

# Transformative Innovation

Pursue Essential Research to unleash breakthrough innovations that help realize more sustainable lifestyles by solving social issues and easing people's pains.

## Social issues

The World Meteorological Organization (WMO) reported that 2023 was the warmest year on record, and climate change is affecting many aspects of our lives, causing poor health and affecting the growth of agricultural products due to heat and other factors.

Furthermore, the increase in plastic waste is a global issue, and an intergovernmental negotiating committee is formulating an international treaty under the supervision of the United Nations. In Japan, enforcement of the Act on Promotion of Resource Circulation for Plastics in 2022 has accelerated municipalities' initiatives for garbage separation, requiring cooperation from consumers.

Efforts for decarbonization and resource circulation are also becoming increasingly important. In order to go zero-carbon and zero-waste, not only national and local governments and companies, but also each and every consumer must change the lifestyle to which they have become accustomed.

The 2022 OECD household survey conducted in nine countries showed that more than half of the respondents expected that climate change and environmental issues would reduce the quality of life for current and future generations, and while they are willing to compromise their current lifestyles to protect the environment, they tend to avoid extra costs and choose actions that are easy to adopt. In Japan, there is a report that consumption-based household greenhouse gas emissions account for approximately 60% of the total; therefore, it is important for each household to strive to reduce greenhouse gas emissions.



Ministry of the Environment Annual Report on the Environment, the Sound Material-Cycle Society and Biodiversity in Japan 2023  
<https://www.env.go.jp/policy/hakusyo/r05/pdf.html>

OECD "OECD Studies on Environmental Policy and Household Behaviour"  
[https://www.oecd-ilibrary.org/environment/how-green-is-household-behaviour\\_2bbbb663-en](https://www.oecd-ilibrary.org/environment/how-green-is-household-behaviour_2bbbb663-en)

## Policies

We want to become an essential entity for consumers and customers by proposing products and services that solve social issues and change and enrich their lives. To this end, we have adopted the following three basic policies for our Research and Development activities.

1. Globally competitive core technologies and product development
2. Create both customer value and sustainable value
3. Enhancing development based on speed as a competitive axis

Under these basic policies, we will promote the development of technologies and products that realize a Kirei World in which everyone lives in harmony and sustainable lifestyles in line with the ESG Strategy, "the Kirei Lifestyle Plan."

As its development policy, in 2023 Kao published the "Kao Sustainable Product Development Policy" based on the new concept of "Maximum with minimum." We will promote the reduction of greenhouse gas emissions and plastic waste through initiatives to use plant-derived raw materials to reduce the use of raw materials derived from fossil fuels, develop containers that are easy to recycle, and so on. We believe that it will help accelerate the realization of a

sustainable society, in which we simultaneously minimize our environmental impact and maximize consumer value by developing technologies and products that will reduce the use of detergent and water while allowing people to wear beautiful clothes for a long time. This means changing their lives for the better without any extra burden. We will also expand this activity globally.

It is Essential Research and Technology Innovation that makes the concept of "Maximum with minimum" into products.

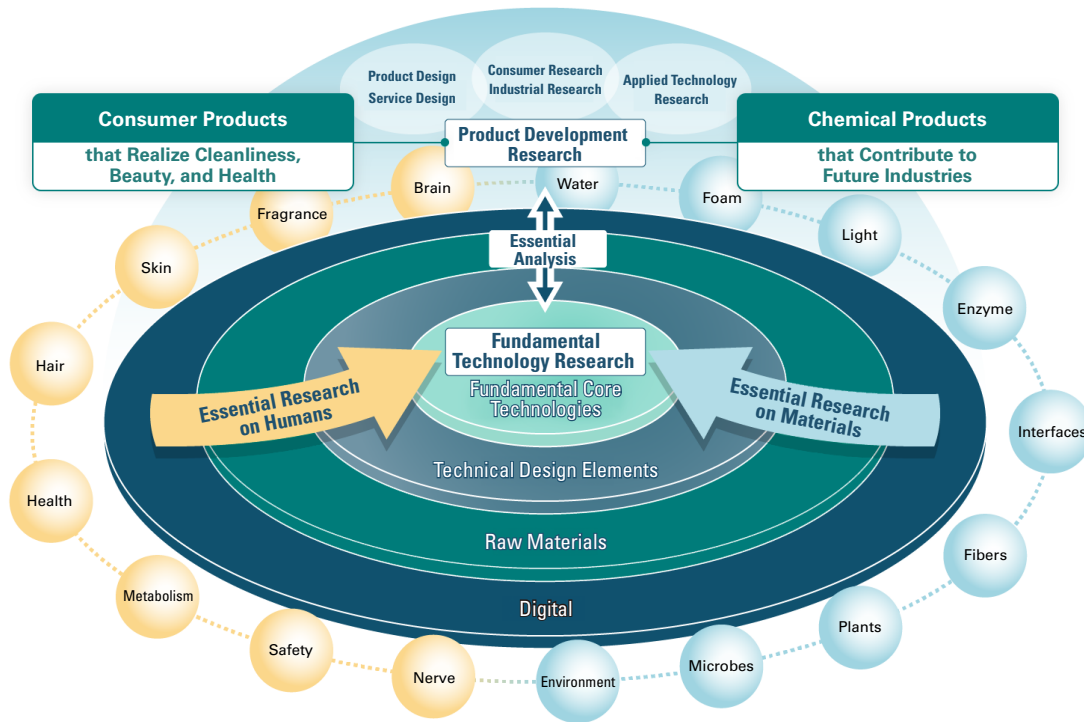
The essence of universality, mechanisms, and root causes are revealed as we, driven by the pursuit of Essential Research backed by inquisitive minds, exhaustively investigate objects and phenomena through the lens of science. They provide new evidence for solving problems facing society and consumers alike, and spark ideas for new technologies as well as consumer and customer value creation.

To solve problems and provide value, we will promote technology innovation by raising the level of our core technologies, maximizing the use of technology assets, and building new technologies.

When promoting technology innovation, it is important to provide value that corresponds broadly to the issues facing consumers and customers, but we also emphasize providing value that helps to solve the most pressing problems in specific domains. We propose highly satisfactory products and services through unique technologies and solutions that capture the essence deep within those problems and bring a sharp sense of value.

# Transformative Innovation

## Research and Development Activities of Kao



Research & Development  
<https://www.kao.com/global/en/innovation/research-development/>

## Strategy

### Risks and opportunities

#### Risks

It takes years of research and development to establish technologies and apply them to products. In particular, since developing technologies for going from carbon-

zero to carbon-negative and to waste-zero involves advanced and complex processes, there is only so much that one company can do. In addition, there is a concern that if the original strategy or policy is significantly revised due to entering a new industry or a policy change, the investment made up to that point could be rendered useless.

Looking at day-to-day activities, damage due to leaks or disasters involving hazardous materials handled in R&D at Kao, as well as leaks of technical information related to pre-launch product development strategies or upcoming products, are also risks to the continuation of

business activities. We must also prepare for disasters arising from climate change.

#### Opportunities

One path to solving high-level challenges is open innovation. By combining external technologies with Kao's own technology assets and research findings, we believe that new ideas and approaches for environmental and social issues that are difficult to solve can be embodied as products, services, businesses, and systems. To realize a sustainable society, we will promote collaboration with companies and governments that address the same issues in a wide range of supply chains.

## Strategy

We will live up to the trust in the safety and security of our soaps and detergents earned since our foundation in 1890 and promote the Management of Technology (MOT) by aligning management and business strategies with research and technology development strategies. Meanwhile, we will identify possibilities and domains where our core technologies, which are the source of our differentiation, can lead to new value.

With technology innovation as the driving force, we will tackle environmental problems and other social issues from backcasting and forecasting perspectives. This will involve accelerating our global growth by promoting the development of new technologies to address various issues around the world and rapidly expanding technologies and value that we have established over the years in the right places.

# Transformative Innovation

## 1. Strengthen existing businesses by deepening existing technologies (short-term)

In response to diverse consumer and customer values, we will promote product development by continuously improving and utilizing our technology assets together with our business and manufacturing divisions. We will embody ESG-driven *Yoki-Monozukuri* in line with the concept of “Maximum with minimum,” which provides value through selecting raw materials that minimize environmental impact, substituting scarce raw materials, and reducing CO<sub>2</sub> emissions during product use. Furthermore, we will aim to accelerate the speed of development by actively incorporating digital technologies such as big data and artificial intelligence.

## 2. Expand existing business in borderline areas (by 2025)

We will reassess the strengths of our existing core technologies from the perspectives of ESG and QOL, and envision the world of the future by forecasting from Essential Research and technologies. We will provide products and services that bring unprecedented value through new combinations of various technologies based on our own core technologies, such as resource circulation for plastic film packaging using micro-interface control, and proposals for hygiene products and services using bacteria- and microbe-control technologies.

## 3. Creation of new businesses by backcasting from future society (by 2030)

We will re-envision inclusive future lifestyles and society from a backcasting perspective as we face global warming, climate change, and the super-aging society. We will identify the technologies needed to achieve the desired state and create new markets by utilizing multiple aspects of Kao's core technologies and

combining them with new ones. Furthermore, to drastically reduce CO<sub>2</sub> emissions, we will work to develop carbon-negative technologies that convert recovered CO<sub>2</sub> into new value.

 **Integrated Report 2024**  
<https://www.kao.com/global/en/investor-relations/library/reports/>

## Social impact

We will propose distinctive technologies and innovative products and systems to solve social issues, significantly change and enrich people's lives, and realize a circular society and safer, more secure, and healthier lifestyles.

## Contributions to the SDGs



## Business impact

Through Research and Development activities, we will increase sales of new and improved products, increase revenues and brand loyalty, and create new markets through new businesses.

The perspective of cost is also extremely important in product development. The Scarcity of raw materials will lead to cost increases and procurement risks in the future, and long development lead times will also result in higher costs. As such, we will review the way we promote R&D activities to improve the ROIC.

## Governance

### Framework

The R&D Division is in charge of promoting Transformative innovation. Under the supervision of the Board of Directors, the Internal Control Committee carries out risk management and the ESG Managing Committee conducts opportunity management. These committees are both headed by the President & CEO.

Risk management is performed by the Internal Control Committee (which meets twice a year) and its subcommittee, the Risk & Crisis Management Committee (which meets four times per year). The Executive Officer Responsible for Corporate Strategy chairs the committee.

Opportunity management is carried out by the ESG Managing Committee (which meets six times a year). Comprising outside experts, the ESG External Advisory Board provides advice and suggestions on issues raised by the ESG Managing Committee and offers outside viewpoints to be reflected into management, and the ESG Promotion Meeting executes the strategies.

A system is in place for product development (vertical axis in the figure on the next page) and fundamental technology (horizontal axis in the figure on the next page) laboratories to accumulate wisdom and organically collaborate with each other. We set R&D strategies in line with our management and business strategies to transform science into technology and technology into unique products and services, thereby contributing to business by solving problems that consumers and society face.

In existing business domains, our product development laboratories view issues facing consumers and customers through the lens of science, collaborate

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with business divisions to define the policy for the value we will provide at an early stage, and continue to provide innovative products by evolving and making the most of technology assets. In addition, in the new business domains, our technology development laboratories play a central role in creating technology innovations to address social issues from a future perspective, and we are considering early social implementation and commercialization through collaboration inside and outside the company.

These Research and Development activities are shared with research management on a monthly and semi-annual basis to check the progress of research themes, shared labor costs, actual budget performance, and the like.

In order to respond quickly and flexibly to changes in the business and social environment, the R&D Strategy acts as an intermediary and sets up a forum in the annual plan for reporting to operational and business management, including Executive Officers, so that policies, strategy implementation, and progress in

Research and Development activities are shared. Members of this forum verify progress and revise strategies as necessary, speeding up decision-making and accelerating global growth.

## Education and promotion

Creating innovations requires nurturing a culture that encourages researchers to take on challenges in new domains by cooperating with many researchers, in addition to fostering a high level of expertise, creativity, and originality in individual researchers.

We have set up a research report database so that everyone can have access to in-house research findings, technology assets, and the latest research results. We also provide opportunities for exposure to cutting-edge science and technology through lectures and research guidance by outside experts. In addition, we hold presentation sessions where researchers can discuss their ideas to generate new findings. While increasing efficiency by utilizing online conferencing and other digital tools, we emphasize dialogue, including the participation of researchers from outside Japan, to create innovations by fusing different types of knowledge.

## Collaboration with stakeholders

In promoting Transformative Innovation, multifaceted cooperation and collaboration with industry, government, and academia are necessary.

With universities, we are strengthening our core technologies and building new technologies through joint research that makes the most of cutting-edge science and technology. We share scientific findings with the academic community through presentations at conferences and in papers.

We cooperate with governments in efforts to establish a circular society, by recycling packaging, reusing diapers, in alignment with laws and local situations. Kao aims to establish technologies through collaborative demonstration experiments and introduce them to society as quickly as possible.

We also cooperate with suppliers to ensure a stable supply of raw materials.

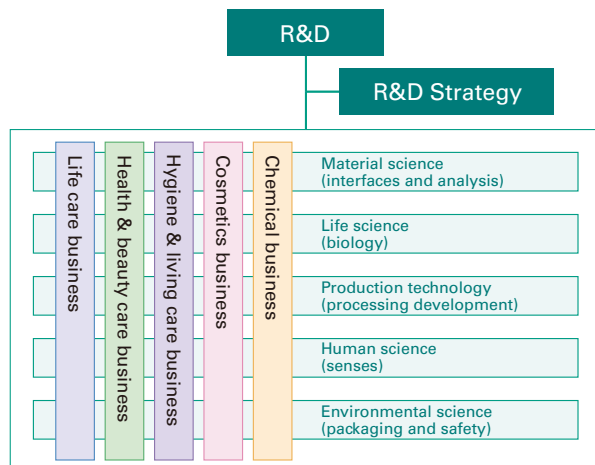
New value is created when two or more parties mutually supplement and combine their strengths, and this enables quick delivery of products and services to consumers.

## Risk management

We address a wide range of risks in our R&D activities, prioritizing risks with the greatest business impact. So that we can respond promptly to risks in line with business changes, we are optimizing the allocation of R&D expenses and personnel, and making modifications according to the situation by visualizing the degree of progress and risk of research themes. We are also preparing for changes in the business environment by co-creating with governments and various stakeholders to keep abreast of the latest circumstances.

To avoid losing business opportunities stemming from prolonged R&D lead time, we are also enhancing the precision of our products and services by verifying new value as early as possible while promoting their social implementations.

Furthermore, with regard to risks related to the continuation of business activities, we identify risks such as technical information leaks, chemicals management, and the impact of natural disasters on



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R&D functions, and conduct self-audits to ensure that all researchers are fully aware of these risks by working with the Risk and Crisis Management Committee and the Responsible Care Promotion Committee within the Internal Control Committee.

## Metrics and targets

### Mid- to long-term targets and 2023 results

Among the 19 Kao Actions in the ESG Strategy, the Kirei Lifestyle Plan, R&D has set two objects for Transformative Innovation.

Since R&D activities involve a wide range of goals, such as improved quality of life, safer and healthier products, decarbonization, zero waste, water conservation and diversity management, we set research themes and departmental goals so that researchers can promote Research and Development activities with a high level of awareness.

#### 2030 long-term targets

##### **1. Propose products with a major positive impact on lifestyles**

Propose ten or more product releases by 2030 incorporating innovations capable of causing major positive change with respect to lifestyles, society or the environment (cumulative beginning in 2019)

##### **2. Propose businesses and systems with a major positive impact on lifestyles**

Propose ten or more businesses or schemes by 2030 incorporating innovations capable of causing major positive change with respect to lifestyles, society or the environment (cumulative beginning in 2019)

#### 2023 results

At the Kao Group Technology Innovation session in November 2018, we announced our new technologies in five domains: surface chemistry, environment, skin, health and hair.

For “surface chemistry,” we are expanding the use of a sustainable surfactant known as “Bio IOS.” In recognition of its unique function, we received the 72nd (FY2023) Chemical Technology Award from the Chemical Society of Japan.

For “environment,” we are conducting a demonstration experiment for recycling film packaging. In 2023, we worked with Lion Corporation to commercialize refill packs that use recycled materials as the middle layer through horizontal material recycling, in which used refill packs are recycled as the same type of container. “NEWTLAC 5000,” an asphalt modifier that improves pavement durability made by transforming waste PET using proprietary technologies, received the Minister of the Environment’s Award at the 22nd Green and Sustainable Chemistry Awards by the Japan Association for Chemical Innovation (JACI).

For “skin,” we launched in the US market “re/cover,” which combines the fine fiber technology that forms a natural ultra-thin film with a serum for eczema. For “health,” Healthcare Systems Co., Ltd. launched “the Babywell Check,” a mail-in testing service that uses Kao’s skin RNA monitoring technology to monitor the skin barrier condition of infants. For the “hair” domain, a naturally occurring source of black hair melanin (coloring ingredient: dihydroxy indole) is being developed for hair colors, shampoos, and conditioners.

In 2023, we continued our Research and Development activities in these five domains and proposed numerous products based on our technologies.

#### Reviews of 2023 results

Our long-term goal for 2030 is to propose products, businesses, and systems that will have a big positive impact on lifestyles.

In FY2023, as we recovered from the COVID-19 pandemic, consumers began to go out more frequently and became more conscious about UV protection. To address such needs, we proposed “*Bioré UV Aqua Rich Aqua Protect Mist*,” which utilizes a coating film technology that achieves a sweat- and friction-resistant formula that easily comes off with cleanser as needed and a type of formulation that is easy to reapply on the go. This gas-free mist formula received high praise for its usability and comfort as we experienced unusually high temperatures.

In addition, we published a paper entitled “*Contribution to holding large-scale meetings amid the COVID-19 pandemic*,” which delves into scientific study on how to hold large-scale events amid the risk of infection and how to reduce the risk, earning the 2023 Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Science and Technology Award (Science and Technology Promotion). This is the result of activities we started in 2020 with a diverse group of external researchers.

In 2023, our proposal of products and systems continue to gain strong approval. We will continue our R&D activities to increase the number of innovations by promoting widespread adoption of science and technology through product proposals, presentations at academic conferences and papers, to transform consumers’ lifestyles and enrich society.

# Transformative Innovation

## Main initiatives

### Promote ESG-driven *Yoki-Monozukuri* by deepening core technologies (short-term)

Under the Kao Sustainable Product Development Policy, which was published in 2023, we take a holistic approach to minimizing environmental and social impact and maximizing value for consumers, aiming to achieve ESG-driven *Yoki-Monozukuri* that consumers can easily adopt in their daily lives. Kao's proprietary core technologies, which we have established over the years, serve as effective solutions to this challenge. For example, we launched "*Attack ZERO Perfect Stick*." This product features a unique, easily dissolvable hollow powder structure created using the processing technology, and is formulated with agglomerated active ingredients for cleaning, odor removal, and anti-bacterial purposes. The stick-type formula does not require measuring, reducing water in the product and the plastic used per wash while making this product easy to use. It has excellent cleaning power and leverages the unique characteristics of agglomerated powder detergents, relative to commonly used liquid detergents. We will continue to make life more comfortable and sustainable through promoting the development of core technologies.

### Global development of products that help improve quality of life (mid-term)

Introduced at the November 2018 Technology Innovation, the fine-fiber technology creates a natural-looking film by spraying ultra-fine fibers onto the skin using the electrospinning method. This film allows water vapor through the gaps, and its capillary force enables the formula to adhere evenly to the skin

without occluding it. Although we have been providing portable devices, we have successfully developed a patch-type sheet. In the United States, where many consumers suffer from problems of eczema, we have launched "re/cover," a skin care product that protects and keeps skin healthy by combining the fine-fiber sheet developed in Japan and plant extracts developed in the United States.

By collaborating globally and utilizing technologies in the right places, we quickly deliver products to market that are essential to consumers who have concerns.

### Initiatives for carbon neutrality in production of chemical raw materials (long-term)

One way to promote carbon neutrality is to replace raw materials derived from fossil resources with biomass-derived materials that do not compete with food. However, for aromatic compounds of high industrial value, it was difficult to commercially produce a single compound from biomass, although utilizing lignin in cellulose is being considered. Taking advantage of our enzyme production technology for detergents, Kao has established a technology for producing by fermentation gallic acid and 4-amino-3-hydroxybenzoic acid (4,3-AHBA), which are aromatic compounds, from glucose, using coryneform bacteria. Gallic acid is expected to be employed as a raw material for semiconductors and rust inhibitors for boilers, and 4,3-AHBA as a raw material for biomass-derived, heat-resistant plastic materials. Until now, gallic acid has been produced from the sumac family of plants, whose production areas are limited, but it is now possible to produce it in a stable way. We will also expand research and development of other

aromatic compounds to contribute to the stable supply of raw materials and promotion of carbon neutrality.

# Transformative Innovation

## Employees' opinions

**Global collaboration to improve QOL of eczema consumers through utilization of Kao's unique technology assets and product development.**



### Asuka Imai

Kao USA Inc.  
Kao Americas Research Labs

It is said that about thirty million people are suffering from eczema, a type of inflammatory skin condition, across the United States. By aiming to provide a unique, perceivable and accessible solution for those consumers, we developed re/cover Calming Eczema Serum and Moisture Patch. In the Moisture Patch, we used Kao's innovative technology, Fine Fiber Sheet, which can create an ultra-thin and breathable layer, and can be invisible and applicable on any skin tone. Throughout the project, we collaborated with various US local and global team members as a One-Kao team for delivering value to consumers. Our goal is to

contribute to society through continuous product development that can improve the quality of life for those consumers suffering from different skin conditions and allow them to do what they really want to do.

