2018 R&D Strategy

Driving the evolution of Hitachi towards further globalization

28 June 2018

Norihiro Suzuki, Ph.D.
Vice President & Executive Officer
Chief Technology Officer
General Manager, Research & Development Group
Hitachi, Ltd.
R&D 100th Anniversary
~ New challenges for the next 100 years ~

Mission
Contribute to society through the development of superior, original technology and products

Hitachi Founding Spirit
Harmony • Sincerity • Pioneering Spirit

For invention and discovery
“We must have the ethos of those entering a deep untrodden mountain”

(Quote from article in Tokyo Asahi Shimbun, 1930)

Founder & First Director of the Research Unit
Namihei ODAIRA

First General Manager of the Hitachi Research Laboratory & the Central Research Laboratory
Kumeo BABA
Contents

1. Progress in FY2018 Mid-term Management Plan & Basic stance in FY2018
2. Enhancing co-creation of global solutions
3. Creating and focusing on world-leading technology
4. Promoting basic research to resolve societal issues
5. Summary
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2. Enhancing co-creation of global solutions
3. Creating and focusing on world-leading technology
4. Promoting basic research to resolve societal issues
5. Summary
An Innovation Partner for the IoT Era

Accelerate collaborative creation with customers through advanced Social Innovation Business

Four Focus Business Domains

- Power • Energy
- Industry • Distribution • Water
- Urban
- Finance • Social • Healthcare

Growing need for Social Innovation Business

The United Nations has adopted "SDGs."
It is now the challenge for global enterprises to realize an “Inclusive Society" and their own business growth.

SDGs market: USD 12 trillion/year
(Forecast up to 2030)*

IoT: Internet of Things, SDGs: Sustainable Development Goals
* BSDC “Better Business, Better World”
1.2 FY2018 R&D Group organization

Global R&D driving new growth in Social Innovation Business

Technology Strategy Office
Global R&D Strategy

Global Center for Social Innovation (CSI)
Global co-creation to create service business

Center for Technology Innovation (CTI)
Technology PF for product & service business growth

Center for Exploratory Research (CER)
Open innovation to resolve future challenges in society

N. Suzuki
Vice President
CTO
GM of R&D Group

M. Akatsu
GM & Head of Strategy Planning Center

K. Funaki
GM

M. Aoki
GM

S. Yamada
GM

Y. Yagawa
Deputy GM

S. Sameshima
Deputy GM

Newly appointed Hitachi Fellow
Kazuo Yano
April 2018 ~
(Artificial intelligence)

Newly appointed Corporate Scientist
Shizu Takeda
April 2018 ~
(Regenerative medicine)
1.3 R&D for Social Innovation Business

**Hitachi’s Social Innovation Business**
- For a sustainable society
- Co-create digital innovations with customers
- Global deployment of solutions

**Step 1 (FY2015～)**
Co-create with customers

- Estab. global CSI structure
  - Systematized NEXPERIENCE - a methodology for co-creation
  - Co-creation activities

**Step 2 (FY2016～FY2017)**
Digital innovation

- Co-creation using Lumada
  - Utilize NEXPERIENCE
  - Increase customer cases & solution cores
  - Develop AI/IoT tool sets

**Step 3 (FY2018～)**
Scale up globally

- Accelerate with open innovation
  - Expand co-creation centers
  - Establish industry-government-academia eco-system

**Activity of center for social innovation**
- Go to market strategy
- Shared vision with customer
- Concept design
- Prototype Demo
- PoC at customer site
- Go to market Scale

**Methodology**
- NEXPERIENCE
  - Ethnography
  - Discover business opportunity
  - Showcase

**IoT platform**
- Solution core, Customer cases
  - Studio
  - Edge
  - Foundry

**AI: Artificial intelligence, IoT: Internet of Things**
Enhancing global co-creation

Utilize regional co-creation centers to contribute to Lumada business

CSI-North America
CSI-China
CSI-Asia
CSI-Europe

Mori GM
Chen GM
Saikalis GM
Kitagawa GM

Beijing
Guangzhou

December 2017
New Beijing office & co-creation space,
New Open Automation Lab in Guangzhou
1.5 Contributing to Lumada business

<table>
<thead>
<tr>
<th>R&amp;D Group</th>
<th>FY2016</th>
<th>FY2017</th>
<th>FY2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of NEXPERIENCE customer cases</td>
<td>175</td>
<td>502</td>
<td>1,000</td>
</tr>
<tr>
<td>Number of Lumada customer cases (R&amp;D Gr/Hitachi Gr)</td>
<td>9/200</td>
<td>98/500+</td>
<td>150</td>
</tr>
<tr>
<td>Lumada core business revenue (JPY 100 billion)</td>
<td>1.2</td>
<td>2.3</td>
<td>3.1</td>
</tr>
<tr>
<td>Lumada business revenue (JPY 100 billion)</td>
<td>9.0</td>
<td>10.1</td>
<td>10.7</td>
</tr>
</tbody>
</table>
1.6 World’s No.1 technology through co-creation

World-leading products & services through No.1 technology for societal needs

<table>
<thead>
<tr>
<th>Railway systems</th>
<th>High-speed elevators</th>
<th>Particle beam therapy*(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Management System</td>
<td><strong>World’s fastest elevator</strong>*(^1)** 1,260m/min. 2 June 2017 News release</td>
<td>4D tumor tracking  Tumor tracking / Spot scanning irradiation</td>
</tr>
<tr>
<td>Rail car</td>
<td>Streamlined car structure</td>
<td></td>
</tr>
<tr>
<td>Autonomous decentralized system/Analysis lead design</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Focus area**

<table>
<thead>
<tr>
<th>Block chain</th>
<th>Autonomous driving</th>
<th>Smart Manufacturing</th>
<th>AI</th>
<th>Robotics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service for supply chains</td>
<td><strong>V2V communication</strong> EU: AutoNet 2030 Connected car</td>
<td><strong>Material</strong> <strong>Machine</strong> <strong>Man</strong> <strong>Method</strong> Digital solutions for manufacturing sites</td>
<td>Maintenance &amp; Repair</td>
<td>Service-support robot</td>
</tr>
</tbody>
</table>

*1 June 2018 Hitachi internal survey
**2 A part of this technology was developed with the Hokkaido University Graduate School of Medicine under the Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST Program) initiated by Council for Science and Technology Policy (CSTP) of the Cabinet Office, Japan.

Develop world No. 1 technology through open innovation
## 1.7 Allocation of R&D Group funds

### Strengthen R&D investment in digital solutions and open innovation

<table>
<thead>
<tr>
<th>Step 1 (FY2015~)</th>
<th>Co-create with customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase co-creation funds</td>
<td>Improve product/service success rate</td>
</tr>
<tr>
<td>New organization from FY2015</td>
<td></td>
</tr>
<tr>
<td>CER: Exploration</td>
<td>100 HC</td>
</tr>
<tr>
<td>CTI: Technology</td>
<td>2,000 HC</td>
</tr>
<tr>
<td>CSI: Co-creation</td>
<td><strong>500 HC</strong>[^1]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 2 (FY2016~FY2017)</th>
<th>Digital innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expand investment in Lumada</td>
<td><strong>Leverage digital for increased efficiency</strong></td>
</tr>
<tr>
<td>Accelerate global deployment</td>
<td></td>
</tr>
</tbody>
</table>

### Step 3 (FY2018~)

Scale up globally

Expand investment in open innovation to build eco-systems

**Portfolio**

- **Frontier & Platform research**
- **Advanced sponsored research**

- **Sponsored research** 33%
- **R&D expenditure FY2018** 48%

**Digital solutions**

<table>
<thead>
<tr>
<th>Year</th>
<th>JPY Billion</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2016</td>
<td>14B</td>
</tr>
<tr>
<td>FY2017</td>
<td>15B</td>
</tr>
<tr>
<td>FY2018</td>
<td>18B</td>
</tr>
</tbody>
</table>

**Open innovation**

- **100% → 163%**

[^1]: Outside of Japan included
[^2]: Roughly 20% of total Hitachi Gr. R&D expenditure
1.8 Digital transformation in R&D

Draastically reduce product development time with Lumada & AI

**Improved productivity in storage**
Optimize test process by analyzing vast inspection item data using AT/H

- Drive testing time: 75% improved
  - Conv. Method 196hrs → 49hrs

**Improved development efficiency in innovative materials**
Highly efficient design & devt. of innovative materials with material informatics (MI)

- Materials design time: 80% improved
  - Conv. method 24 mos. → 4 mos.

**Materials informatics**

- Design period
  - Experiment
  - Simulation
  - Existing DB
  - Scientific papers
  - Data integration
  - Explore materials with data mining & AI
  - New material
  - Trial & Evaluation

**Examples of innovative materials**
- Semiconductor sealing material
- Lead-free solder, etc.

AT/H: Hitachi AI Technology/H, MI: Materials Informatics

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## 1.9 Hitachi Gr. investment in R&D

### Raising R&D efficiency to contribute to Hitachi’s profitability

#### Investment in R&D

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>R&amp;D expenditure (Billion JPY)</th>
<th>Ratio to R&amp;D expenditure/Revenue (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'14</td>
<td>~300</td>
<td>~3</td>
</tr>
<tr>
<td>'15</td>
<td>~300</td>
<td>~3</td>
</tr>
<tr>
<td>'16</td>
<td>~300</td>
<td>~3</td>
</tr>
<tr>
<td>'17</td>
<td>~300</td>
<td>~3</td>
</tr>
<tr>
<td>'18*</td>
<td>~400</td>
<td>~5</td>
</tr>
</tbody>
</table>

(Adjusted operating income ratio to revenue: 6.6, 6.3, 6.4, 7.6, 8.0* for FY2018 to FY2019)

#### R&D efficiency

Profit / Past 3-yr. avg. of R&D expenditure

- **A**
- **B**
- **C**
- **Hitachi**

*Forecast figure for FY2018
1.10 Major awards and recognitions

Major products & services awarded external recognitions especially in the Four Focus Business Domains

<table>
<thead>
<tr>
<th>Four Focus Business Domains</th>
<th>Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil-free scroll compressor</strong>&lt;sup&gt;1&lt;/sup&gt; w/ integrated amorphous core motor</td>
<td><strong>IoT platform</strong></td>
</tr>
<tr>
<td>Japan Industrial Technology Award: Grand Prix, Prime Minister’s Prize</td>
<td>2018 IoT Breakthrough Award Enterprise IoT MMRI award 2017</td>
</tr>
<tr>
<td><strong>IoT sensor</strong></td>
<td></td>
</tr>
<tr>
<td>Monodzukuri Nippon Grand Award: Prime Minister’s Prize</td>
<td></td>
</tr>
<tr>
<td><strong>Particle beam therapy equipment</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>National Commendation for Invention: Imperial Invention Prize</td>
<td></td>
</tr>
<tr>
<td><strong>iPS cell mass culture equipment</strong>&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Nikkan Kogyo Shimbun Best Ten New Products Award</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Products/Materials</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Immunodiagnostic Analyzer e801</strong></td>
<td><strong>Vision Design PJ</strong></td>
</tr>
<tr>
<td>Okochi Memorial Technology Prize</td>
<td>Vision Design</td>
</tr>
<tr>
<td><strong>Image processing module for home air-conditioner</strong></td>
<td>iF Design Award 2018: &quot;Professional Concept&quot; discipline</td>
</tr>
<tr>
<td><em>Infrared LED, image/temperature camera</em></td>
<td></td>
</tr>
<tr>
<td><strong>Dedicated battery for “idling-stop”</strong></td>
<td>30&lt;sup&gt;th&lt;/sup&gt; Nikkei New Office Awards: New Office Promotion Prize</td>
</tr>
<tr>
<td>“Cho” Monodzukuri Innovative Parts and Components Award: Joint Chairs’ Prize</td>
<td></td>
</tr>
<tr>
<td><strong>Image processing module</strong></td>
<td></td>
</tr>
<tr>
<td><strong>JACI GSC Award: Minister of METI Prize</strong></td>
<td></td>
</tr>
</tbody>
</table>

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<sup>1</sup> A part of this work was supported by The New Energy and Industrial Technology Development Organization (NEDO), Japan, program for the development of practical technology to substitute or reduce rare metals. In the practical implementation phase, technology was developed to respond to the need for further reduction in power consumption.

<sup>2</sup> A part of this technology was developed with the Hokkaido University Graduate School of Medicine under the FIRST Program initiated by CSTP of the Cabinet Office of Japan.

<sup>3</sup> A part of this research is supported by the “Project focused on developing key evaluation technology: Evaluation for industrialization in the field of regenerative medicine” from Japan Agency for Medical Research and development (AMED).

iPS: induced pluripotent stem, GSC: Green Sustainable Chemistry
### 1.11 Basic stance in FY2018

**Become a global innovation leader to drive the evolution towards a global company**

<table>
<thead>
<tr>
<th>Hitachi challenge</th>
<th>Directives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetizing capability aimed at creating SIB</td>
<td>Enhancing co-creation of global solutions</td>
</tr>
</tbody>
</table>
| Increasing world-leading products and services | • From individual solution to connected industries  
• Focus on growth domains & regions |
| Participating and engaging with global communities | Creating and focusing on world-leading technology |
|                      | • Create top technology to support SIB  
• Accelerate open innovation |
|                      | Promoting basic research to resolve societal issues |
|                      | • Create disruptive technology  
• Create visions to lead Society 5.0 |

SIB: Social Innovation Business
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2.1 Co-creating global solutions

Expand co-creation in Social Innovation Business and strengthen global deployment

Directive

1. Expand from point solutions to “Connected Industries”
2. Focus globally on growth areas & societal issue

FY2017 results and next steps

- **FY2017 results**
  - Video analytics solution: Daikin, Daicel, et al
  - People flow visualization: Tokyu, et al
  - Fleet management: Penske
  - Logistics solution: MonotaRO, et al

- **Global CSI’s next initiative**
  - Lead business model development for “Connected industries” solutions

Daikin Industries, Ltd., Daicel Corporation, Tokyu Corporation, Penske Corporation, MonotaRO Co., Ltd., NA: North America

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2.2 “Connected Industries” solution examples

**Finance × Healthcare (Dai-ichi Life Insurance)**

Accurately estimate risk of hospitalization from lifestyle-disease assessment models to expand insurance subscription

- Establish appropriate insurance underwriting standards
- Increase in new subscribers: 300+ subscribers/month

Dai-ichi Life
- 10 million people
- Contract/payment data
- Know-how in insurance services

Hitachi
- Analytics for medical cost estimation
- Know-how in diabetes prevention services
- Medical big data AI

**Industry × Finance (Mizuho Financial Group)**

Manage & share global supply chain data, to agilely respond to financing needs

- SMEs
- Mgmt. efficiency, Financial services
- Supply chain Finance
- Order/Purchase information

Mizuho × Hitachi
- Past record, know-how

Hitachi
- Reflect order/purchase info. in operations
- Weekly/Monthly Real-time

- Blockchain PF
- Operation
- Past record, know-how

- Design & mfg. site A
- Design & mfg. site B
- Improve efficiency in procurement and inventory management
- Rapid decision-making in ordering/purchasing
Global deployment

2.3 Focus on growth area & regions (1)

| NA          | Industry: Industrial equip., Mnfg./Mobility solutions  
Finance: Financial system integration |
|-------------|---------------------------------------------------------|
|             | • Expand from maintenance to mobility services  
• Blockchain validation & business deployment |

**Blockchain**

Verification by customer using advanced analytics technology

**Financial Innovation Lab.**

**Case example: Public notary service**

- Workflow mgmt.
- Agreement record mgmt.
- Credit analysis
- ...

**Advanced analytics tech**

**Auditable blockchain** (on Cloud)

**Collaboration with Stanford Univ.**

**Academia**

**Hyperledger**

**OSS community**

**EMEA**

Urban: Railway systems, Railway digital solutions

- Expand from railway carriages & signals to service business

**Dynamic Headway Solution**

Optimization of train operations depending on passenger demand

- Conducting field trial with the Copenhagen Metro

**People flow analysis**

- People-flow data
- Demand forecast

**SI**: System integration, **OSS**: Open source software
Global deployment

2.4 Focus on growth area & regions (2)

**China**
- **Healthcare:** Elderly nursing
- **Urban:** Digital solution for buildings

- Expand digital business for Healthy China 2030
- New elevator/escalators, maintenance and digital solutions

**Digital care management**
Increase sophistication by monitoring brain/bodily functions, and future prediction

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Hitachi</th>
<th>Municipal government/School</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Improved medical checks</td>
<td>Predict risk or change in condition</td>
<td>Hitachi MGRM Net e-Governance</td>
</tr>
<tr>
<td>Medical data</td>
<td>Analysis of brain/bodily functions</td>
<td>Safe monitor in school</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nursing care</th>
<th>Optical Topography</th>
<th>School performance dashboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Improved service</td>
<td>Image analysis of walking</td>
<td>Know-how through PoC with Sino-Fortune Senior Industry Development (Tianjin) Co., Ltd.</td>
</tr>
<tr>
<td>• Prevent accidents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing data</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Home</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Quality care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life data</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**APAC**
- **Industry:** Manufacturing solution
- **Financial/Social:** Digital infrastructure

- Digital infrastructure business w/ govts.
- Digital business focusing on Thai mnfg.

**Digital India**
Digitalization of govt. services through co-creation with MGRM

- Municipal government/School
- Hitachi MGRM Net e-Governance
- Safe monitor in school
- School performance dashboard

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2.5 Global deployment of Social Innovation Business

Accelerate global deployment with Hitachi Global Digital Holdings
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3.1 Technology for world No. 1 Products & Services

Create world No.1 technology platforms based on societal challenges faced by customers

**Policy**
1. Create world No.1 technology to lead Social Innovation Business
2. Further accelerate open innovation

---

**Societal challenges**

**Hitachi**
- North America
- Europe
- China
- Asia
- Japan

**CTI**
- Energy
- Mechanical eng.
- Materials
- Controls
- Electronics
- Digital technology
- Healthcare
- Systems
- Production eng.

**External Resource**

**Research & Development Group**

**Business unit**
- Power products
- Elevators
- Escalators
- Railway
- Automotive products
- Home appliance
- Industrial equipment
- IT products
- Products of other companies

**World No. 1 tech**

**Customer**
- Power Energy
- Industry Distribution
- Urban
- Finance Social Healthcare

**Front**
- Consulting
- Pre-engineering
- SI
- Engineering

**Platform**

**Product**

---

EL: Embedded laboratory, BU: Business Unit

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Proposing an energy system to support Society 5.0

Future energy system
Cooperative mechanisms integrating diverse distributed resources with the core systems in regional communities

Hitachi U.Tokyo Lab. Energy Forum*
“Towards the realization of a energy system supporting Society 5.0”

No. 1 Tech: Power grid control
An analytical tool assessing grid stability taking into account supply-demand balance and grid failure

Wide-area energy grid simulator

Central dispatch center
Renewable energy
Wind
Solar

Power grid
Large power plant

Wide-area grid simulation

Asses renewable energy power output necessary to maintain stable power grid

*Held on 18 April 2018
Optimize the total value chain from production to logistics sites

Smart production / distribution

- Accumulate successful in-house smart manufacturing solutions & deploy externally
- Visualization & increased efficiency of the total supply chain

Examples of external deployment

Okuma goal
2× productivity improvement, halve lead time

Amada goal
Mnfg. innovation by building advanced models

MonotaRO goal
2-3× productivity improvement with logistics robot

No.1 Tech: Robot autonomous cooperation

Realize both flexibility and increased productivity by cooperation between operators and different types of robots

Group control based on autonomous cooperation

- Free layout
- Improve productivity

Deployed in manufacturing & logistics sites

Autonomous cooperation between AGV & picking robot

- Free routing
- 38% ↑ processing speed

Collaboration with Hitachi Transport and U.Edinburgh

Okuma Corporation, Amada Co., Ltd., MonotaRO Co., Ltd. AGV: Automated Guided Vehicle

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3.4 Urban : Railway / Automotive

**Design and control technology for mobility systems and solutions**

### Railway carriage

Delivery of bi-modal (electric/diesel) high-speed railway carriages for GWR (UK); operation commenced

- **No.1 Tech: Analysis-led design**
  - Elemental development
  - Carriage development
  - Experiment & certification
  - Operation
  - Running test
  - Operations commence for high-speed IEP ['17/10]

- **Analysis-led design**
  - Shock absorbing structure
  - Generator with engine
  - Train bogie

### Autonomous driving

V2X cooperative control for autonomous driving tested in Europe, USA and Japan

- **No.1 Tech. : Cooperative control**
  - Demonstrate autonomous driving through OI
  - V2V communication
  - Europe: AutoNet 2030
  - USA: U. Michigan MTC

GWR: Great Western Railway, IEP: Intercity Express Programme, V2X: Vehicle to X, MTC: Metropolitan Transportation Center

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New services utilizing digital technology to improve safety and convenience

**Cyber-security**

Collaborate with Keio U. et al to promote cybersecurity for social infrastructure

**No.1 Tech: Distributed security operations**

Realizing prompt response by sharing data necessary to cope with incidents, and task allocation in case of attack

- Various organizations
- Task allocation through data sharing
- Attack simulation to increase protection
- Hitachi core tech
- Other entities
- Protection

- Incident origin
- Replication analysis based on IT×OT
- 90% prevention

**Ultrasound diagnostic equipment**

Reduce physical burden on patient and improve hospital examination throughput

**No.1 Tech: High definition imaging probe**

Skill-independent operation based on imaging probe, auto image adjuster and auto measurement technology

- Dramatically shortened time from examination to reporting
- High quality 3-D imaging probe
- Autoclassification
- Auto-adjustment
- Automatic measurement
- VIDI1STAR®
3.6 IoT platform

Accelerate global scaling by increasing customer cases & solution cores

Enhancing Lumada through open innovation

Apply Hitachi OT know-how, AI & robotics technology for global collaboration

Partnering & HR training
- Collab. w/ MATLAB and Microsoft Dynamics
- 3,000 data scientists initiative [FY’21]

AI, Robotics, No. 1 technology

Case example: Maintenance & Repair

Capture signs of defect for early maintenance using AI founded on OT

HR: Human resource
AT/MLCP: Hitachi AI Technology/MLCP (Machine Learning Constraint Programming)
Collaboration with academia & startups to enhance disruptive technology development

Academia
- Stanford University (USA)
- SZTAKI (Hungary)
- Tsinghua univ. (China)
- Shanghai Jiaotong Univ. (China)
- Fudan Univ. (China)
- South China Univ.of Tech. (China)
- Shanghai Jiaotong Univ. (China)
- Fudan Univ. (China)
- South China Univ.of Tech. (China)

Industry
- Industry
- Industry
- Energy
- Energy

Blockchain
- Hyperledger
- Edge computing
- Edgecross Consortium

Startup investment
- Geodesic Capital (Silicon Valley)

Venture capital
- Startup investment

Focusing themes
- Blockchain
- Autonomous driving
- Smart manufacturing
- AI
- Robotics

DFKI: Das Deutsche Forschungszentrum für Künstliche Intelligenz, IIT: Indian Institutes of Technology; MTC: Metropolitan Transportation Center, SZTAKI: Számítástechnikai és Automatizálási Kutatóintézete, UTP: Universiti Teknologi PETRONAS

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4.1 Strategy to resolve societal issues

Create disruptive technology & future vision to solve social issues

**Policy**
1) Create disruptive technology through open innovation
2) Create visions to lead Society 5.0

**SDGs**
Sustainable Development Goals

**Society 5.0**
Human-centric Super Smart Society

**CER's research fields**
- Information science
- Life science
- Materials science
- Frontier

**Joint research center**
- Hitachi Cambridge Lab.
- Hitachi U. Tokyo Lab.
- Hitachi Hokkaido U. Lab.
- Hitachi Kyoto U. Lab.
- Hitachi Kobe U. Lab.

**FY2017 achievements**

- **Ultra-electron microscope**
  - Top resolution of 0.67nm
  - Flux line
  - Ferromagnetic material CoFeB 2 nm

- **Ultrasound CT**
  - Imaging of human breast cancer
  - Speed (m/s)
  - 1 cm

- **Happiness Planet**
  - Announce happiness vision
  - Yano Fellow

- **Society 5.0 vision**
  - Energy Forum

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*1 A part of this research was supported by the FIRST Program initiated by CSTP of the Cabinet Office of Japan, and the CREST Program (Start of Core Research for Evolutional Science and Technology) of the Japan Science and Technology Agency (JST).

*2 Joint research with Hokkaido University  CT: Computed tomography
4.2 Creating disruptive technology

Accelerating efforts to realize quantum computing, simple cancer screening

**CMOS annealing machine**
- Scalable based on size of societal challenge to be solved
- 100K bit processing achieved with FPGA

**Simple cancer screening**
- Verified low-burden cancer screening
- Successful detection in adult & pediatric cancer

**Cancer-screening using urine-based tumor-marker**
- Urine sample
- Component analysis (LC/MS)
- Data analysis e.g. Pediatric cancer

**Nematode-based cancer screening**
- Attracted to elements in cancer patient urine
- Automated analysis system
- Data analysis determined by attraction/avoidance response

**Partner**
- Hokkaido U., NEDO
- Nagoya U., Aflac, HIROTSU Bio Science

FPGA: Field-programmable gate array
4.3 Initiatives to create future visions

Create visions through industry-academia-govt. collaboration to resolve societal challenges, and share with the world

Society 5.0 Vision to resolve societal challenges

Hitachi U.Tokyo Lab

[Energy systems]
Energy Forum

[City planning]
Habitat Innovation Project

Hitachi Kyoto U. Lab

Arrived at 23 groupings from over 20,000 future scenarios of 35 years ahead

[AI policy proposal]
Scenarios for the future

Hitachi Hokkaido U. Lab

[Food & Health]
Hokkaido U. COI Symposium

[City planning] Habitat Innovation

2. Challenge-resolving model to actualize “Society 5.0”
3. Business model based on synergy of strengths between Hitachi and U.Tokyo

[City planning] Habitat Innovation Project

Held open forum on 13 June

Foster literacy
Residents
Humane
Privacy

City economy
Participate
Change

Low carbon society

Energy consumption
Energy conservation (Behavioral change)

100yr lifespan city

Daily activity
Safeguarding

Regional revitalization

Migration data
City planning

Tourism / Retail

Transport info.
On-demand Transport
Logistics

Regional energy management

On-demand

City data collaboration platform
Contents

1. Progress in FY2018 Mid-term Management Plan & Basic stance in FY2018
2. Enhancing co-creation of global solutions
3. Creating and focusing on world-leading technology
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## 5.1 Summary

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### Open Social Innovation Community

- **Stakeholders:** Investors, Environmental NGOs, Customers, Communities, Employees
- **Academia:** Hitachi-U.Tokyo Lab, Hitachi-Kyoto U. Lab, Hitachi-Hokkaido U. Lab, U. Cambridge, Stanford U.
- **Public-Private initiatives:** WEF Society 5.0, Made in China 2025, Industrie 4.0, Digital India, Thailand 4.0
- **Startup communities:** Domestic ventures, Silicon Valley, Boston, Munich, Israel, Shenzhen, India
- **Connected Laboratories:**
  - LUMADA
  - LDAP

Connect with the world & enhance technology platforms in an open environment

NGO: Non-Governmental Organization
New challenges for the next 100 years at “Collaboration Forest”

To be completed in March 2019
HITACHI
Inspire the Next