German – Japanese Symposium
Berlin, Germany, Tuesday, 28 June 2016
The Japanese Science and Technology Policy toward Innovation
～ The 1st Science and Technology Overseas Outreach Caravan ～

内閣府
Cabinet Office, Government of Japan

The Japanese Science, Technology and Innovation Policy

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Director for SIP

28th June 2016
Bureau of Science, Technology and Innovation,
Cabinet Office,
Government of Japan

< Outline >

1. Introduction of the CSTI

- Council for Science, Technology and Innovation (CSTI)

2. Formulation of the 5th S&T Basic Plan

3. National Energy and Environment Strategy for Technological Innovation towards 2050 (NESTI 2050)

4. SIP and ImPACT

- Cross-Ministerial Strategic Innovation Promotion Program (SIP)
  - ◆Automated Driving System
- Impulsing Paradigm Change through Disruptive Technologies Program (ImPACT)

5. Growth Strategy 2016

Prior "Three Arrows" : Japan Revitalization Strategy

NEW

Three Arrows of the Economic Policies

Cabinet decision on June 14, 2013

1st Bold Monetary Policy

2nd Flexible Fiscal Policy

3rd Japan Revitalization Strategy
New Growth Strategy

Three Action Plans

Ⅰ. Plan for the Revitalization of Japanese Industry

Ⅱ. Strategic Market Creation Plan

Ⅲ. Strategy of Global Outreach

Three Arrows of the Economic Policies

Cabinet decision on Sep. 25, 2015

1st A robust economy that gives rise to hope

- **Nominal GDP toward 600 trillion yen**

2nd Dream-weaving Childcare Supports

- **Desirable birthrate of 1.8**

3rd Social Security that provides reassurance

- **No one forced to leave their jobs for nursing care**

★Achieving economic growth, creation of new value, and enhancement of industrial competitiveness through Science, Technology and Innovation

★Integrating STI policy and Ｉndustrial policy

Administrative Organization for Promoting STI

Cabinet Office

Roles:

- Support the Cabinet in **formulating important policies** and in **overall coordination** of Ministries
- Make total **planning and coordination from a higher standpoint of view than other Ministries**

Councils on key policy fields

1. Council on Fiscal and Economic Policy
2. **Council for Science, Technology and Innovation**
3. Advisory Council for National Strategic Special Zones
4. Central Disaster Management Council
5. Council for Gender Equality

Chairperson

Shinzo ABE
Prime Minister

Council for Science, Technology and Innovation (CSTI)

Chair: Prime Minister
Member: 7 cabinet members (including PM & Minister for S&T Policy) and **8 executive members**
Secretariat: STI Bureau, CAO

<Main Functions>

1. Investigate and discuss **basic S&T Innovation policies**
2. Investigate and discuss S&T **budgets** and the allocation of **human resources**
3. Assess Japan's **key R&D**
4. Investigate and discuss **Framework conditions** for the promotion of innovation

・Basic policies on S&T (Budget Allocation, Basic Strategy etc)
・Response
・Consultation

Executive Members of CSTI

Dr. Kazuo KYUMA
Former Executive Adviser, Mitsubishi Electric Corp.
(Full-time Position)

Dr. Yuko HARAYAMA
Former Professor, Tohoku University
(Full-time Position)

Dr. Takahiro UEYAMA
Former Vice President; Professor, National Graduate Institute for Policy Studies
(Full-time Position)

Mr. Takeshi UCHIYAMADA
Chairman of the board, Toyota Motor Corp.

Head of an Affiliated Organization

Dr. Kazuhito HASHIMOTO
President, National Institute for Materials Science

Dr. Motoko KOTANI
Professor, Tohoku University

Mr. Masakazu TOKURA
Representative Director, & President
Sumitomo Chemical Co., Ltd.

Dr. Takashi ONISHI
President, Science Council of Japan

5th S&T Basic Law and S&T Basic Plans

- The Science and Technology Basic Plan is a comprehensive plan prepared by the Japanese government in accordance with the Science and Technology Basic Law in order to promote science and technology in Japan over a five-year term, based on a 10-year forward outlook.

- The 5th Basic Plan (FY2016 to FY2020), the first plan formulated by the Council for Science, Technology and Innovation (CSTI), is focused on enhancing "Science, Technology and Innovation (STI) measures."

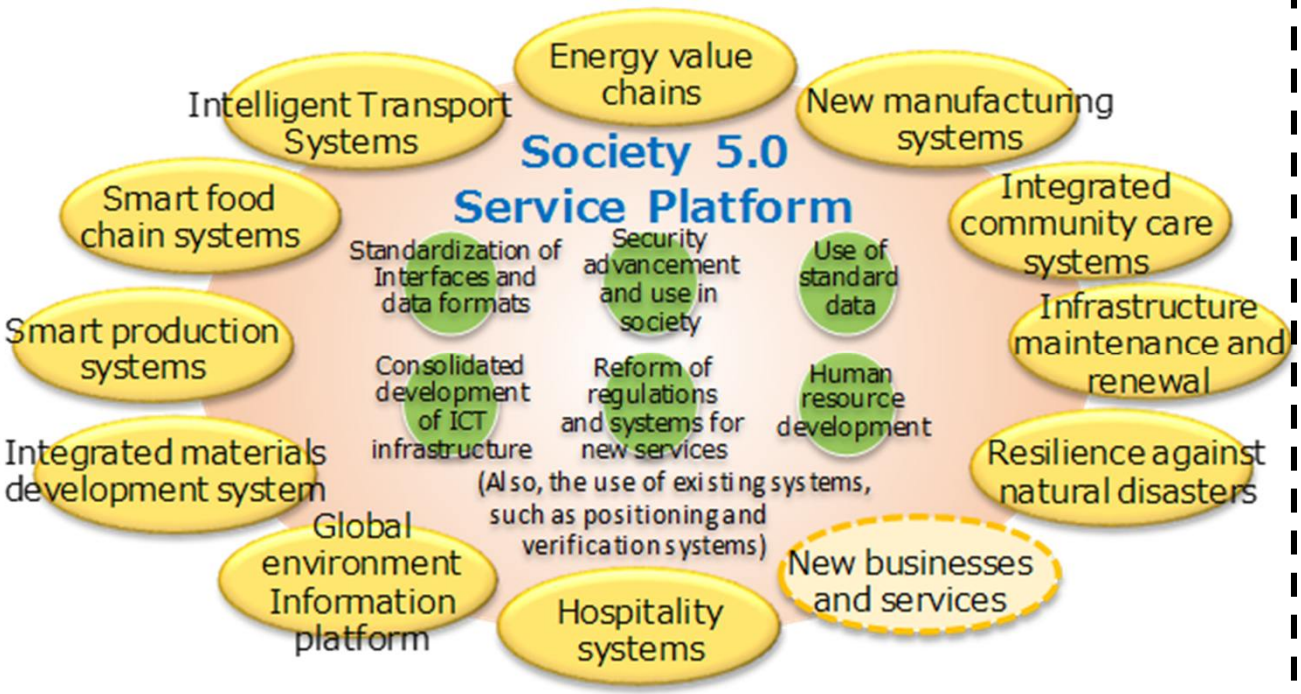
- Executing this Basic Plan will require a wide spectrum of parties
  —including the government, academia, industry, and citizens
  —to work together and lead to transform Japan into "the most innovation-friendly country in the world."

Table of contents

Key elements of the 5th Basic Plan

"society 5.0"

- ✓ aim at "systemization" of services and businesses, system advancement, and coordination between multiple systems;
- ✓ promote the measures needed to develop **a common platform** for this goal



※ Objective of **"Society 5.0"**

The next new social-economy after hunter-gatherer society, agrarian society, industrial society, and information society, "Society 5.0":

- Sophisticatedly integrates cyberspace with physical space;
- Achieves both economic growth and addresses social challenges by providing the necessary goods and services to the people who need them, regardless of their age, gender, region, and language etc.;
- Realizes the human-centered society where people can live vigorous and comfortable lives.

Outlook on National Energy & Environment Strategy for Technological Innovation towards 2050 (NESTI 2050)

Ⅰ. Strategy

○ To meet the "2℃ target" referred in COP21, global GHG emissions need to be reduced to about 24 billion tons per year by 2050. Currently, global annual GHG emissions are approximated to 50 billion tons. Since the amount is projected to be about 57 billion tons based on submitted INDCs, approximately 30 billion tons of additional reduction is necessary. In so doing, it is essential to promote innovation for drastically reducing emissions on a worldwide scale.

○ Looking ahead to 2050, Japan has identified a number of innovative technologies with potential to make huge impacts on emission reductions, while assuming that the entire energy system will be optimized with the realization of "super smart society" (Society 5.0). R&D of the prioritized technologies will be promoted in the medium-to-long term, while identifying and addressing technological challenges.

⇒ Out of 30 billion tons of CO_2 reductions that are necessary to meet the 2 ℃ target, **several billion to 10 billion tons or more** of reductions are expected through this strategy.

* Based on the figures estimated by IEA. In the selected technological areas, the application of innovative technologies is added to the application of technologies whose development and demonstration have already been advanced.

Ⅱ. Identified target technology fields

Technologies :
(1) that are innovative and not the extension of the existing efforts but discontinuous and impactful
(2) with the potential for widespread adoption and significant emission reductions
(3) that require medium-to-long-term investment and combined forces among industry, academia and government
(4) in which Japan can take the lead or demonstrate our superiority

Energy Systems Integration Technologies
so that various components (i.e. energy production, transport, consumption) are networked by ICT and energy system is optimized by AI, big data and IoT

Core Technologies for Systems
namely, next generation power electronics, innovative sensors and superconductivity

Each innovative technologies

Energy Saving	1 Production process	○ Membrane Separation / Catalysts
	2 Structural material	○ Ultralight and super heat-resistant
Energy storage	3 Storage Battery	○ Metal-Air Batteries / All-Solid-State Batteries
	4 Hydrogen	○ CO_2 free hydrogen
Energy generation	5 Photovoltaic	○ Perovskite structure / Quantum dot
	6 Geo-Thermal	○ Hot dry rock geo-thermal / Supercritical geo-thermal
7 Capture and Effective Usage of Carbon Dioxide		

Ⅲ. Enhanced R&D systems

1. Forming R&D Structures as Unified Government Agencies
2. Creation of Innovation Technology Seeds and Flexible Positioning
3. Mechanisms to Encourage Industry Investment in R&D
4. Promotion of International Coordination and Joint R&D

Leading the world through innovation while keeping mitigation efforts and economic growth compatible with each other.

NESTI 2050

Headquarters for Science and Technology to foster innovation

- *Promoting effective measures across ministries to create innovation beyond the borders of disciplines, ministries and sectors*

Three Arrows of Reinforcement of the HQ

1st

Improvement of the process for policy-making "S&T Budgeting Strategy Committee" and "Action Plans for S&T Priority Measures"

- *Prioritized area: "Energy", "Next-generation infrastructures", "Local resources", "Health & Medical"*
- *Budget for FY2014: ¥335bil*

2nd

SIP (Cross-Ministerial Strategic Innovation Promotion Program)

- *Budget for FY2016: ¥50bil*

3rd

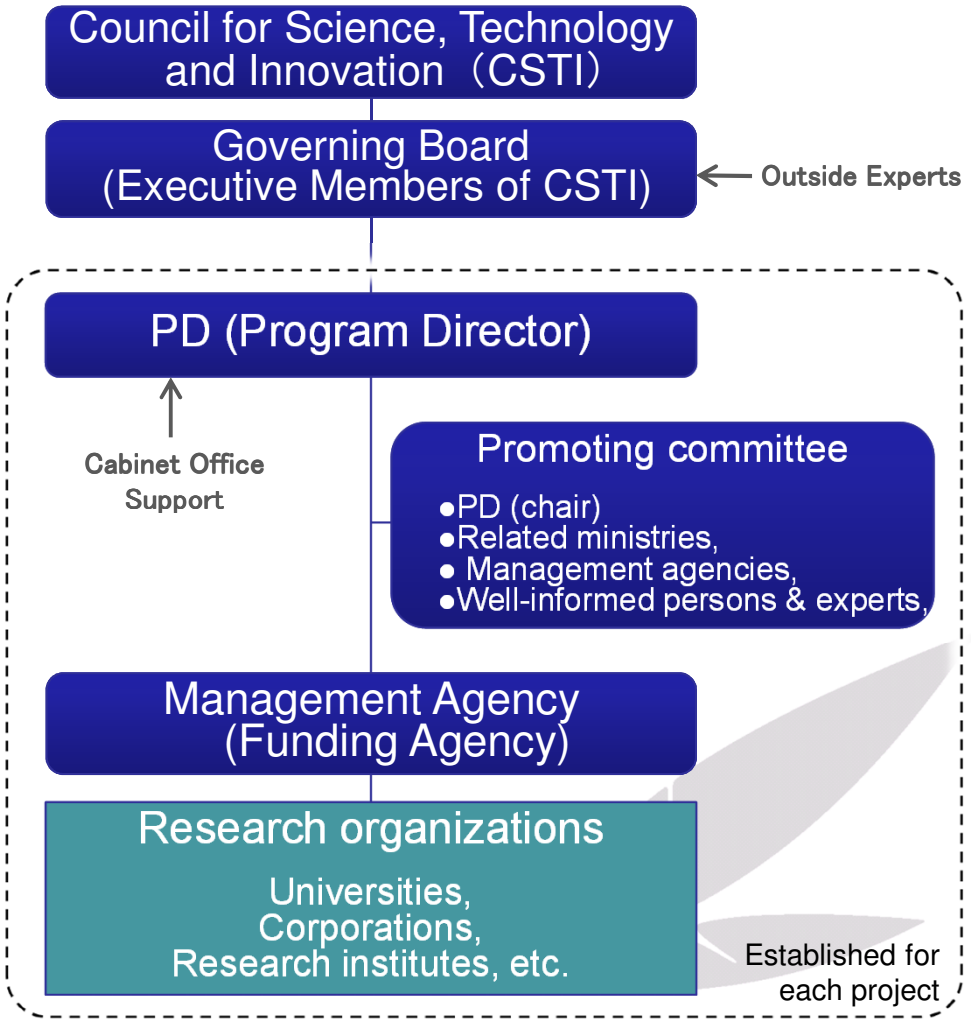
ImPACT (Impulsing PAradigm Change through disruptive Technologies)

- *Budget for FY2014-2018: ¥55bil*

SIP（Cross-Ministerial Strategic Innovation Promotion Program）

- Realizing Science, Technology and Innovation through promoting R&D overlooking from basic research to application and commercialization by cross-ministerial cooperation.
- Council for Science, Technology and Innovation（CSTI） defined the themes to solve societal issues and achieve economic growth
- CSTI appoints Program Directors (PDs) for each project and allocates the budget.

< Governance structure >



Established in 2013
Total ¥50B (budget for FY2016)

11 Themes of SIP

Priority policy issues	Themes	Objective
Energy	Innovative Combustion Technology	Improving fuel efficiency of automobile engines
	Next-Generation Power Electronics	Integrating new semiconductor materials into highly efficient power electronics system
	Structural Materials for Innovation (SM⁴I)	Developing both ultra-strong and -light heat-resistant materials for airplane such as CFRP, alloys, intermetallic, and ceramic-coatings and Materials integration system to predict performance of materials.
	Energy Carriers	Promoting R&D to contribute to the efficient and cost-effective technologies for utilizing hydrogen
	Next-Generation Technology for Ocean Resources Exploration	Establishing technologies for efficiently exploring submarine hydrothermal polymetallic ore
Next-generation infrastructures	Automated Driving System	Developing new transportation system including technologies for avoidance accidents and alleviating congestion
	Infrastructure Maintenance, Renovation and Management	Developing low-cost operation & maintenance system and long life materials for infrastructures
	Enhancement of Societal Resiliency against Natural Disasters	Developing technologies for observation, forecast and prediction of natural disasters
	Cyber-Security for Critical Infrastructures	Development of technologies that monitor, analyze, and defend control and communication system as well as confirm integrity and authenticity of system components to protect critical infrastructures against cyber threats.
Local resources	Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries	Realizing evolutionary high-yield and high-profit models by utilization of advanced IT etc
	Innovative Design/Manufacturing Technologies	Establishing new styles of innovations arising from regions using new technologies such as Additive Manufacturing

SIP（Cross-Ministerial Strategic Innovation Promotion Program）

- Program Directors for SIP -

Innovative Combustion Technology

Masanori Sugiyama
Toyota Motor Corp.

Structural Materials for Innovation（SM⁴I）

Teruo Kishi
Univ. of Tokyo, NIMS

Energy Carriers

Shigeru Muraki
Tokyo Gas Co.,Ltd.

Next-Generation Technology for Ocean Resources Exploration

Tetsuro Urabe
Univ. of Tokyo, JMEC

Next-Generation Power Electronics

Tatsuo Oomori
Mitsubishi Electric Corp.

Infrastructure Maintenance, Renovation and Management

Yozo Fujino
Yokohama National Univ.

Automated Driving System

Seigo Kuzumaki
Toyota Motor Corp.

Enhancement of Societal Resiliency against Natural Disasters

Masayoshi Nakashima
Kyoto Univ.

Cyber-Security for Critical Infrastructures

Atsuhiro Goto
Institute of Information Security

Tech. for Creating Next-Generation Agriculture, Forestry and Fisheries

Takeshi Nishio
Hosei Univ.

Innovative Design/Manufacturing Technologies

Naoya Sasaki
Hitachi Ltd.

Automated Driving System

【 **Description** 】Developing new transportation systems including technologies for avoiding accidents and alleviating congestion.
【 **Objective** 】 To achieve “Level 2” by the end of the mid-2010s and “Level 3” by early 2020s.
【 **Duration** / **Budget** 】 Five years （ 2014 - 2018 ） / \2.62 Billion （ for FY 2016 ）

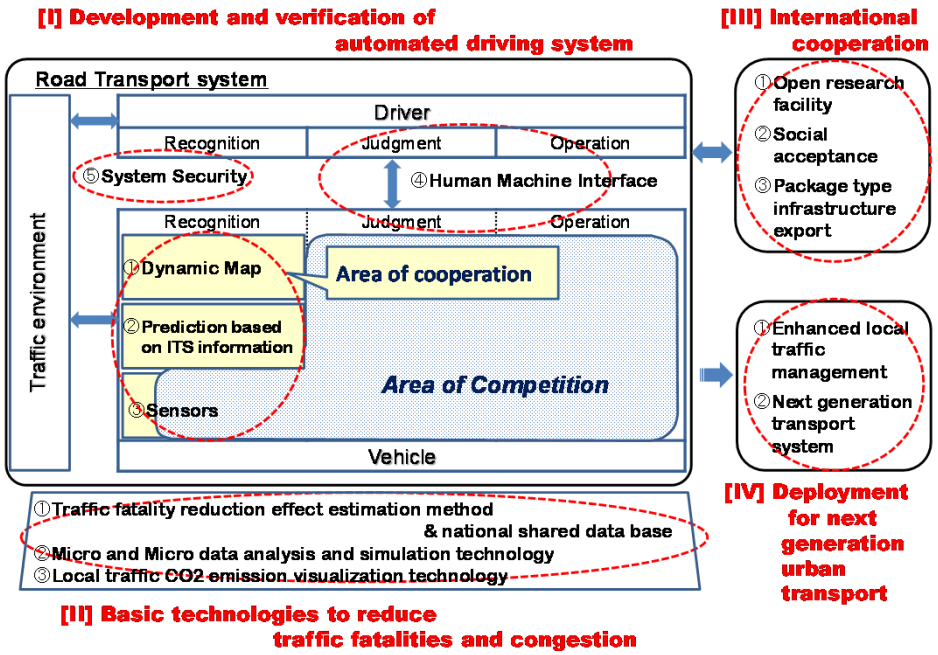
Goal & Strategy

1. Achieving the national goal, i.e. Reducing road crashes, etc.
   The national infrastructure for achieving the national goal
2. Realizing and spreading of Automated driving system
   Promoting practical implementation by progressing both R&D and international cooperation simultaneously
3. Implementation of next-generation public transportation system
   Developing in collaboration with Tokyo Metropolitan Govt. with Tokyo Olympics and Paralympics as a milestone

■ Definition of Automated Driving Levels

Automation Level (SIP definition)	Overview	Systems to realize the level
Level 4	All functions of acceleration, steering, and braking are controlled without a driver. Driver is completely uninvolved.	Fully automated driving system
Level 3	Vehicle controls all functions of acceleration, steering, and braking. Driver intervenes in the cases of emergency	Semi automated driving system
Level 2	Simultaneous multiple functions of acceleration, steering, or braking	
Level 1	Single function, either acceleration, steering, or braking	Safe driving assistance system

■ Scope of Research on Automated Driving



■ **Program Director（PD）:** Seigo KUZUMAKI（Toyota Motor Corp.）

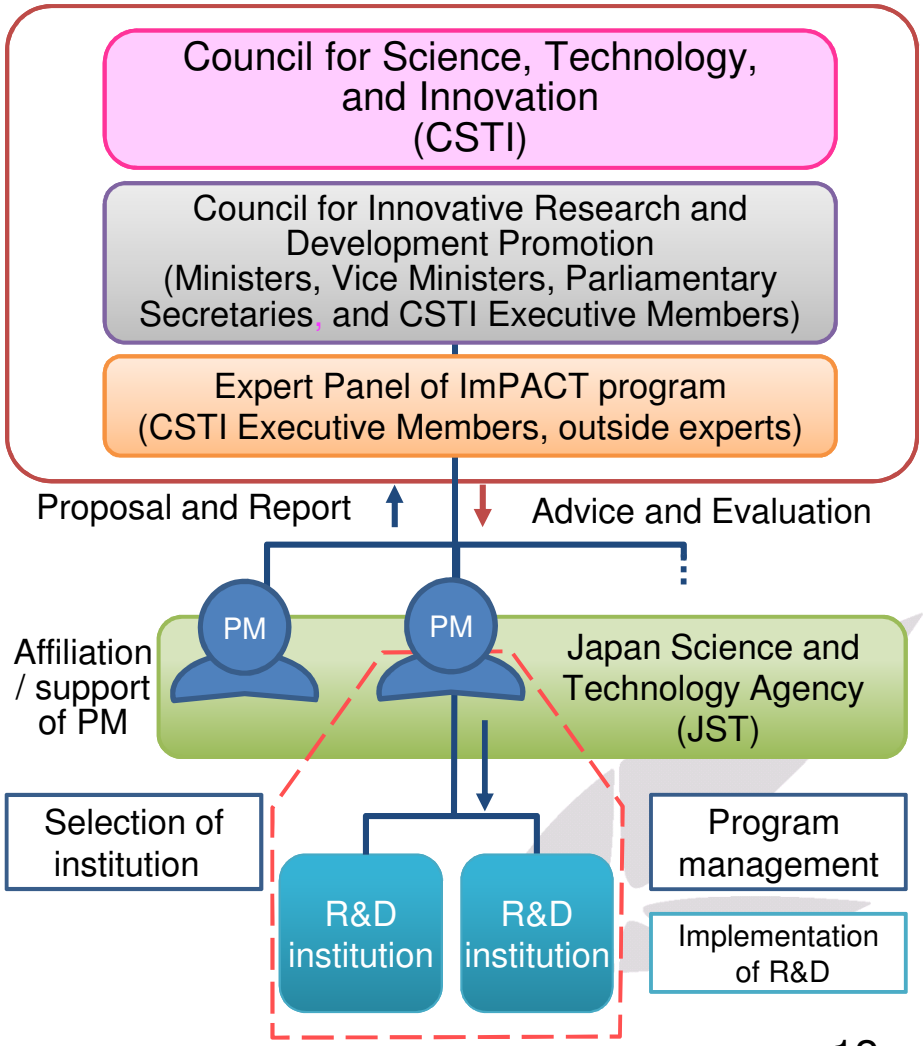
ImPACT (Impulsing PAradigm Change through disruptive Technologies Program)

— Synergize the US DARPA model with the Japanese FIRST model —

- Create disruptive innovations which revolutionize industries and society through high risk / high impact R&Ds.
- Giving great authority for planning, acting and managing the program to Program manager(PM).
- PM is expected to work as a producer, not as a researcher.
- Reinforcing the supporting system for PMs by following the previous Japanese Big Program, FIRST(*) Program, with the help of JST(Japan Science & Technology Agency).

(*) Funding Program for World-Leading Innovatie R&D on Science and Technology (2009-2013)

\55 billion fund was budgeted in FY2013 for 5 years program.



“Growth Strategy 2016” toward nominal GDP 600 trillion yen

- Implementing difficult structural reforms (reforms on bedrock regulations (energy, agriculture, medical care etc.) / initiatives through National Strategic Special Zones)
- Moving forward toward the elimination of “Six Handicaps to growth” (e.g. appreciation of yen, high corporate tax rate, delay in the conclusion of TPP)

・Employment, corporate profits at historically high level
・However, actions of private companies (investments, wage hikes etc.) still lack force

“**3 challenges**”, to accelerate corporate actions, in the context of the virtuous cycle of economy in motion
①Stimulate potential demand and create/expand new promising markets to raise GDP to 600 trillion yen
(“10 Strategic public-private joint projects”)
②Enhance drastically productivity to overcome decreasing population and workforce shortage
③Enhance capabilities of individuals to facilitate transformation of the industrial structure

1．“10 STRATEGIC PUBLIC-PRIVATE JOINT PROJECTS” toward GDP 600 trillion yen

1-1 ： Creation of new promising markets

①Realize the 4th Industrial Revolution (e.g. IoT, Big Data, A.I., Robots)
【Creation of added value: 30 trillion yen (by 2020)】

②Toward a world leading health care country
【Market size: 16 trillion yen (2011) => 26 trillion yen (2020)】

③Overcome environment-energy constraints and expand investments
【Energy related investments: 18 trillion yen (2014FY) => 28 trillion yen 2030FY)】

④Foster sport sector to become a growing industry
【Market size: 5.5 trillion yen(2015) => 15 trillion yen(2025)】

⑤Revitalize markets for transaction of existing houses and reform
【Market size: 11 trillion yen(2013) =>20 trillion yen(2025)】

1-2 : Further promotion of Local Abenomics

⑥Enhance productivity in service industries
【Added value: 343 trillion yen (2014) => 410 trillion yen (2020)】

⑦Innovate small, medium and intermediate-sized firms

⑧Promote proactive agriculture and exports
【Market size of vertical integrated (from production to sales) agriculture: 4.7 trillion yen (2013FY) => 10 trillion yen (2020FY)】

⑨Make tourism a key industry
【consumption by foreign visitors*: 3.5 trillion (2015) => 8 trillion yen (2020) => 15 trillion yen (2030) 】

1-3 : Stimulation of domestic consumer sentiment

⑩Stimulate domestic consumer sentiment through public-private sector collaboration etc.

2. REGULATORY AND INSTITUTIONAL REFORMS TO REALIZE REVOLUTION IN PRODUCTIVITY

- Introduction of new mechanism for regulatory and institutional reforms
- Utilization of National Strategic Special Zones to accelerate structural reforms
- Further reinforcement of Corporate Governance
- Further utilization of private sector resources to public services / facilities (PPP/PFI etc.)
【Projects volume: 2.4 trillion yen (FY2013-14)=> 21 trillion yen (FY2013-2022)】

3. PROMOTION OF INNOVATION / PROVISION OF HUMAN RESOUCES WITH CHALLENGER’S SPIRITS

- Promotion of innovation and venture business
- Development and securement of human resources who drive the economic growth
- Creation of employment environment and promotion of social participation of women, to remove the constraints to growth

4. TAKING IN GROWING MARKET OUTSIDE

- Support the expansion of SMEs to international markets, making the most of TPP
【13.8 trillion yen (2013FY) => 25.2 trillion yen (2020FY)】
- Expansion of the exports of infrastructure systems
【16 trillion yen (2013) => 30 trillion yen (2020)】
- Promotion of inward foreign direct investment to Japan
【24.4 trillion yen (2015) => 35 trillion yen (2020)】
- Promotion of conclusion / revision of economic partnership agreements (EPAs), investment agreements and tax treaties

5． Utilization of growing momentum for reforms

- Promote leading projects for year 2020

- considering that these technologies could continue to be in practical use after 2020 as a legacy of Tokyo Olympic and Paralympic games; *Automated driving system, Decentralized energy system, Advanced robot technologies etc.*

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