Summary of Japan’s Robot Strategy
- It’s vision, strategy and action plan -

January 23rd, 2015
Overview – Background and attitude about “Robot Revolution”

◇ Japan as "a Robotics superpower"
  ● The world biggest number of shipments and operating units of industrial robot in the world
◇ Japan is "an issue advanced country" for such as low birth rate and longevity, aging infrastructure, which is expected to utilize robot technology.
◇ Europe and the United States are catching up with the new production systems with digital and network technology as a key to advancement. China and developing country are also accelerating investment to robots. (Chinese robot introduction amount outnumber Japan.)

Lead the world by intensive utilize of robot in data-driven era.

What is Robot Revolution?

1. Dramatic changes in robot ("autonomy", "being information terminal", "networking")
   Even car, consumer electronics, mobile phone and house become robots
2. Utilizing robot in various fields from manufacturing to daily life
3. Through the resolution of social issues and strengthening of international competitiveness, realizing a society in which the robot creates new value.

Three Pillars realizing the revolution

1. Becoming the robot innovation hub of the world,
2. the world’s leading robot utilization society, (SME, nursing/medical care, infrastructure, etc.)
3. Leading the world with robotics in IoT era (Robot with IT utilizing big-data, network and AI)
Based on the results of "the robot revolution realization council", establish a promoting organization that involves the industry, academia, and government to realize robot revolution in actual fields. Considering discussion on AI and IoT in Industrial Competitiveness Council and the Council for Science, Technology and Innovation.

**Robot Revolution Initiative**

- **Major Efforts**
  - Matching seeds to needs, sharing and diffusing best practices, driving international projects, utilizing national institutes, use of Obs, international standardization, security issues and etc.

- **Member**
  - Major industrial association (Robot, parts, users (automobile, agriculture, medical/nursing care, infrastructure, etc.))
  - University, research institutes (NEDO, AIST, NII, etc.)
  - Cooperation organization in local area

- **<Expected structure>**
  - Management Committee (key stakeholders)
  - WG1
  - WG2
  - WG3
  - ...
Need to promote research and development for core element technologies and/or innovative next-generation technologies in order to win the data drive society.

The next-generation technologies (AI, sensor and cognition systems, mechanisms/actuators and its control systems and platform technologies to integrate these core elements) that give a significant impact when implemented in industry and society must be developed.

Research and development of element technologies must be performed with collaboration and information sharing among researchers by workshops, promoting competition among research institutes by contest and award scheme, and introducing the open innovation.

<table>
<thead>
<tr>
<th>Core Technology</th>
<th>Current Major Issues</th>
<th>Expected Researches for Issues</th>
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</thead>
<tbody>
<tr>
<td>Artificial intelligence</td>
<td>Reasoning</td>
<td>• Advancement of data-driven (AI technology learns from big-data)</td>
</tr>
<tr>
<td>Technology for automated Behavior based on human indication and environment</td>
<td>Learning</td>
<td>• Advancement of knowledge representing and reasoning AI (Technology for reasoning from existing knowledge)</td>
</tr>
<tr>
<td>Intelligence Architecture</td>
<td></td>
<td>• Advancement of artificial brain AI (Simulating brain functions by software, and hardware realize brain like functions)</td>
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<tr>
<td>Sensing and cognition</td>
<td></td>
<td></td>
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<tr>
<td>Mechanism, actuator and control</td>
<td></td>
<td></td>
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<tr>
<td>OS, middleware, etc.</td>
<td></td>
<td></td>
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<tr>
<td>Safety evaluation, standard</td>
<td></td>
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<tr>
<td>Other Technologies</td>
<td></td>
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<tr>
<td>Technologies from other fields</td>
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**Scheme for Research and Development**

**Present**
- **Parallel researches for element technologies**
- **Review by stage gate**
- **Transfer to practical use anytime**
- **Utilize existing robots**

**2 years later**
- **Utilize new robots**

**2020**
- **Goal**
- **DARPA style**

**2025**
- **Goal**

**Various research and development by industry, academia, and government**

**Stimulate research and development by workshops and challenge programs**
### International Standardization
- Indispensable for expanding our robotics technology to the world
  - Securement of the compatibility (e.g. connection, interface, OS)
  - Assurance of quality and safety (Safety, certification)
  - Establishment of necessary test method (e.g. collision test, stability test)

### Field-Testing of Robots
- Valid for acceleration for development and introduction
  - Stable operation for securing the needs for equipment
  - Clarifying the concrete and institutional effect that leads to future commercialization
  - Endure into the future
  - Locate the “Fukushima Hama Doori Robot Testing Zone (provisional name)”

### Robot Olympic
- Utilize as a good chance for introducing and expanding robots
  - Progressing and acceleration of research and development and supplying the place of demonstration for 5 years
  - Establish an executive committee within this year and determine the competition items by 2016
  - Held a preparatory competition in 2018

### Human Resource Development
- Fostering software human resources and SIers is a key for robot utilization by
  - Make use of retired workers in production technical fields and OJT-type expansion (short term)
  - Utilization of public job training
  - Integrative curriculum at the graduate school

### Robot Award
- A large impact by evaluating the excellent cases
  - Publication of advanced cases and utilization and share the best practice
  - Establishment of new award and expansion of awards
Promote regulatory reforms that are well-balanced in both of deregulation and rule establishment aimed at robot utilization.

Sort out issues occasionally through “Robot Revolution Initiative”. Coordinate with government Regulatory Reform Council and implement comprehensive reform which look down on the related systems. Construct a robot barrier-free society.

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
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<tbody>
<tr>
<td>◆ Establishment of new radio wave utilization system that supports robot utilization (Radio Act)</td>
<td>(Treating of radio used for remote controlling and unmanned robot such as the rule of sharing the frequency with existing radio wave systems and the simple procedure for radio station licenses) Implement necessary action serially after considering the requirement condition and technical review by 2016FY.</td>
</tr>
<tr>
<td>◆ Smooth pre-market review process for brand-new medical devices (The Act on Securing Quality, Efficacy and Safety of Pharmaceuticals, Medical Devices, Regenerative and Cellular Therapy Products, Gene Therapy Products, and Cosmetics)</td>
<td>(Handling of new medical device which utilize robotic technique such as surgical robot which is expected to alleviate the burdens of patients) Conduct smooth pre-market review for brand-new medical devices, increase the ratio where medical devices are approved in the standard review period (10 months for priority items) up to 80 percentage in 2018FY.</td>
</tr>
<tr>
<td>◆ Reviewing the various legal systems related nursing care</td>
<td>(Flexibility of the procedure that require to add the new nursing-care insurance devices which are currently carried out once in three years (Reception of the request and consideration that can respond to the technical innovation)) From 2015, MHLW receives the requests regarding the coverage of the nursing-care insurance system occasionally and add the new target items occasionally.</td>
</tr>
<tr>
<td>◆ Road Traffic Act and Road Transport Vehicle Act</td>
<td>(electric personal assistive mobility devices use at public road) In addition to the utilizing the relaxation of the standards for road transport vehicles, based on the evaluation results of “Evaluation and Research Committee for Structural Reform Special Districts”, which is planned to be conducted during FY2014, the way to deal with these assistive mobility devices will be considered, including whether to make the use of “Special System for Corporate Field Tests”, which was created in 2014.</td>
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<tr>
<td>◆ Laws and Regulations related to uninhabited airborne robot(Aviation Law and the like)</td>
<td>(Concrete rule about uninhabited airborne type robots (UAV) which is expected to be used at the disaster sites and the like) As for the Large-size uninhabited aerial vehicles, domestic rules will be established by participating the consideration of the revision of the international standards at International Civil Aviation Organization (ICAO) and based on such revision which is expected to take place in 2019 or later. As for the small-size uninhabited aerial vehicles, while identifying their operational situation, further examination will be proceeded to the laws and regulations.</td>
</tr>
<tr>
<td>◆ Laws and regulations related to public infrastructure maintenance and repair</td>
<td>(Valid method for utilizing robot effectively (a rule related to the utilizing robot in checking where visual inspection is required)) Through the based on the on-site verification results, trial, and evaluation, examination will be proceeded about the method for utilizing robot. Based on the results, method will be applied to the fields where robots are to be utilized.</td>
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</table>
**Manufacturing**

- Promote to introduce robot to backyard operations such as logistics, wholesale, retail, hotels, and restaurants
- Through collecting examples of the best practice and dissemination nationwide, create a virtuous cycle of solving labor shortage in the service industry, improving productivity, and increasing wages
- Bring into perspective a study toward automating human-based process, such as development of the next-generation element technologies

**Priority areas**

- Promote to introduce robot to mainly labor-intensive work such as parts processing and assembly and food processing
- Challenge for robot introduction to setup process where robotization has been difficult in the past, and sophisticate robot by utilizing IT
- Foster SIer who integrates users and producers
- Standard modularization for Robots (Hardware/Software) and streamlining the common platform (Robot OS (=Operating System for Robots))

**The 2020 vision to aim for**

- Increase the rate of robotization in the assembly process: **25%** for large-scale companies, **10%** for small and medium-sized companies
- The rate of robotization in the automobile assembly process is about 7%: by the Economic Research Institute, Japan Society for the Promotion of Machine industry
- Best practice of utilizing next-generation robots: **30 cases**
- Interoperable hardware products: **more than 1,000 types**
- Expand the market scale related to SIer business (exceed the increase in the size of the market for robots)

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**Service**

- Need to improve the labor production which is lower than any other country

**Priority areas**

- Promote to introduce robot to backyard operations such as logistics, wholesale, retail, hotels, and restaurants
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- Bring into perspective a study toward automating human-based process, such as development of the next-generation element technologies

**The 2020 vision to aim for**

- The rate of use of robots for picking, screening, and checking operations: **about 30%**
- Collect the best practice mainly for the backyard operations including collecting and placing tables and cleaning in the wholesale and retail businesses, hotels, and restaurants (**about 100 examples**)

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*Note: The text above is a summary of the information presented in the slides. The actual content may require additional context or interpretation.*
Nursing

Rise of the aging rate, increase of the necessary care workers, 70% of workers suffer from backache

- Support the development and practical realization and spread in the important 5 development fields, transfer support from bed, walking support, excretion support, watching over who have dementia, bathing support
- Spread the medical devices such as surgical robots
- Smooth pre-market review of brand-new medical device

Through the sales figures increase, increase rate rise and fall

Priority areas

The 2020 vision to aim for

- Expand the domestic market scale of nursing care robots to 50 billion yen
- Lower the risk of care givers of suffering from a backache to zero by using nursing care robots for helping the aged transfer
- Change the awareness of nursing methods using the newest robot technology

Increase the percentage of people who wish to use nursing care robots for providing care to 80% from the current 59.8%. Increase the percentage of people who wish to have robots used when undergoing care to 80% from the current 65.1%

Medicals

<Scale of domestic market in the medical equipment>

Priority areas

The 2020 vision to aim for

- More than 100 cases of support to put medical care-related equipment using robot technology will be implemented in 5 years from 2015 to 2020
**Action plan—Sectoral issue (3) Infrastructure, disaster, construction/agriculture, food industry—**

### Infrastructure, disaster, construction

**Aim for solving the medium- and long-term labor shortage, by labor-saving and automation in construction.**

**Aim for more efficient and sophisticated maintenance, by leveraging the robot to visual inspections of infrastructure.**

**Aim for faster understanding disaster situation by disaster survey robot, and efficient construction by unmanned systems in landslide disaster site.**

**Achieve to unprecedented large-scale, low-cost production by overcoming the work capacity limitation by automation introducing the GPS automatic navigated farm machines including tractor.**

**Aim for mechanization and automation of human-intensive hard work by introducing assist-suits and herbicides robots.**

**Realize labor saving and high-quality production by advanced environmental control systems, damaged produce inspection systems and big-data analysis.**

### Agriculture, food industry

**Aim for 30% of the adoption rate of intelligent construction for high productivity and labor-saving.**

**Aim for high effective maintenance and repair by sensor, robot and non-destructive inspection to at least 20% of the aging important infrastructure.**

**Achieve for unmanned construction efficiency comparable with manned construction in harsh landslide and volcanic disaster site.**

### Priority areas

- A decrease and aging of the number of workers cause serious labor shortage
- Possibility facing serious labor shortage by aging progresses

<table>
<thead>
<tr>
<th>Employees of construction industry: $10^4$</th>
<th>Investment of construction industry: tril. yen</th>
</tr>
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<tbody>
<tr>
<td>Employees</td>
<td>Investment</td>
</tr>
<tr>
<td>72.8% of peak ('97)</td>
<td>58.0% of peak ('92)</td>
</tr>
<tr>
<td>50 or younger 61%</td>
<td>65 or older 61%</td>
</tr>
</tbody>
</table>

| Core agriculture workers 1.74 mil.        |
| Average age: 66.5 y.o.                    |
| 50 or younger                             |
| 178 thou. (10.2%)                         |
| Percentage of total core agriculture workers (right axis) |
| 65 or older 61%                           |
| 1.067 mil.                                |
| 1.0 mil.                                  |
| 0.616 mil.                                |
| 61%                                       |

### The 2020 vision to aim for

**The 2020 vision to aim for**

- **Achieve for implementation of automatic driving tractors to actual field until 2020.**
- **Aim to introduce more than 20 types robots for labor-saving in agriculture and food industry.**