

Hokkaido University

# Semiconductor VISION

Breathing Life into  
Semiconductors  
to Shape the Future



**IFERS**  
Institute for Frontier Education  
and Research on Semiconductors

Health & Wellness



Entertainment



We envision not merely a digital society powered by advanced electronic technologies that improve efficiency, but a well-being society in which semiconductors imbued with the warmth of human life and the scents of earth and water play an active role.

Hokkaido has emerged as a focal point of interest amid the increasingly turbulent global climate, with semiconductors serving as the driving force behind unlocking greater potential in the region.

How will Hokkaido University's commitment to semiconductor initiatives encourage engagement with society and shape the future? The Hokkaido University Semiconductor Vision sets out our ideas and plans from the perspectives of research, human resource development, and social collaboration.

Peace



Mobility



Realizing a well-being society where semiconductors with a human touch play an active role

Communication



Agriculture & Fishery



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Light to the North,

Light from the North,

Light to the World.



## Message from the President

Semiconductors are found in smartphones, cars, home appliances, medical devices, and just about anything powered by electricity. They are the ever-important tech crew working behind the scenes of our lives to ensure that everything runs smoothly. Today, however, they have become a strategic resource that could determine our nation's fate.

Even AI cannot fully take the wheel without semiconductors. They are its keys to ignition. Currently, governments and companies across the globe are competing to secure the most advanced technologies. The result has been advancements in research and development at breakneck speed.

As AI continues to develop, in many industries, it will increasingly do the work once performed by humans, and mobility and telecommunications will achieve ever-faster speeds. Semiconductors are no doubt a vital resource for making our daily lives more convenient and for increasing industrial productivity. This being the case, they are at the core of developments in digital technology.

Here at Hokkaido University, located on Japan's northern frontier, we are committed to conducting research at the highest global standards and producing future leaders. We believe it is our responsibility to equip our students and send them out into the world as the next generation of talent. Together with Rapidus, we are striving to play a central role in the emerging semiconductor ecosystem of Hokkaido, and to support its endeavors to manufacture a new generation of semiconductor chips.

Cutting-edge semiconductor technology presents us with the opportunity to meaningfully change the world. However, we should not pursue change by

prioritizing efficiency and productivity at the expense of harmony with nature and a truly fulfilling way of life. The changes we introduce must keep humans at the center and help realize a sustainable, well-being society for all. With this in mind, we will help "create" cutting-edge semiconductors through education and research, "activate" them by developing use-cases, and "integrate" them through industry-academia collaboration and social engagement.

As a comprehensive university spanning diverse academic fields in both education and research, Hokkaido University must also respond to the ethical and social questions posed by semiconductors. By harnessing the power of semiconductor technology, we are striving to realize the sustainable well-being society envisioned in our HU VISION 2030.

With Rapidus coming to Hokkaido, we will work together to advance cutting-edge semiconductor research, cultivate the next generation of talent, and, through advanced semiconductor technology, help change the world. Or, to put it simply: "Light to the North, Light from the North, Light to the World." This is the Hokkaido University Semiconductor Vision that will guide us on that journey.

20th President of Hokkaido University

HOUKIN Kiyohiro

Born in Sapporo in 1954. Doctor of Medicine. Dr. Houkin graduated from the Hokkaido University School of Medicine in 1979, and has worked as a neurosurgeon at Hokkaido University Hospital and private hospitals. He was appointed the Director of Hokkaido University Hospital in 2013, and has served as President since October 2020.

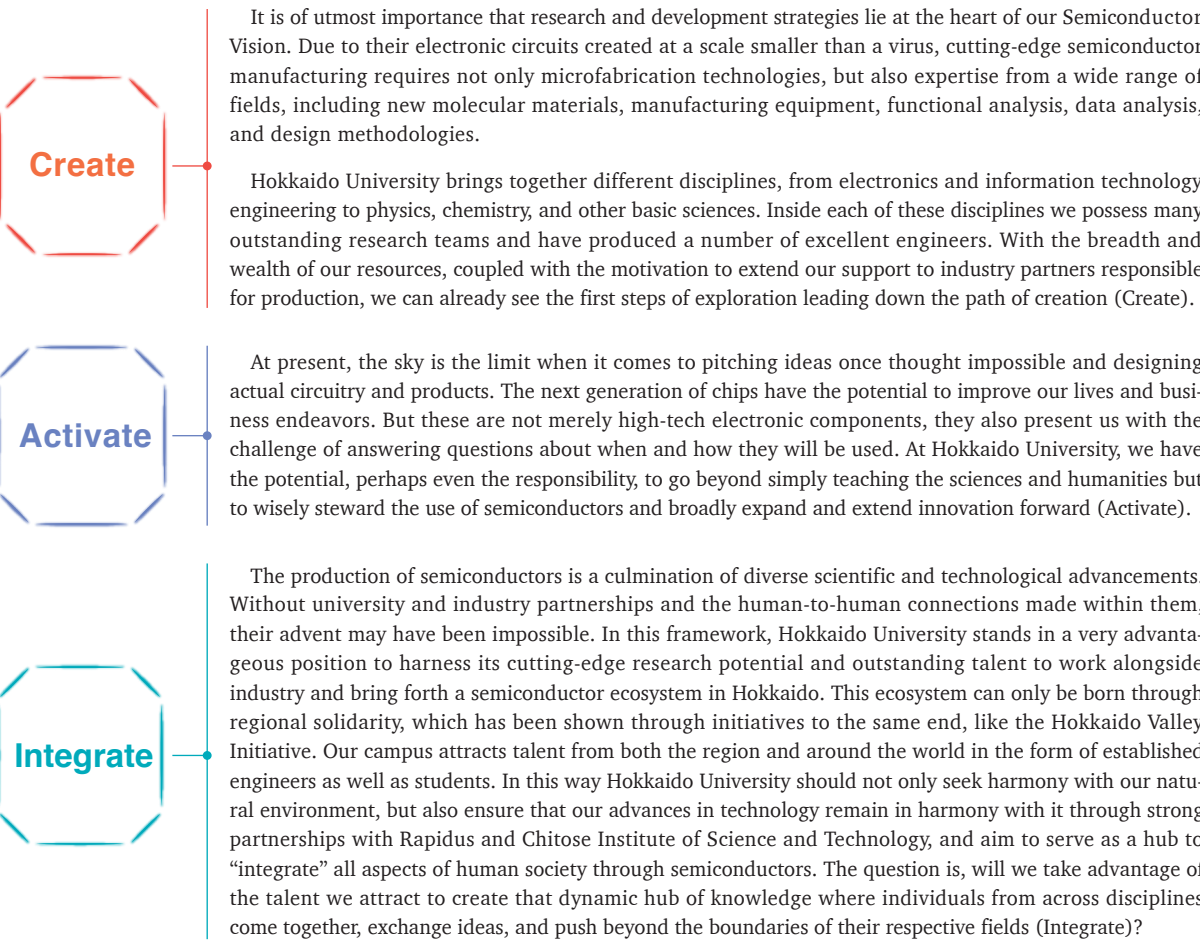
# Hokkaido University Semiconductor Vision: A General Overview

Toward the “Excellence and Extension” in the semiconductor field  
— the Second Ambitious Challenge

## Three Strategic Pathways: Create, Activate, Integrate

There are three paths that we must firmly establish to realize a well-being society, supported by the power of electronic technology. These three paths are: “creating” high-performance semiconductors (Create); using them

to introduce new ideas to society (Activate); and “integrating” the discoveries from education and research into communities, industry, and the natural environment (Integrate).



## Becoming a Novel Japan University

When we intertwine the 3 paths of “Create”, “Activate”, and “Integrate” into a single approach, something comparable to a chemical reaction takes place, and Hokkaido University begins to actively evolve.

First, we learn from the challenges presented to us by society and the surrounding region. Then, by cultivating personnel who harness creative potential and take plans from the drawing board into reality, society benefits from the resulting inventions and discoveries. Finally, the results of that process not only bring change to Hokkaido, but industries and people’s daily lives. In this way, semiconductors present us with the potential to create a dynamic cycle.

This is where the axes of “Excellence”, referring to the excellence in education and research, and “Extension”, referring to extending the results of the research conducted at the university back into society, come into play. This framework presents us with the opportunity to raise our academic standards to levels unrivaled by anywhere else in the world and to share the results with industries. One way to take hold of this opportunity is to foster start-ups that can give back to the community.

There are also major societal issues that may be hidden from view. To uncover these issues, it is important that we carefully search every corner where needs may be hidden as they relate to semiconductors. This could include everything from our daily routines to industrial activities at large.

In this way it is important that we ask ourselves what kind of environments need these semiconductor innovations to aid in ushering in a well-being society. Surely it is not simply limited to manufacturing but also includes food-related systems (agriculture and fishery), transportation methods (mobility), person-to-person connection (communication), well-being (health and wellness), media (entertainment), political and economic security (peace) and many more aspects of daily life. Perhaps, it is returning to these fundamentals that will unlock the future well-being society we are building towards.

At the very heart of this dynamic cycle lies the ‘Novel Japan University’—the new model of Japanese higher education that Hokkaido University is striving to achieve. By incorporating all these initiatives and endeavors, we can guide Hokkaido University to unlock even greater potential.

## A Foundational Identity

The intertwining “Create”, “Activate”, and “Integrate” paths already stand on the firm foundation of our identity as a university that has been cultivated through our 150-year history. We can first see the makings of this identity as embodied by the first vice president of Hokkaido University, Dr. William S. Clark, when he brought from his home of Massachusetts his expertise in cold climate agriculture to help revolutionize Hokkaido’s agricultural industry. We can think of this as the embodiment of the First Ambitious Challenge taken on by Hokkaido University. In the same way, this next generation of semiconductors and the artificial intelligence (AI) that directly benefits from them are no doubt just the beginning of a new wave of technological innovation that will affect agriculture and other fundamental industries for generations to come. With this firmly laid out, I believe we can call this new endeavor Hokkaido University’s Second Ambitious Challenge.

Our university also benefits from a liberal arts approach to academics that actively supports a fusion of differing ideas across contexts. We house a total of 12 undergraduate schools (faculties) across both the arts and humanities, and sciences. We also house specialized research centers such as the Center for Human Nature, Artificial Intelligence, and Neuroscience; the Center for Ainu and Indigenous Studies; and the Slavic-Eurasian Research Center among others. Our school benefits from a wide variety, 21 to be exact, of research institutes and faculties that make collaboration between specializations possible. Together with the creative capacity born of unparalleled diversity, we can contribute practical developments to the semiconductor sector.

Hokkaido University is deeply rooted in its local community and strives to take its research and contributions beyond the classroom. It’s clear from the array of research fields encompassed here that we have a cornucopia of use-case scenarios

just waiting to be explored in the semiconductor field. Perhaps we will find what we are looking for in our research forest that covers 0.2% of Japan's land area and provides researchers access to flora and fauna off campus, in addition to the on-campus agricultural areas. Or on one of our research ships that allows students to take to the high seas in a real-world setting to discover the secrets of the ocean. Or maybe with our Arctic Circle research team that investigates the effects of global warming right at the sites where glacial melting occurs. Here at Hokkaido University, we believe that semiconductors have the power to connect the natural world and humanity. What yet-undiscovered uses for semiconductors could help us identify and solve social issues?

We are a university with a strong international reputation that attracts passionate talent from around the world. Rapidus is a company at the heart of the supply chain attracting engineers on the front lines of semiconductor production from around the world. The comprehensive partnership between these two powerhouses can attract talent to Hokkaido University in the form of researchers and students not only with the ambition to succeed, but also with a shared vision to work toward.

## Breathing Life into Semiconductors

There is no doubt that, building upon our proud history and accomplishments, Hokkaido University will breathe life into the next generation of semiconductor technology. We will not settle for purely technical advances in electronics or the digital world. But with the scents of earth and water, the most fundamental of building blocks, we will continue to strive to usher in a well-being society where the warmth of human life and flourishing is made possible through semiconductors.

While the world appears to be swept up in a chaotic storm, Hokkaido has become a stand-out region in the Japanese archipelago and will continue to expand its influence as it becomes a driving force in the semiconductor industry.

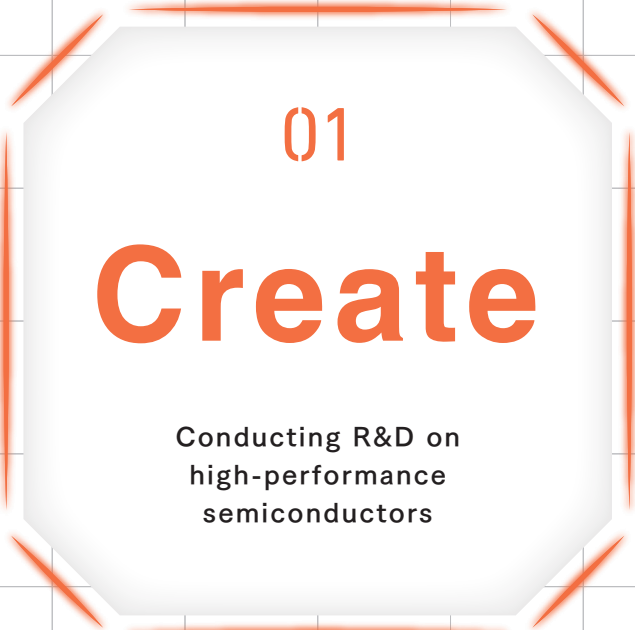
With our semiconductor endeavors underway, it is exciting to consider how Hokkaido University will continue connecting with the community. What kind of future will we usher in? It is through the perspectives of research, personnel development, and societal collaboration that we will map out our ideas and the pathway forward. That is our Hokkaido University Semiconductor Vision.

### Hokkaido University Semiconductor Vision

Realizing a well-being society where semiconductors with a human touch play an active role —Breathing Life into Semiconductors to Shape the Future—



|        |          |           |
|--------|----------|-----------|
| Create | Activate | Integrate |
|--------|----------|-----------|



## Fostering Reliable Talent and Advanced Technologies

### Background

Semiconductors are used in virtually all electronics produced today, and in that sense serve as a kind of support infrastructure in our society. However, even within the field of technological production, creating semiconductors involves a high level of precision and a deep understanding of the entire production process. This includes understanding the raw materials involved, the steps of production, the equipment used, and the ability to exercise control over the more precise details of each step.

Given the widespread use of semiconductors in society, it is also in our best interest to continue production in a manner that is both environmentally friendly and sustainable.

### IFERS MISSION

Academic specializations at Hokkaido University encompass a wide variety of research areas, such as Electronics, Informatics, Engineering, Physics, and Chemical Sciences, which can be harnessed cross-disciplinarily to tackle the many challenges that the design and manufacture of cutting-edge semiconductors present.



### Education

At Hokkaido University, we recognize the importance of training personnel who understand the different domains involved in semiconductor production. Whether it's raw materials, the steps of production, manufacturing equipment, or data on semiconductors themselves, it is our goal to train personnel who are equipped to tackle the intricacies involved in semiconductor production and design.

By studying semiconductor production in a real-world setting, our students can get a hands-on feel for the many real-world problems faced in their production. Then, and perhaps most importantly, they can apply that knowledge to search for solutions to those problems. On this basis, we have high hopes that our graduates will go on to create cutting-edge semiconductors that can live up to their full technological potential.

We provide an ideal environment for students to excel in their studies, including a Semiconductor Prototyping Lab. When combined with instruction from teachers with hands-on industry experience, and the practical application of AI and data science, we are blazing a trail into the uncharted territory of semiconductor education where students can learn and experience the entire semiconductor manufacturing process.



### Research

A semiconductor system built to benefit society must find its foundations in high quality research. To accelerate research in the semiconductor industry, the following hierarchy must be acknowledged.

- Raw Materials
- Devices
- Processes
- Architecture

When we carry out research in cooperation with this hierarchy, we can create a new comprehensive system that reduces energy consumption and provides higher speeds along with enhanced functionality across the board.

Hokkaido University can take advantage of its strength in creating a raw materials ecosystem and open the gates to an ever-expanding network that directly affects the other building blocks of the semiconductor manufacturing process.

While taking the surrounding environment into account and building with stability in mind, we can bring our society closer to one of high-speed connection and low energy consumption with minimal adverse environmental effects. From this vantage point an eco-friendly, well-being society truly turns into a reality we can aspire towards.

At the same time, we are supporting a large-scale semiconductor production system, which includes the production of chiplets, to further research and development. Through this we hope to realize a future with the technological foundations to support a well-being society and the people who call it home.



### Community Engagement

The cycle of design and implementation has the potential to create high-value, cutting-edge technologies.

Hokkaido University leverages its advanced facilities and knowledge to enable co-creation in research and development. In this way, we will enable our graduates to understand and guide the entire semiconductor manufacturing process, from the prototyping stages to the finished product. Through collaboration with local government and industry partners, we seek to create a shared environment where researchers can collaborate and accelerate the creation of technological value and its deployment in society.

Create   **Activate**   Integrate

02

Activate

Developing new applications  
using innovative ideas

## Pioneering Use-Cases to Enrich Society

### Background

By recognizing where and how semiconductors could be used, we can bring to light the undiscovered potential they present to society, individuals, and the planet and, in doing so, create a flourishing society driven by technological progress and guided by the warmth of human creativity, empathy, and responsibility.

### IFERS MISSION

Through uncovering the latent needs emerging from society and daily life, Hokkaido University can use its research resources along with its strength in the fields of AI and data science to test and verify new uses for semiconductors, which will ultimately lead us to solutions to the problems facing our world today.



Education

As we strive to realize a well-being society, it is paramount that we use the technological power presented to us wisely and have the capacity to imagine and create use-case scenarios. Meanwhile, learning the proper way to create semiconductors is important, but it is equally vital that we determine how to use them ethically. Semiconductors present us with that opportunity along with a way to revolutionize society. Through linking innovative ideas with semiconductor production, we can solve the current problems facing our society and lead it into a brighter future.

At Hokkaido University we seek to develop talent who can conceptualize and put the knowledge and skills they have gained to good use overcoming the problems facing society. By providing an environment that allows students to collaborate across the humanities and sciences, interact with people from different cultures, and develop an appreciation for nature, we foster empathy and knowledge across a wide range of fields, enabling students to contribute to a prosperous society both economically and culturally.

Furthermore, in taking advantage of the breadth of disciplines we offer in a way only a comprehensive university can, and coupling that knowledge with AI and data science, we provide opportunities to imagine new use-case scenarios, gain hands-on experience in a wide range of real-world environments, and ultimately expand the semiconductor field.



Research

Recognizing how semiconductors can be used to meaningfully enrich society, individuals, and the planet is not only a question of hardware. To achieve our goals and realize their full potential, semiconductor software is of utmost importance.

Hokkaido University is dedicated to focusing on developing semiconductor systems that address challenges faced in the real world. These challenges include improving productivity in agriculture through digital transformation, advancing telemedicine, and strengthening IT infrastructure across Hokkaido.

We aim to make effective use of hardware capabilities and to further improve the products and services that support people's lives. We also conduct research and development on integrated systems incorporating digital twins and artificial intelligence. By reproducing and analyzing complex societal challenges, we collaborate with researchers both inside and outside of the university to further advance systems that support people's lives and enable them to live well.

It is necessary to utilize semiconductors in advancing research systems to ensure that the research results are shared far and wide.

By advancing data-driven research approaches based on the concept of AI for Science, we promote the efficient creation and effective use of research results.



Community  
Engagement

Real-world challenges constantly emerge both in daily life and industry. Through the power of semiconductors and AI, we are equipped to design new solutions and activate them in real-world settings through practical testing. By taking advantage of this iterative cycle, we can develop semiconductor-driven solutions that tangibly change the way people live.

Through the cycle of technological development, originating in local communities and linking use cases with real life, we can bring the power of semiconductors into everyday life to build a digital society of the future.

Hokkaido University will strive to build a model for social implementation that contributes to the well-being of communities, through collaboration with local governments and financial institutions, while making the value that semiconductors bring to everyday life visible.

Create      Activate      **Integrate**

03  
**Integrate**

Advancing industry  
collaboration and  
regional engagement

**Connecting Technology,  
Knowledge, and Society**

**Background**

When it comes to semiconductors, what does it mean to “integrate”?

One meaning is “incorporating raw materials as technical elements” of semiconductors themselves. The semiconductor industry draws on a vast array of knowledge, technologies and disciplines; by properly combining and integrating these, we can produce the semiconductor products we use in our daily lives.

Another meaning of “integrate” in reference to semiconductors is to “connect knowledge and technology to people, communities, and society at large.” Cutting-edge semiconductors have the power to transform society. To successfully “create” and “activate” them, it is vital to bring together the right people with the right tools.

**IFERS MISSION**

Hokkaido University strives to nurture graduates who can optimize the whole semiconductor production process.

Hokkaido University aims to serve as a core hub supporting the semiconductor ecosystem, where the right knowledge and technology are connected to the right people and integrated across research disciplines.

  
**Education**

Semiconductors adeptly combine a wide range of technologies that, in turn, benefit society. It takes individuals who can integrate a broad range of world-class research and cutting-edge technology to create innovative systems that ultimately solve the challenges facing society.

Hokkaido University aims to foster professionals capable of taking a holistic view, integrating knowledge across fields, technologies, and people, and approaching manufacturing through an integrated approach encompassing ‘design, manufacturing, and implementation’.

At the same time, we hope to nurture the ability to integrate different fields of knowledge, and a diverse range of people, thereby creating a better society.

  
**Research**

We believe that the key to the sustainable development of semiconductor research lies in identifying challenges in the field and societal needs, crystallizing them into technology, and bridging the research community and the wider world in the process.

By advancing research and development, and technological advancement as two sides of the same coin and refining them in parallel, Hokkaido University seeks to build a hub of collective intelligence that produces chains of knowledge. We will strive to develop this hub as a platform that advances not only the creation of technology, but the entire process through to its integrated implementation in society.

Furthermore, through participating in collaborative research and academic societies, we will continue to contribute to the open and healthy development of a semiconductor research community, supporting a better future for semiconductor technologies.

  
**Community  
Engagement**

To accelerate the creation and social implementation of advanced semiconductors, it is essential to establish a coherent ecosystem in which education, industry, government, finance, and international partners work in unison, enabling the circulation of knowledge, talent, and capital.

Hokkaido University will share its international networks, advanced courses, and facilities across Hokkaido to realize the wide-scale “democratization of knowledge,” ensuring that anyone can access world-class education.

Centered on IFERS, we will directly link international collaboration with standardization efforts and the global exchange of talent, forming a focal point for a semiconductor ecosystem that extends from Hokkaido to the world.

Through these initiatives, Hokkaido University will function as a cross-disciplinary co-creation hub that brings together research, education, industry, and society, and build a platform that expands the value of semiconductor technologies to local communities and the world. As a core university in Hokkaido, we will also play a central role in the Hokkaido Valley initiative.

# Institute for Frontier Education and Research on Semiconductors (IFERS)

## ■ Message from the Executive Director

Along with aiding in the development of a sustainable society through the creation and spread of knowledge, the mission of the university is to nurture graduates who can shape the future. It also plays a particularly important role in the semiconductor field, as it is responsible for fostering both academic research and talent. This includes supporting research across a broad spectrum spanning basic scientific disciplines to societal implementation, while cultivating talent with a long-term perspective.

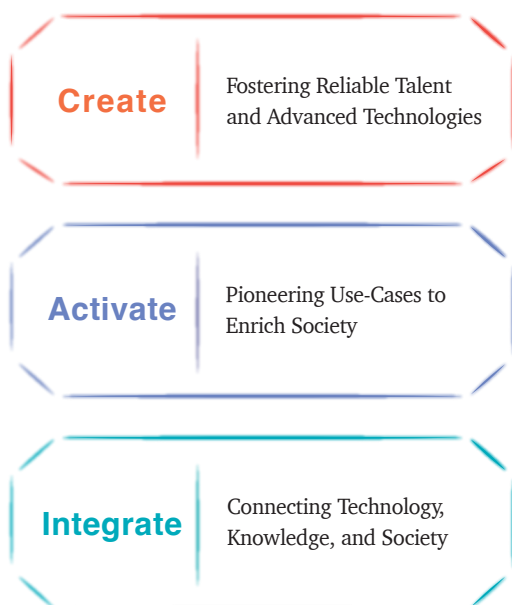
At Hokkaido University, our goal is to lead the way in cutting-edge semiconductor research by fully leveraging our strong foundation in science and engineering, along with our extensive interdisciplinary research. We also aim to serve as a hub that connects academia and industry, as well as the region and the global community, while cultivating graduates equipped to meet the challenges of the next generation.



ISHIMORI Kouichiro  
Hokkaido University Vice President  
IFERS Executive Director

## ■ IFERS MISSION

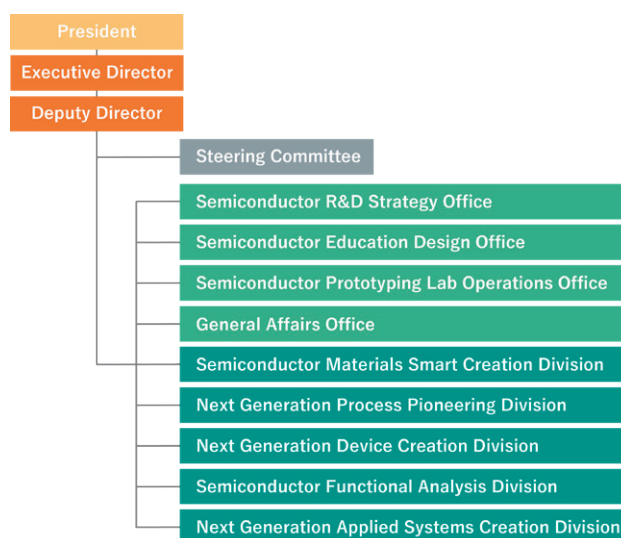
As Hokkaido University's semiconductor headquarters, IFERS will work toward realizing Hokkaido University Semiconductor Vision through the following three approaches.



## ■ IFERS Overview

First established as the Semiconductor Hub Development Promotion Office in October 2023, IFERS was reorganized in 2025 to be the headquarters for semiconductor education and research at Hokkaido University.

It seeks to strengthen education and research in the semiconductor field and promote university-wide policy planning, the effective integration of educational and research resources, and enhanced collaboration with external institutions.



**Institute for Frontier Education and Research on  
Semiconductors (IFERS), Hokkaido University**

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