【Provisional】

Summary of Japan’s Robot Strategy

- It’s vision, strategy and action plan -

February 10th, 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.

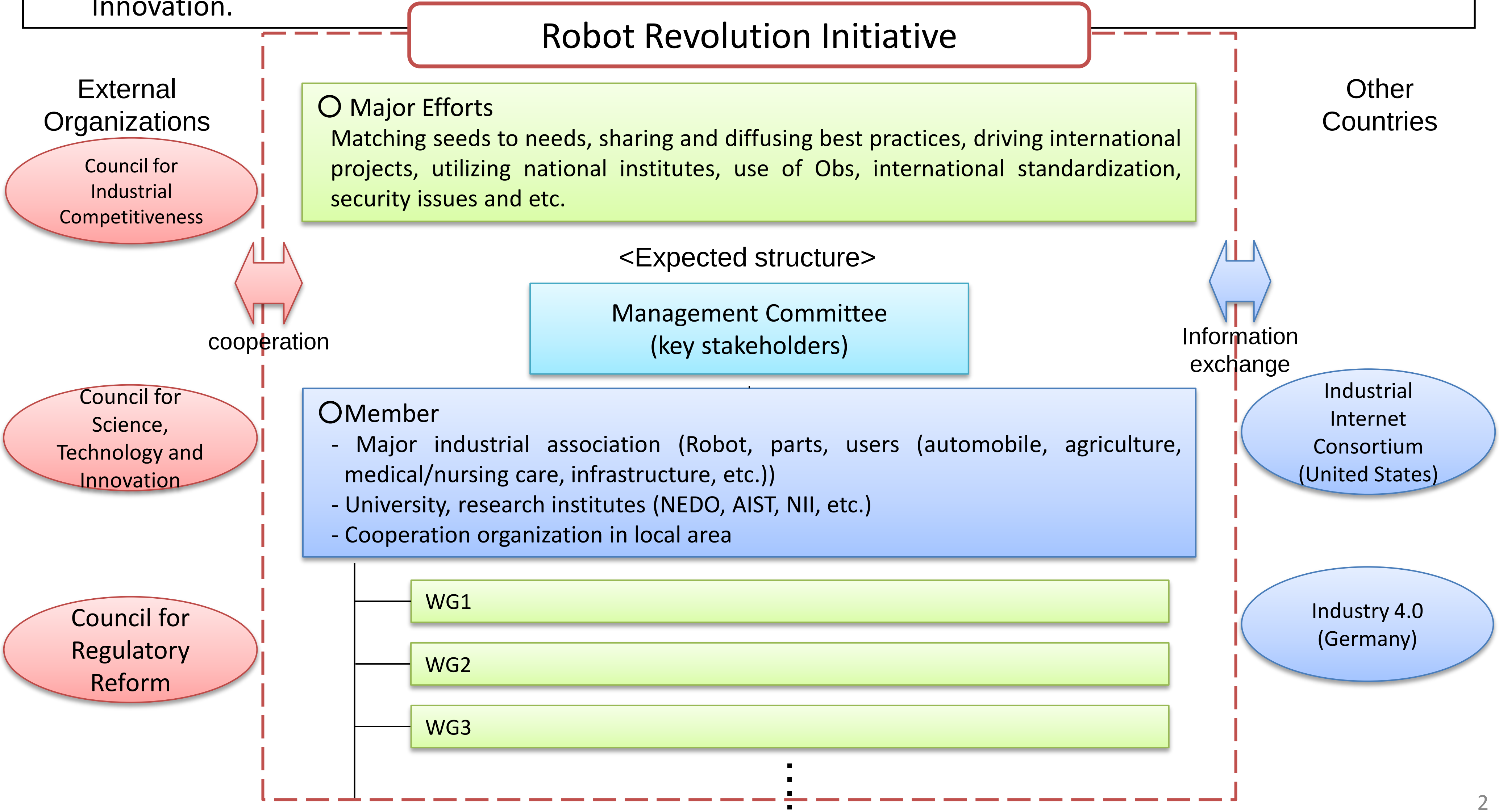
Towards Robot Revolution

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)

Action plan - Cross-cutting issue (1) the foundation of "Robot Revolution Initiative" -

◇ 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

External Organizations

- Council for Industrial Competitiveness
- Council for Science, Technology and Innovation
- Council for Regulatory Reform

cooperation

○ 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.

<Expected structure>

Management Committee
(key stakeholders)

○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

WG1

WG2

WG3

⋮

Other Countries

Information exchange

- Industrial Internet Consortium (United States)
- Industry 4.0 (Germany)

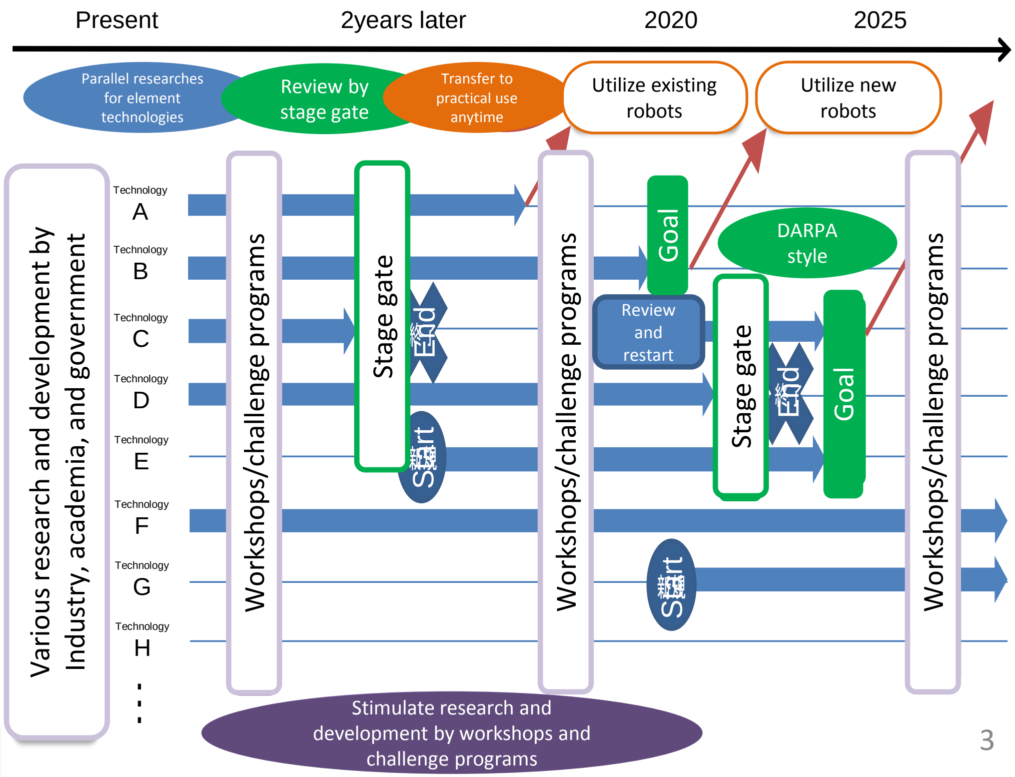
Action Plan - Cross-cutting issue (2) Technology development towards next generation -

- ◇ 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.

Expected technologies to be developed

Core technology		Current major issues	Expected researches for issues
Artificial intelligence Technology for automated Behavior based on human indication and environment	Reasoning	Although it is possible to provide one answer to one question based on given information, it is difficult to give a natural response based on the analogy of the context of conversation or instruction or by reading between the lines, or respond to unknown situations (machine translation is still developing).	○ Advancement of data-driven (AI technology learns from big-data) ○ Advancement of knowledge representing and reasoning AI (Technology for reasoning from existing knowledge) ○ Advancement of artificial brain AI (Simulating brain functions by software, and hardware realize brain like functions)
	Learning	Pre-programmed movements can be made, but it is difficult to autonomous change or determine tasks by recognizing task progress or situations in the surrounding, or make a movement by imitating the craftsmanship.	
	Intelligence Architecture	It is necessary to study modularization of AI and software (e.g., thinking system and reflex system in the brain structure) in terms of concentration of research and development resources and improvement of development productivity.	
Sensing and cognition		…	…
Mechanism, actuator and control		…	…
OS, middleware, etc.		…	…
Safety evaluation, standard		…	…
Other technologies			
Technologies from other fields		…	…

Scheme for Research and Development



Present
2years later
2020
2025
Parallel researches for element technologies
Review by stage gate
Transfer to practical use anytime
Utilize existing robots
Utilize new robots
Various research and development by Industry, academia, and government
Technology A
Technology B
Technology C
Technology D
Technology E
Technology F
Technology G
Technology H
⋮
Workshops/challenge programs
Stage gate
End
Start
Workshops/challenge programs
Goal
Review and restart
DARPA style
Stage gate
End
Goal
Start
Workshops/challenge programs
Stimulate research and development by workshops and challenge programs

Action Plan - Cross-cutting issue (3) Standardization and Field-Testing -

◇ Act from cross-cutting and medium-long term prospective such as international standardization, Field-Testing of Robots which is valid for acceleration for development and introduction, human resource development who progress the introduction and expansion of robot.

◇ The executive committee will be started within this year to establish the system, the concrete style and competition items will be determined by 2016, and also a preparatory competition will be held in 2018. And then, the Robot Olympic will be held in 2020.

◆ **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)

◆ **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

◆ **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)"

◆ **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

Action Plan - Cross-cutting issue (4) Implementation of Robot Related Regulation Reform-

- ◇ 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.

◆ **Establishment of new radio wave utilization system that supports robot utilization（Radio Act）**

（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.

◆ **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）**

（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.

◆ **Reviewing the various legal systems related nursing care**

（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.

◆ **Road Traffic Act and Road Transport Vehicle Act**

（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.

◆ **Laws and Regulations related to uninhabited airborne robot(Aviation Law and the like)**

（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.

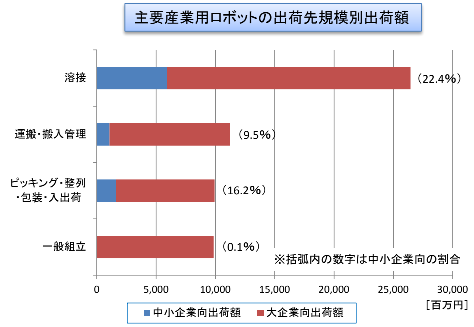
◆ **Laws and regulations related to public infrastructure maintenance and repair**

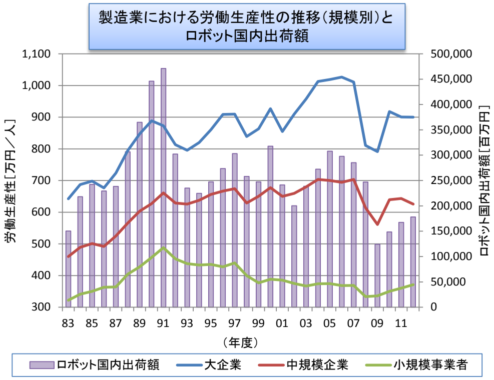
（Valid method for utilizing robot effectively (a rule related to the utilizing robot in checking where visual inspection is required ）

→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

Action plan ー Sectoral issue (1) Manufacturing, service ー

Manufacturing





Robots are introduced to mainly major companies, labor productivity have levelled off in recent years

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

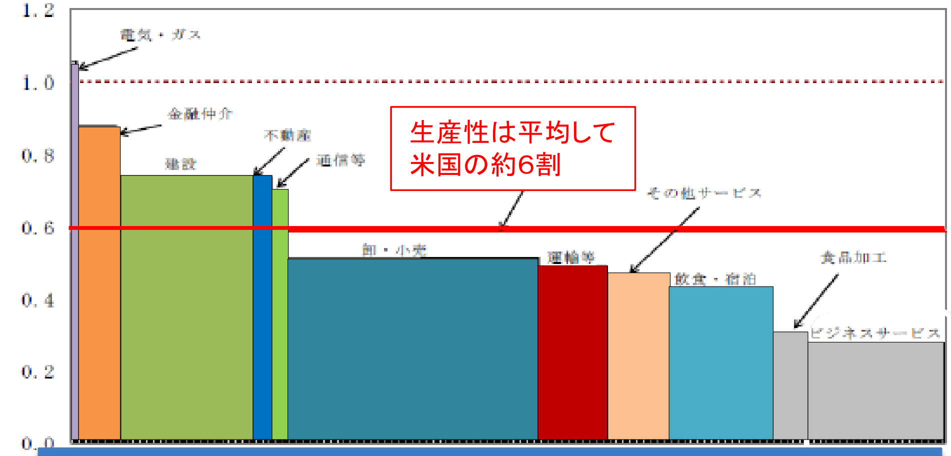
- ◆ Increase the rate of robotization in the assembly process: **25%** for large-scale companies･**10%** for small and medium-sized companies

※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）

Service

＜Comparison between Japan and US in the service field of the labor production standard＞



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

Priority areas

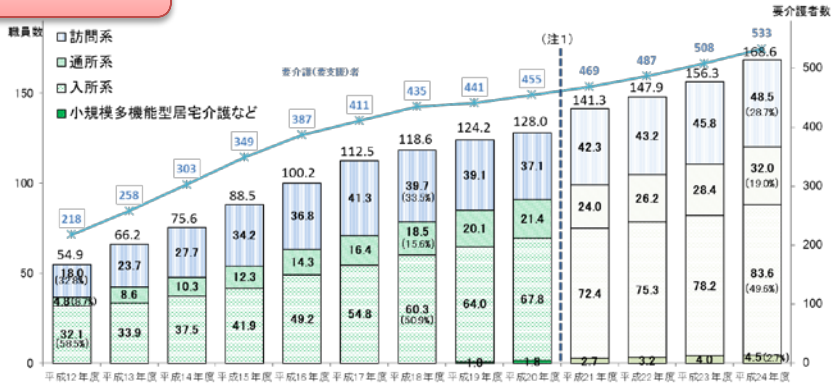
- ✓ Promote to introduce robot to backyard operations such as logistics, wholesale, retail, hotels, and restaurants
- ✓ Through collecting examples of the best practice and dissemination nationwide, create a virtuous cycle of solving labor shortage in the service industry, improving productivity, and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

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**）

Action plan ー Sectoral issue (2) Nursing and medical fields ー

Nursing



	平成12年度 (2000年度)	平成24年度 (2012年度) (推計値)	平成27年度 (2015年度) (推計値)	平成37年度 (2025年度) (推計値)
介護職員	55万人	149万人	167～176万人 (164～172万人)	237～249万人 (218～229万人)

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

Priority areas

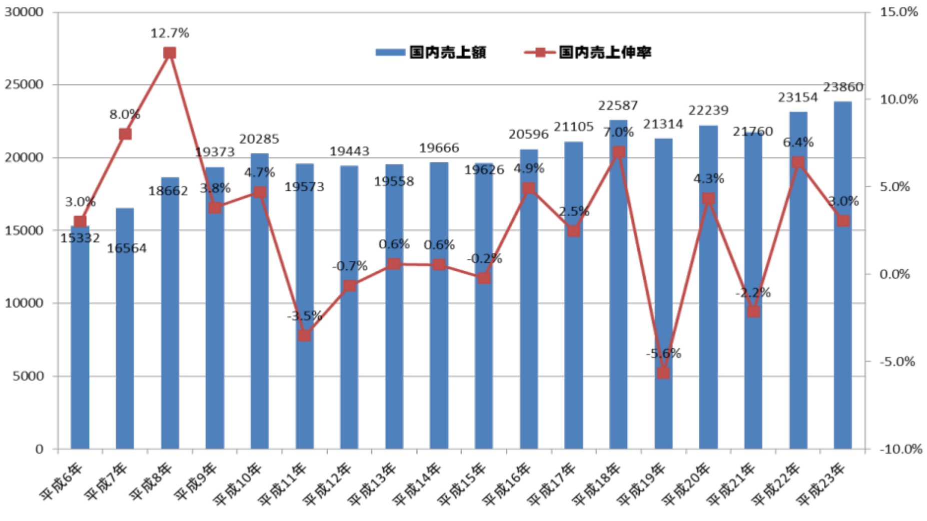
- ✓ Support the development and practical realization and spread in the important 5 development fields, transfer support from bed, walking support, excretion support, watching over who have dementia, bathing support

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＞



厚生労働省 薬事工業生産動態統計年報

Though the sales figures increase, increase rate rise and fall

Priority areas

- ✓ Spread the medical devices such as surgical robots
- ✓ Smooth pre-market review of brand-new medical device

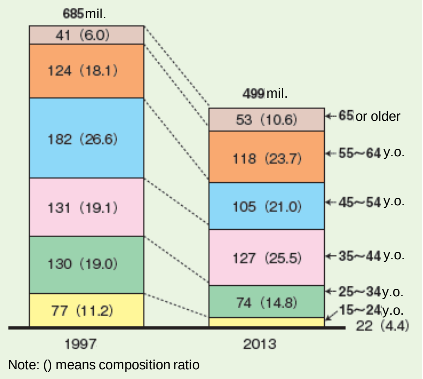
The 2020 vision to aim for

- ◆ 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 ー Sectoral issue (3) Infrastructure, disaster, construction/agriculture, food industry ー

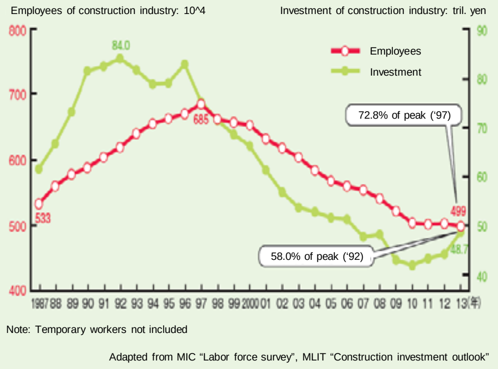
Infrastructure, disaster, construction

Age group changes in the number of workers



Note: () means composition ratio

Trends in construction investment and its employees



Note: Temporary workers not included

Adapted from MIC "Labor force survey", MLIT "Construction investment outlook"

(From "Construction industry handbook 2014" (Japan Federation of Construction Contractors))

A decrease and aging of the number of workers cause serious labor shortage

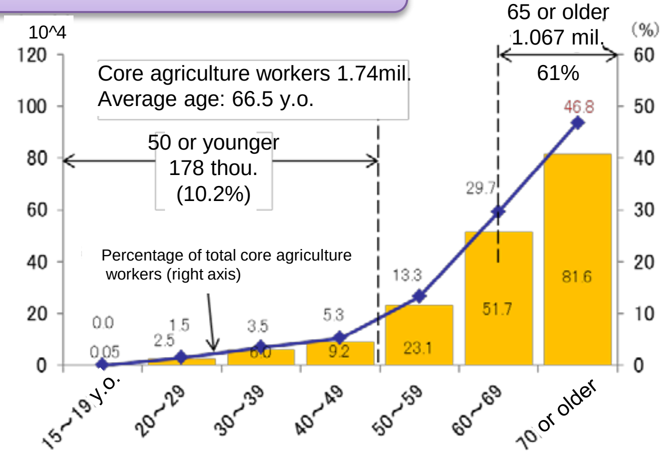
Priority areas

- ✓ 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.

The 2020 vision to aim for

- ◆ 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.

Agriculture, food industry



Possibility facing serious labor shortage by aging progresses

Priority areas

- ✓ 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.

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.