2021 IR Day
Activities to Achieve the Long-term Vision
-Acquire Next-generation Technologies
and Create New Businesses-

Managing Executive Officer,
Senior General Manager, Technology and R&D Division

Kazumasa KIMURA

General Manager, Intellectual Property Dept.  Hiroyuki INOUE

29th November, 2021
1. R&D activities in Nabtesco

Managing Executive Officer,
Senior General Manager, Technology and R&D Division
Kazumasa KIMURA

<Biography>
Jun. 2011  General Manager, Manufacturing Department, Tsu Plant, Precision Equipment Company
Mar. 2017  Executive Officer and President, Power Control Company
Jan. 2019  Executive Officer, Corporate Planning, Accounting & Finance, Information Systems and Corporate Communication
Mar. 2019  Director of Nabtesco Corporation (to present)
Jan. 2021  Managing Executive Officer (to present), Component Solution Segment, Senior General Manager, Technology and R&D Division, and in charge of Production Innovation (to present)

2. Intellectual Asset Management in Nabtesco
~Ambidexterity with IP landscape~

General Manager, Intellectual Property Dept.
Hiroyuki INOUE

<Biography>
1995  Join Technology and R&D Division
2007  Resisted as CPA
2020  General Manager, Intellectual Property Dept.  (to present)
R&D activities in Nabtesco
Management Materiality

Measures to improve our financial performance
- Achieve the revenue targets
- Distribute managerial resources efficiently
- Continue to improve capital efficiency

Measures to enhance our management foundation
- ESG items having a major impact on financial issues
  - Increase the effectiveness of our management entities
  - Countermeasures for climate change
  - Deliver solutions for social challenges through business
  - Build a resilient supply chain
- ESG items that drive sustainability power
  - Ensure management transparency
  - Foster environmental management
  - Pursue safety, comfort and a sense of security
  - Respect diversity and various expertise in the workplace
  - Enhance work style reforms
  - Promote engagement with local community

Specific measures to achieve the long-term vision
- Acquire next-generation technologies and create new businesses
- Foster smart manufacturing
- Strengthen global bases

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<Missions>

1. Acquire leading-edge technologies in advance with each business unit
   - Acquire and R&D of leading-edge technologies (Fostering open innovation)

2. Start-up new businesses
   - Promoting innovation through enhancement of basic technologies and Corporate Venture Capital

3. Cross functional actions for group R&D team synergies.
   - Fostering the sharing of advanced technologies and know-how across the business units and providing opportunities for education.

<Organization>

Technology and R&D Division

- Strategic Business Development Dept.
- Quality Promotion Dept.
- Intellectual Property Dept.
- Nabtesco R&D Center
- Electric & Electronics Engineering Dept.
- CAE Engineering Dept.
- AM Engineering Dept.
- System Development Dept.
### Establish global R&D hubs in Technology and R&D function

<table>
<thead>
<tr>
<th>Hubs</th>
<th>Missions</th>
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<tbody>
<tr>
<td><strong>Headquarter (Tokyo)</strong></td>
<td>Acquire leading-edge technologies in advance with each business unit</td>
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<tr>
<td><strong>Nabtesco R&amp;D center (Kyoto)</strong></td>
<td>Start-up new businesses</td>
</tr>
<tr>
<td><strong>Nabtesco R&amp;D center (Kawasaki)</strong></td>
<td>Cross functional action for group R&amp;D team synergies.</td>
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<tr>
<td><strong>Oversea (Germany)</strong></td>
<td>- Conduct the Technology and R&amp;D strategy council</td>
</tr>
<tr>
<td></td>
<td>- Provide educations/training</td>
</tr>
<tr>
<td></td>
<td>- Create opportunity for new technologies and know-how sharing</td>
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</table>

- **CAE**
- **AM**
- **Digital Twin**
- **Power electronics**
- **IoT**
- **V-model development**
- **MBD**

*1 AM: Additive Manufacturing  *2 Model Based Development
Nabtesco R&D center (Kyoto)

Located in KRP*1 (Kyoto Research Park) and consolidate main functions of Technology and R&D div. to improve the R&D environment and upgrade open innovation.

■ Fostering innovation with open communication
  - Drop-in meeting rooms
  - Open communication space for the lively discussion

■ Laboratories by technology to improve the R&D environment
  - Metallic AM*2 Lab.
  - Elements Lab.
  - Power electronics Lab.

*1 KRP: It is an organization to support innovations with new business, R&D and so on since 1989. There are over 500 organization.
*2 AM: Additive Manufacturing
Existing R&D area

New R&D area

Business Units

“Best Solution Partner”

- Working to acquire advanced tool-based development methodologies, element technologies and know-how ahead of competitors and to share them with the business departments.

- Enhance cross functional actions for group R&D team synergies.
Functions of Technology and R&D Div. (From now on)

- Innovative innovation
  - Working to acquire advanced tool-based development methodologies, elements and know-how ahead of competitors and to share them with business departments
  - Enhance cross functional actions for group R&D team synergies

- Continuous innovation
  - Environmentally
  - Electrification
  - AI and IoT

- Open Innovation

- Oversea Innovation Hub

- R&D for Leading-edge technologies

- “Leaders in Innovation”
Activities to Achieve the Long-term Vision
Proactively introduce and build leading-edge element technologies, development methodologies, manufacturing technologies to create innovation

- Build Digital Twins
- Utilize new R&D methodologies
- Use AI
Build Digital Twins

to innovate design and R&D process

Digital Twin: Collect various information into digital space and reflect real world.

[Pros of Digital Twins]
- Estimate deterioration level to support Condition Based Maintenance Business
- Able to find the most robust design

Step 1
• Preparation for Digital twin
  - Preparation of Model and utilize data science

Step 2
• Build Digital twin partially
  - Use rapid calculation for the best design and validate by actual product
  - System building

Step 3
Completion of Digital twin building
- Run the system
- Share the methodology to the other business dept.

Digital Twin: Collect various information into digital space and reflect real world.

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Nabtesco
Utilize **V-model development**\(^*1\) and **MBD**\(^*2\) to innovate design and R&D methodology

\*[\(^*1\)] V-model development; Set the same level process in developing(left) and testing steps (right), and show each process by V shape to the correspondence.

\*[\(^*2\)] MBD; Model Based Development Development with prior evaluation through 1D-CAE or other simulation models
Use AI to innovate data application

Collect data (with sensing technology)

**<Cloud AI>**
- Preventive maintenance
- Condition monitoring
- Diagnosis service

**<Edge computing>** (Edge AI)
- Estimate the condition of products
- Assess the working condition
- Assess the deterioration level

Estimate the condition of products by data analysis algorithm

MRO business

Component development
Promote open innovation to acquire leading-edge technologies and new technologies from companies, universities and research institutions globally.

**Core technologies**
- Research components for fastening
- Noise and vibration simulation etc.

**Component products**
- Research for sensors and circuit board mounting technologies
- Establish a design and development process etc.

**Systematized products**
- Research for Digital data application
- Application of metallic AM

**Element technologies**
- Control motors
  - Research for high frequency wave
  - Research for motors and inverters
- Materials
  - Research for tribology
- AI
  - Research for Digital data application
- AM processing
  - Application of metallic AM
Technology and R&D div. develop a technology and start a new business

CMFS (Condition Monitoring system with Fail-Safe)

Sensors are monitoring the load conditions within yaw driving units and equalize the load imposed on each of the yaw drive units when it paused and prevent overload.

CMFS (Condition Monitoring system with Fail-Safe)

Sensor to detect external load

Overload preventive system

Load sharing ratio(%) Activate

Voltage from brakes(V)

Overload prevention

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The first launch of data business for Nabtesco

<Subscription of diagnostic service>

Customers
(Power producers, Wind turbine manufacturers)

Nabtesco

Contract

Diagnostic service and information flow

Grant access right

Control data and Web

Data analysis and control

Diagnose products (MRO business)

Diagnostic service

Error record for yaw drive units

Yaw load monitoring map

Critical load area

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Established Nabtesco Technology Ventures AG in Switzerland in 2018 and CVC promotion div. in July 2021 to accelerate new technology development

Regarding the business domains to be invested
Motion control and peripheral technologies (including artificial intelligence and IoT)
Or, domains related to "disruptive innovation"
<Example>
  Robotics, construction machinery, medical/welfare equipment, AM, motors, sensors
  Domains related to production technologies; Machining and surface processing technologies, model base development and others

Example of investment:
Through this collaboration, Nabtesco will contribute to digital transformation (DX) of ship operations, decarbonisation in the shipping industry, and reduction of environmental impact, by leveraging Nabtesco’s main engine remote control system together with Deep Sea’s world-leading AI technology.
Intellectual Asset Management in Nabtesco
～Ambidexterity with IP landscape～
Definition of Core Value in Nabtesco

Core Value

Core competence (Core strengthen)

Things need for customers' value

Core competence

Brand Credibility

IP Patent portfolio

Know-how Data for equipment and processing

Network Alliances and connections

Human resources

Products Capability and quality

Business record Regulation and agreement

Supply chain

It is including something that competitors may have it already but new players could not have it easily.
Long-term Vision
Leaders in innovation for the future

Mid-term Management Plan

Strategy to acquire and enhance core value
(Sales, R&D, production, service)

Core value to be gained in the future

IoT technology
Electric actuator related technology

Current core value

High power density design technology
Processing, assembling, surface treatment and others

Sales and construction network

Intellectual asset strategy

IP landscape
IP creation activities and open innovation
Building IP portfolios
IP clearance (prevent infringement)
Analysis competitors IP strategy
Elimination of imitation products
Legal work on technological issues, alliance and agreement strategies

Brand and trademarks management strategy
Technological agreements strategy
Secret information management

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Future core value to be gained

1. Own development
2. Use other core value across the divisions
3. Open innovation, M&A

Building IP portfolios

IP clearance

Intensive secret information management

Possible to use one "core value" to the other business divisions

Explore candidates by IP landscape

Current core value

Gap
**Intellectual Asset Management in Nabtesco**

**Definition of Intellectual Asset Management**

*1 Identify original “Intellectual Asset” in the company

*2 Use and compound the asset effectively

*3 Manage the asset to gain profit

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**IP strategy activity in Nabtesco**

*1 Identify current core value

*2 Identify core value to be gained in the future

*3 Integration of our core value and open innovation partner’s core value through IP landscape

*4 Intensive secret information management

*5 Turn disadvantage to the advantage by IP management

*6 Prevent dilution of our advantage by other company’s IP

*7 Elimination of imitation products by our top brand value

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*1 METI: https://www.meti.go.jp/policy/intellectual_assets/teigi.html

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### Remarks for Competitive Environment and Management Strategy

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<td>Important to create a high entry barrier and avoid direct competition*¹</td>
<td>Example Railroad vehicle equipment</td>
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### Relationship of Competitive Environment to Our IP Management Strategy

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<td>Maintain the differentiation</td>
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#### Monopolistic Environment with Profit*¹
- **Create an entry barrier**
- **IP portfolio**
- **IP landscape**
  - Acquire and enhance core value
  - Secret information management
  - IP clearance

#### Competitive Environment with Reasonable Competition*²
- **Elimination of imitation products**
- **Brand management**
- **Enhance IP portfolio**
- **Prolongation of entry barrier (Exploiting)**

#### Volatile Environment with Uncertainty*³
- **Create an entry barrier**

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- **IP portfolio**
- **IP clearance**
- **IP landscape**
  - Acquire and enhance core value
  - Secret information management

#### Management resources for differentiation are important*²

- Elimination of imitation products
- Brand management
- Enhance IP portfolio
- Disappearance of IP portfolio
- Expiration of IP and disappearance of entry barrier

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Remarks for Competitive Environment and Management Strategy

**Monopolistic environment with profit**

- Important to watch the market change and adjust it quickly.
- Management resources for differentiation are important.
- Important to create a high entry barrier and avoid direct competition.

**Competitive environment with reasonable competition**

- Increase charms for co-creation partners.
- IP landscape

**Volatile environment with uncertainty**

- Idea makes public knowledge.
- Identify the fount of the differentiation (Exploration).
- Consider M&A if we rely core value on co-creation partners.

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Corresponding management theories; Exploring and Exploiting (ambidexterity), Dynamic Capability, etc.
Promote intellectual asset management by the organic collaboration of the three committees to be a leader in innovation.

**Nabtesco Intellectual Property Strategy Committee**
(approx. once a year)

Deliberates on the firm-wide intellectual property strategies

Members are CEO and other managements and organized by General Manager of IP dept.

**Nabtesco Intellectual Property Strategy Subcommittee**
Horizontally cross-functional activities
(approx. twice a year)

1. Sharing intellectual property strategy activities
2. Discussing about common IP issues in in-house companies and group companies

Members: Senior general manager of the technology and R&D div., General manager of the IP dept., General managers and those in similar positions of the in-house companies.

**Company Intellectual Property Strategy Committee**
Vertically cross functional activities
(approx. twice a year)

1. Discuss to acquire and enhance core value and IP strategy
2. Discuss on each in-house company’s intellectual property strategies

Members: President of the in-house company, General manager of the IP Dept., General managers and those in similar positions, head of each dept.
Effective use of use IP landscape
Definition of IP landscape

IP landscape, is not a patent map, is an technology information snapshot generating by various information collected from Nabtesco, competitors, R&D trend in the market, management strategies, IP and other information to indicate our current market position and future trend.

Refer from patent office; Research regarding skill standard for IP resources with changing in corporate IP strategy and industrial structure

**Patent map**
Analysis only patent info

**IP landscape**
Analysis various disclosed information related to patent, IR and others

Use various different information to foresee the market change and decide IP strategy with business dept.
IP landscape make visible the part of information from corporate disclosures, although there are not only current technology trend such as patents but also **potential technologies to be used in the future and issues to be solved**. Therefore, use of **IP landscape could improve the prediction for the business strategy**.

Big picture of the corporate information

Disclosed information on the newspaper, IR information, patent pending and others

Confidential information such as know-how
Classification of IP landscape

- New products and service
  - Analysis of technology trend including alternative technologies
  - Explore new markets and new technologies
  - Explore candidates for co-creation and M&A
- Existing products and service
  - Analysis of our core value
  - Explore new usage of products

Existing market

New market
- Each dots show patent pending and those are allocated closely based on the technological similarity.
- Dots could show mountain and valley by density of the patents.
- If there are overlap at the landscape, there are technological correlation and one’s core value can utilize to the other businesses.
- Stars; Those areas are able to strengthen current core value or put together other core values for new value.

*IP landscape above generated based on the patents from Nabtesco group as of October, 2021
Example of IP landscape ~Core value for SDGs~

- Each dots show patent pending and those are allocated closely based on the technological similarity.
- Dots could show mountain and valley by density of the patents.
- **Our products and services will contribute SDGs indirectly through our customers.**
- **Nabtesco will enhance SDGs related IP creation.**

Relevant patents

- Wind turbine related.
- Improve the efficiency of power consumption and decrease the failure.
- Platform doors
- Safety drive for buses
- Downsizing and weight saving in mobility.
- Prolong life cycle, improve durability, disposal and recycling.
- Weight saving in mobility and excavators.
- High efficiency, accommodation to emission regulation by region and electrification of actuators.

*IP landscape above generated based on the patents from Nabtesco group as of October, 2021*
Comparison of technological areas between Nabtesco and M&A candidate to know **whether there are a complementally relationship in technologies**

- Length of the chart equal to number of patent pending
- Our technological weakness could supplement by M&A if the candidate have strength in that technologies

Red arrow show the technologies has complementally relationship with Nabtesco
Example of IP landscape
~Explore new markets and new technologies~

Analyze entire system **to know the actual needs from customers**
→ Utilize it to individual products and services development

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**Macro research for patent regard offshore wind power generation systems**

- Stable supply for power system
- Safety operation and efficiency of power generation
- Prediction of wing
- Remote monitoring, Preventive maintenance
- Detection of blade corruption
- Provision of salt damage
- Dimension of power
- Prediction of power generation amount
- Simulation for control

**Source:** Pictures above were from “NEDO white paper on renewable energy technology, Chapter 3 Wind turbine power generation”

CMFS (Condition Monitoring system with Fail-Safe) will sell from January 2022

Outer appearance of the CMFS and diagnostic service

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Nabtesco was awarded the Minister of Economy, Trade and Industry Award at the FY2018 Intellectual Property Achievement Awards hosted by the Japan Patent Office of the Ministry of Economy, Trade and Industry in April 2018, for the successful activities driven by the intellectual property management strategy.