# TECHNOLOGY

**December 12, 2023**
**Toshiya Eguchi**
**Executive Vice President and Executive Officer**

Giving Shape to Ideas

# Continuing to meet society's needs to "see" by evolving the core technology that has been refined for 150 years with AI

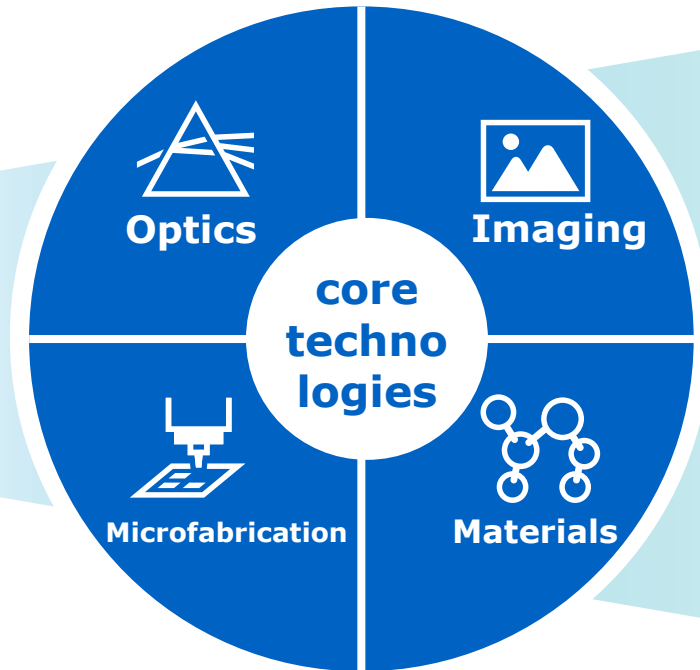1873                                                     2030

**Origin** → **Expanding business with "strengths of core technology"** → **Solving social issues with "core technology + AI"**

**Optics**   **Imaging**

**core techno logies**

**Microfabrication**   **Materials**

1. **Technology that contributes to the strengthening business**

   **FORXAI Imaging AI**

2. **Technology that contributes to the environment and decarbonization**

   **AI enhanced sensing**

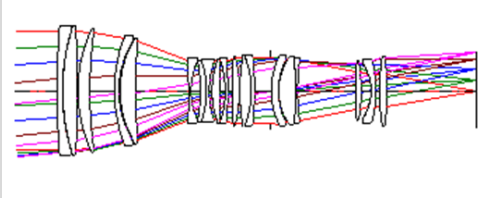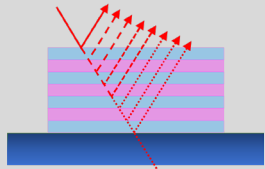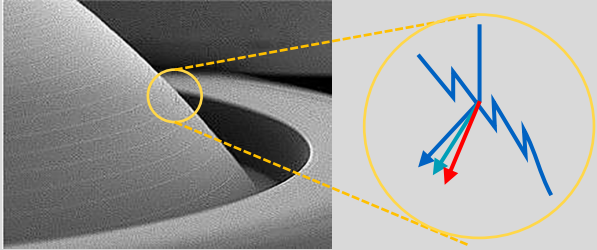   **Addressing climate change**      **Effective use of limited resources**
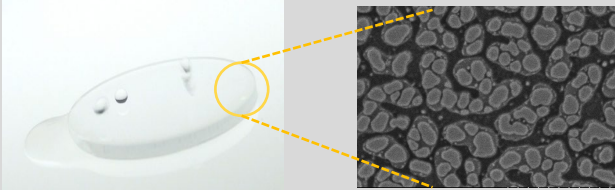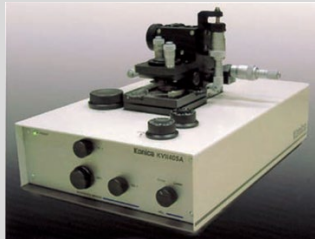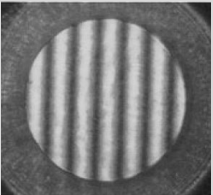
3. **DX promotion and utilization of generative AI**

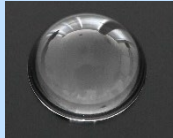# 1. TECHNOLOGIES THAT CONTRIBUTE TO THE STRENGTHENING BUSINESSES

# The essence of "strengths of core technology" (optics, microfabrication) and contributions to the strengthening business

- Based on our in-house developed "high-precision measurement technology", we provide top-level products while strengthening related technologies.

## Design simulation

**Ray tracing**

**Light reflection from multilayer films**

## Microfabrication

**Control of light by surface diffraction structures**

## Thin film formation

**Super-hydrophobic lens by thin film coating and nano-structure**

## High precision measurement

**Internally developed interferometer**

**Transmitted wavefront aberration measurement of lenses(~λ/100)**

### Optical components

Ultra-high precision polished lens (for semiconductor manufacturing equipment)

Automotive lens (Wide angle/far infrared)
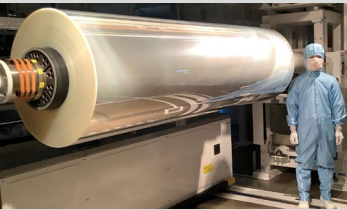
### Optical measurement equipment

Color and appearance measurement

Light and display measurement

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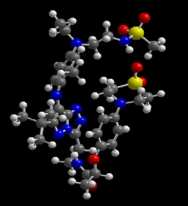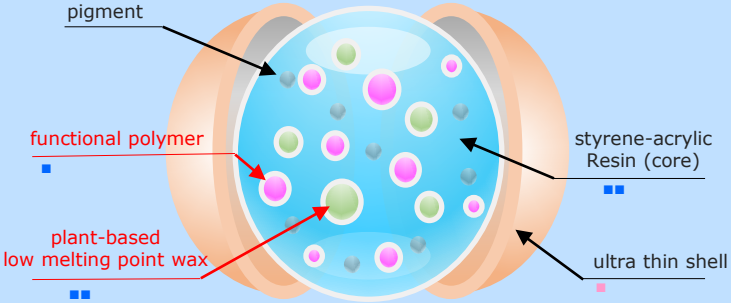# The essence of "strengths of core technology" (materials) and contributions to the strengthening business

- Based on advanced material design and analysis technology, we provide materials that are environmentally friendly and meet the needs to see in terms of color and light.

## Particle formation /Dispersion

Emulsion polymerization process

Core shell design

## Chemical synthesis

Functionality molecular design

High purity Compound

## Materials library

Luminescence materials

Pigment materials

## Film-casting

Post-stretching technology (wider)

## Material design /analysis

Precision analysis

Data driven (MI/PI)

## Environmentally friendly chemical toner

pigment

functional polymer

plant-based low melting point wax

styrene-acrylic Resin (core)

ultra thin shell

- : Contributes to melting properties
- : Contributes to heat resistance properties
- : Derived from biomass

## Display

Large TV
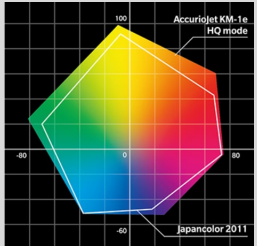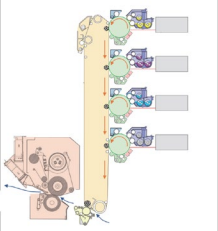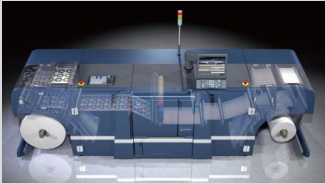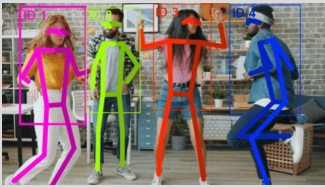
Smart device

High performance display

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# The essence of "strengths of core technology" (image) and contributions to the strengthening business

- Refine image input, processing, and mechanical processes to provide genre-top services

## Image input


**High-speed, high-precision scanning**


**Spectrophotometers**

## Image processing


**Highly accurate color reproduction**


**High-speed, high-definition image processing**

## Mechanical processing


**High-speed, high-quality process**


**High precision roll paper transport**

## Image recognition +AI


**Object recognition/skeleton detection**


**2D/3D skeleton tracking**

### Professional print


Commercial printing


Package printing


Label printing


Textile printing

### Medical imaging


DR


Ultrasound diagnosis


Medical IT

# Adding value with FORXAI Imaging AI

- Applying FORXAI Imaging AI for human behavior, inspection and advanced medical care to each business area
- Contributing to business expansion by rolling out solutions that contribute to DX of customer workflows

| Business area | Industry | Healthcare | Professional printing | Digital workplace |
|---|---|---|---|---|
| | **esφi** | **KINOSIS** | **AccurioDX** | **tomoLinks** |
| Examples of applied technology | Automotive visual inspection: Classifying vehicle paint defects | Advanced medical care: Observing and quantifying the "movement" of organs and joints using dynamic radiography images analysis | Image quality inspection AI: Automate image quality setting and inspection | Skeleton detection AI: Analyzing student/teacher behavior |

## Powered by FORXAI

## 2. TECHNOLOGY THAT CONTRIBUTES TO THE ENVIRONMENT AND DECARBONIZATION

# Separation and capture of CO2

- Achieving carbon minus by harnessing our technologies in film and nanoparticle manufacturing to develop membranes for $CO_2$ capture

## Materials technology/nanotechnology/film forming technology

**Precision control of nanostructure at the molecular level**
**High permeability and selectivity**

**Asymmetric membrane via phase separation**
**High performance and durability**

N2   CO2

nm scale structure

μm scale structure

Dense selective layer

Porous support layer

S4800 5.0kV 8.3mm x2.50k SE(M)          20.0um
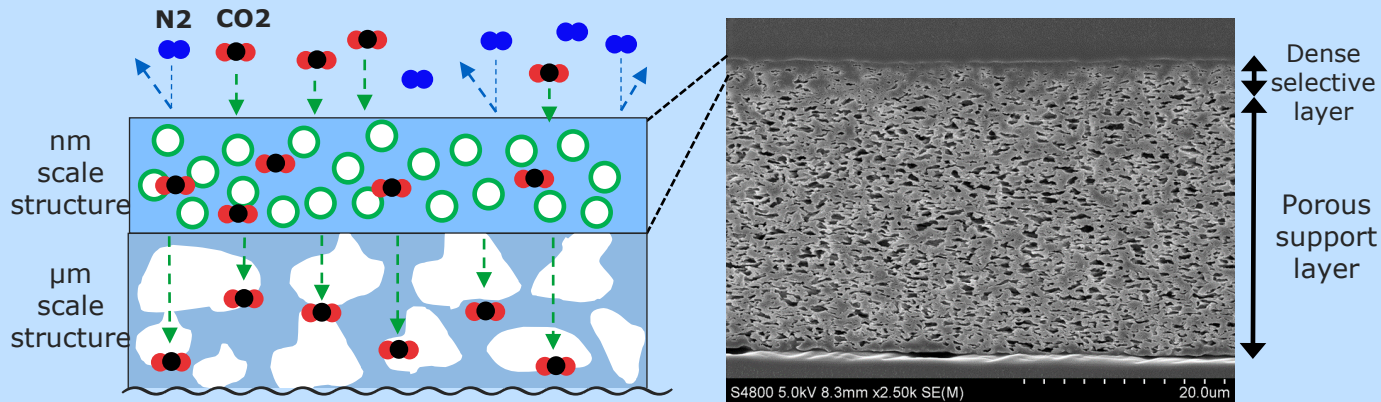
**Target performance: >10-fold increase in permeability and more than double the selectivity relative to existing membranes**

## Mass-scale film production technology (TAC)

**Solution casting process enabling low-cost production**

**CO2 Separation membrane**

## CO2 capture using membrane separation method

**Membrane separation method**
- Low cost
- Easily miniaturized
- Low footprint

**Initial target: Medium-sized factories and power plants**

Scale-up

Future expansion of target markets

Significant membrane performance improvement
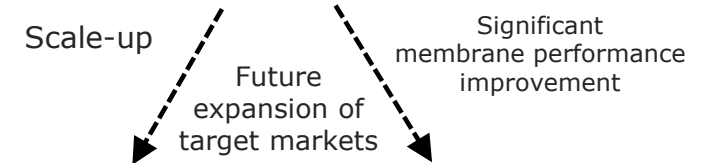
**Large-scale emission source**
Current method is amine solution method

**Direct Air Capture (DAC)**
Future technology

# Evolving core technology with AI "AI-enhanced sensing technology concept"

- Systematize "measurement using various sensing devices" and "AI processing of large amounts of acquired data"
- Development of AI enabled unique sensors to realize measurement of complex phenomena that previously relied on human experience and intuition

| **Sensing devices** | **Large amount of data** | **AI** | **Business development** |

**Sensors identified by data (molecular level status)**

Interaction fluorescence detection

Ultrasound

Fluorescent fingerprint

Hyperspectral camera

Infrared spectroscopy

Surface elemental analysis

pH meter

Thermometer

**Sensors you can tell by looking at them**

**Measuring complex phenomena**

**Accumulated leverage your data**

**Biomanufacturing (New search)**
Measurement solution business by bioreactor monitoring technology

**Ink, Film**
New functional materials development, production

**Recycled materials**
Separation of waste plastic, material design and evaluation

**Food inspection**
Quality inspection of foods, etc.

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# Fluorescent Analysis with Inductive Recognition System "FLAIRS"

- Unique sensor technology developed for product and process quality prediction and process management of liquid materials with complex compositions, such as beverages, chemicals and bio-manufacturing

## Materials technology/nanotechnology

- Uniquely designed fluorescent small molecules
- More than 1,000 combinations
- Achieving fluorescent detection markers

+Analyte
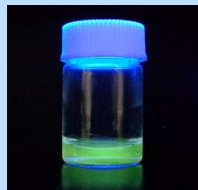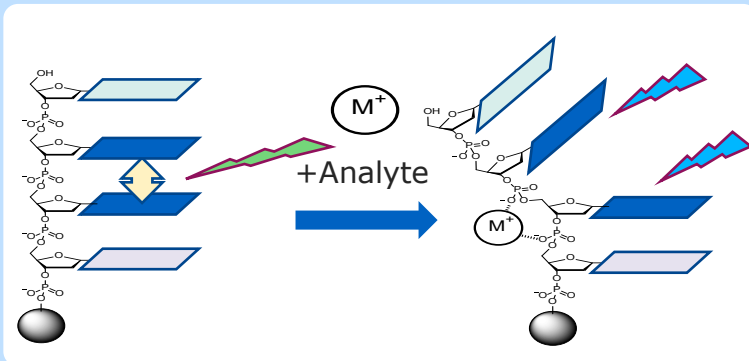
## Optical measuring technology

- Weak fluorescence detection system design
- High-speed measurement with chip array

Observation system

Excitation lighting

Fluorescence

Work
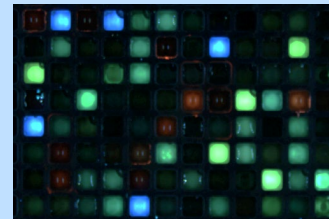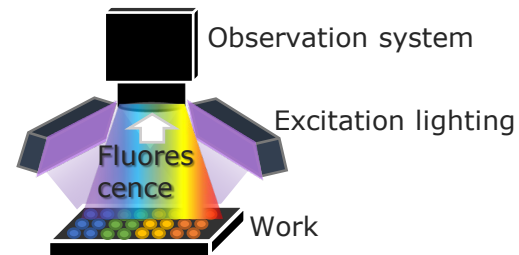
## Measurement example

### Wine grape variety identification

Sauvignon blanc
Merlot
Chardonnay
Koshu
Delaware
Pinot noir
Muscat Berry A

LD2
LD1
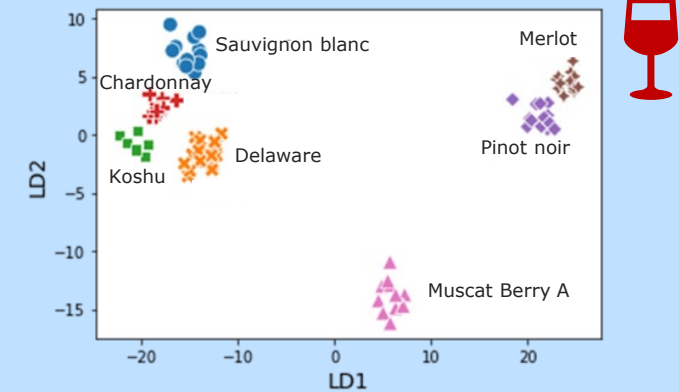
### Prediction of winning brands in Japanese sake contest

1,000 brands Sake measurement

Judge evaluation Result prediction

Sake 1
Sake 2
Sake 3

# "Bio-manufacturing" using non-petrified raw materials

- Established Konica Minolta-AIST Bioprocess Technology Cooperative Research Laboratory (June 2023)
- Aiming for social implementation of next-generation manufacturing process monitoring for "bio-manufacturing"



**Challenges in biomanufacturing**

- Microbial behavior changes due to subtle differences in conditions
- Yield and quality stability
- Scale up

**Non-fossil derived raw materials**

**Microbial culture**
Understanding Microbial activity (proliferation)
**Interaction fluorescence detection**

**Separation**
Understanding optimal conditions for separation
**High-throughput evaluation technology**

**Purification**
Understanding if there is variations in refining
**Fluorescent fingerprint***

**Desired product**

Fluorescent fingerprint*: A technology that identifies the state and properties of a material from the unique fluorescence patterns obtained by irradiating the material with light of various wavelengths.

# 3. DX PROMOTION AND UTILIZATION OF GENERATIVE AI

# DX Professional Engineers (Imaging IoT Engineers)

- Strengthen AI engineers, data scientists, and solution architects/developers by training and hiring. Aiming to have 1,000 engineers by the end of FY23.

**911 DX Professional Engineers (October 2023)\***

**AI engineers/ Data scientists**

**Imaging AI**

**510 people**

**IoT Platform**

**Edge Device**

**Solution architects/ developers**

**401 people**

(Equivalent to IPA ITSS Level Lv3-7)

\*Number of standard and expert certifiers.
1,831 people including entry certifiers.

**Number of DX Professional Engineers *in Japan**

(people)

| Year | Value |
|------|-------|
| 2017 | 113 |
| 2019 | 340 |
| 2021 | 600 |
| 2023 (projection) | 1,017 |

(projection)

- ■ **AI engineers / Data scientists**
- ■ **Solution architects / Developers**

# In-house and Customer DX initiatives

- We have placed DX specialists in all departments throughout the company to promote data utilization.
- DX specialist engineers and field members worked together on approximately 300 DX themes in two years.

| Value chain | | | |
|---|---|---|---|
| Data-driven development | Smart factory | SQL recommendation | Business management |

**Subject**

**In-house DX**

| Materials informatics | Image AI Data science | BI tools Data science | BI tools Generative AI |
|---|---|---|---|

**Customer DX**

| Plant | Mobility | Printing | Nursing care | Education | Healthcare |
|---|---|---|---|---|---|
| Gas monitoring | Visual inspection | Automatic quality optimization | HitomeQ Care Support | tomoLinks | KINOSIS |

# "Smart Factory" Display film production using data

- Commercialization of MI technology, which achieves the desired function by selecting materials with low environmental impact and mixing multiple compounds, and PI technology (core technology + AI), which stably produces high-quality products.

**Environmental material technology**

**Materials Informatics (MI)**

+

Material exploration
- Plant-derived polymer
- Functional additives
- Recycled solvent

**A.I.**

▶ **Materials**

Functional expression technology in multi-compound composite materials cultivated through photographic film
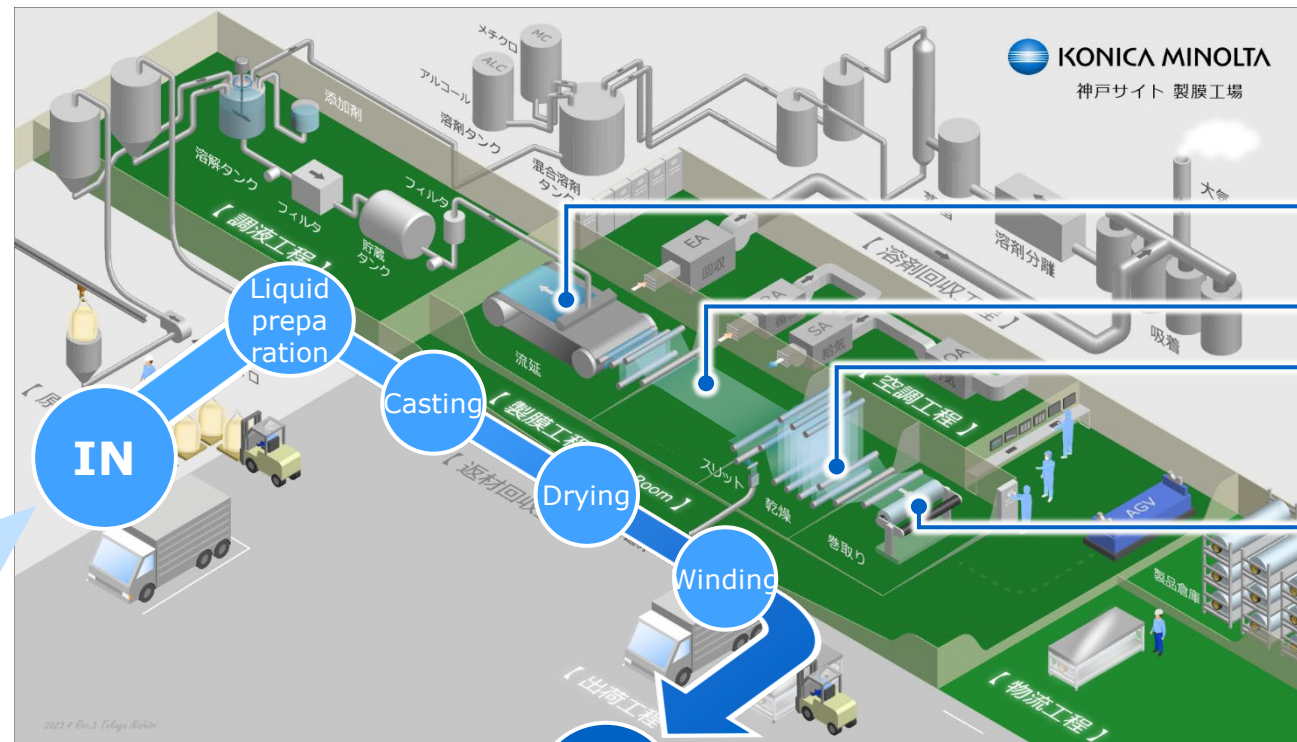


IN → Liquid preparation → Casting → Drying → Winding → OUT
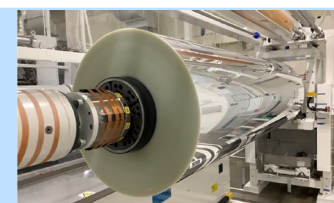
**Film**

**In-house special inspection /automation technology**

**Database construction**

Automatic film thickness control

Film breakage prediction

Defect classification

Roll inspection system

+

**Process informatics (PI)**

Mecha | **A.I.** | Optics

Imaging | Microfabrication

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# Initiatives for governance on AI usage

- June 2021: Established basic policy on the use of AI
- December 2021: Established AI governance system (AI Ethics Review Committee, regulations on the use of AI)
- May 2023: Established internal guidelines for the use of generated AI
  **80 risk assessments conducted, approximately 10,000 employees trained**
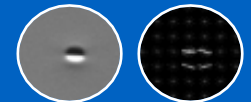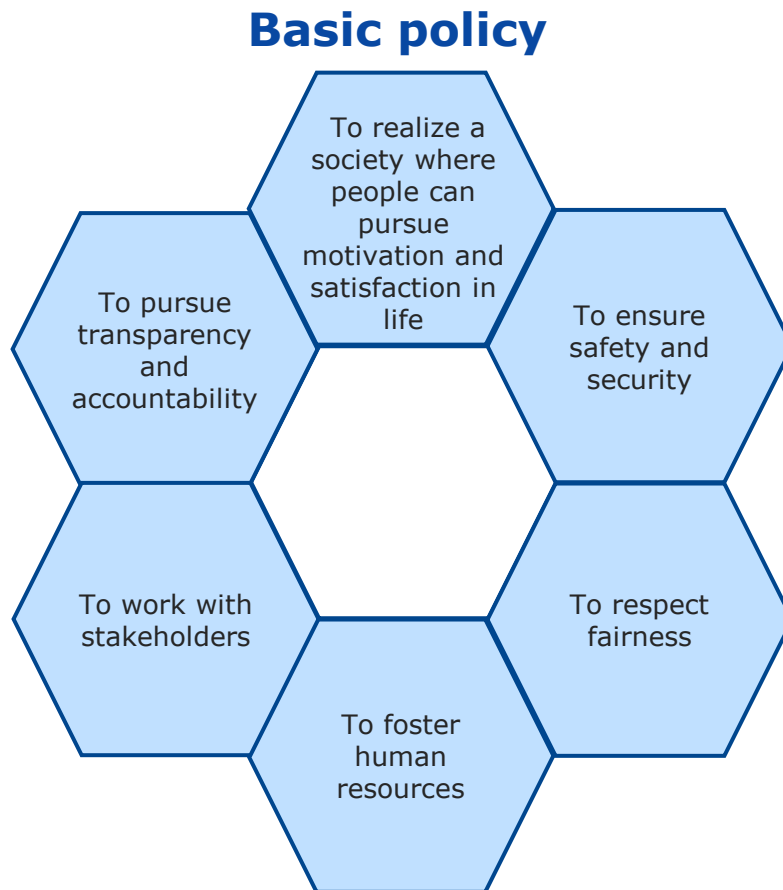
## Basic policy

- To realize a society where people can pursue motivation and satisfaction in life
- To pursue transparency and accountability
- To ensure safety and security
- To work with stakeholders
- To foster human resources
- To respect fairness

## Governance system

**AI ethics review committee**

- External experts (Ethics/Sociology)
- Technology/Legal/Quality Assurance Officer
- AI engineer (In-house expert)

- Risk management
- Incident response
- Enlightenment, Education

**Responsible AI Office (Company-wide promotion)**

**Each organization Promotion Officer (Global)**

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# Flexible promotion of generative AI utilization, supported by the governance system
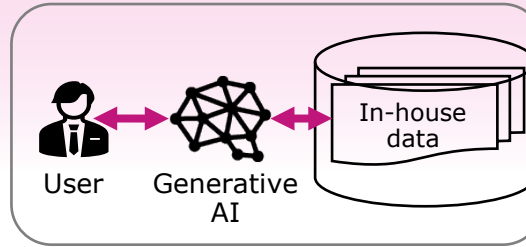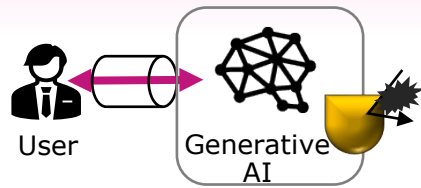
- Established company-wide generative AI utilization team. With the help of generative AI usage platform and business-specific tools, provided support for utilization of latest GPT to accelerate internal and external business.
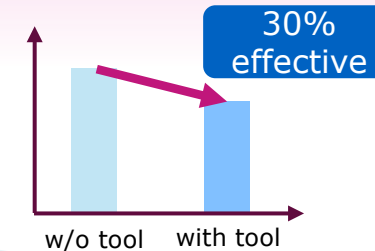


**Business utilization**

**Operation utilization**

**In-house business knowledge integrated application**

**Secure AI chat tool**

**Software development efficiency**

30% effective

**Manual creation assist**

User — Generative AI

User — Generative AI — In-house data

w/o tool    with tool

Manual creation tool for all industries

**Company-wide GPT application competition**

- Support for creating ideas for research commercialization
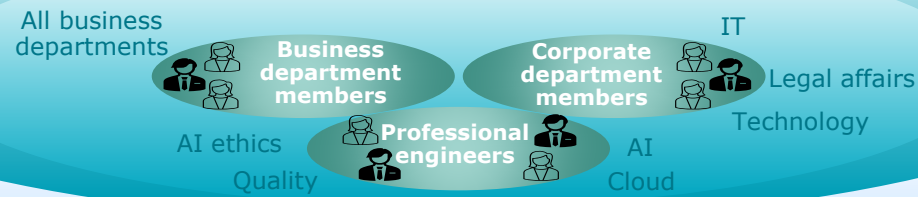- Financial analysis support
- AI quality guidelines
  ...

**Company-wide generative AI utilization promotion team**

All business departments

**Business department members**

**Corporate department members**

IT

Legal affairs

Technology

AI ethics

Quality

**Professional engineers**

AI Cloud

Deliberation

Support

**AI Ethics Review Committee**

**Responsible AI Office**

**Governance system**

# Appendix

# Glossary

●FORXAI Imaging AI

Part of our imaging IoT platform FORXAI, consists of high-speed, high-precision AI processing technologies mainly for images.

● esφi

EINES' tunnel-type paint defect inspection system, which has been installed by multiple European and American automobile companies.

● X-ray dynamic analysis/KINOSIS

KINOSIS is an x-ray dynamic analysis workstation, which enables more detailed diagnosis by continuously taking X-ray images to observe the movement of the affected area.

● AccurioDX

A co-creation platform that revolutionizes communication between people and companies through digital printing.

● tomoLinks

Educational support services that utilize ICT to understand the characteristics of each student and realize optimal learning.

● Imaging IoT engineers

Engineers with the skills to analyze image data and various sensor information using AI technology such as deep learning to support decision-making and judgment in various workplaces.