NEC TNFD Report 2nd Edition

June 24, 2024
NEC Corporation

Message from the Executive in Charge of the Environment

NEC has announced its vision of the ideal future society as "NEC 2030VISION". The three pillars of this vision are "Environment," "Society," and "Life". The "Environment" is the foundation of "Society" and "Life". Recently, society has been making great strides in addressing climate change, but we recognize that natural capital and biodiversity are even broader themes than climate change, and that their loss is closely related to social issues such as poverty and human rights.

At COP15, the Conference of the Parties to the Convention on Biological Diversity (COP15), the concept of "Nature Positive" was presented to halt biodiversity loss and restore natural capital. While carbon neutrality is based on a single indicator of GHG emissions, natural capital requires a variety of information on water, air, plants, and animals in each region to be understood and acted upon.

To lead the world on this path, NEC published the first TNFD report in the Japanese ICT industry in July 2023, referring to the beta v0.4 of the TNFD recommendations. This time, we further brushed up the report with reference to the TNFD Final Recommendations v1.0 issued in September 2023. Specifically, we conducted a more comprehensive assessment of natural capital dependencies and impacts and risks related to direct operations and supply chains. We sought the assistance of outside experts and tested various assessment methods that were beginning to emerge in the marketplace.

As part of the assessment of opportunities, the potential for contribution through technologies such as AI, image recognition, simulation, digital twin, telecommunications, and satellites was also described. Weaving information about natural capital into information systems for product planning, design, procurement, manufacturing, and sales can contribute to business transformation in a variety of sectors.

Since we published our first TNFD report in 2023, we have been consulted by various industries to prepare TNFD reports. In the process, we have found issues common to each company, such as the use of databases and tools, and understanding the impact in the supply chain. We believe that business transformation aimed at nature positivity requires data-driven management that accumulates a variety of data and utilizes digital technology to make data-driven decisions.

NEC views itself as an "Environmental Client Zero" and actively tackling new environmental issues and creating solutions. We share what we learned to our customers and the society. Though TNFD reports should be incorporated into ESG data books and integrated reports in the future, we publish this TNFD report as a separate document because there were many learnings to share. We hope that TNFD reports will be catalysts for a positive relationship between business and nature.

NEC Corporation
Corporate EVP and CSCO (Chief Supply Chain Officer)
Noritaka Taguma

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Introduction

Natural capital[1] such as forests, soil, water, air, animals, and plants, supports life on the Earth and provides essential services to society and economy. However, the Dasgupta Review, published by the UK Treasury in 2021, estimates that natural capital per capita in the global population declined by 40% from 1992 to 2014. The World Economic Forum also estimates that more than half of global GDP (US$44 trillion) is dependent on natural capital and that US$10.1 trillion of new market opportunities related to natural capital will be created by 2030.

The risks and opportunities associated with natural capital are becoming too great for companies to ignore. However, as companies identify risks and opportunities and transform their businesses, they will face the following challenges. These challenges are caused by the lack of a cycle from data visualization, connection, decision making, to value creation.

Fig.1 : Challenges in Addressing Natural Risks and Opportunities

Departments	Examples of Challenges
Corporate Planning/ Environmental/ Sustainability	Unable to make decisions for investment on countermeasures, due to lack of quantitative information on financial impacts
Product Design	Local environmental impacts/dependencies of parts/components manufacturing are not visible
Procurement	Obtaining environmental information from large numbers of suppliers is time-consuming Environmental consideration cannot be given when selecting suppliers or placing orders, since environmental impact is calculated based on annual procurement results
Manufacturing	Need to consider trade-offs between environment and quality/cost/productivity
Sales	Cost of environmental measures cannot be passed on the price to customers

Companies need to visualize their dependencies on and impacts on the environment in each business functions from planning, design, procurement, manufacturing, distribution, and sales in order to transform their businesses. In addition, the simultaneous visibility of environmental information, quality, cost, and other information will facilitate decision-making for business transformation. This is truly a DX (Digital Transformation) process. In order to promote this process, it is essential to implement a cycle of value creation through data acquisition, visualization, analysis, and connection, in which ICT plays a major role.

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[1] The term biodiversity is used to refer to the diversity of animals and plants. Natural capital consists of water, soil, and air, as well as animals and plants. In this report, the term biodiversity is included in the term "natural capital".

Fig.2: ICT's Contribution to Harmonious Coexistence with the Earth
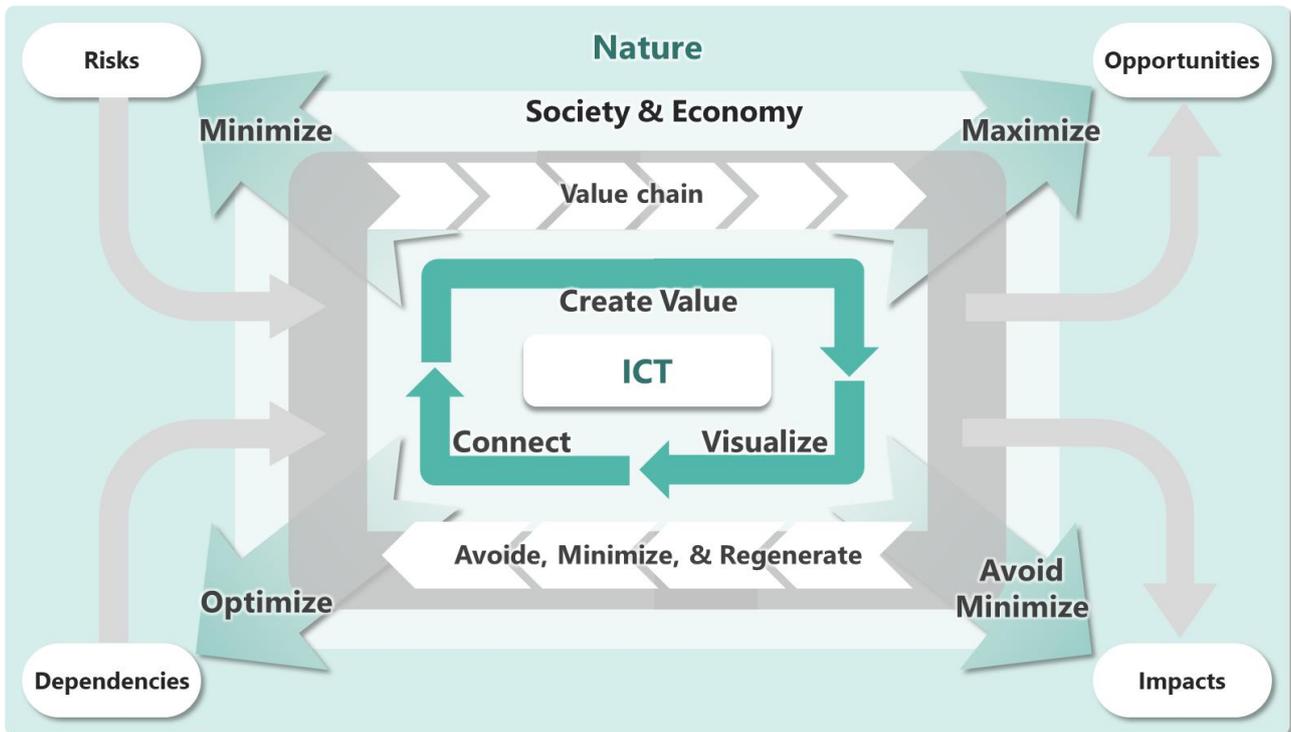
NEC views its own efforts as an opportunity to discover customer values and aims for nature-positive business management through DX. Although there are many unresolved issues, we will share our progress through TNFD reports. It may be impossible to understand all of nature's mechanisms through ICT. However, it is necessary for building sustainable society to continue our effort to quantify nature's values and incorporate them into economy. NEC will contribute to the creation of a social system that realize a positive circle between the environment and the economy.

In order to analyze the relationship between business and natural capital from various angles, this report was prepared by a cross-organizational team of the NEC Group. In addition to the environmental department, many business divisions participated in editing this report.

2. General Requirements

① Materiality

In this report, we used the double materiality approach to evaluate the impacts of natural capital on business activities and the impacts of business activities on natural capital.

② Scope

Risks (direct operations, upstream and downstream of the value chain) and opportunities are covered in this report. As direct operations, we identified 150 types of business activities of the NEC Group. Then, we conducted a risk analysis by determining the business activities to be investigated in depth according to their dependence on and potential impact on the natural environment, as well as the scale and nature of the business. In terms of upstream risks in the value chain, we took on the challenge of assessing risks in a wide range of environmental themes, using procurement amounts and the International Input-Output Table, while also taking a deeper look at water risks. Regarding downstream risks, we described resource recycling and chemicals in products. As for opportunities, how our ICT solutions can contribute was explained. Also, opportunities to contribute to local ecosystem conservation through our site activities were described.

③ Location

Sixteen direct production sites, two major data centers using cooling towers, and 2,000 production sites of suppliers were evaluated using the WRI Aqueduct water risk assessment tool. The status of two direct production sites (Suzhou, Jiangsu Province, China and Pathum Thani, Thailand) that were found to be located in areas with water risk are described. In addition, we confirmed that approximately 2% of the production sites of our suppliers were located in areas of water risk. Detailed interviews are being conducted with suppliers that have such production sites, and the details of these interviews are described.

④ Integration with Other Sustainability Issues

Climate change and natural capital affect each other. With regard to the physical risks of direct operations, flood risks under a 4°C scenario of climate change are assessed through simulations. Other sustainability issues are disclosed in the NEC ESG Data Book.

⑤ Time Horizons

The short term is defined as from the current fiscal year to 2025, the medium term from 2026 to 2030, and the long term from 2031 to 2040.

Fig.3: Time horizons

	Fiscal year	Alignment with Environmental Strategy	Alignment with Company-wid Strategy
Short term	2024–2025	NEC Eco Action Plan	2025 Mid-Term Management Plan
Med term	2026–2030	NEC Environmental Management Action Plan 2030	NEC 2030VISION
Long term	2031–2040	SBT Net-Zero	-

⑥ Human Rights and Stakeholder Engagement

In 2015, NEC formulated the NEC Group Human Rights Policy, declaring its intention to advance initiatives to promote respect for human rights across its entire value chain through dialogue and consultation with stakeholders and by implementing human rights due diligence. Furthermore, in June 2022, the policy was revised and these revisions clearly show senior management's commitment to respecting human rights as well as its governance system, as required by the United Nations Guiding Principles on Business and Human Rights (UNGPs). The policy was reported at the Board of Directors' meeting held in fiscal 2023. In revising the policy, we held talks with a wide range of internal and external stakeholders, including labour unions, experts from

the International Labor Organization (ILO), international NPOs, investors, and lawyers specializing in human rights and business.

As part of other stakeholder engagement activities, NEC discloses information in its annual Integrated Report and ESG Data Book, and engages in mutual dialogue on ESG Day every year. NEC has also established the NEC Sustainability Advisory Committee as an advisory body to the executive officer in charge of sustainability, and holds regular dialogues between external experts in the field of sustainability and management. NEC also conducts annual environmental education for all employees, including those at overseas sites. In addition, the Abiko Plant, which restores habitats for endangered species, conducts dialogues and on-site activities together with local NPOs, government authorities, and experts.

3. Governance

As part of its corporate social responsibility activities, NEC engages in environmental management. NEC seeks to reduce environmental impacts to society by providing products and services that contribute to environment, as well as reducing the impacts of its own business activities, by conserving energy at its facilities and at the transportation stage, and by reducing the chemical substances it uses.

In order to promote environmental management throughout the entire group, including our company, affiliated companies, production sites, and research laboratories, we have established an "Environmental Policy" and ensure that all employees, from directors to employees, comply with the policy and act in an environmentally conscious manner. Furthermore, we require all suppliers, contractors and other stakeholders engaged in our supply chains to behave in a manner consistent with relevant guidelines and agreements.

Fig.4: Environmental Policy

NEC Environmental Policy

NEC views the operation of business in harmony with the environment as one of its top priority issues and is committed to reducing the environmental impact of the entire global supply chain and contributing to a sustainable society.

1. We will create social value focused on delivering ICT solutions and services leveraging advanced technologies to contribute to their adaptation, and we will contribute to the reduction of the environmental burden on customers and the global environment and to the mitigation of the impacts of climate change.

2. We will assess the environmental impact throughout the entire lifecycle of ICT solutions and service development with considerations for reducing environmental burden.

3. We will comply with environmental laws and regulations associated with our business activities, honor agreements with stakeholders, and strive to conserve energy, save resources, and prevent environmental pollution caused by chemical substances and waste throughout the entire supply chain.

4. We will prioritize the procurement of environmentally friendly hardware, software and services.

5. We will disclose environmental information regarding our business activities, ICT solutions and services to our stakeholders.

6. We will raise the environmental awareness of each and every one of our employees worldwide and contribute to the conservation of the global environment through the promotion of climate change action, resource circulation and biodiversity.

7. We will strive to improve our environmental management system with environmental targets and conduct periodic reviews to realize continual improvement.

Discussions are held regarding strategies and the impact of important environmental issues at the Executive Committee or at the Business Strategy Council (consisting of executive officers, among others), both of which discuss management issues at NEC. Matters to be discussed by the Executive Committee or by the Business Strategy Council are debated beforehand by the environmental management committees in each business unit, as well as by special sub-groups for each topic, and depending on their importance, matters are also deliberated on by the Environmental Management Promotion Council, which comprises managers in charge of the environment in each business unit. Matters that have a significant impact on NEC's operations are discussed by the Board of Directors. Each business unit has established environment-oriented management committees and a system for specific measures to be carried out by its divisions, affiliated companies, and subsidiaries of NEC throughout the world. By forming specific action plans based on the environmental strategy devised by the Executive Committee or by the Business Strategy Council, we can implement consistent environment-oriented management throughout NEC.

For business promotion activities that view the environment as a new business opportunity, we have established a dedicated team, the Carbon Neutral Business Promotion PMO, to support the formulation of strategies and business acceleration across the entire company, including group companies.

Fig.5: NEC's Environmental Promotion Structure
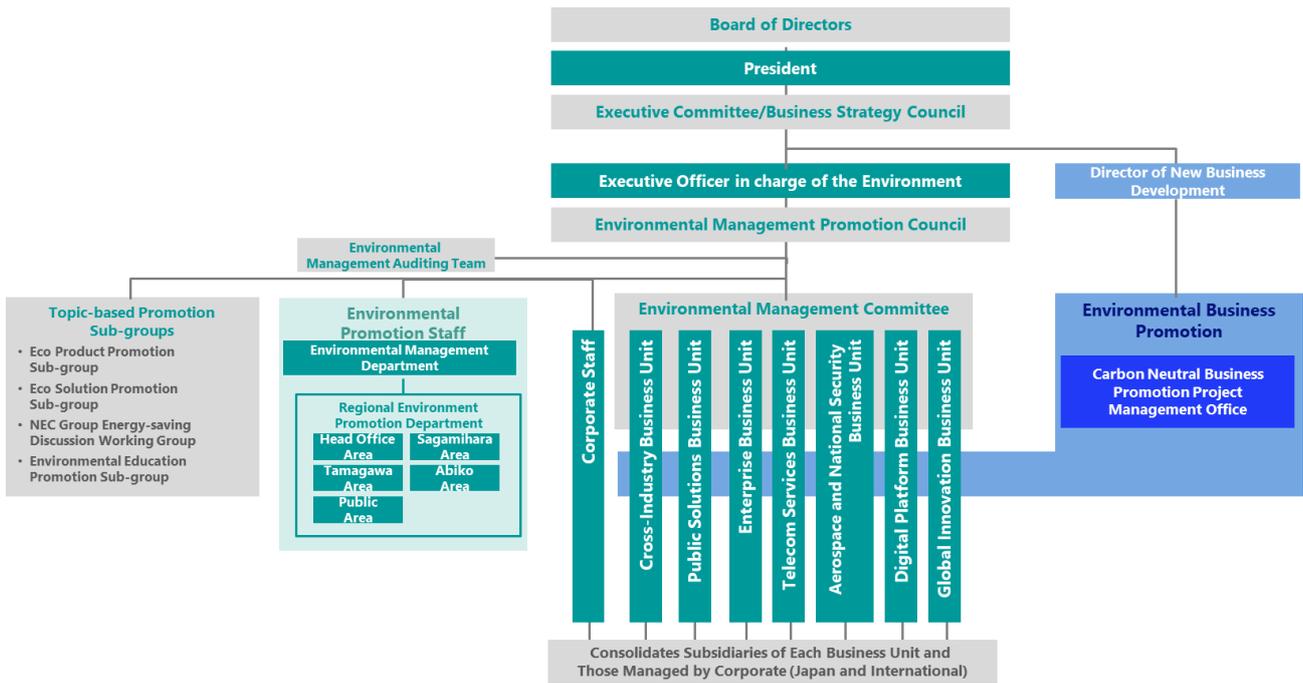
NEC also established the Sustainability Advisory Committee in FY2021 to promote management for sustainability as a means to improve corporate and social value. The CFO and the officers in charge of promoting sustainability hold regular high-level discussions with external sustainability experts with the goal of confirming the direction of the Company and improving its efforts in an era of high uncertainty and rapid change. In addition to management-level activities, NEC for GREEN is an online community for voluntary employees to gather and discuss environmental issues in general, with more than 1,800 participants from across the NEC Group, sharing trends and discussing new business opportunities related to environmental issues on a daily basis.

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The NEC Group Human Rights Policy applies to all officers and employees of NEC and its consolidated subsidiaries, including fixed-term contract employees, temporary employees, and part-time employees. We also encourage our suppliers, business partners and customers to understand this policy and share our commitment to respecting human rights. This policy, as well as our initiatives for promoting respect for human rights based on this policy, will be reviewed periodically and updated or revised as necessary.

4. Strategy

4.1. Risk (direct operation)

NEC is engaged in a variety of business activities, primarily in IT services and social infrastructure. The following steps were used to narrow down the business activities whose risks should be analyzed. We searched for risks broadly, using tools such as ENCORE[2] produced by the United Nations Environment Programme and other organizations.

Fig. 6: Risk Analysis

Understanding Dependencies and Impacts

Step1: Make a thorough list of NEC's business activities

Based on the Global Industry Classification Standard (GICS), we thoroughly listed a wide range of business activities that NEC Group is conducting. (150 activities).

Step2: Extraction of business activities that are considered to have a significant dependencies on and impacts on natural capital

Using ENCORE, we created a heat map on the degree of dependence of each business activity on ecosystem services (21 types*) and the degree of impact of impact drivers (11 types*). We then extracted business activities that were considered to have a high degree of dependence or impact.

Step3: Identifying of significant business activities based on NEC's actual situations

We identified business activities that should be subject to in-depth risk assessment based on the scale of sales, importance in the Mid-term Management Plan 2025, and the specifics of NEC's business. Even for businesses not identified in ENCORE and businesses with small sales, we selected those that we considered important based on our own knowledge and examples disclosed by other companies, and conducted a comprehensive evaluation.

Risk analysis for identified business activities

Fig.7: ecosystem services and impact drivers as defined in ENCORE

Ecosystem Services (*)	Impact Drivers (**)
• Animal-based energy • Bio-remediation • Buffering and attenuation of mass flows • Climate regulation • Dilution by atmosphere and ecosystems • Disease control • Fibres and other materials • Filtration • Flood and storm protection • Genetic materials • Ground water • Maintain nursery habitats • Mass stabilization and erosion control • Mediation of sensory impacts • Pest control • Pollination • Soil quality • Surface water • Ventilation • Water flow maintenance • Water quality	• Disturbances • Freshwater ecosystem use • GHG emissions • Marine ecosystem use • Non-GHG air pollutants • Other resource use • Soil pollutants • Solid waste • Terrestrial ecosystem use • Water pollutants • Water use

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[2] Exploring Natural Capital Opportunities, Risks and Exposure: Led by the Natural Capital Finance Alliance, in collaboration with UNEP-WCMC and others. A tool to help users understand and visualize the impact of environmental change on the economy. https://encore.naturalcapital.finance/en

With regard to ENCORE's process (business activity) category, "Infrastructure Ownership," we interpreted this as "Environmental Impacts of Data Center Operations" because the description stated "Impacts from a group of servers associated with a cloud facility."

Fig.8: Heat Map Excerpt

Sectors	Sub-industry	Process	Terrestrial ecosystem use	Freshwater ecosystem use	Marine ecosystem use	Water use	Other resource use	GHG emissions	Non-GHG air pollutants	Water pollutants	Solid waste	Soil pollutants	Disturbances
Consumer Discretionary	Broadcasting	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	Computer & Electronics Retail	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	Department Stores	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Industrials	Diversified Support Services	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Staples	Drug Retail	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	Education Services	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Utilities	Electric Utilities	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Staples	Food Retail	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	General Merchandise Stores	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Health Care	Health Care Services	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Health Care	Health Care Technology	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	Home furnishing Retail	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	Home Improvement Retail	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Industrials	Human Resource & Employment Services	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Staples	Hypermarkets & Super Centres	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Utilities	Independent Power Producers & Energy Traders	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	Internet & Direct Marketing Retail	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Information Technology	IT Consulting & Other Services	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	Movies & Entertainment	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Information Technology	Office Services & Supplies	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	Publishing	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Industrials	Research & Consulting Services	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Industrials	Security & Alarm Services	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Consumer Discretionary	Specialty Stores	Infrastructure holdings	NA	NA	NA	H	NA	NA	M	H	M	H	NA
Information Technology	Communications Equipment	Electronics and hardware pr	NA	NA	NA	NA	NA	NA	NA	H	M	H	M
Consumer Discretionary	Consumer Electronics	Electronics and hardware pr	NA	NA	NA	NA	NA	NA	NA	H	M	H	M
Industrials	Electrical Components & Equipment	Electronics and hardware pr	NA	NA	NA	NA	NA	NA	NA	H	M	H	M
Information Technology	Electronic Components	Electronics and hardware pr	NA	NA	NA	NA	NA	NA	NA	H	M	H	M
Information Technology	Electronic Equipment & Instruments	Electronics and hardware pr	NA	NA	NA	NA	NA	NA	NA	H	M	H	M
Information Technology	Electronic Manufacturing Services	Electronics and hardware pr	NA	NA	NA	NA	NA	NA	NA	H	M	H	M
Information Technology	Technology Hardware, Storage & Peripherals	Electronics and hardware pr	NA	NA	NA	NA	NA	NA	NA	M	M	H	M

Through the above screening process, the following business activities were identified for in-depth risk analysis.

Fig.9: Identified business activities for deep-dive analysis

Evaluation of ENCORE			NEC's cases
Dependency	**Optical Submarine Cable Installation**	Cable installation depends on the natural "water flow maintenance (sea state stability)" function.	Stable ocean weather and water currents are important for cable installation.
Impact	**Optical Submarine Cable Installation**	The laying of submarine cables involves "marine ecosystems" and "water quality".	Laying cables on the bottom of the world's oceans.
	Data Center Operations	Data centers may "use water" in cooling towers for air conditioning.	Some data centers use cooling towers.
	Equipment Manufacturing (Telecommunications, Aerospace)	Manufacturing plants may "use water".	Plants use water.
		Manufacturing plants may "discharge wastewater".	Plants discharge wastewater.
		Manufacturing plants may "produce waste".	Plants generate waste.
		Manufacturing plants may "use chemicals that cause soil contamination".	Plants use chemicals.

Next, we conducted a deep-dive analysis of the risks of the three identified businesses.

## <Optical Submarine Cable Installation Business>

Fig.10: Risks Considered

Dependency and Impact	Risks considered			
Dependence on sea state stability function	Physical	Acute & Chronic	Extended installation times and increased costs due to unstable sea conditions caused by climate change.	Med & Long term
Impacts on marine ecosystems and water quality	Transitional	Policy	Stricter regulations and, in some cases, increased costs.	
		Market	Stricter customer requirements and, in some cases, increased costs.	
		Technology	In case technological development is delayed, competitiveness will be reduced.	
		Reputation	In case of ecological impact, company's brand value will decrease.	

-Current status and countermeasures

In laying submarine cables, NEC takes into account the effects of weather. For example, in the North Pacific region, the weather tends to be rough during the winter season. Therefore, in order to avoid construction during this period, NEC plans prior permitting and cable production in consultation with cable owners. In addition, by conducting oceanographic surveys, we propose routes to cable owners that avoid areas prone to undersea earthquakes and landslides, thereby increasing resilience to natural disasters.

The submarine cable is as thin as 17 mm in diameter, yet strong enough to withstand 8,000 m on the seafloor. In addition, the development of multi-core fiber cables with multiple transmission paths in one fiber has enabled us to expand the transmission capacity without changing the cable thickness. This has made it possible to provide cable owners with a system that offers a higher return on investment while limiting the environmental impact.

Fig.11: OCC SC530 LW cable
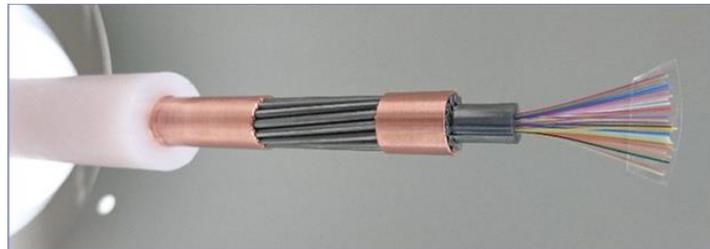
NEC has held numerous discussions with submarine cable owners and the national and local governments where the cables are installed and complies with local laws and ordinances while laying the cables in an environmentally conscious manner. For example, in Florida, U.S.A., the cable installation was schedule so that it avoids the sea turtle spawning season. Also, depending on the environment in which the cables are to be installed, we conduct preliminary surveys of marine organisms and install silt curtains to prevent sand from flying around when installing the cables.

## <Data Center Operation Business>

Fig.12 Risks Considered

Dependency and Impact	Risks considered			
Water use	Physical	Acute & Chronic	Halt due to inability to operate cooling towers due to drought.	Med& long term
	Transitional	Policy	Decreased sales in case that water withdrawal restrictions become more severe and the company is unable to properly react it.	
		Market	Decrease in sales in the event that customer demands become more stringent and the company is unable to meet them.	
		Technology	In case that technological development is delayed, competitiveness will be reduced.	
		Reputation	In case of the company causes regional drought, company's brand value will decrease.	

-Current status and countermeasures

Among NEC's major data centers, only the Kanagawa Data Center and Kobe Data Center utilize water-consuming cooling towers. These data center locations were analyzed with WRI Aqueduct[3] and confirmed that there is no high risk of water stress, water withdrawal, drought, annual/seasonal fluctuations, or groundwater depletion. In addition, interviews with the Water Resources Department of the Ministry of Land, Infrastructure, Transport and Tourism of Japan indicated that water use restrictions have occurred only once in the Kanagawa area and three times in the Kobe area over the past 30 years. Furthermore, the Kanagawa Data Center and Kobe Data Center have access to both tap water and well water. In the event of a drought, operations can continue while reducing the burden on water demand in the watershed. There has never been a water outage during data center operations.

In addition, we will continue to conduct fact-finding surveys on data centers of domestic and overseas group companies.

Fig.13: Water withdrawal risk analysis using Aqueduct (data center).
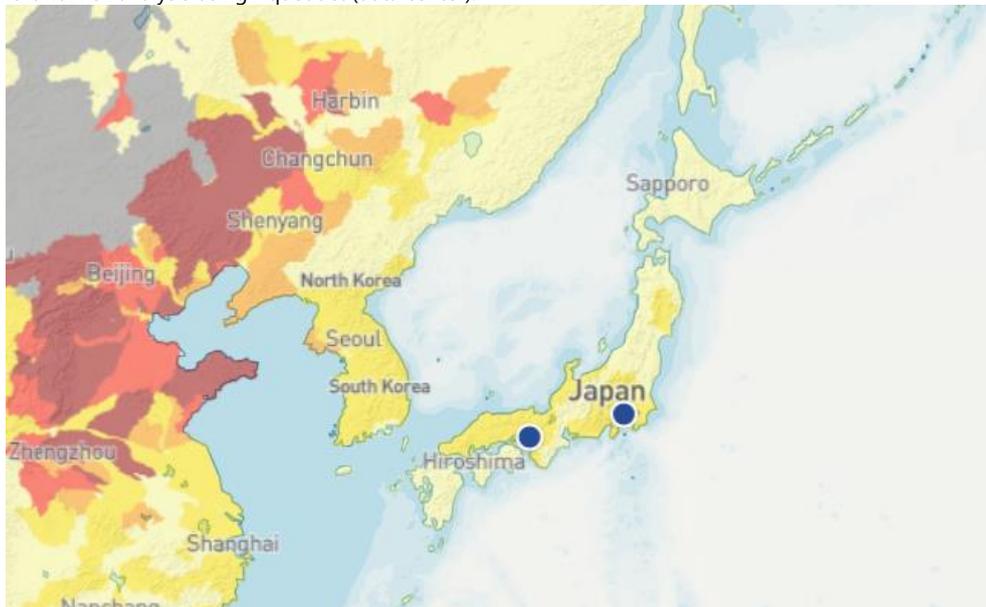
Source: Aqueduct

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[3] A tool provided by the World Resources Institute (WRI) to identify and assess water risks around the world: https://www.wri.org/aqueduct

<Equipment Manufacturing (telecommunications and aerospace) Business>

Fig.14: Risks Considered

Dependency and Impact	Risks considered			
Water use Flood & storm protection	Physical	Acute & Chronic	Plant shutdowns due to drought and flood damage	Med & long term
Wastewater Waste Soil contamination	Transitional	Policy	Decreased sales in case that pollution regulations become more stringent and cannot be met	Short term
		Market	Decrease in sales in the event that customer requirements become more demanding and cannot be met	
		Technology	In case that technological development is delayed, competitiveness will be reduced	
		Reputation	In case of spills, loss of the company's reputation and brand value	

-Current status and countermeasures
water risk

Water risks such as water scarcity, water quality, and flooding were assessed by using WRI Aqueduct for the locations of 16 domestic and international manufacturing sites. As a result, sites in Suzhou, Jiangsu Province, China and Pathum Thani, Thailand were identified as being located in areas with water-related risks.

Fig.15: Water risk analysis using: Aqueduct.
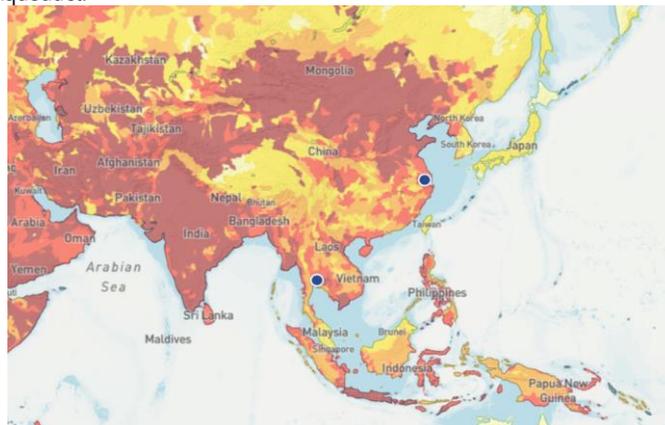
Source: Aqueduct

Fig.16: Type of risk per location

Sites	High risk by Aqueduct
Suzhou, China	Water Stress, Flood, Untreated Connected Wastewater
Pathum Thani, Thailand	Water Stress, Drought, Flood, Untreated Connected Wastewater

For these sites, water consumption was checked using NEC's environmental performance management solution, GreenGlobeX[4] . The Suzhou site in China uses only 6,000 m3/year of water[5] and we believe that the risk of water stress is low.

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[4] GreenGlobeX https://jpn.nec.com/environment/biz_solution/performance/index.html
[5] 6,000 m3 is equivalent to the water consumption of an office of 120-300 people (Reference data)

Fig.17: Water Consumption at Production Sites
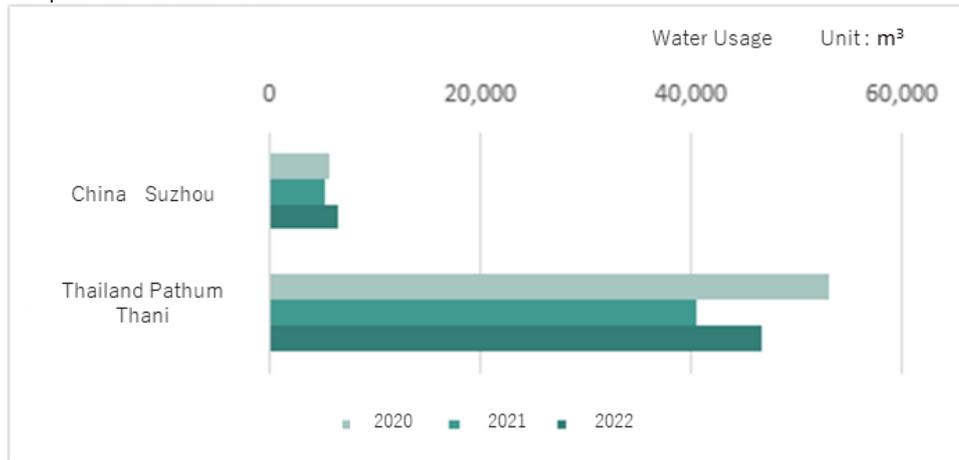
Source: Prepared by NEC based on data extracted from GreenGlobeX

In addition, we confirmed the situation through detailed interviews with the site managers. The site in Suzhou, China is housed on the second floor and higher of a tenant building, and wastewater is connected to a municipal sewage treatment plant, so flood and wastewater risks can be judged to be low.

The Pathum Thani site in Thailand has not experienced flooding since 2011, when it suffered a major flooding disaster. The government has improved dam control, and many measures against flooding, such as building levees around industrial parks, have been implemented. The NEC's plant has also implemented various BCP measures against major flooding disasters to minimize the impact on business. Extensive measures are in place for water stress, drought, and wastewater as well.

Fig.18: Water Risk Countermeasures in Thailand

Risk	Initiatives at Thai sites
Water stress, Drought	Installation of water storage tanks and water recycling system, prioritization of water use within sites
Flood	Installation of water gates and water-tight doors, stockpiling of sandbags, annual BCP drills and procedure reviews Power supply facilities at a height of 2.5m, and secure emergency evacuation areas for other facilities.
Wastewater pollution	Primary treatment of wastewater and discharge to industrial park sewage treatment, periodic water quality testing

Furthermore, with the cooperation of Gaia Vision, a start-up company from the University of Tokyo, high-resolution flood simulations were conducted for the 1.5°C and 4°C climate scenarios. The results show that the flood depth in this area is 0.6 m under the current conditions, 0.7 m under the 1.5°C scenario, and 0.8 m under the 4°C scenario in a 1-in-100 year probability event. Although the inundation depth increases as the temperature rises, it was determined that the current countermeasures can cover this increase.

Based on these circumstances, we have determined that measures to address water-related risks at this location have been minimized. In addition, since this site accounts for less than 1% of the NEC Group's total sales, we believe that it poses little business risk.

Waste Risk

For more than 20 years, we have been working to reduce landfill waste to less than 0.5% of the total amount of waste generated at our manufacturing sites. Specifically, we are promoting and expanding the sale of valuable resources, thorough separation of waste, reduction of paper use by promoting computerization, and reuse of cushioning materials. In addition, we are thoroughly promoting proper management and prevention of illegal dumping through electronic manifest management and on-site visits to waste management contractors.

Soil contamination/chemical risk

For the use of heavy metals and organic solvents, prior assessment of the environmental impact are conducted: usage conditions, management methods, and legal compliance. Also, education and training are proved to our employees to prevent the occurrence of leakage accidents.

For potential contamination from past business activities, we conduct voluntary soil/groundwater studies and take appropriate measures in addition to the investigation triggered by the "Soil Contamination Countermeasures Law".

4.2. Risk (Upstream in the Value Chain)

Visualization of Environmental Impacts of Value chains Using Input-output Tables

It is very difficult to trace back the huge number of suppliers upstream in the value chain to understand their dependences and impacts on nature. In cooperation with aiESG, a start-up company from Kyushu University, we conducted a trial analysis using NEC's procurement data and statistical data from the International Input-Output Table and AI, and gained the results that shows NEC's upstream environmental impact was one-half to one-third of the G7 average for all industries. However, we also found some points to note and issues to be addressed in utilizing statistical data, such as the difference between procurement countries and production countries that actually have environmental impacts. Further study is needed to identify environmental impacts and regions that should be explored in depth.

Fig.19: Percentage of environmental impact of the NEC value chain relative to the G7 all-industry average
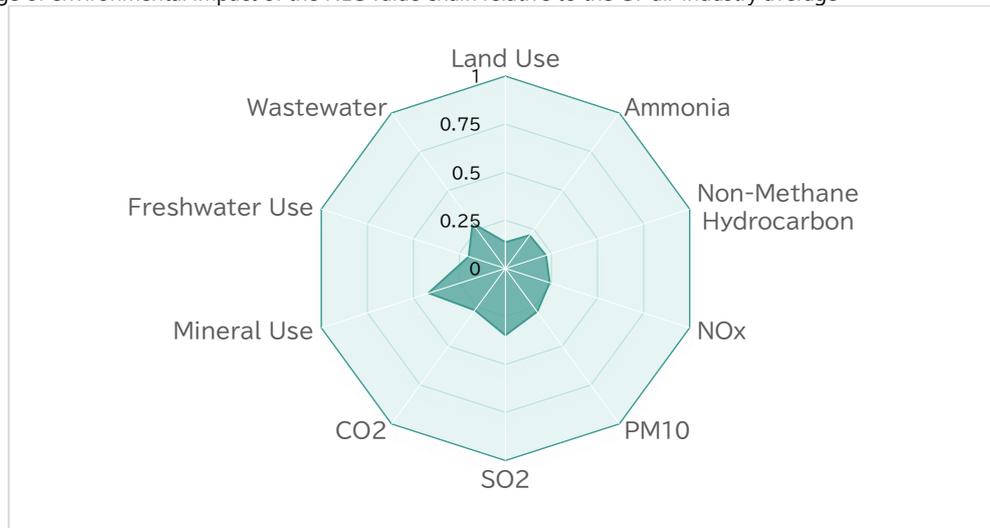
water risk

According to AWS[6] (Alliance for Water Stewardship), the ICT industry tends to have significant water use upstream in the value chain. In addition, the location of facilities is characterized by concentration in specific watersheds.

Fig.20: ICT Industry Value Chain Water Consumption Diagram
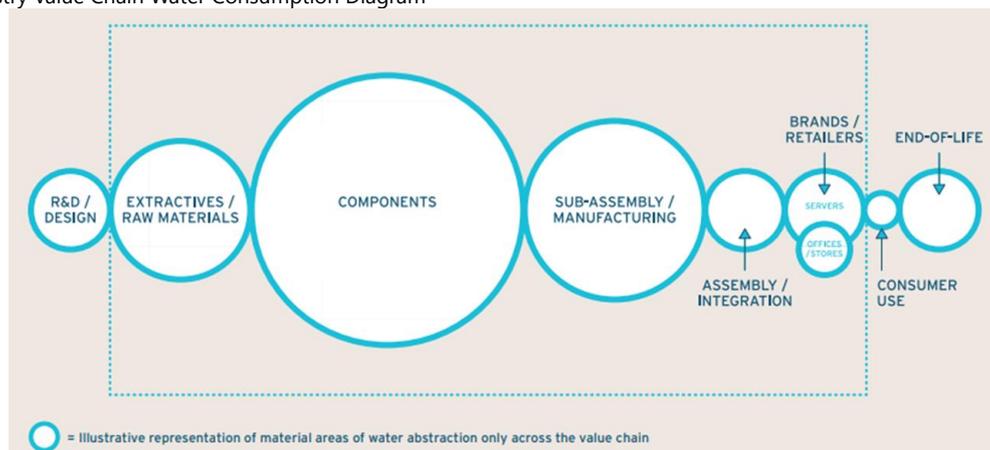
Source: Water Risk in the ICT Sector: The Case for Action (2021)

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[6] A community of global members comprised of businesses, NGOs and public agencies. It contributes to the sustainability of local water resources through the adoption and promotion of the International Standard for Water Stewardship (or AWS Standard), a universal framework for the sustainable use of water. https://a4ws.org/

Fig.21: Number of locations by major basins in the 3300 facilities of the ICT value chain
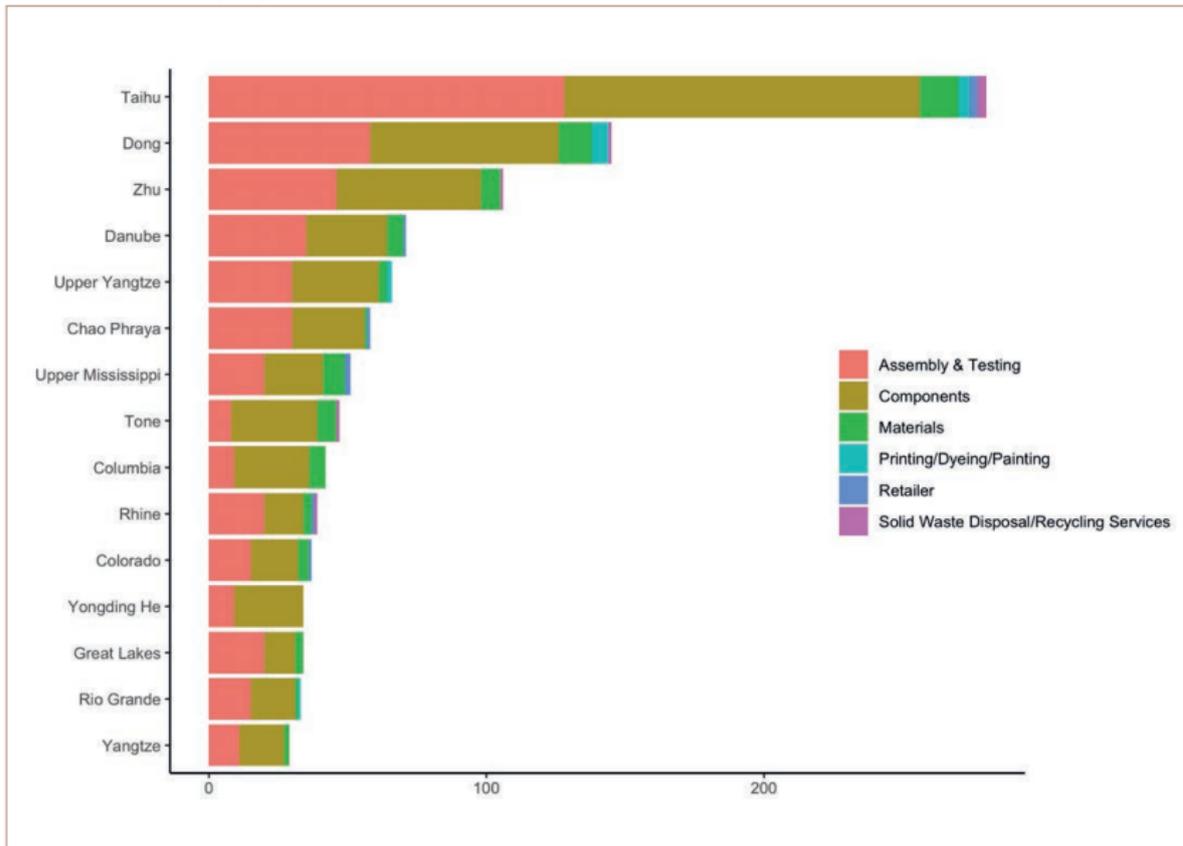
Source: Water Risk in the ICT Sector: The Case for Action (2021)

In addition, NEC conducted assessment using WRI Aqueduct for the risk of approximately 2,000 production sites of our hardware suppliers, which are considered to have a relatively high dependencies/impacts on water. It was identified that approximately 2% of these sites are located in areas where water risk is present: China, Southeast Asia, and the West Coast of the United States and Mexico.

Furthermore, NEC is conducting detailed interviews with suppliers that have sites located in areas that have been assessed as risky. As a result, NEC has confirmed that each company has evaluated the risks (water shortage, flooding, water pollution, etc.) of its location and is taking appropriate measures to deal with them. Through the interactive interviews, NEC and its suppliers share a common understanding of the importance of risk management and learned from each other.

4.3. Risk (downstream in the value chain)

With respect to the downstream of the value chain, we considered risks in the use and disposal phases of the hardware.

Chemical Substances Contained in Products

NEC conducts detailed assessments of the environmental impact of chemical substances and promotes the reduction of their use and the substitution of safer substances. Specifically, NEC quickly identify trends in laws and regulations around the world and incorporate information in our "Environmental Specifications Pertaining to Procurement Restrictions for the Inclusion of Chemical Substances in Products" to promote management in cooperation with suppliers. The specifications list banned substances, conditionally banned substances, and controlled substances, and require the calculation of content concentration and the submission of a guarantee. Furthermore, NEC analyzes the applicable substances when procured parts are received. The survey and tabulation of chemical substances contained in each part are conducted using solutions such as "ProChemist[7] " developed by NEC. Through these efforts, NEC manages compliance with laws and regulations as well as environmental impact during hardware use and disposal.

End-of-Life Products

NEC has been collecting, reusing, and recycling end-of-life information and telecommunications equipment since 1969, and in 2001 acquired certification as a "wide-area processor" ahead of other manufacturers. PCs, general-purpose computers, servers, and printers collected from corporations and individuals are reused or material recycled at a rate of more than 92% by weight (FY2022 results). Specifically, parts are reused as used and reconditioned parts units, and iron, copper, aluminum, precious metals, glass, and plastics are recycled as materials.

NEC is also working with Seven Bank to reuse ATMs by collecting them, cleaning their sensors and internals, and checking their operation. To date, more than 13,000 ATMs have been reused. For ATMs that cannot be reused as they are, we are working to reuse their parts. This leads to the effective use of resources such as plastic.

Fig.22: Reuse of Seven Bank ATMs

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4.4. Opportunities (direct operations)

On the premises of NEC Abiko Plant, there are four ponds called "Yotsuike (meaning four ponds in Japanese)" which are thought to be originating from the floodplain of Tone River. NEC has been working with the Teganuma Aquatic Life Study Group since 2009 to conserve the ecosystem of Yotsuike Ponds. These activities provide an opportunity to contribute to ecosystem conservation in Chiba Prefecture and the Tone River basin. NEC has also positioned this site as a demonstration site for ICT solutions, and together with NEC Solution Innovators, we are evaluating biodiversity conservation priorities, holding workshops to generate business ideas related to biodiversity, and conducting an environmental DNA survey.

Fig.23: Biodiversity Conservation Activities

Aim of Conservation Activities in Abiko Plant
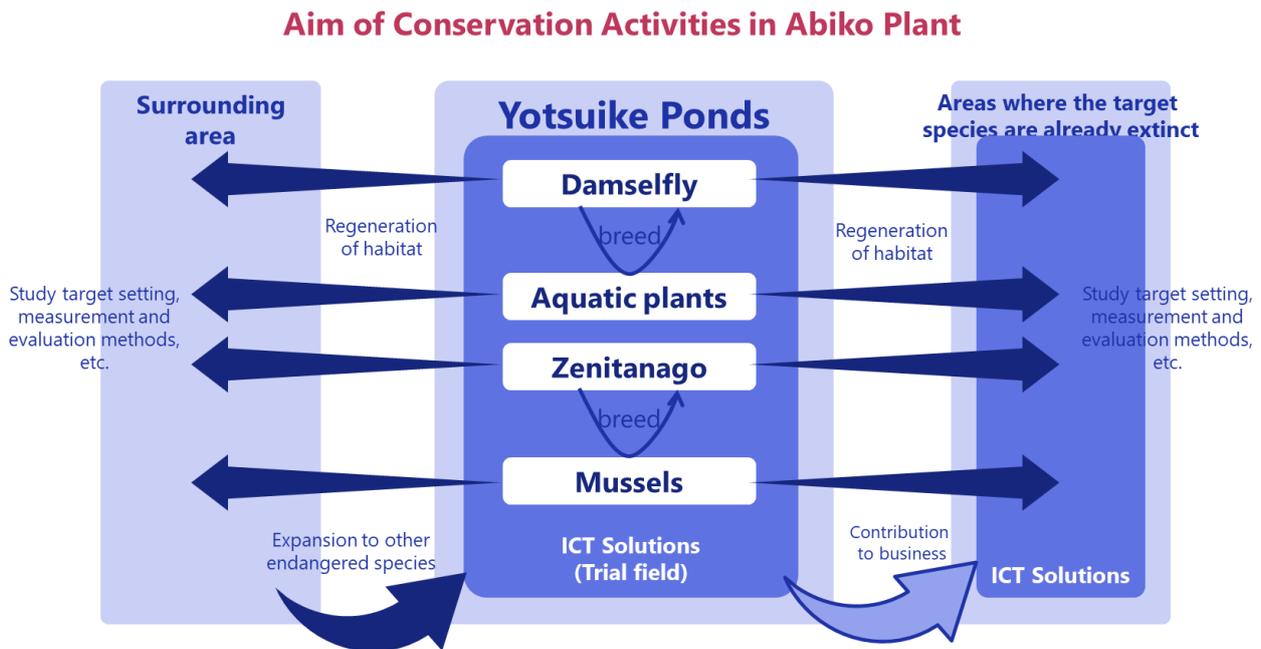
In Yotsuike Ponds, we are promoting the conservation of the "Giant Monoceros Damselfly *Pseudocopera rubripes*" (Endangered IB (EN) designated by the Ministry of the Environment). We are also conducting conservation activities for Zenitanago ray finned fish *Acheilognathus typus* (endangered IA (CR)) using freshwater mussels found during the maintenance of our ponds in 2012. To preserve the habitat of the giant monoceros damselfly and the ray finned fish, we are tackling to remove invasive species such as American crayfish and blue gill. The number of existing habitats for the giant monoceros damselfly is less than 20% of the known habitats in Japan. The population of Zenitanago ray finned fish, a species endemic to Japan, is currently declining dramatically in all areas of its distribution, and is nearly extinct in the Kanto region.

Fig.24: Panoramic view of Yotsuike Ponds   Fig. 25: Giant Monoceros Damselfly
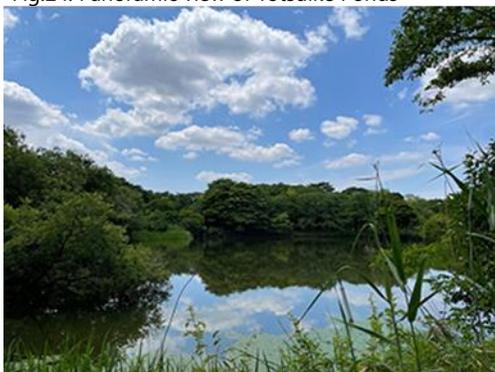

Every year, NEC holds a "Biodiversity Dialogue" at NEC Abiko Plant with the Teganuma Aquatic Life Study Group, experts, and the Abiko City Office to review the results of our activities and discuss future initiatives.

With our efforts for over 10 years being evaluated, we received the "Selection Committee's Special Award" at the Japan Nature Conservation Grand Prize 2022, which is awarded to initiatives that have made significant contributions to the conservation of nature and biodiversity in Japan. In October 2023, Yotsuike Ponds was certified by the Ministry of the Environment as a "nature symbiosis site" (an area where biodiversity is being conserved through private sector efforts). With this certification, the site at NEC Abiko Plant will contribute to achieving the global goal of 30 by 30, which aims to effectively conserve at least 30% of the land and sea as healthy ecosystems by 2030.

The map below shows the biodiversity conservation priorities of Abiko City, where NEC Abiko Plant is located, and the surrounding cities and towns. Redder color indicates irreplaceability, and most of the red areas were water bodies in plain areas such as Tone River, Teganuma Swamp, and Inbanuma Swamp.

Fig.26： Biodiversity conservation priorities in and around Abiko City.

Conservation Priorities
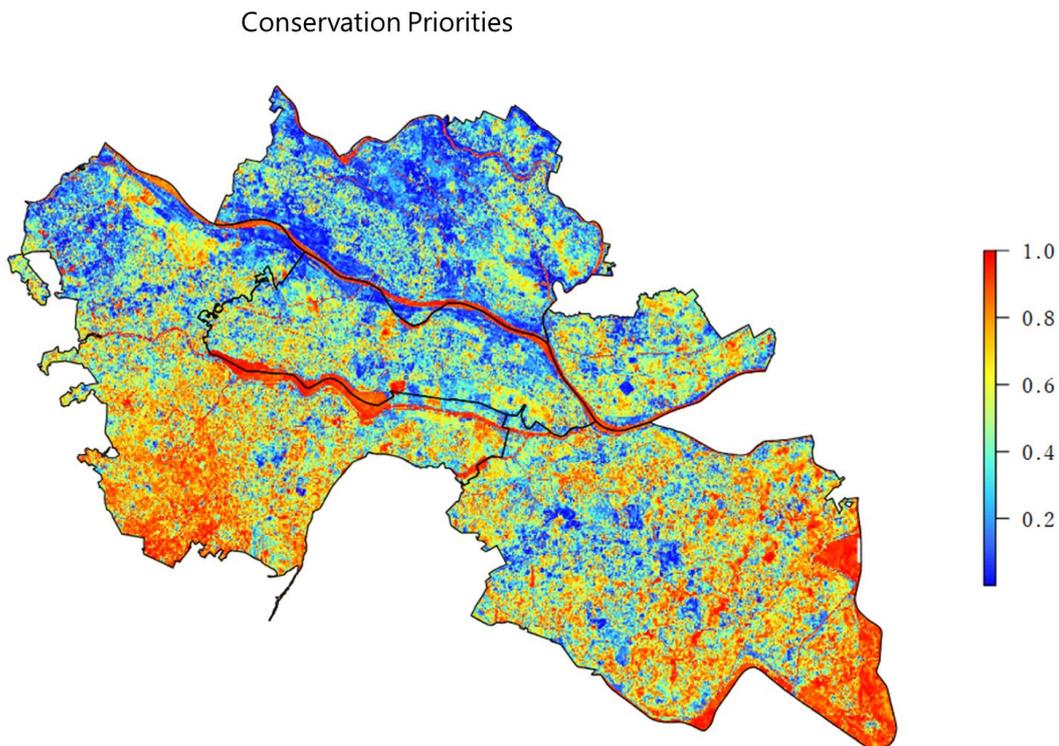
Source: Think Nature Inc.

NEC is contributing to ecosystem protection in this area by conserving the Yotsuike Ponds at NEC Abiko Plant and sharing our experience with local government, citizen groups, and other companies in the neighboring area. Specifically, we are participating in the "Biodiversity Chiba Corporate Network" and sharing our knowledge from Yotsuike Ponds with the Chiba Biodiversity Center and other member companies working to protect the ecosystem in Chiba Prefecture. In May 2024, we organized a "Biodiversity x Business" ideation workshop with Frantz Dhers of the NPO Nelis. We are exploring ways to coexist with nature around us and make ecosystem conservation economically sustainable.

At Yotsuike Ponds, we also use environmental DNA to survey the diversity of species. Environmental DNA is a technology that evaluates the types of organisms living in the environment by analyzing the DNA of organisms that exist in the environment, such as in water. It is one of the promising technologies as an alternative to or complementary with conventional surveys of plants and animals, which require a large number of man-hours. Another advantage of this method is that it has minimal impact on the environment.

[8] Kubota Y. et al. (2017). Journal of the Ecological Society of Japan 67:267-286.
Guisan A. et al. "Habitat Suitability and Distribution Models: with Applications in R".
Lehtomäki J. et al. (2018). Diversity and Distributions 25: 414-429.
Shiono T. et al. (2021). Global Ecology and Conservation 30, e01783.

4.5. Opportunities (downstream of the value chain)

NEC's ICT solutions, including AI, IoT/sensors, telecommunications, and satellites, have opportunities to serve a variety of industries, including TNFD's priority sectors.

Fig.27: Sectors and natural capital to which NEC's digital technology could contribute
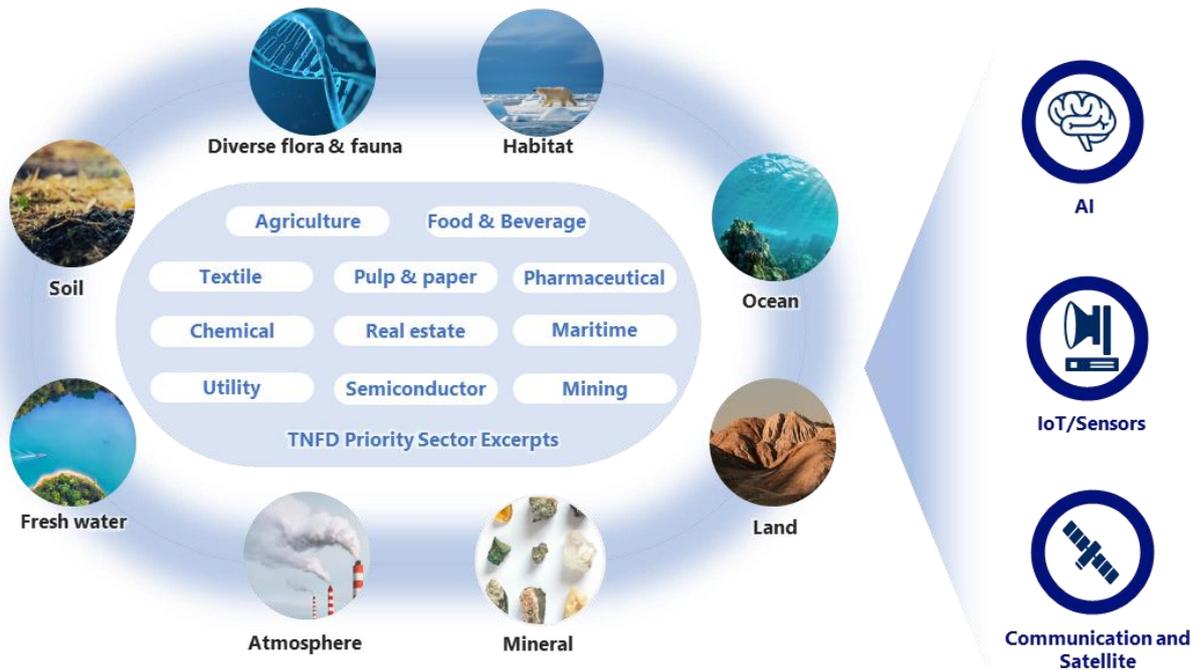
As companies transform toward nature-positive management, they need to visualize their dependencies on and impacts on nature, quantify risks and opportunities, and incorporate them into business activities such as product planning, design, procurement, manufacturing, distribution, and sales. It is also necessary to coordinate information among functional departments within a company and among companies in the supply chain. NEC's ICT solutions can contribute to companies in various industries as they pursue such transformation. Specifically, there are opportunities to contribute to the following areas:

- Inter-company data sharing throughout the value chain (e.g., Digital Product Passport: Plastics Information Distribution Platform)
- Enterprise systems that support the use of data in the value chain (Product Lifetime Management: Obbligato, etc.)
- Solutions to reduce environmental dependencies and impacts in upstream of the value chain (AI farming system: CropScope, etc.)
- Consumer-behaviour analysis to make environmental efforts economically sustainable (e.g., causal analysis solutions)

For a company to achieve transformation, it must overcome the problems that each functional department has with its data. For example, in the design department, LCA data is applied after design is completed, so environmental considerations cannot be made during design. In the procurement department, environmental impact is calculated based on procurement amounts after a year's procurement activities are completed, so consideration cannot be given when selecting suppliers or placing orders. In the manufacturing department, in case multiple products are made on a single line, it is difficult to understand the actual amount of environmental impact (water use, chemical substance use, etc.) for each product. In addition, decision-making is difficult unless environmental information can be visualized together with cost and quality information. And sales departments are faced with issues such as not having clear target customers for products with environmental measures and not being able to pass environmental considerations on to the price.

This situation not only prevents the company's and its suppliers' efforts to reduce environmental impact

from being reflected in added value, but also block the improvement cycle among internal and external stakeholders.

Fig.28: Challenges of Data-Driven Nature Positive Management
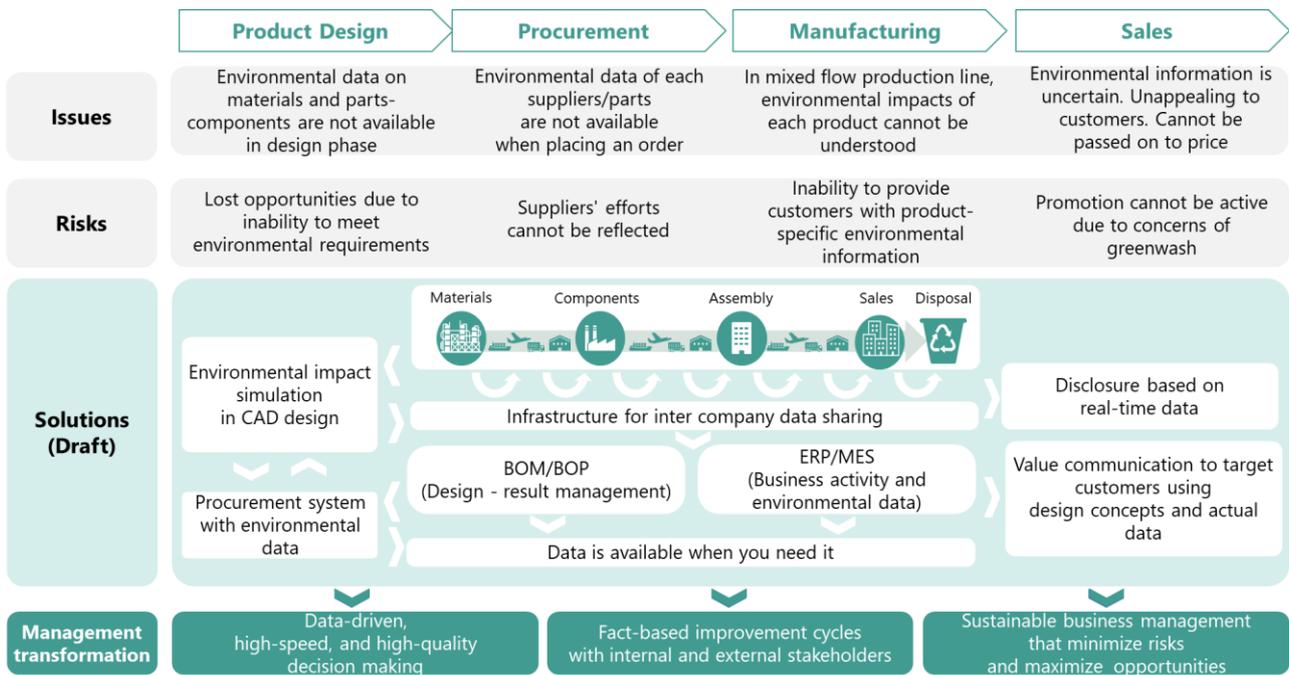
To overcome this situation, it is necessary to aim for data-driven management where necessary data is available when needed by reforming business systems. As illustrated in the figure above, environmental information on raw materials and components procured through the value chain must be distributed among companies. By linking them with BOM (Bill of Materials)/BOP (Bill of Process), ERP, and MES, and by normalizing and systematizing the aggregate data within the company, the data becomes "usable".

This allows the manufacturing departments to identify bottleneck process/equipment/pats in reducing environmental impact and devote resources to implementing countermeasures. The design departments can design products while simultaneously referring to the environmental information of various materials and components, which can be incorporated into decisions in design. If such concepts, facts, and target customers in product design can be shared with the sales department, the sales department can confidently promote the added value of the product to customers. In addition, by making this information visible, the procurement departments to select and place orders with the appropriate suppliers in a timely manner.

Inter-company data collaboration across the value chain

NEC is working to build a traceability infrastructure that enables the sharing of product-related information among various stakeholders in the value chain in a transparent and reliable manner. For example, under the Strategic Innovation Program (SIP) led by the Cabinet Office of Japan[9], we have developed a prototype of a "Data Infrastructure for Plastics"[10] that manages the life cycle of plastics and other materials and can be used domestically and internationally. (For more details click here). NEC has various data trust and security technologies that will contribute to ensuring traceability throughout the value chain.

Enterprise systems that support the use of data in the value chain

In order to make effective use of value chain data, it is also essential to develop enterprise systems that can deal with such data. For example, NEC provides Obbligato[11], a system for managing product design information in the manufacturing industry. This system stores information on the components that make up a product, and in the future, by storing environmental data received from upstream in the value chain, it could be used to compile and disclose nature dependency/impact information for each product.

Solutions to reduce environmental impacts and dependencies in upstream of the value chain

The NEC offers digital technologies that can visualize, analyze, and countermeasure dependencies/impacts on nature. There are opportunities to contribute to various sectors, including the priority sectors identified by the TNFD. Priority sectors such as textiles, pharmaceutical, and the food and beverage industry are required to disclose environmental information on upstream agricultural lands where raw materials are produced.

Fig.29: TNFD Draft Sector Guidance (excerpts)

|	TNFD Sector Indicators (example)
Textile	Nitrogen and phosphorus inputs and runoff in agricultural lands upstream of the value chain
Pharmaceutical	Nitrogen and phosphorus inputs and runoff in agricultural lands upstream of the value chain
Food & Beverage	Nitrogen use efficiency in agricultural lands upstream of the value chain, production in water risk areas

NEC's AI farming system "CropScope" provides a platform that consolidates data related to agricultural production in one place for reference by all stakeholders, forecasting and optimization using accumulated farming data, and remote automatic control. As a result, the farming AI for processing tomatoes developed jointly with Kagome Co., Ltd. has achieved a "20% reduction in nitrogen fertilizer" and a "20% increase in yield with 15% less irrigation" in tomato field in Portugal, and a "23% yield increase with 19% less irrigation" in tomato field in Northern Italy.

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[9] Cross-ministerial Strategic Innovation Promotion Program (SIP) https://www8.cao.go.jp/cstp/gaiyo/sip/
[10] Cabinet Office: Strategic Innovation Program (SIP) 3rd Term (2023-) List of Proposals
https://www8.cao.go.jp/cstp/gaiyo/sip/sip3rd_list.html
[11] NEC PLM Solutions Obbligato https://jpn.nec.com/obbligato/index.html

Fig.30: CropScope Deployment Results

14 Countries

Australia, Spain, Portugal, USA, Thailand, Brazil, Vietnam, India, Colombia, Turkey, Japan, Italy, Chile, Senegal

Proven Crops

Tomato, Potato, Wheat, Sugarcane, Maize, Spice, Broccoli, Onion, Carrot, Coffee, Grape, Paddy Rice, Soybeans, Sugar Beet
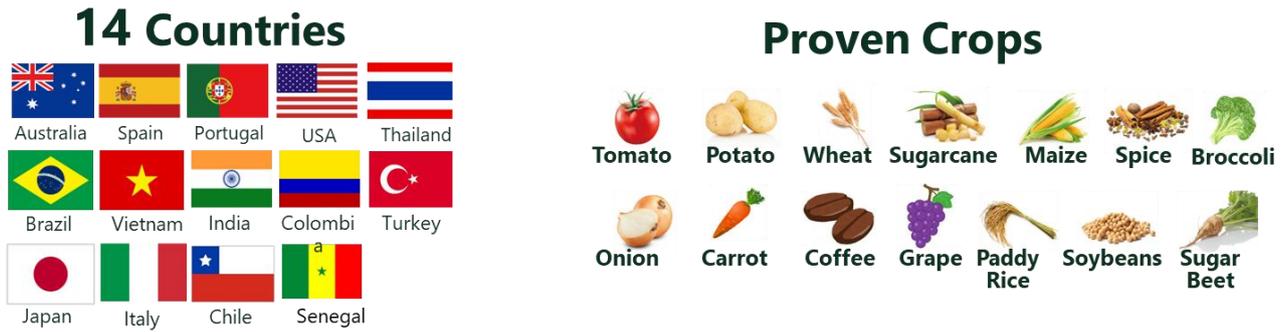
Consumer-behaviour analysis to make environmental efforts economically sustainable

Even if we can visualize the dependencies on and impacts on nature through the use of AI farming systems and traceability infrastructure, we will not be able to restore nature if these activities are over in the short term. In order to make these activities sustainable, the value of these activities must be properly communicated to society and actual actions must be taken to establish a cycle in which invested capital is recovered and used for the development of the activities.

NEC's causal analysis solution, an AI service that supports data-based decision making, is beginning to be used in initiatives that contribute to nature positivity. For example, IDEA Consultants, Inc., a partner company of this solution, used causal analysis in a project of the Ministry of the Environment of Japan to study methods to promote behavioral change of consumers. The company succeeded in obtaining suggestions for effective measures to promote the purchase of oysters that have acquired ASC certification, one of the sustainable certifications for farmed marine products (for details, click here).

By not only delivering correct data to consumers, but also communicating value more effectively and efficiently based on the data and linking it to action, we will be able to recover the costs spent on environmental considerations as added value. By doing so, we will establish a sustainable cycle of budget allocation and activities for long-term change making.

Fig 31: Overview of the study of methods to promote behavior change using causal analysis solutions (causal analysis)
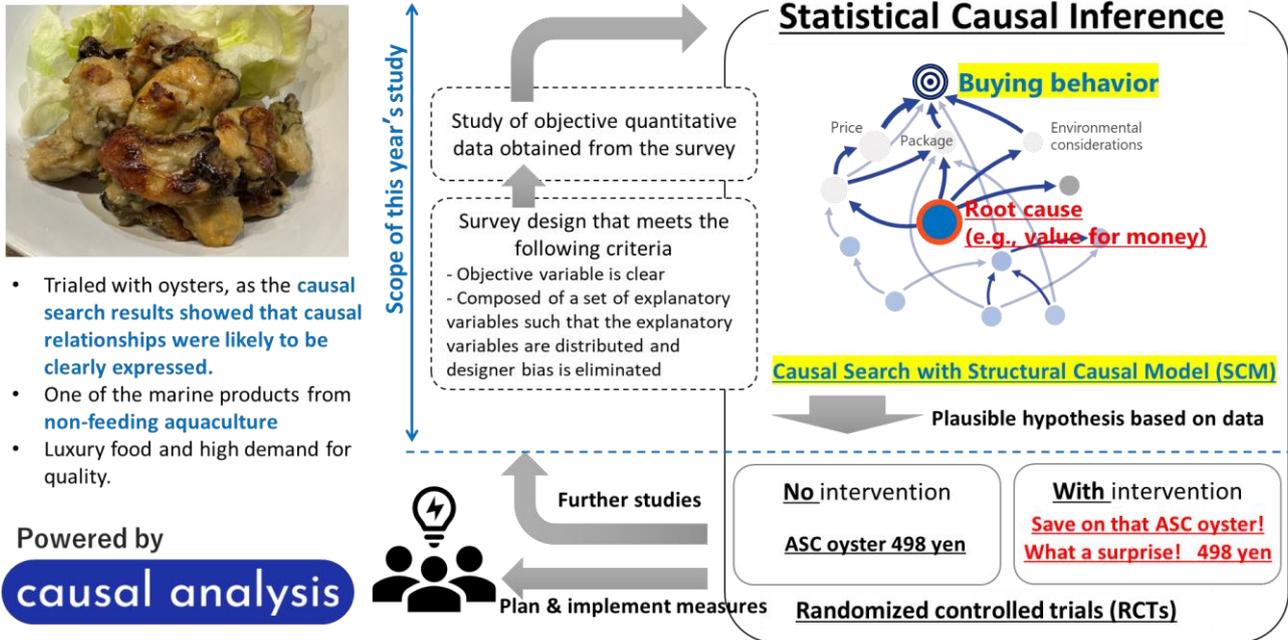
Fig.32: ICT's Contribution Image
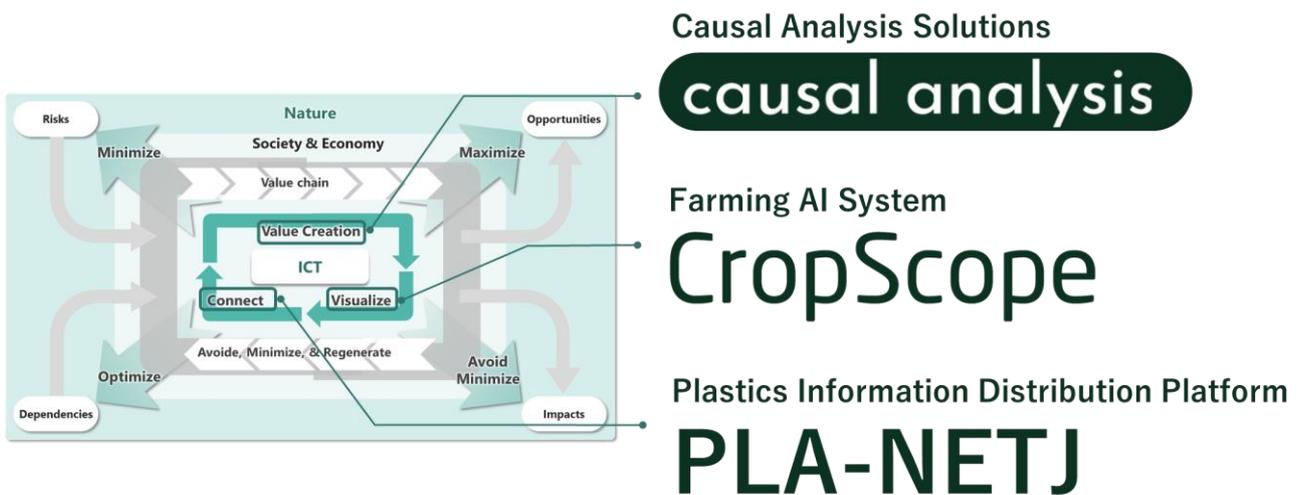
In addition to the above, NEC has a variety of other solutions that can contribute to the creation of a nature-positive society. (See Chapter 7)

5. Risk and Impact management

NEC has established a Risk Control and Compliance Committee to manage risks throughout the company. This committee fulfills a supervisory function by confirming the results of activities, issues, and future plans for specific risk measures, and decide overall direction of risk management activities. It also reports to the Executive Committee and the Board of Directors as necessary.

With regard to climate change, biodiversity, environmental issues in the value chain, natural disasters, lifelines of business locations including water supply, and violations of environmental laws and regulations, the departments in charge regularly monitor changes in internal and external factors. If a potentially significant business impact is identified, a response is discussed at the Risk Control and Compliance Committee.

In addition, within the company-wide environmental management system, risks and opportunities are identified annually based on internal and external trends and reflected in the review of the "Eco Action Plan", a 5-years environmental action plan. Furthermore, NEC recognizes the impact of environmental risks on its business and continuously strives to reduce risks through assessment, inspection, and education based on the following approach.

Risk countermeasures are promoted by classifying risks into three categories: "factory-related risks," "product-related risks," and "sales and maintenance-related risks.

The first type of plant-related risk includes leakage of hazardous substances, soil contamination, and groundwater contamination caused by natural disasters or equipment failure.

The second product-related risk is the risk of contamination with substances regulated by the EU RoHS Directive and violation of labeling regulations, which is addressed through thorough compliance with guidelines based on product assessments and centralized management of information using an in-house system.

The third type of risk, sales and maintenance risk, is the risk of violations of the Waste Disposal and Public Cleansing Law due to inadequate waste disposal outsourcing. At the same time, we have established "Environmental Risk Information Escalation and Response Rules" to strengthen our governance of environmental risks.

In addition, NEC requires its suppliers, who are upstream in the value chain, to take environmental conservation initiatives, including biodiversity, water, and soil conservation, in its "Guidelines for Responsible Business Conduct in Supply Chains". NEC also conducts an annual survey of its suppliers to determine the status of their initiatives.

Fig.33: Guidelines for Responsible Business Conduct in the Supply Chain

Source: https://www.nec.com/en/global/purchasing/sustainable.html
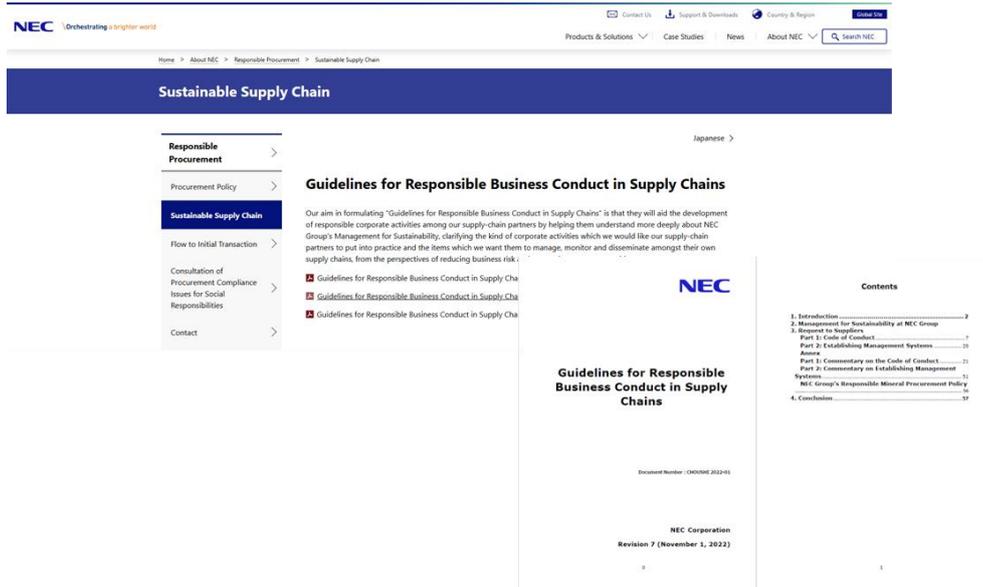
Through the preparation of this TNFD report, we identified following risk and conducted in-depth analysis of current risk management status. As a result, considering the nature and location of our business, we did not find any significant risks at present. However, we will incorporate the perspectives we learned during this in-depth evaluation into our regular risk management process going forward. As for business opportunities, we will consider them in our mid-term management plan.

Fig.34: Major risks assessed in depth in this report

	Main risks assessed in depth
Direct operation	- Ecosystem/water quality risks of submarine cable installation projects - Water withdrawal risk in data center operations - Flood/water withdrawal/drainage/waste/soil risk in equipment manufacturing business
Supply chain	- Water risk for parts procurement suppliers

6. Metrics and Targets

NEC uses GreenGlobeX, an environmental performance management solution developed in-house, to compile and manage data. NEC also formulates an "Eco Action Plan" in line with the period of its mid-term management plan, which is also reviewed annually based on internal and external trends.

Below is a table of correspondence to the TNFD Core Metrics. Information for the entire company and for the locations where risk was considered in the "Strategy" section is provided.

Fig.35: TNFD Core Metrics Correspondence Table

	Driver	Indicator	Results in FY2022	Target for FY2025
C1.0	Land-use change	Spatial footprint	**Prior assessment will be done in case a new plant is built** (No targets and performance management since no major projects involve land alteration)	
C1.1		Land-use change	**OECM site: 4.343 ha (Yotsuike Pond in Abiko Plant)**	
C2.0	Pollution	Soil pollution	**Appropriate surveys and measures are taken in accordance with regulations in case of land use change.** (No target and performance management due to thorough leakage control)	
C2.1		Wastewater	**BOD discharge: 40.7t.** Each site sets its own standards, which are stricter than laws and ordinances. **Total water discharge: 1,658,000 m^3** Sewage: 1,370,000m^3 Public water body: 288,000m^3	**BOD discharge: 1% reduction from FY2017** According to Aqueduct, two sites are located in areas with a risk of the unconnected sewage infrastructure, but no specific targets have been set because these sites are already connected to the sewage infrastructure.
C2.2		Waste	**Total amount of waste: 42,000t. Percentage of landfill volume to total waste: less than 0.5% Product recovery and recycling rate: 92%**	**Total waste: 4.8% reduction from FY2018 Percentage of landfill volume to total waste: Maintain less than 0.5%. Product recovery resource reuse rate: 90% or more**
C2.3		Plastic	**Amount of waste plastic: 3,900t.**	**Waste plastic volume: 4.2% reduction from FY 2019**
C2.4		Non-GHG air pollution	**NOx emissions: 13.7t. SOx emissions: 0.01t. VOC emissions: 86t.**	**NOx emissions: 1.0% reduction from FY2017 SOx emissions: 1.0% reduction from FY2017 VOC emissions: 1.0% reduction from FY2017**
C3.0	Resource use	Water withdrawal from areas of water scarcity	**Water withdrawals for sites identified as water stressed areas by Aqueduct: Suzhou, China 6,420m^3 Thailand Pathum Thani 46,671m^3** Total water withdrawal: 2,067,000 m^3 City water 901,000m^3 Groundwater 985,000m^3 Industrial water 181,000m^3 Recycled water 4,000 m^3	**The site in China does not use water for manufacturing, no individual targets set. The site in Thailand has water storage tanks and water recycling facilities and priority of water use during drought. Continue to work closely with government/industrial parks.** Total water withdrawal from direct operations: 10.5% reduction from FY2017
C3.1		Quantity of high-risk natural commodities	**Examples of SBTN commodities in components: copper, steel, aluminum** Nature risk assessment methods for the top end of the supply chain have not yet been established. Trial risk assessment using the International Input-Output Table was done. Regarding conflict minerals, we have established a "Responsible Mineral Procurement Policy" and published a "Conflict Minerals Survey Report for FY2022".	
C7.0	Risk	Transition risks	**No assets or revenues were found to be vulnerable to transition risk as a result of the in-depth evaluation under "Strategies."** We continue to watch regulatory, market, and technology trends.	
C7.1		Physical risks	**The site in Thailand', located in a water risk area, accounts for less than 1% of NEC's total sales.** Risks are minimized due to thorough countermeasures at the site in Thailand.	
C7.2		Significant fine & penalties	**No environment-related fines or penalties were received in FY2022.**	
C8.0	Opportunity	Related investment	**Expanding our lineup of products and services that have a positive impact** (such as CropScope, an AI farming system that reduces nitrogen fertilizer and water use on farmland) Many underlying technologies that can be applied to the natural capital field (e.g., data trust technology that can be applied to supply chain management) Quantitative figures have not yet been determined.	
C8.1		Related revenue		

The latest environmental data is published annually in the NEC ESG Data Book.

7. Potential of Digital Technologies

This chapter introduces NEC's digital technologies that have the potential to contribute toward Nature Positive society.

Fig.36: List of digital technologies that could contribute to Nature Positive

| Customers		Products/Services/Initiatives
General	1	Environmental performance management: GreenGlobeX
	2	Carbon neutral and other SX consulting services
	3	Intercompany data sharing: Plastic Data Sharing Platform
	4	Climate change adaptation finance
Agriculture, Forestry, and Fisheries	5	Agricultural ICT platform: CropScope
	6	HYPERPOST/farmland management system
	7	Wood traceability management
	8	Satellite monitoring for sustainable fishery
Manufacturing	9	Product lifecycle management: Obbligato
	10	Chemical management: ProChemist
	11	Aluminum Upcycling
	12	Manufacturing facility management
	13	Business continuity and disaster preparedness solutions
Public Services	14	IoT street lighting system
	15	City water cloud service
	16	Calsos: remote monitoring and control of infrastructure
Other	17	NEC Sake Moromi (Sake Mash) Analysis Cloud Service
	18	Environmental DNA
	19	Causal analysis for policy making

GreenGlobeX is a solution that efficiently collects and compiles environmental data from multiple locations, including factories and offices. The introduction of this system will lead to target management and visualization, as well as efficient management by drastically reducing man-hours previously allocated to data collection, aggregation, and progress management.

While this system is used by corporate headquarters departments to aggregate domestic and international site data for GHG emissions aggregation work, a comparison of data by site is useful for natural capital risk analysis. Specifically, by combining data on water consumption and wastewater discharge for production sites entered into GreenGlobeX with area-specific risk assessment tools such as WRI Aqueduct, it is possible to identify high-risk sites. (For more information, click here)
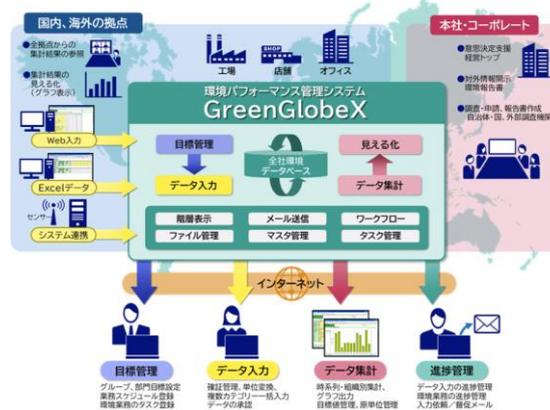
To help customers achieve sustainability transformation (SX), including carbon neutrality, NEC provides SX consulting services that support the formulation of strategic roadmaps, management, and implementation of priority measures, leveraging knowledge gained from NEC's own initiatives. We also provide comprehensive support for solving various customer issues with solutions that facilitate the implementation of SX.

NEC, together with group/affiliated companies ABeam Consulting Ltd. and GX Concierge Co., also offers services to support clients in preparing TNFD reports. We support the transition toward nature-positive business management through digital technology and consulting, capitalizing on the know-how accumulated through NEC's own initiatives.
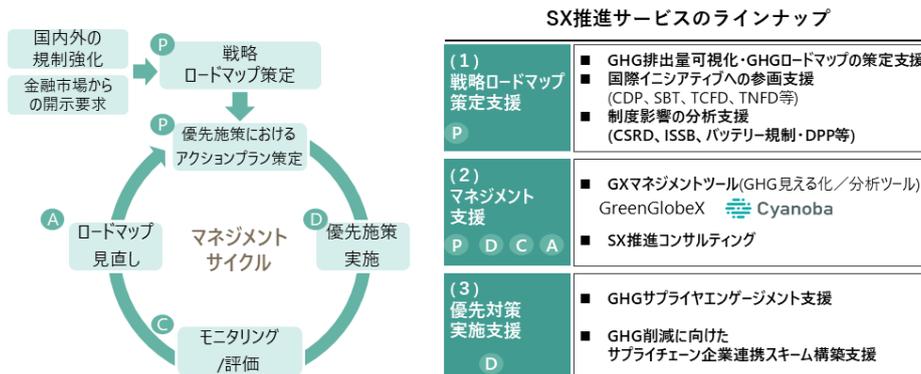
NEC is actively engaged in constructing a traceability infrastructure that facilitates the transparent and trustworthy sharing of product-related information among stakeholders in the value chain. As an example, through the Strategic Innovation Program (SIP) led by the Cabinet Office, NEC has successfully developed a prototype of a "Plastics Data Sharing Platform." This platform effectively manages the life cycle of plastics and other materials and can be utilized both domestically and internationally. (For more information, click here). NEC possesses a range of data trust and security technologies that play a crucial role in ensuring end-to-end traceability across the value chain.

General | #4. Climate Change Adaptation Finance

In response to climate change, society needs to both adapt to climate change and take mitigation measures. Climate Change Adaptation Finance is a mechanism that aims to appropriately recognize the value of disaster reduction solutions. This is achieved by quantitatively evaluating the expected disaster mitigation effects and financing solutions for risk reduction. The mechanism also evaluates potential environmental benefits, such as CO_2 emission reduction.

The scheme not only provides incentives for beneficiary's preventive investment, but also an attractive financial framework from the investor's perspective to investment in disaster prevention solutions.

On March 15, 2024, NEC established the Adaptation Finance Consortium in collaboration with Mitsui Sumitomo Insurance Company, Limited. The purpose is to drive the market expansion of adaptation finance, reduce disaster risks, and realize a resilient and sustainable society. NEC's goal is to create a new financial mechanism through IT that accelerates societal resilience.
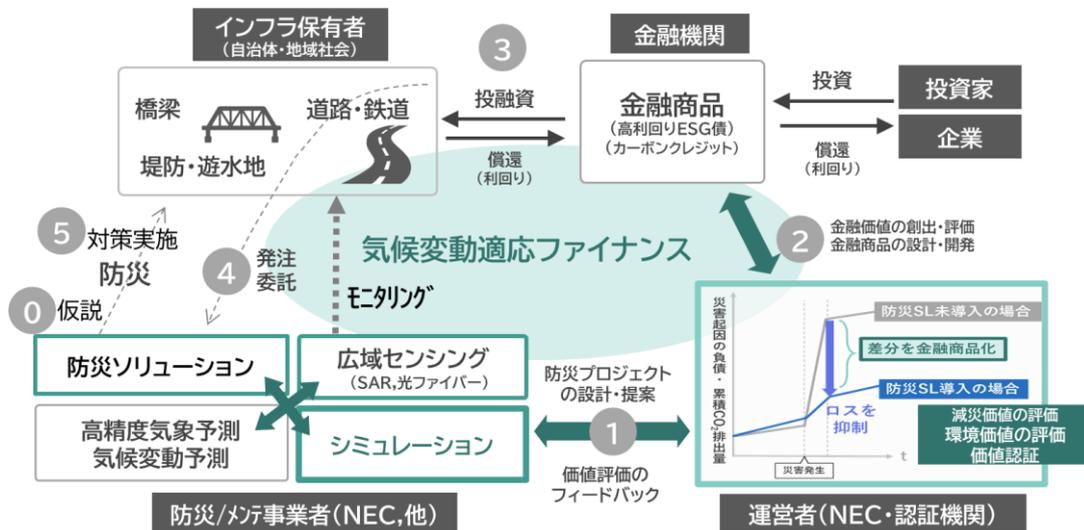
The agricultural ICT platform "CropScope" aims to revolutionize agricultural production sites through AI-based digital agriculture. It provides a platform that consolidates production-related data in one place for reference by all stakeholders, enables forecasting and optimization using accumulated farming data, and allows remote automatic control using equipment and systems. As an example, through the application of AI farming techniques in tomato cultivation developed in collaboration with Kagome Co., Ltd., we have achieved significant results. In Portugal, we achieved 20% reduction in nitrogen fertilizer, and 20% increase in yield with 15% less irrigation in tomato cultivation. In Northern Italy, we achieved 23% yield increase with 19% less irrigation in tomato cultivation.

Kagome Co., Ltd. and NEC Corporation established a joint venture company, DXAS Agricultural Technology, in September 2022. This company aims to provide AI-based agricultural support specifically for processing tomatoes. It offers AI farming advice and automatic irrigation control services, particularly focused on low-volume, high-frequency irrigation. By addressing water scarcity issues on farms, DXAS Agricultural Technology promotes more environmentally-friendly and profitable farming practices, contributing to sustainable agriculture worldwide.
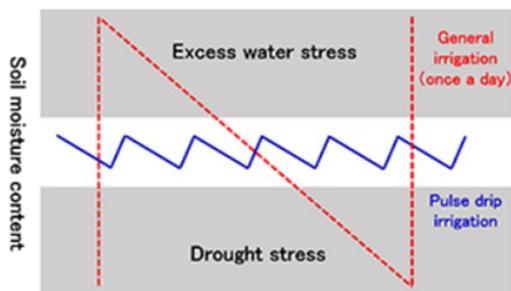
Q Larger view

Conventional irrigation causes plants to be stressed from excess water or drought, while pulse drip irrigation can maintain water conditions that are stress-free


Q Larger view

The automated irrigation system makes it possible to automatically control AI farming advice, such as irrigation frequency, to help eliminate complicated and time-consuming manual work

MSK Farm Machinery Corporation conducted a demonstration experiment at a farm in Hokkaido, Japan in June 2021 to support farm management and develop services for crops such as wheat, corn, potatoes, and others. The results showed a 15% reduction in fertilizer application for wheat, and a 10-20% increase in yield for wheat, corn, and potatoes, compared to fields where the Field Visualization Service and Variable Fertilizer Application Service were not used. (For more information, click here)

In February 2024, we signed a partnership agreement with Sumitomo Corporation for global sales expansion, focusing primarily on South America and the ASEAN region. Along with expanding the range of targeted crops, we plan to add functions that optimize and streamline the entire process from cultivation to harvesting and processing. As part of this partnership, CropScope is being introduced on a trial basis to major sugar companies in Thailand and Brazil. (For more information, click here)

| Agriculture | #6. HYPERPOST/farmland management system |

The system utilizes tablet terminals and cloud technology to visualize the cultivation environment, including EC and pH values, temperature, humidity, and solar radiation, as well as growth conditions such as growth photos and yield, of crops. It is a farm ICT system that enables field managers to remotely check field data and receive guidance from farm management specialists. （For more information, click here

| Forestry | #7. Wood traceability management |

NEC group is working to build a next-generation timber distribution system utilizing blockchain (distributed ledger) technology. By registering process information from logging to sawing/processing, transportation, and sales on the blockchain, customers can use the information to ensure traceability of timber and to certify legality, FSC-certified timber, and place of origin. This verification experiment is being conducted in Sendai City, Miyagi Prefecture, as part of the "D Makes Forests and Cities X" project (project sponsor: Miyagi Jyujyo Forest Products Co., Ltd.), which is funded by the Agriculture, Forestry and Fisheries Mirai Fund in FY2022.
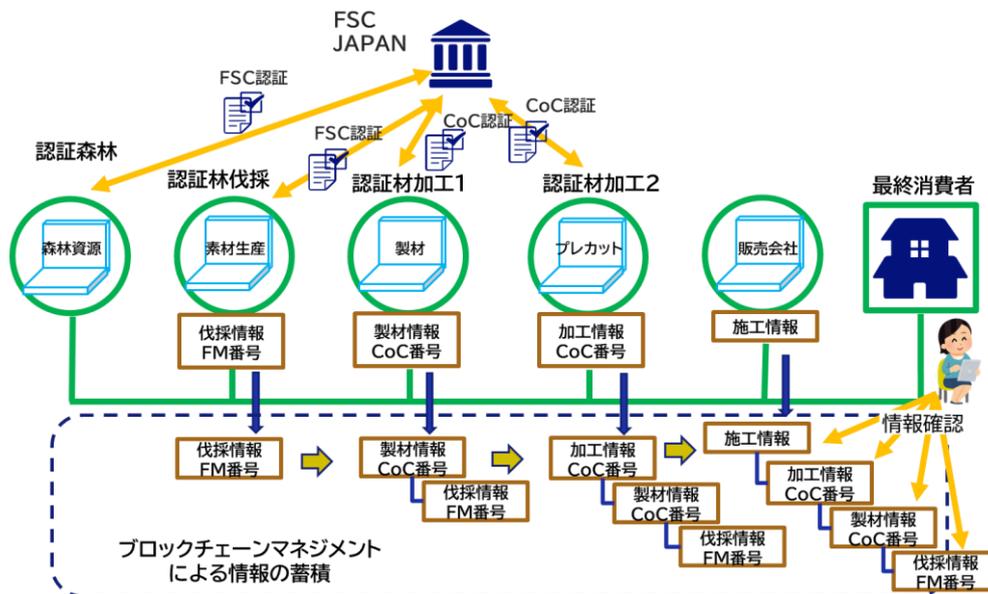
The Climate Change Observation Satellite "SHIKISAI" is an Earth observation satellite that studies the distribution of the Earth's color and temperature. It observes the entire Earth from an orbit that circles the Earth from north to south at an altitude of 800 km and can observe various objects, including land, atmosphere, oceans, snow, and ice, based on ground-based light. The observation data is utilized for various purposes, such as understanding the status of global warming, supporting sustainable fisheries and agriculture, as well as urban preservation, and disaster prevention measures. NEC, as the prime manufacturer of the JAXA-owned "SHIKISAI" (GCOM-C), is involved in a wide range of activities from development to operation.

Conventional satellites display ground images in 1,000-meter squares, but SHIKISAI has improved the resolution to 250-meter squares, providing 16 times more information in the same area. In addition, by observing almost the entire Earth once every two days, it can capture daily changes. This combination of fine resolution and high observation frequency allows for detailed analysis of cloud cover, atmospheric dust, ocean water color, vegetation, snow and ice, as well as surface temperatures of the Earth and oceans. Such information is valuable for analyzing global environmental changes.

The use of ICT is crucial in promoting resource management in fisheries that aim to sustainably utilize fishery resources. Satellite data plays a vital role in this process by enabling the monitoring of seawater temperature, which leads to sustainable and efficient fisheries.

The issue is that conventional satellites only have a resolution of a few kilometers, providing only a rough overview of the entire image. Climate change has significantly altered the distribution of sea surface temperatures, affecting the growth environment and distribution of marine organisms.

The 250-meter resolution allows for the estimation and prediction of fish distribution by species through detailed knowledge of changing seawater temperature conditions. This is particularly beneficial for coastal aquaculture, as it can help reduce damage caused by rising sea surface temperatures and eutrophication. Fishing at the right place and time can reduce fuel consumption of vessels, and international cooperation can prevent overfishing and promote sustainable fishing.
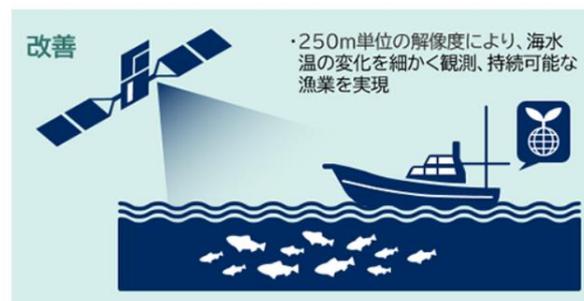
  As the environment surrounding the manufacturing industry becomes more complex, the key to the survival of the manufacturing industry is the realization of "Monozukuri DX," a transformation to data-driven manufacturing that can detect changes and respond quickly and flexibly. Product Lifecycle Management (PLM) is an important strategy for digitally connecting the engineering chain and supply chain.

"Obbligato" is designed to achieve "Connected Manufacturing" by seamlessly connecting all kinds of information inside and outside the company and consolidating information centered on BOM/BOP, the standard information for manufacturing, to achieve resilient, carbon-neutral, and sustainable manufacturing.

"Obbligato" also provides a function for managing the content of chemical substances in your products. It allows you to import BOMs, survey your suppliers for chemical substances in their parts, and register their responses to enable you to track the chemical substances contained in each of your products.(For more information, click here.)

**Manufacturing**   **#10. Chemical management: ProChemist**

     This is a cloud service for managing the chemical substance content of products. It can be used as a service-type introduction or a survey site for suppliers. By linking with other ProChemist package systems and customer systems, operations such as survey requests and response acquisition can be realized. It is also possible to register chemSHERPA data in advance and provide only model number responses to multiple requesting companies, automatically distributing updated data. It supports chemSHERPA and conventional formats (JAMP, JGPSSI), and tabulates information on ingredients and legal compliance judgments for each. （For more information, click here）
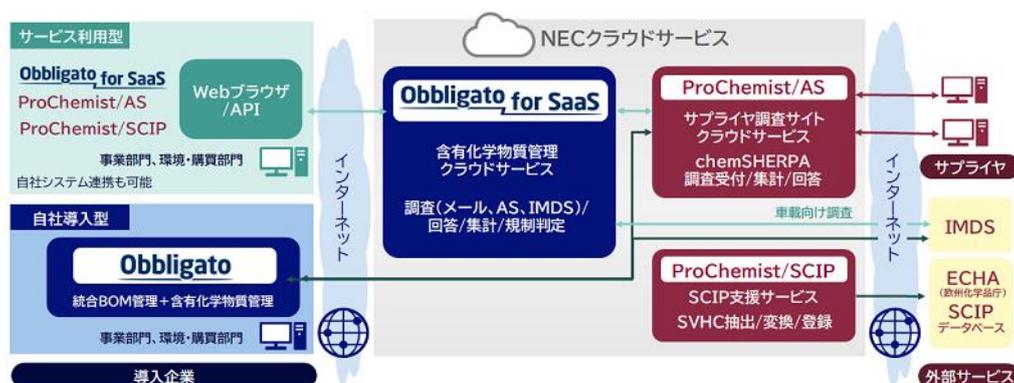
NEC, in collaboration with the University of Toyama, is developing technology to recycle waste aluminum with high purity. The components are analyzed using AI and data science to find the best way to remove impurities.

In Japan, the recycling rate of aluminum cans amounts to about 90%. On the other hand, it is very difficult to recycle aluminum from other product categories into "aluminum expanded material" used for automobile bodies, etc., where the impurity content is strictly controlled. This process is known as upgrade recycling. The goal is to establish upgrade recycling technology by collecting and analyzing data obtained from equipment in bulk and using AI to visualize the recycling process and impurities.

NEC and the University of Toyama aim to establish underlying technologies by 2026 and commercialize them by 2028. (For more details, click here. NEC's new aluminum alloys. (For more information, click here)

AI精練工程最適化
NECのAI技術で不純物除去する処方箋を自動策定
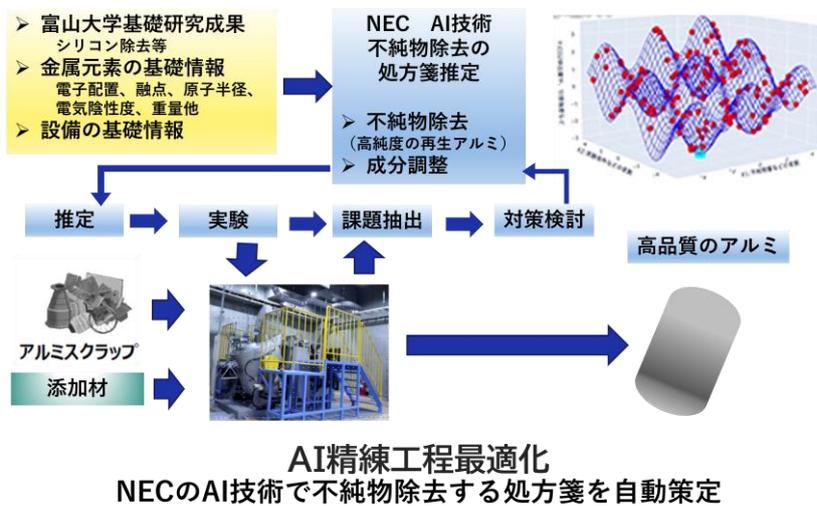
NEC proposes optimal operation methods for each factory by consolidating advanced technologies and know-how cultivated over many years in factories and laboratories inside and outside NEC. (For more information, click here.)

| Manufacturing | **#13. Business continuity and disaster preparedness solutions** |
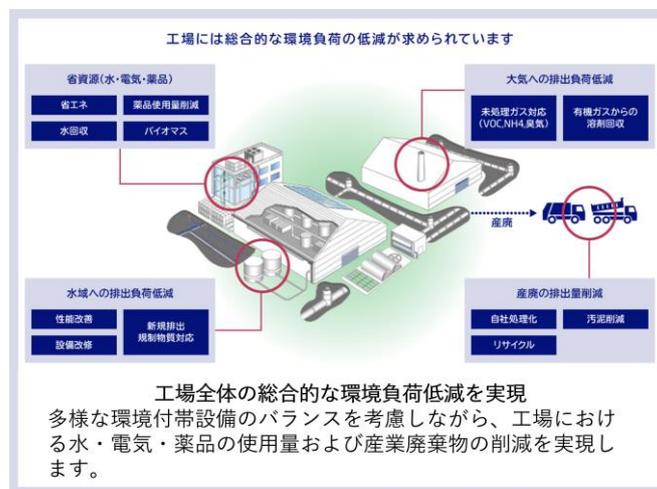
  A company's business continuity plan (BCP) includes various phases, from the risk assessment phase (ground risk survey, seismic diagnosis, etc.) to the emergency response support and early recovery (DR) phase after a disaster. NEC Facilities has expertise in all of these steps and provides integrated solutions that take all steps into consideration. (For more information, click here.)

| Public | **#14: IoT street lighting system** |
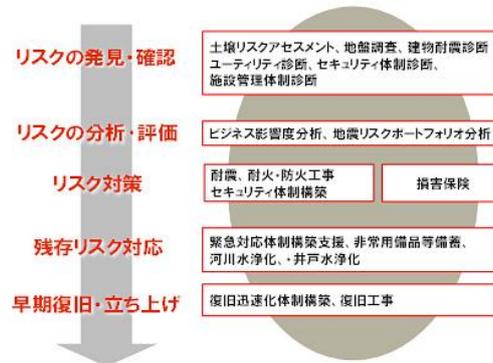
  NEC has delivered an "IoT Street Lighting System" to Suginami Ward, Tokyo, for real-time monitoring of rivers and road flooding along the Kanda River and in the plaza in front of JR Asagaya Station. In recent years, flood countermeasures in urban areas have become an issue, such as the increasing number of torrential rains and rapid river flooding caused by large typhoons. Suginami Ward is required to take further measures against flood damage, such as river overflows and flooded roads, in order to create a safe and secure city.

  By utilizing the sensor technology and wireless network technology that NEC has cultivated through the development and provision of smart streetlights, as well as NEC's cloud-based smart streetlight management system, not only information from cameras and flooding sensors installed on streetlights but also information on the location and age of installation and the operational status of installed equipment can be collected and centrally managed in a cloud environment. This will contribute to ensuring the safety of ward residents and improving the work efficiency of ward staff. (For more information, click here.)

Orchestrating a brighter world　NEC

NEC is providing the Tokyo Metropolitan Government's Bureau of Waterworks with the NEC Waterworks Contact Point Cloud Service. This service enables users to inquire about water and sewage rates, water usage, pay bills electronically, and check online notifications and announcements via a smartphone application or website. The service is also linked to smart meters, making it easy to monitor daily water usage. Additionally, the service can send notifications to pre-registered contacts when water leakage or non-use of water for a certain period of time is detected. This feature is particularly beneficial for elderly individuals living alone. Implementing this service will promote paperless and cashless water billing, as well as contribute to reducing environmental impact such as CO_2 emissions and water use. (For more information, click here)

Calsos Remote Control System supports IoT for diverse industries such as water supply and sewage, manufacturing, and agriculture. We provide reliable remote monitoring solutions that enable timely information communication with remote locations, such as reporting of abnormalities in unmanned public facilities, including water and sewage facilities, and facilities in office buildings, factories, and stores, as well as crime and disaster prevention information.

This remote monitoring and control system can be easily introduced at low cost because it is a one-package system that monitors, reports, and controls information on equipment operation status, failures, and water levels and flow rates at water and sewage facilities using various communication infrastructures.

It supports not only stand-alone operation, but also cloud and on-premise operation, and is scalable, allowing it to flexibly respond to various operational configurations. (For more information, click here.)

There are numerous intricate and complex processes and data involved in sake brewing, ranging from the soaking time of rice in water to the fermentation duration and temperature, as well as the ingredients used. NEC's Sake Moromi Analysis Cloud Service digitalizes the management of this data. Moromi refers to the liquid that is fermented from steamed rice, rice malt, sake mother, and added water. It is the stage prior to the production of sake, and the quality of moromi is known to greatly influence the taste of the final product.

With the service, it is possible to register various component information such as product temperature and titer during the raw material processing and koji processes, as well as the temperature and alcohol content during the sake mother and malt processes. Furthermore, it allows for the registration of sensory test results and fire storage information. The service enables the display of the BMD curve and A-B straight line for each brewing, facilitating comparisons with past and ideal brewing data. Additionally, it provides the capability to analyze the relationship between sensory test results and the production process. This visualization of the brewmaster's experience and intuition, combined with the ability to compare with past preparation data, is expected to enhance the quality of sake by offering insights into the production process.(For more information, click here.)

NEC Sake Moromi (Sake Mash) Analysis Cloud Service

Raw Material Processing & Koji
- ● Origin, Variety, Refining Ratio
- ● Soaking Time, Water Absorption
- ● Koji Mold, Koji Yield
- ● Temperature Progress
- ● Moromi Utilization Destination
- ● Strength Value

NEW Temperature Sensor Data Import

Yeast Starter & Moromi（Sake Mash）
- ● Temperature Progress
- ● Component Inspection
- ● A-B Line
- ● BMD Curve
- ● Glucose Transition
- ● Moromi Progress Record

Pasteurization & Storage
- ● Storage Temperature
- ● Pasteurization Date

Sensory Evaluation
- ● Fruit
- ● Color Depth, Sweetness/Dryness

Brewing Analysis
- ● Year-on-Year Comparison ● Brand Comparison ● Sensory Results ● Tagging ● A-B BMD Target Line Comparison
- ● Relationship between Koji and Moromi

The NEC Sake Moromi Analysis Cloud Service is also used in the NEC Rice Paddy Cultivation Project ("Tambo Project"). The Tambo Project is a project that NEC Group employees and their families have been participating in since 2004 in cooperation with the Asaza Foundation, a certified NPO, to experience from rice farming to sake making, with the aim of restoring abandoned farmland and preserving biodiversity in the water source area of Kasumigaura. In 2023, this field was certified as one of the "Monitoring Site 1000" by the Ministry of the Environment. In the rice field project, the "NEC Sake Moromi Analysis Cloud Service" is being used in cooperation with Hirose Shoten (a sake brewing company).

19,605
「NEC田んぼ作りプロジェクト」への累計参加者数（2024年3月末現在）

自然体験参加型プログラムでモノ作りの原点を知る

Others	#18. Environmental DNA

The Abiko Plant, in collaboration with NEC Solution Innovators, has been conducting research using environmental DNA since FY2022. Environmental DNA is a technology that evaluates the diversity of species by analyzing DNA derived from living organisms in the environment, such as water.

NEC and NEC Solution Innovators have participated in an industry-government-academia project "Nature Positive Sustainable Development Hub" led by Tohoku University, along with 27 companies and organizations. In October 2022, the project was selected for the "COI-NEXT" program by the Japan Science and Technology Agency (JST), which supports co-creation opportunities. Since then, the project has been actively involved in biodiversity surveys using environmental DNA and the development of evaluation methods.

In late February 2024, due to its successful activities and achievements, the project was selected as a long-term grant recipient by JST. This recognition further supports the continuation of the project's research activities.

Our goal is to contribute to the generation of data on biodiversity through the research at Yotsuike Ponds and the activities at the Hub.

| Others	#19. Causal analysis for policy making

The Policy Planning Support Service aims to address various challenges that arise during the policy planning process. We offer support services that tackle issues such as difficulties in utilizing accumulated data, time-consuming policy analysis, and challenges in demonstrating the effectiveness of policies. Our approach is centered around leveraging data to enable evidence-based policymaking.

We provide two key services: Proof of Concept (PoC) and Software as a Service (SaaS). These services cover key stages of the policymaking process, including questionnaire design and collection, AI analysis (causal analysis solution), and consideration of the results.

Our service places a strong emphasis on the use of resident questionnaires as a primary data source. By analyzing past data, we can identify the most effective measures implemented previously. This analysis enables the formulation of policies that are aligned with consumer needs. Additionally, our services facilitate quantitative evaluations of current policies to assess their effectiveness.

Through the use of data and analysis, we support evidence-based policymaking. By harnessing the power of resident questionnaires and accumulated data, we aim to enhance the policy planning process, leading to better-informed decision-making and improved policy outcomes.

Our service acts as a valuable tool for policy planners, enabling them to utilize data effectively, streamline policy analysis, and explain policy effectiveness more efficiently.
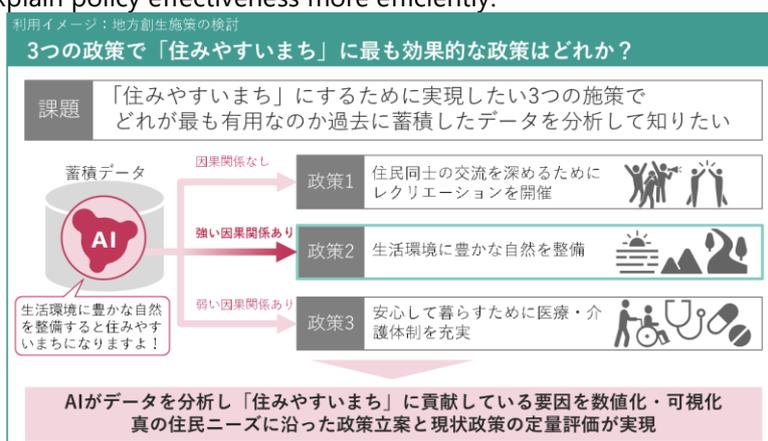
On March 31, 2023, the Cabinet approved the National Biodiversity Strategy 2023-2030 (Ministry of the Environment), which establishes five basic strategies, 15 state goals (ideal state), and 25 action goals (actions to be taken) for each basic strategy. It also plans relevant measures for each of the 25 action goals. The respective ministries and agencies are responsible for planning related measures for each of these 25 action goals. To support the planning, decision-making, implementation, and evaluation of these measures, we provide policy planning support services utilizing data. (For more information, click here Policy Planning Support Services / causal analysis solution)

8. Message from the Director of New Business Development

On March 29, 2024, the Nature Positive Economy Transition Strategy, developed jointly by the Ministry of the Environment, Ministry of Agriculture, Forestry and Fisheries, Ministry of Economy, Trade and Industry, and Ministry of Land, Infrastructure, Transport and Tourism, was released in Japan. The strategy highlights the importance of advancing DX and utilizing it to reduce the burden on natural capital, address resource constraints, population decline, and aging society. In this report, NEC described some of our DX solutions that can contribute in those areas.

The "CropScope" agricultural ICT platform reduces water usage while increasing yields and labor productivity through automatic irrigation. The report emphasizes the interconnectedness between the food supply chain, including agriculture, forestry, and fisheries, as well as apparel, textiles, and pharmaceuticals, with natural capital such as cotton and herbal medicine. Digital transformation provides opportunities for value creation in these sectors.

Efforts to reduce environmental impact in upstream can have a systemic impact throughout the value chain, moving the industry towards a nature-positive society. The report introduces the "Plastic Data Distribution Platform," which is a trial to connects data throughout value chain.

Furthermore, corporate efforts to address environmental issues must be accepted by consumers and lead to behavioral change. The report presents the causal analysis Solution as a technology for visualizing cause and effect relationships, enabling data-driven decision-making towards nature positivity.

It is important to recognize that digital technologies themselves have environmental footprints such as water and electricity consumption in data centers and electronic devices and semiconductor supply chain. The report shares the challenge of assessing the environmental impact of the NEC Group's businesses upstream in the value chain using statistical data.

Our society and economy are built on natural capital. As a contrast to climate change mitigation that common KPI and goal is set, for nature related issues, we need to understand local ecosystem and socio-economy. It seems tremendous efforts to understand each local situations and make decision for nature positivity. However, NEC believes in the power of humanity and technology. As described in this report, digital technology enables visualization, connection, and value creation. This leads to "trade on" between economy and nature.

To realize it, not only technological but also social innovation is needed. We will continue to work with all of our stakeholders in order to achieve NEC 2030VISION's commitment to "Live harmoniously with the earth to secure the future."

SVP Corporate and General Manager, Corporate Business Development Division,
NEC Corporation
Shigeki Wada

For inquiries regarding this report, please contact

NEC Corporation
Environmental Management Division
info@eco.jp.nec.com

For inquiries about environmental solutions and consulting, please contact

NEC Corporation
Carbon Neutral Business Promotion PMO Group
inquiry@gx-biz.jp.nec.com