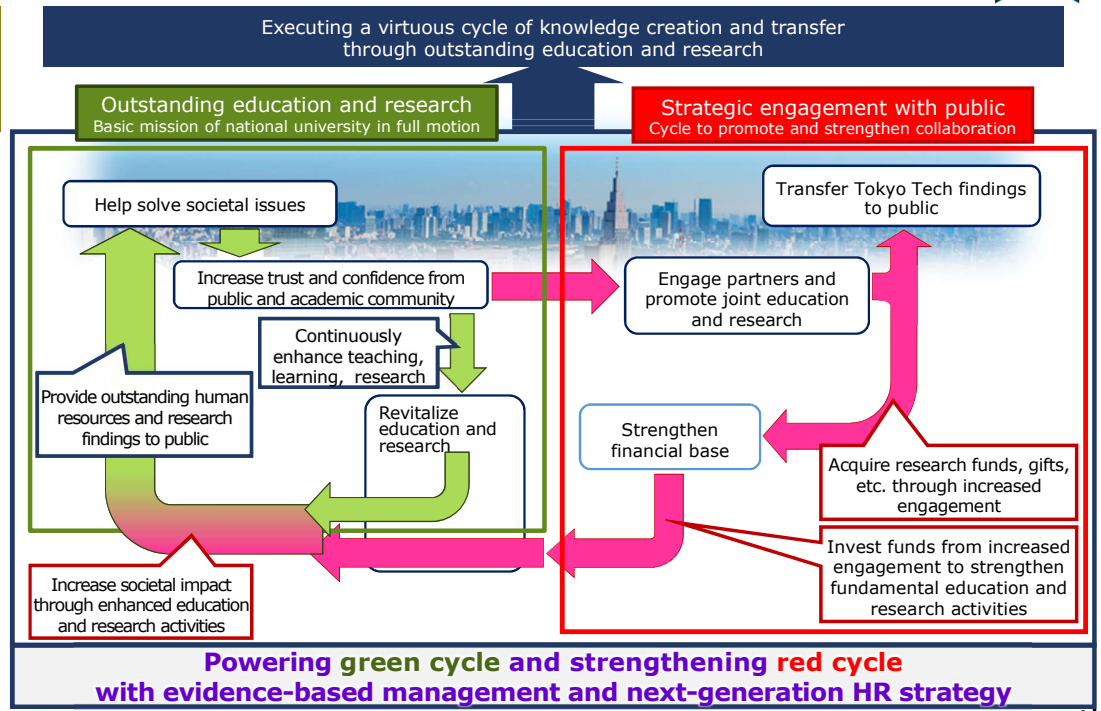
Developing together with society



## Vision for management reforms based on Tokyo Tech's DNU proposal

### Basic concept of virtuous cycle

- Increase engagement with public, acquire increased research funding, gifts, etc., and strengthen financial base.
- Use acquired funds to enhance education, invest in fundamental research, develop outstanding human resources, and generate research findings to create new value and contribute to a more prosperous future for all.



## 1. Progress of Designated National University Corporation proposal

# Tokyo Institute of Technology

(Organization of Schools, research institutions, number of students, faculty, staff)



- School of Science
- School of Engineering
- School of Materials and Chemical Technology
- School of Computing
- School of Life Science and Technology
- School of Environment and Society
- Institute for Liberal Arts
- Institute of Innovative Research

(As of May 1, 2021)

Students (full time)	Bachelor's	4,858
	of whom int'l	271 (5%)
Faculty	Master's & doctoral	5,634
	of whom int'l	1,473 (26%)
Admin and tech. staff	Full-time	1,105
	Fixed-term	494
Admin and tech. staff	Full-time	608
	Fixed-term	1,449

## ✓ University reforms of 2012-2017 to achieve global standards

- **Education reforms**
  - Three schools and six graduate schools reorganized into six new Schools in April 2016
  - Seamless transition between degree programs, quarter system, numbering etc.
  - Establishment of interdisciplinary graduate majors such as Energy Science and Engineering, Human Centered Science and Biomedical Engineering
  - Launch of a liberal arts education that nurtures students' visions from bachelor's to doctoral level
- **Research reforms**
  - Institute of Innovative Research was established in April 2016 to create a global hub of interdisciplinary research, four existing affiliated laboratories reorganized into one institute
  - The Institute's research system was enhanced and made more flexible through reallocation of Institute-wide resources (4 Research Laboratories, 5 Research Centers, 14 Research Units as of Dec. 2021)
- **Governance reforms**
  - Strengthened decision making powers of president (Strategic Management Council, Office of Institutional Research and Decision Support, International Advisory Board, etc.)
  - Appointment of deans and directors by president, and Institute-wide management of faculty positions
  - Gradual increase of space and budget at the discretion of the president

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# Reinforcing student-centered education system



- **Doctoral degrees through Tokyo Tech's outstanding graduate-level education programs**
  - Three academies established against the backdrop of Tokyo Tech's priority fields
  - Systematic collaboration with businesses, universities, research institutions, etc. at home and overseas to create a 5-year integrate doctoral program that develops doctoral graduates who can lead in all sectors
  - Enhanced learning and student support by utilizing funding, etc. from industry
- **Progress of B2D Scheme**
  - Students who aim to obtain doctoral degree selected in 2nd year of bachelor level, experience a tailored curriculum that allows seamless transition from one level to next
  - With the aim of develop outstanding, unique doctoral degree holders who can lead society, the scheme requires students to begin research in the 2nd year of their bachelor's degree, conduct exchanges with students from different fields in each semester, and study abroad at least twice before obtaining their doctoral degrees.
  - In the two years since FY20, 31 students have begun their B2D journeys
- **Providing graduate-level courses in English**
  - Tokyo Tech increased master's and doctoral degree courses available in English from 41.3% in FY16 to 93.9% in FY20.

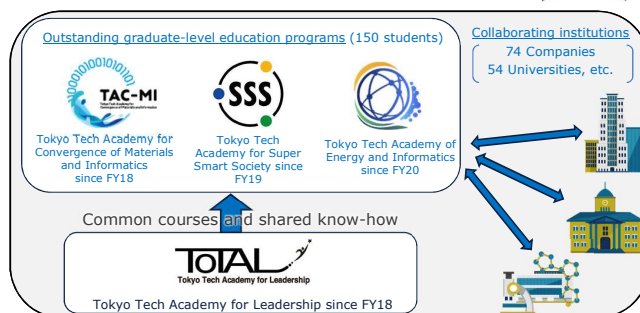


Fig. 1 Outstanding graduate-level education programs in collaboration with broader community

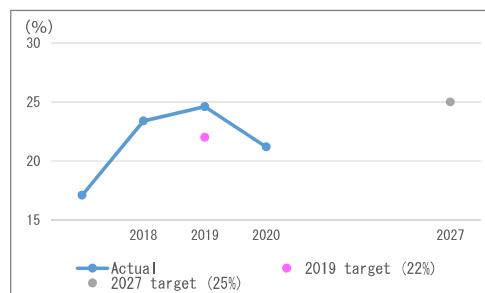


Fig. 2 Ratio of international students  
GA Tech: 26.0%, Imperial 52.2%

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# Trailblazing new frontiers in science and technology 1/3



- Forging an environment where emerging researchers can focus on fundamental research
  - Organization for Fundamental Research (OFR) established to support exchanges between emerging researchers and promote new, interdisciplinary research under guidance of outstanding senior researchers
  - OFR accepted 76 full-time assistant professors, fundamental research efforts over 90% at Specialized Academies, 77% at Comprehensive Academy
- Strengthening of priority fields and strategic areas
  - Advancement in the formation of hubs of excellence in Tokyo Tech's priority fields (Next-generation element strategy, Digital society devices and systems, Integrated energy science)  
Example: Reorganized prior research institutes to establish Laboratory for Zero-Carbon Energy
  - Promotion of strategic areas (CPS<sup>2</sup> (Cyber Physical & Social Systems), SSI (Sustainable Social Infrastructure), HLS (Holistic Life Science)) and enhanced startup support in these areas  
Examples: Established Nano Sensing Research Unit and Biomedical AI Unit with emerging researchers as PIs
- Creating innovative science and technology to generate impact and societal change  
(See next slide)

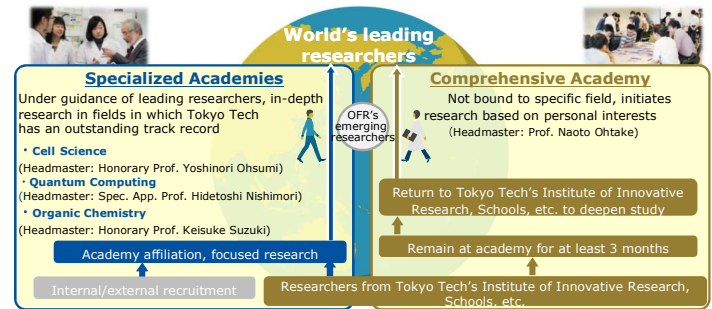


Fig. 3 Development of emerging researchers at Organization for Fundamental Research, launched in July 2018

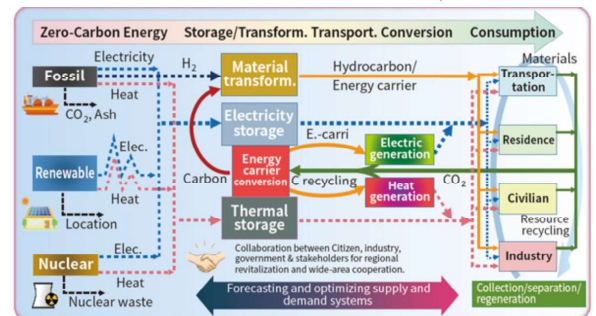


Fig. 4 Energy society envisioned by Laboratory for Zero-Carbon Energy, established in June 2021

# Trailblazing new frontiers in science and technology 2/3



## Earth-Life Science Institute



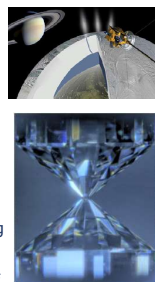
Director :  
Kei Hirose  
(Professor)

### Any other "bioplanets" in the universe?

Through understanding the chemical evolution of the atmosphere and ocean of the Earth and other planets and materials cycle, we elucidate the universality of how the environment that nurtures life is formed and evolved. Mechanisms for long-term maintenance of Pluto's ocean (Kamata et al., 2019 *Nature Geoscience*), elucidation of the water environment and climatic conditions of early Mars (Fukushi et al., 2019 *Nature Communications*), etc.

### Fate of Earth's water?

From the chemical composition of the Earth's core, the process of Earth formation was elucidated. Storing 50 times as much as seawater in a metallic core at the center of the earth (Tagawa et al., 2021 *Nature Communications*), the presence of large amounts of hydrogen and oxygen in the core (Hirose et al., 2021 *Nature Reviews*), etc.

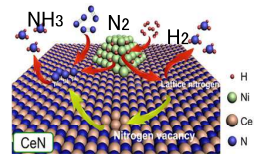


## Materials Research Center for Element Strategy



Director :  
Hideo Hosono  
(Institute Professor)

Ammonia is a key chemical to realize carbon-free society. Its industrial synthesis has been performed by Haber-Bosch process (established in 1913) which needs high pressure-high temperature and emit larger amount of CO<sub>2</sub> to obtain H<sub>2</sub> from natural gas. This research aims at creation of novel catalysts which make possible to synthesize ammonia at mild condition using hydrogen produced by renewable energy. Ruthenium has been used as the catalyst for such ammonia synthesis, but we aim to replace Ru with a non-rare metal without degrading the catalytic activity. A startup company "Tsubame BHB" was established in 2017 to industrialize the novel catalyst and relevant process developed by us and the pilot plant has been operating over 2 years.



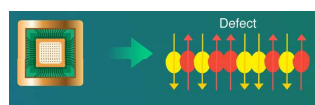
Caption: Ru-free catalyst for green ammonia synthesis. A novel concept for activation of N<sub>2</sub> utilizing surface N-vacancy on the nitride in stead of Ru metal loaded is a key to success (Nature 2020)

## Quantum Computing Unit



Research Unit Leader :  
Hidetoshi Nishimori  
(Specially Appointed Professor)

Properties of qubits, the basic elements of quantum computers, have been studied. We have clarified how noise affects the performance of qubits, establishing the path to follow for better quantum computers.



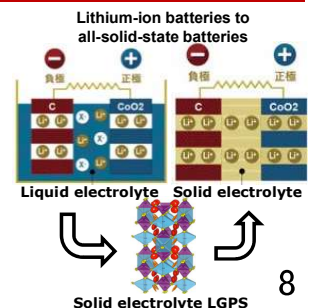
Estimated the effects of noise by measuring the number of defects in the output.

## Research Center for All-Solid-State Battery



Director :  
Ryoji Kanno  
(Institute Professor)

New batteries with superior performance to lithium-ion batteries are expected to be developed as the paradigm shift towards electric vehicles progresses. The solid electrolyte developed at the Center paved the way for all-solid-state batteries, which are safe, have high energy density and operate over a wide temperature range. The Center is leading the R&D of all-solid-state batteries in the world.



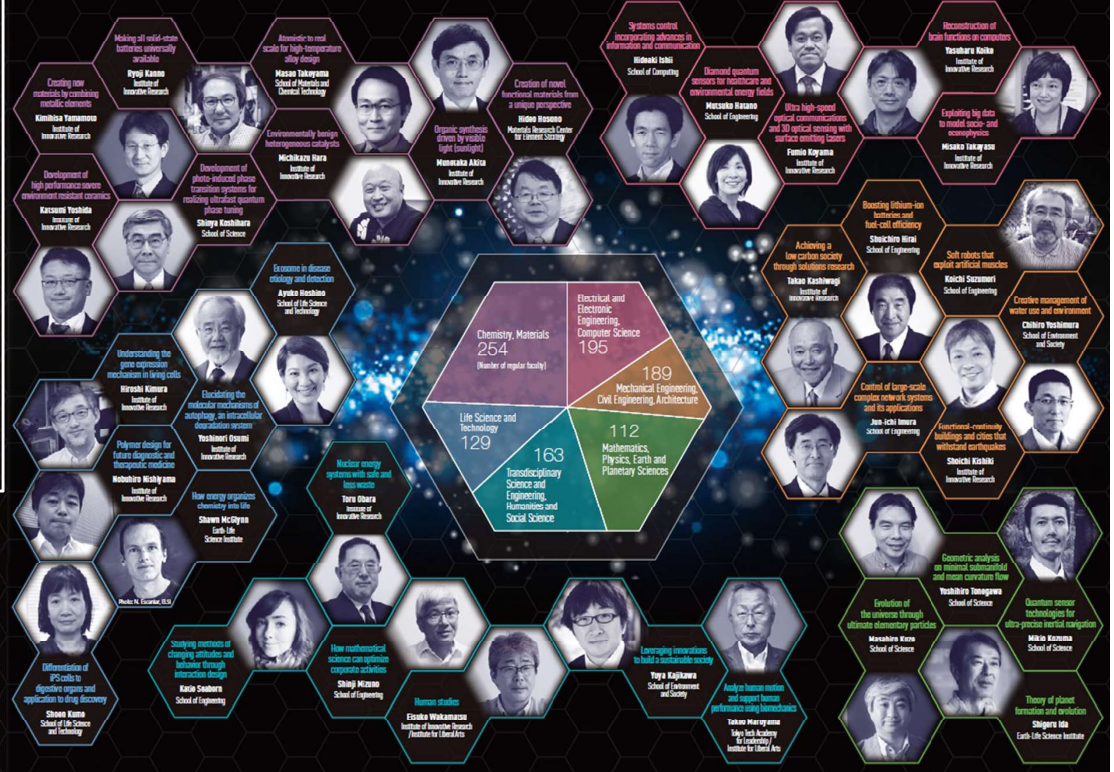


# TOKYO TECH RESEARCH MAP 2021-2022

- Based on an Institute-wide survey of all researchers, the Tokyo Tech Research Map features 35 researchers from over 1,000 faculty members.

- The map is updated every other year. The 2021-2022 map is the third version.

- List of up-and-coming Tokyo Tech researchers available at [https://www.ori.titech.ac.jp/en/assets/img/about/analysis/TTR2021-22\\_EN\\_0312\\_ERP.pdf](https://www.ori.titech.ac.jp/en/assets/img/about/analysis/TTR2021-22_EN_0312_ERP.pdf)



## Trailblazing new frontiers in science and technology 3/3

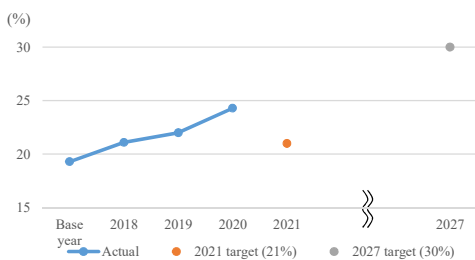


Fig. 5 Ratio of international faculty  
GA Tech: 30.7%, Imperial: 37.4%

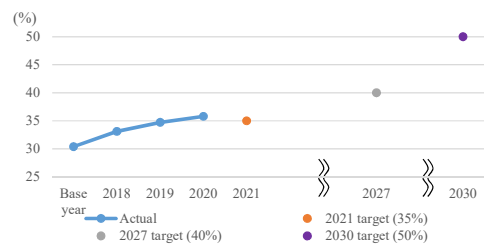


Fig. 6 Ratio of internationally coauthored papers  
GA Tech: 35.1%, Imperial: 57.4%

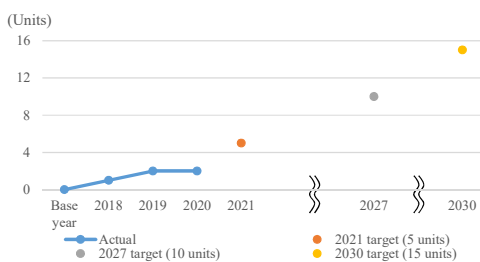


Fig. 7 Number of independent Research Units  
UC Berkeley: 41 units (25.3 per 1,000 faculty members)

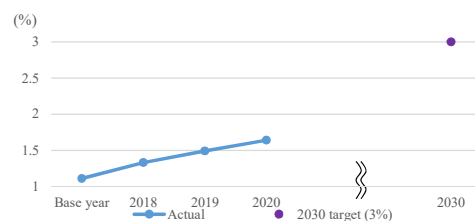


Fig. 8 Ratio of papers in top 1% cited  
GA Tech: 2.82%, Imperial: 3.30%

# Transferring ideas and allowing them to germinate



- **Advancement of strategic collaborations with industry and expansion of consulting functions**
  - Open Innovation Platform established to plan and execute joint, large-scale research between organizations
  - Establishment of nine Collaborative Research Clusters where certain functions of corporate research laboratories are located on campus, allowing corporate partners to plan new research topics and conduct joint research with Tokyo Tech researchers in multiple areas
  - Tokyo Tech Innovation Co., Ltd. (TTI) established as subsidiary of Tokyo Tech, initiating consulting and training services offered to the public
- **Progress in initiative to achieve 100 Tokyo Tech-born startups**
  - Improved startup support for students and faculty, entrepreneurship support programs, and enhanced support for Tokyo Tech-born startups through leased office space and other measures
  - Number of Tokyo Tech-born startups increased from 61 in FY14 to 83 in FY20 (excl. dissolved companies, etc. and companies no longer utilizing the designation)
- **Increased number of lectures for lifelong learning programs**
  - Lectures offered through non-degree programs by the Tokyo Tech Professional Academy and TTI increased from 18 in FY16 to 25 in FY21.

Collaborative Research Clusters and launch dates

Cluster Name	Launch Date
Komatsu Collaborative Research Cluster for Innovative Technologies	Apr 2019
aiwell AI Proteomics Collaborative Research Cluster	Apr 2019
AGC Material Collaborative Research Cluster	July 2019
DENSO Mobility Collaborative Research Cluster	Apr 2020
Idemitsu Kosan Collaborative Research Cluster for Advanced Materials	Apr 2020
TEPCO Collaborative Research Cluster for Decontamination and Decommissioning (D&D) Frontier Technology Creation	Apr 2020
LG Material & Life solution Collaborative Research Cluster	Apr 2021
ULVAC Advanced Technology Collaborative Research Cluster	Sept 2021
Multimodal Cell Analysis Collaborative Research Cluster	Oct 2021

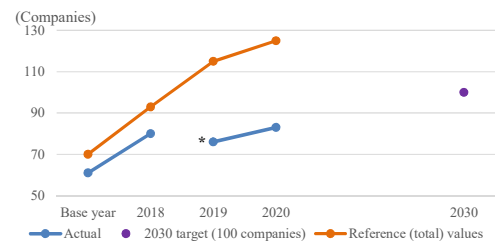


Fig. 9 Number of Tokyo Tech-born startups (excl. dissolved companies, etc.) UC system: 843 companies

\*Change in numbers due to amendment of regulations regarding Tokyo Tech Venture designation of startup companies that utilize Tokyo Tech research findings, etc.

# Strengthening management and financial base



- **Introduction of President-Provost system**
  - System established in April 2020, allowing president to lead strategic public collaboration activities while provost manages effective use of campus resources
- **Increased income from collaborations with industry**
  - Through increased large-scale, organizational-level joint research with industry, etc., income from collaborations with industry increased from JPY1.69 billion in FY14 to JPY3.04 billion in FY20
  - Introduction of strategic industry collaboration costs for certain large-scale partnerships, etc. allowed the Institute to raise indirect expenses equivalent to over 40% of direct expenses
- **Strengthened Tokyo Institute of Technology Fund**
  - Developed broader donation options with help of fundraisers, conducted fundraising activities in cooperation with Tokyo Tech Alumni Association
- **Additional income secured through Tamachi Campus\* redevelopment**
  - After agreements were signed with selected business partners in Feb. 2021, Tokyo Tech secured additional annual income of JPY4.5 billion from land lease fees, etc., beginning in 2026 and lasting 75 years

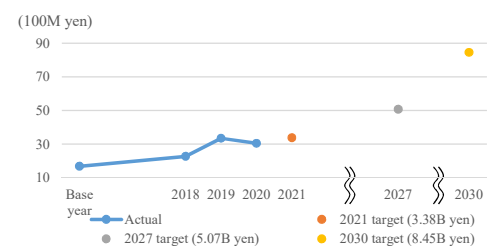


Fig. 10. Income from collaborations with industry GA Tech: Approx. JPY9.8 billion



Fig. 11 Agreement signed with planned contractors regarding Tamachi Campus Redevelopment Project

\*Tamachi Campus is in outstanding geographical location with convenient local and international transportation links nearby (10 min. to Tokyo Station and 30 min. to Haneda Airport).

# Continuous virtuous cycle in motion:

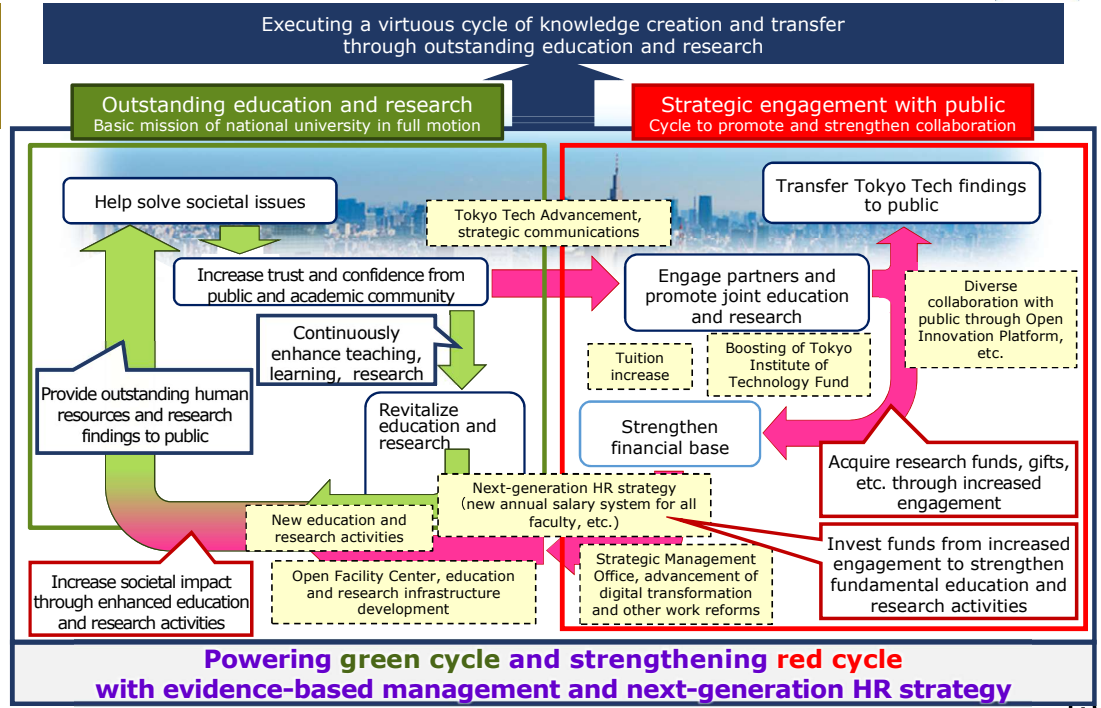
Developing together with society



**Vision for management reforms based on Tokyo Tech's DNU proposal**

## Basic concept of virtuous cycle

- Increase engagement with public, acquire increased research funding, gifts, etc., and strengthen financial base.
- Use acquired funds to enhance education, invest in fundamental research, develop outstanding human resources, and generate research findings to create new value and contribute to a more prosperous future for all.



## 2. Enhancing the international presence of Tokyo Tech as a Designated National University Corporation



# Creating a better future together with the public



## ● Establishment of Laboratory for Design of Social Innovation in Global Networks (DLab)

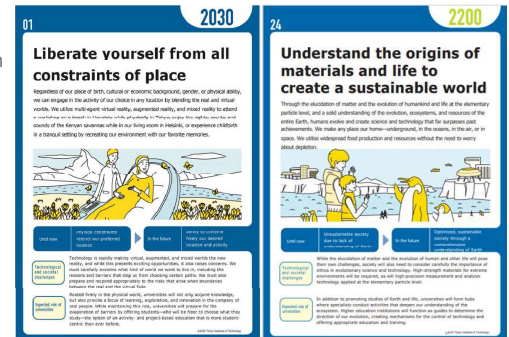
- DLab unites Tokyo Tech faculty, staff, students, and alumni with members of the public to design a better, more desirable future together
- Discussions involve a diverse members of the public who identify the science and technology, social systems, changes in values, and other elements require to realize this future
- The DLab Challenge Research Grant provides support for research that leads to the realization the Future Scenarios created at DLab, and the creation of new academic disciplines required the process



Tokyo Tech Future Chronology launched in Jan. 2020



Presenting Future Scenario at Feb. 2021 KAIST SUMMIT



Future Scenarios—No. 1 and No. 24

## DLab Challenge Research Grant 2021 topics

Future life in the fusion of update-speed gap between communication technology and architecture
Establishing a method for building future narratives to increase stakeholders' commitment to future scenarios by connecting human and information technology
Construction of a network of researchers for interdisciplinary collaborative research based on the enhancement of serendipity
Tomorrow's studio: Smart creation using mixed reality for enhancing real-time interaction in design education

The Board notes that this program, with its unique appeal in Japan and abroad, could be featured with prominence in Tokyo Tech's augmented fundraising campaign.

(comments from international advisory board 2019)

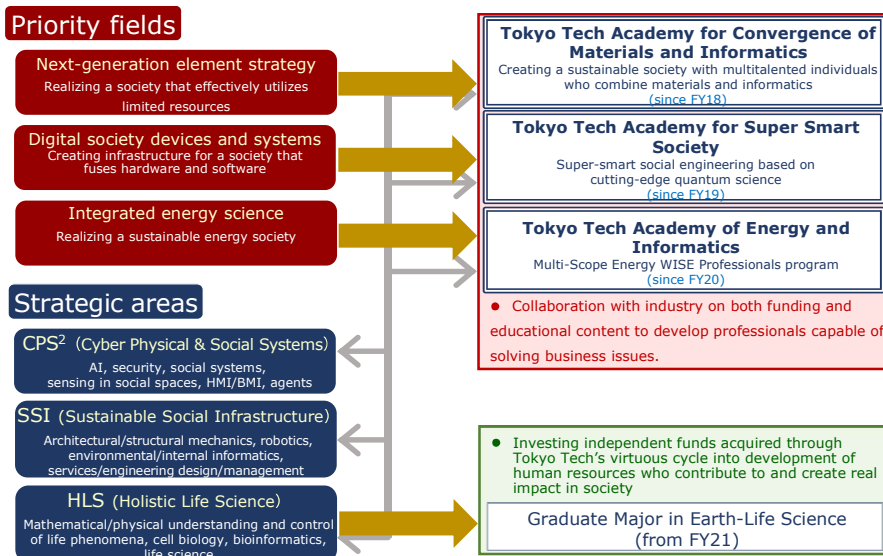
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# Cultivating knowledge and talent together with the public



## ● Collaboration with other institutions based on Tokyo Tech's priority fields and strategic areas

- After analysis of its history, achievements, faculty distribution, etc., Tokyo Tech pinpointed three priority fields and strategic areas in research and education, and appointed a director to discuss and plan research strategies from an Institute-wide perspective.
- Focus on and visualization of the Institute's strengths and vision has facilitated increased collaborations with both industry and overseas institutions



## «Collaborating institutions»

E.g. Multi-Scope Energy WISE Professionals program

Massachusetts Institute of Technology, Princeton University, Georgia Institute of Technology, University of California, Santa Barbara, Judge Business School, University of Cambridge, Imperial College London, Institut National des Sciences Appliquées de Lyon, RWTH Aachen, University of Stuttgart, Uppsala University, Swiss Federal Institute of Technology in Lausanne, University of New South Wales, Nanyang Technological University, Tsinghua University, Korea Advanced Institute of Science and Technology, National Science and Technology Development Agency, Thailand, CEA-Liten

We also praise Tokyo Tech's creation of new strategic research areas within the centralized concept of its World Research Hub Initiative, and the attention given to the Institute's Vision for Society through carefully crafted programs in Cyber Physical and Social Systems, Sustainable Social Infrastructure, and Holistic Life Science, all very compelling.

(comments from international advisory board 2019)

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# Sharing knowledge and talent through hubs across the globe



## ● Tokyo Tech ANNEXes

- ANNEXes introduce Tokyo Tech's leading science and technology to researchers at local research institutions and companies, promote joint research, acquisition of international funding, and co-supervised doctoral programs.



## ● WRHI - Tokyo Tech World Research Hub Initiative -

- Building on strong WPI\* achievements, invites and hires world-class researchers to Tokyo Tech, promotes interdisciplinary exchanges between leading researchers who advance international joint research

Year	Employed	Visiting
2016	23	29
2017	30	20
2018	58	9
2019	72	6
2020	80	4
Total	263	68

\*WPI: World Premier International Research Center Initiative

«Main home institutions of invited faculty»  
Harvard University, Massachusetts Institute of Technology, University of Cambridge, University of Oxford, ETH Zurich, Max Planck Institute, Technische Universität Berlin, Indian Institute of Technology

## ▶ The International Research Frontiers Initiative

will be established during the 4<sup>th</sup> mid-term goals and plans.

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## 3. Future plans and prospects for 4th mid-term goals and plans period

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# Essence of 4th mid-term goals and plans

within framework of DNU proposal



**Pioneering a new era through continuous dialogue with society and the discovery of hidden possibilities in science and technology**

## Reinforce student-centered education system

- Establishment of a broader study path for bachelor's program students that allows them to expand to fields such as the humanities and social sciences in addition to science and engineering
- Expansion of the B2D scheme, treatment of doctoral students as both educators and researchers, establishment of new system for working adults who want to pursue a doctorate
- Expansion of advanced data science/AI studies from graduate level to all levels of study
- Increase percentage of students with international experience to 90% or more by the time they complete their master's degree

## Trailblaze new frontiers in science and technology

- With newly established International Research Frontier Initiative at forefront, unite researchers from inside and outside Tokyo Tech to promote unexplored, highly innovative research
- Advance world-leading research based on research and personnel strategies, actively and openly share significance of this research with public
- Through co-creation involving the humanities, social sciences, and science and technology, embrace the challenge of resolving new issues identified through dialogue with the public and a shared image of a better society

## Transfer ideas and allow them to germinate

- Provide continuous, sustainable support for entrepreneurship education, startup support, growth support (increase total number of research-based Tokyo Tech-born startups to approx. 110 companies)
- Promote further industry-academia collaboration and transfer Tokyo Tech ideas to society (increase income from collaboration with industry to JPY3.6 billion per year)
- Enhance advanced lifelong learning and outreach activities (increase study programs for working adults to over 50)

**Connecting people via the Laboratory for Design of Social Innovation in Global Networks (DLab), promoting and facilitating activities that help realize a more desirable, prosperous future**

**Strategic allocation of resources and utilization of assets to maximize potential of Tokyo Tech's accumulated human resources and knowledge**

## Strengthen management and financial base

- Advanced governance system that utilizes expertise of specialized personnel, etc.
- Strengthened communications to gain further trust, confidence from society
- Advanced shared facilities and technical support based on a solid research infrastructure strategy
- Promoting and realizing the concept of a Campus Innovation Ecosystem
- At least 20% increased income from collaboration with industry, gifts, asset loans
- Advanced, secure ICT utilization based on basic strategy for DX promotion

Attracting diverse talent from around the world



Gaining trust, support, and investment from society



# A driving force behind future creation

-Tamachi Campus Redevelopment Project-



- With the Tamachi Campus Redevelopment Project as a backdrop, creating a better future through long-term investments in people as the source of knowledge and an ecosystem of innovation.

Tokyo Tech	Fixed-term land leasehold on Tamachi Campus site
Business partners	NTT Urban Development Corporation, Kajima Corporation, East Japan Railway Company, Tokyu Land Corporation lease the land, develop the complex, which includes Tokyo Tech facilities, in an integrated manner, manage and operate certain facilities during the lease period.
Scale	Total floor space approx. 250,000m <sup>2</sup>
Land lease fees	New Tokyo Tech facilities (in accord and satisfaction) + JPY5 billion in 2030 + JPY4.5billion / year
Period	75 years from 2026 onwards



Conception of surroundings upon completion of Tamachi Campus Redevelopment Project

Images courtesy of NTT Urban Development Corporation, Kajima Corporation, East Japan Railway Company, and Tokyu Land Corporation

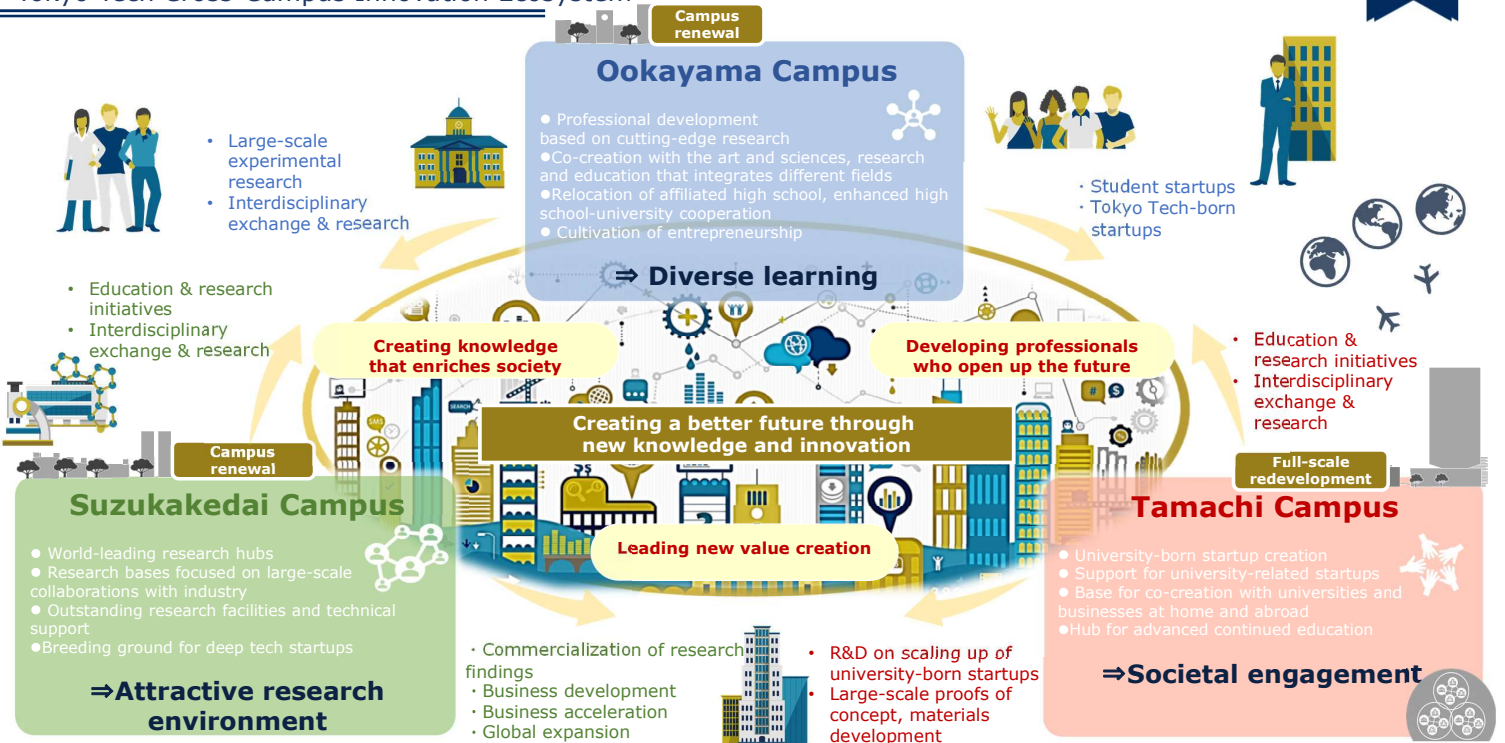
Assuming annual investment profit of over 2%, corresponds to a JPY200 billion fund

Other universities	
Keio University	JPY78.3B
University of Tokyo	JPY14.9B
Harvard Univ.	JPY4.2T
UC Berkeley	JPY490B

3rd mid-term period	4th mid-term goals and plans period						5th mid-term period	6th mid-term period	7th mid-term period	8th mid-term period	9th mid-term period	10th mid-term period	11th mid-term period	
2020	2021	2022	2023	2024	2025	2026	2027	(2028-2033)	(2034-2039)	(2040-2045)	(2046-2051)	(2052-2057)	(2058-2063)	(2064-2100)

# Creating a better future through new knowledge and innovation

-Tokyo Tech Cross-Campus Innovation Ecosystem-



This is the world we envision as we stand at the chasm of potential, on the path to well-being for all humankind.

We relish the thousand failures that push us through the darkness in search of that elusive solution. The dream we share knows no boundaries. We advance together.

Our unfearing minds resist the stereotype, refute the pre-established, and embrace the unconventional.

for we see an alternate future.

# Tokyo Tech

An alternate future

Out of reach, beyond belief, unimaginable, unknown.