Feature 2016 Nobel Prize Winner and Japan's Efforts to Promote Academic and	
Basic Research	1
1 Summary of Professor Ohsumi's Prize-Winning Research	1
(1) Professor Ohsumi's research accomplishments: from yeast to mammals	
His efforts developed into an important research field	2
(2) Key to Professor Ohsumi's success: Keep asking questions	3
(3) Future prospects of autophagy research	5
2 Research and Development Environment That Facilitated Groundbreaking Academic and	
Basic Research	5
(1) Changes in the number of Professor Ohsumi's papers and in the number of papers on autophagy	5
(2) Professor Ohsumi expands his network of research collaborators	9
(3) Contribution of the Grants-in-Aid for Scientific Research (KAKENHI)	10
(4) Contribution of young researchers to Professor Ohsumi's research	13
3 Efforts of the Government to Strengthen Japan's Basic Science Capability	
(1) Japan's dwindling basic science capability: three critical issues	
(2) The government's effort to strengthen Japan's basic science capability	20
Introduction	24
Chapter 1 Why Do We Need Open Innovation Now?	26
Section 1 What is Open Innovation?	
1 Innovation in Transition and Key Players	26
1 Inno tation in 11 and 110 1 injoin	
2 The Limitations of Self-sufficiency (Closed Innovation)	26
	26 27
2 The Limitations of Self-sufficiency (Closed Innovation)	26 27
The Limitations of Self-sufficiency (Closed Innovation) What is Open Innovation?	26 27 28
The Limitations of Self-sufficiency (Closed Innovation). What is Open Innovation? Definitions of Open Innovation.	26 27 28 28
The Limitations of Self-sufficiency (Closed Innovation). What is Open Innovation? Definitions of Open Innovation. (2) Core Realms That Should Be Protected.	26 27 28 28 31
2 The Limitations of Self-sufficiency (Closed Innovation)	26 27 28 31 32
2 The Limitations of Self-sufficiency (Closed Innovation). 3 What is Open Innovation? (1) Definitions of Open Innovation. (2) Core Realms That Should Be Protected. 4 Examples of Open Innovation. Section 2 Current Status of Open Innovation.	26 27 28 31 32
2 The Limitations of Self-sufficiency (Closed Innovation)	2628313235
The Limitations of Self-sufficiency (Closed Innovation)	26272831323535 on47
2 The Limitations of Self-sufficiency (Closed Innovation)	262728313235353535
The Limitations of Self-sufficiency (Closed Innovation)	262728313535353535

3 Problems Concerning Open Innovation in Japan	86
Chapter 2 To Accelerate Open Innovation	88
Section 1 Issues and Future Direction Concerning Open Innovation	88
1 Promoting cooperation of full-scale industry-academia-government collaboration	
among organizations	88
(1) Organizational Management Issues and Directions	89
(2) Increase incentives for collaboration	110
(3) Challenges and Direction for Improvement of the System by Companies	123
2 Promoting creation and development of startups	131
(1) Challenges and direction for personnel for startups	131
(2) Challenges and direction for the environment to create and develop startups	132
3 Personnel for promoting open innovation	142
(1) Personnel necessary for open innovation	143
(2) Direction for securing and cultivating personnel that are necessary for open innovation	148
Section 2 Discussions in the Government and Role of Each Sector	172
1 How to remove obstacles to open innovation	172
2 Institutional reforms required from the government	175
3 Actions that universities and R&D agencies should take	177
4 Actions that the industrial sector is expected to take	179
Conclusion What We Aim to Achieve through Open Innovation in the Future	180

Part II Measures Implemented to Promote Science and Technology

Chapter 1	Development of Science and Technology	185
Section 1	The Science and Technology Basic Plan	185
Section 2	Council for Science, Technology and Innovation	186
1	Major Endeavors of CSTI in FY2016	188
2	Strategic Prioritization in the Science and Technology-related Budget	189
3	R&D Evaluation of Projects of National Importance	192
4	Major Deliberations at Expert Panels	192
Section 3	Comprehensive Strategy on Science, Technology and Innovation	193
Section 4	Administrative Structure and Budget for Science, Technology and Innovation Policies	195
1	Administrative Structure for Science, Technology and Innovation Policies	195
2	Science and Technology Budgets	198
Chapter 2	Acting to Create New Value for the Development of Future Industry and	
	Social Transformation	201
Section 1	Fostering R&D and Human Resources that Boldly Challenge the Future	201
Section 2	Realizing "Society 5.0"	
1	Vision of Society 5.0	
2	Undertakings necessary for the realization	203
Section 3	Enhancing Competitiveness and Consolidating Fundamental Technologies in	
	Society 5.0	
1	Efforts necessary for enhancement of competitiveness	
2	Strategic strengthening of infrastructure technology	205
Chapter 3	Addressing Economic and Social Challenges	211
Section 1	Sustainable Growth and Self-sustaining Regional Development	
1	Ensuring stable energy, resources, and food	211
2	Achieving a sustainable society to handle hyper-aging, depopulation, etc.	224
3	Improving competitiveness in manufacturing and value creation	233
Section 2	Ensure Safety and Security for Our Nation and its Citizens and a High-quality,	
	Prosperous Way of Life	235
1	Addressing natural disaster	235
2	Ensuring food safety, living environments, and occupational health	243
3	Ensuring Cybersecurity	248
4	Addressing national security issues	249
Section 3	Addressing Global Challenges and Contributing to Global Development	253
1	Addressing global climate change	253
2	Responding to biodiversity loss	260

Section 4	Pioneering Strategically Important Frontiers	261
1	The promotion of oceanographic R&D	261
2	Promotion of R&D in space science	263
Chanton 4	Dainfaraing the "Eurodementale" for STI	0.00
_	Reinforcing the "Fundamentals" for STI	
	Developing High-quality Human Resources	
1	Developing, securing and improving career prospects of human resources as intellectual professiona	
2	Promoting diversity and career mobility	
	Promoting Excellence in Knowledge Creation	
1	Promoting academic and basic research as a source of innovation	282
2	Strategic enhancement of common-platform technology, facilities, equipment, and information	200
	infrastructure supporting research and development activity	
3	Promotion of open science	
Section 3	Strengthening Funding Reform	
1	Fundamental funds reform	
2	Reform of public funds	
3	Integrated promotion of the national university reform and the research funding reform	306
Chapter 5	Establishing a Systemic Virtuous Cycle of Human Resources, Knowledge and	
	Capital for Innovation	307
Section 1	Enhancing Mechanisms for Promoting Open-innovation	307
1	Enhancing systems of promotion in companies, universities, and public research institutes	307
2	Inducing a virtuous cycle of human resources for innovation creation	318
3	Creating "spaces for co-creation" to concentrate human resources, knowledge, and capital	318
Section 2	Enhancing the Creation of SMEs and Startup Companies to Tackle New Business	
	Opportunities	317
1	Cultivating an entrepreneurial mentality	317
2	Promoting the creation of startup companies at universities	317
3	Creating environments conducive to new business	318
4	Helping initial demand and endorsing the trustworthiness of new products and services	318
Section 3	Strategic Use of International Intellectual Property and Standardization	319
1	Promoting use of IP assets in innovation creation	319
2	Accelerating strategic international standardization and enhancing related support systems	321
Section 4	Reviewing and Improving the Regulatory Environment for Innovation	323
1	Reviewing systems in accordance to new products, services, and business models	323
2	Improving IP systems in response to the tremendous development in ICT	324
Section 5	Developing Innovation Systems that Contribute to "Regional Revitalization"	
1	Revitalizing regional companies	
2	Driving innovation systems that make use of local characteristics	325
3	Promoting policies that encourage local initiative	327
Section 6	Cultivating Opportunities for Generating Innovation in Anticipation of Global Needs	328

1	Promoting R&D that anticipates global needs
2	Developing systems to promote inclusive innovation
Chapter 6	Deepening the Relationship between STI and Society
Section 1	Promoting Co-creative STI
1	Dialogue and collaboration with stakeholders
2	Stakeholder initiatives for co-creation
3	Scientific advice for policymaking
4	Ethical, legal, and social initiatives
Section 2	Ensuring Research Integrity
Chapter 7	Enhancing the Capacity to Promote Scientific and Technological Innovation
Section 1	Reforming Universities and Enhancing their Function
1	University Reform
Section 2	Reforming National R&D Agencies and Enhancing their Function
1	National R&D Agency Reforms
Section 3	Strategic International Implementation of STI Policies
1	Utilization of international frameworks
2	Utilization of international organizations
3	Utilization of research institutions
4	Promotion of International Activities Related to Advanced Science and Technology
5	Cooperation with Other Countries
Section 4	Pursuing Effective STI Policies and Enhancing the Chief Controller Function344
1	Following up the Basic Plan
2	National Guideline on the Method of Evaluation for Government R&D
3	Promoting Policies Supported by Objective Evidence
4	Strengthening the Leadership Functions of the CSTI
Section 5	Ensuring R&D Investment for the Future
Scientific a	and Technological Achievements Which Contribute to Daily Life

Figures & Tables



F			

Figure 1	Yearly change in the number of research papers published by Professor Ohsumi (1980–2015)	. 6
Figure 2	Cumulative number of citations of Professor Ohsumi's papers	
Figure 3	Number of annual citations of Professor Ohsumi's key publications	
Figure 4	Change in the number of research papers that use "autophagy" as a keyword	
Figure 5	Changes in the research areas in which autophagy-related core papers (i.e., core	
	papers with titles containing the word "autophagy") were published	. 8
Figure 6	Comparison of the number of core paper titles containing the terms "autophagy"	
Ü	and "stem cell" detected in the Science Maps 2002 to 2014	. 9
Table 7	Comparison of the number of papers published by Professor Ohsumi and the	
	number of researchers who co-authored papers with him during the five year	
	periods before and after he was appointed at the National Institute for Basic	
	Biology. The number of citations of papers he published between 1991 and 1995	
	and between 1996 and 2000 were also compared	. 9
Table 8	Number of research papers published by Professor Ohsumi in different research	
	areas over time	10
Figure 9	Change in the amount of KAKENHI provided to Professor Ohsumi	11
Figure 10	Change in research categories of KAKENHI provided to Professor Ohsumi	
Table 11	List of titles of Professor Ohsumi's research projects funded by KAKENHI	12
Figure 12	National percentages of frequently cited research papers produced by	
	leading countries	15
Figure 13	Comparison of the number of adjusted top 10% papers produced and the form of	
	co-authorship among the three countries	16
Figure 14	Change in the amount of government subsidies for national universities	16
Figure 15	Change in the amount of ordinary expenses in private universities and	
	subsidies provided to cover these expenses	16
Figure 16	Change in the amount of funding for independent research	
	(compared to 10 years ago)	17
Figure 17	Percentage of time allocated to various activities by university faculty members 1	17
Figure 18	Change in the employment structure in different age groups across	
	11 research universities	18
Figure 19	Change in the number and percentage of master's graduates who have entered	
	doctoral programs	19
Figure 20	Conditions important for master's graduates in deciding whether to pursue	
	doctoral degree	19
Figure 21	Comparison of the number of adjusted top 10% papers produced at ranked	
	universities between Japan and Germany	19

Part I

Figure 1-1-1	Concept Diagram of Closed Innovation and Open Innovation	30
Figure 1-1-2	Illustration of the Concept of Realms in an Open-Close Strategy	32
Table 1-1-3	Specific Examples of Open-Close Strategies	32
Figure 1-1-4	Ten-year Comparison of Product Life-cycles	36
Figure 1-1-5	Trends in Product Life-cycle Optimization Initiatives and Business	
	Performance (Operating Profit) Over the Last Three Years	37
Figure 1-1-6	Aging of the Population and Future Estimates	38
Figure 1-1-7	Changes in the Content of Research and Development by Japanese Companies	
Figure 1-1-8	Structure of Scientific Paper Production in Japan	41
Figure 1-1-9	International Comparison of Research and Development Efficiency	41
Figure 1-1-10	External Sources of Knowledge and Technology Acquired by Companies	
	Undertaking Innovation Activities	42
Figure 1-1-11	Illustration of Collaboration at the Pre-competitive Stage	44
Figure 1-1-12	Example of Collaboration at the Pre-competitive Stage (Research Association	
	of Automotive Internal Combustion Engines (AICE) Initiatives)	45
Figure 1-1-13	Number of Joint Research and Funded Research Projects at Universities, etc.	
	and Proportion Undertaken in Partnership With SMEs	46
Figure 1-1-14	National University Management Strategy	
	Designated National Research and Development Agency System	
	Number of Adjusted Top 10% Papers by Country/Region:	
	Top 10 Countries and Regions (Fractional Count)	51
Figure 1-1-17	Papers Cited in U.S.A. Patents as a Percentage of All Papers	52
Figure 1-1-18	Venture Capital Investment in Each Country as a Proportion of GDP	
	(actual figures for FY2009)	55
Figure 1-1-19	Startup Ecosystem	56
Table 1-1-20	Trends in Open Innovation Policy in Major Countries	58
Figure 1-1-21	Stanford University OTL's Income From Royalties and Profit on Sale	
	of Stock	60
Figure 1-1-22	Fraunhofer's Research Budget (unit: €1 million)	
	The Fraunhofer Model	
Table 1-1-24	Changes in References to Industry-Academia-Government Collaboration	
	and Open Innovation in the Science and Technology Basic Plans	64
Figure 1-1-25	Changes in the Number of Organizations Undertaking Joint/Funded Research	
	in General and the Number of Organizations With Relevant Regulations	66
Figure 1-1-26	Scale of Joint Research Involving Universities and Private Sector Companies	66
C	Number of Large-scale Joint Research Projects Involving R&D Agencies	
	and Private Sector Companies	67
Figure 1-1-28	Percentage of University Research Expenditure Funded by the Private Sector	
~	(2018)	o=

Table 1-1-29	Disparity in Investment in Domestic and Overseas Universities by One	
	Japanese Company	
Figure 1-1-30	Changes in the Number of Approved TLOs	69
Figure 1-1-31	Comparison of Changes in the Number of Cases of Technology Licensing in	
	Which Approved TLOs Are Involved and Their Royalty Income and Changes	
	in the Number of Patent Licenses Granted by Universities and Their Income	
	From These	70
Figure 1-1-32	Changes in the Number of Patents Held by Universities and the Number	
	Licensed by Them	72
Figure 1-1-33	Changes in the Income of Universities (left) and R&D Agencies (right)	
	From Intellectual Property	72
Figure 1-1-34	Trends in Full-scale Joint Research by Industry and Academia	76
Figure 1-1-35	Number of University Startups Established	77
Table 1-1-36	Aggregate Market Value of Listed University Startups (as of the end of	
	April 2016)	78
Figure 1-1-37	New Firm Establishment Rate in Major Countries (number of new companies	
	established / total number of companies)	78
Figure 1-1-38	Major Countries by Percentage of Entrepreneurs and Individuals Planning	
	to Start a Company (total entrepreneurial activity index)	7 9
Figure 1-1-39	Number of Researchers Per 10,000 Population in Major Countries	82
Figure 1-1-40	Individuals Earning Doctorates in Major Countries by Field of Specialism	83
Figure 1-1-41	Extent of Usage of Universities and Scientific and Technical Literature as a	
	Source of Knowledge for Inventions (figures for master's degree holders,	
	doctorate holders, and thesis-only doctorate holders)	83
Figure 1-1-42	Movement Between Sectors	84
Figure 1-1-43	Changes in the Value of Tax Breaks Under the Research and Development	
	Tax System (¥100 million)	86
Table 1-2-1	Comparison of practices in industry-academic collaborative research	
	between Japanese and US universities	90
Figure 1-2-2	Flow of planning of industry-academia collaboration projects	91
Table 1-2-3	Inclusion of personnel expenses of researchers and other full-time staff in	
	the amount charged to entrustors (private companies) of entrusted research	
	projects, etc	94
Figure 1-2-4	Problems of university contacts from the companies' perspective	96
Table 1-2-5	Number of faculty and staff at universities, etc. who used	
	the cross-appointment system (FY2015)	98
Table 1-2-6	Challenges related to the use of the cross-appointment system	98
Figure 1-2-7	Average income and expenditure of universities' industry-academia	
	collaboration headquarters and TLOs (FY2014)1	01

Figure 1-2-8	Average number of foreign applications filed by universities alone and	
	number of foreign applications supported by the Japan Science and	
	Technology Agency (JST)	101
Figure 1 -2- 9	Changes in the number of institutions implementing joint research and	
	contracted research and number of institutions that have already established	
	related rules	103
Figure 1 - 2 - 10	Changes in the number of institutions implementing joint research and	
	contracted research and number of institutions that have already established	
	related policies	103
Figure 1 - 2-11	Introduction of the conflict of interest management system for organizations	
	at universities (establishment of rules, etc.) (survey in 2012)	104
Figure 1-2-12	Distribution of the number of staff members in universities'	
	industry-academia collaboration departments (as of May 1, 2015)	106
Figure 1-2-13	Case examples of deployment of personnel in charge of	
	industry-academia collaboration at universities in the United States	106
Figure 1-2-14	Quantitative (left) and qualitative (right) sufficiency of URAs	107
Figure 1-2-15	Number of URAs by employment period	108
Figure 1-2-16	Current composition of financial resources for the employment of URAs	108
Figure 1-2-17	Expected future funds for URAs	108
Figure 1 - 2-18	Presence/absence of an IR organization at universities	109
Figure 1 -2- 19	Percentage of faculty members engaged in industry-university collaboration.	111
Figure 1-2-20	Change in the composition of job hours of teachers at universities, etc	111
Figure 1-2-21	Necessity of organizational support for industry-academia collaboration and	
	intellectual property-related works	112
Figure 1-2-22	Effective means to increase research time	112
Figure 1-2-23	Status of performance evaluation of researchers (NISTEP regular survey)	113
Figure 1-2-24	Special measures based on research achievements at universities	115
Table 1-2-25	How corporations handle expenses exceeding the amount agreed under	
	entrusted research contracts	116
Figure 1 - 2 - 26	Status of introduction of indirect expenses for joint research projects at	
	Japanese universities	117
Figure 1-2-27	Composition of financial resources of universities in Japan, the United States,	
	and Europe	119
Figure 1-2-28	Example of fund classification at US universities	120
Table 1-2-29	Challenges and constrains for promotion of open innovation by companies	
	(summary made in the White Paper on Open Innovation)	124
Figure 1-2-30	Establishment of organizations for promoting external cooperation	126
Figure 1 - 2-31	State of external transmission for promotion of open innovation	127
Figure 1 - 2-32	Degree of recognition of open innovation in companies	127
Figure 1 - 2 - 33	Amount of the agreement for joint research, etc. based on the person who	
	holds the authority for approval (Classification)	128

Figure 1-2-34	Support for Members or Spin-off of the Organization in Large Companies	129
Figure 1-2-35	Current of Near Future Management Needs of Startups	131
Figure 1-2-36	Investment Ratio According to the Type of Business	
	(limited to Domestic investments)	133
Figure 1-2-37	Changes in the stages of investment destination (amount ratio)	133
Figure 1-2-38	Comparison of Investment Scale in the Early Stage between Japan and	
	the U.S.A. (FY2011)	134
Figure 1-2-39	Requests concerning the angel tax system	135
Figure 1-2-40	Comparison of the Form of License based on the Scale of the Licensee	
	(Companies) of University Patents between Japan and the U.S.A	137
Figure 1-2-41	Ratio of Cost Burden in the Case where Universities Independently Hold	
	the Outcome of Joint Researches (Intellectual Property Rights)	139
Figure 1-2-42	Ratio of Cost Burden in the Case where the Outcome of the Joint Research	
	(Intellectual Property Rights) is Jointly Held	139
Figure 1-2-43	Ratio Based on the Composition of the Assignee of a U.S. Patent for which	
	U.S. Universities Hold the Rights	140
Figure 1-2-44	Difference in the Exit of Japanese Startups and U.S. Startups (2015)	141
Figure 1-2-45	External Cooperation Partners of Large Companies	
	(Records of FY2014 (Domestic))	142
Figure 1-2-46	Overall flow of open innovation	143
Figure 1-2-47	Personnel and various organizations involved in open innovation	144
Table 1-2-48	Personnel map that produces open innovation	145
Figure 1-2-49	Perception the Future of University Management and Training Experience	
	of Senior Executives	149
Figure 1-2-50	Training Program for Top Management of University	150
Table 1-2-51	Course of action for managerial personnel of companies to spring up	
	Innovation	151
Table 1-2-52	Operation and outcome of the EDGE Program	151
Figure 1-2-53	Exploration and Development of Global Entrepreneurship for	
	NEXT generation (EDGE-NEXT)	152
Figure 1-2-54	Sido Next Innovator 2016	153
Figure 1-2-55	Degree of interests in being employed by startups	154
Figure 1-2-56	Activities, targets, required image and abilities expected in the PM cultivation	n
	Program	155
Figure 1-2-57	Program for Promoting Cultivation and Active Participation of PMs	156
Figure 1-2-58	Research and development program with the PM system	157
Figure 1-2-59	State of Implementation of Evaluation According to the Job Type of	
	the Professional Staff Members of Universities	158
Figure 1-2-60	Variation in job characteristics	158
Figure 1-2-61	Enforcement policy for the URA system of the University of Tokyo	162

Figure 1-2-62	Comparison between research jobs offered by research entities and	
	those sought by applicants under the Leading Initiative for	
	Excellent Young Researchers	. 164
Figure 1-2-63	Specialized fields that are important in companies' current activities,	
	and their views on university education in these fields	. 165
Figure 1-2-64	Outline of the Program for Leading Graduate Schools	. 166
Figure 1-2-65	Employment situation of doctoral graduates of leading graduate schools (1).	. 167
Figure 1-2-66	Employment situation of doctoral graduates of leading graduate schools (2).	. 167
Figure 1-2-67	Cycle to increase effectiveness of the Action Plan	
	(after the development of the plan)	. 170
Figure 1-2-68	Comprehensive Human Resource Development Initiative Toward the Forth	
	Industrial Revolution	
	—Comprehensive Human Resources Development Program Focusing on	
	AI, IoT and Big Data for Creating Future Society—	. 171
Table 1-2-69	Summary of major challenges discussed in Section 1	. 173
Table 1-2-70	Comparison between Open Innovation 1.0 and Open Innovation 2.0	. 181
Part II		
Table 2-1-1	List of CSTI members	. 187
Figure 2-1-2	Organizational chart of CSTI	. 188
Figure 2-1-3	Outline of the Comprehensive Strategy on Science, Technology and	
	Innovation 2016	. 194
Table 2-1-4	Major reports from Council for Science and Technology (FY 2016)	. 196
Figure 2-1-5	Organizational structure of the Science Council of Japan (SCJ)	. 198
Table 2-1-6	Major recommendations by the Science Council of Japan (SCJ) (FY 2016)	. 198
Table 2-1-7	Changes in science and technology budgets	. 199
Table 2-1-8	Science and technology budgets of each ministry/office/agency	. 200
Table 2-2-1	Major projects for realization of Society 5.0 (fiscal 2016)	.210
Table 2-3-1	Major projects for stable supply of energy, resources and food (FY2016)	. 222
Table 2-3-2	Major policies for the realization of sustainable society in response to	
	super aging and population decline (FY2016)	. 233
Table 2-3-3	Major policies for strengthening of the competitiveness of	
	monozukuri/kotozukuri (FY2016)	. 234
Figure 2-3-4	IDense Oceanfloor Network System for Earthquakes and Tsunamis (DONET)	236
Figure 2-3-5	Seafloor observation network for earthquakes and tsunamis along	
	the Japan Trench (S-net)	. 237
Table 2-3-6	Major policies for response to natural disasters (FY2016)	. 241
Table 2-3-7	Major projects for recovery and reconstruction from the earthquake disaster	
	(FY2016)	. 242
Figure 2-3-8	Monitoring system implementation by ministries in accordance with	
	the Comprehensive Monitoring Strategy (FY2016)	. 245

Figure 2-3-9	Radioactive substances distribution map	245
Figure 2-3-10	Sample of Radiation measurement map	246
Figure 2-3-11	Japan Environment and Children's Study (JECS)	247
Table 2-3-12	Major policies to ensure food safety, living environment, occupational	
	health, etc. (FY2016)	248
Table 2-3-13	Major policies for cyber security (FY2016)	249
Figure 2-3-14	Outline of Innovative Science & Technology Initiative for Security	250
Figure 2-3-15	Outline of research for advancement of image analysis technology to	
	address terrorism	251
Table 2-3-16	Major policies to address national security issues (FY2016)	252
Table 2-3-17	Major policies to address global climate change (FY2018)	260
Table 2-3-18	Points of the Implementation schedule of the Basic Plan on Space Policy	
	(Revised in FY2016)	264
Table 2-3-19	Major policies to open up frontiers important for national strategies	
	(FY2016)	268
Figure 2-4-1	Ratio of full-time teachers aged 40 or younger in universities	269
Table 2-4-2	Breakdown of successful candidates of the Second-Step Professional	
	Engineer Examination by Technical Discipline (FY 2016)	272
Figure 2-4-3	The 6th Science Intercollegiate opening ceremony	275
Figure 2-4-4	Participants in the International Student Contests in Science and	
	Technology (FY 2016)	275
Figure 2-4-5	The 6th Japan High School Science Championship	277
Figure 2-4-6	The 4th Japan Junior High School Science Championship	277
Figure 2-4-7	Percentage of female researchers by country	278
Figure 2-4-8	Changes in the number of foreign researchers in Japan	
	(Short or mid-length to long stay)	280
Figure 2-4-9	Changes in the number of Japanese researchers overseas	
	(Short or mid-length to long stay)	280
Figure 2-4-10	Large-scale projects that will be implemented under the Large-Scale	
	Academic Frontier Promotion Project	284
Figure 2-4-11	World Premier International Research Center Initiative (WPI)	288
Figure 2-4-12	Examples of technologies and instruments for advanced measurement and	
	analysis	289
Figure 2-4-13	Organizations adopted for the Project for Promoting Public Utilization of	
	Advanced Research Infrastructure (support for formation of advanced	
	research platforms)	292
Figure 2-4-14	Organizations adopted for the Project for Promoting Public Utilization of	
	Advanced Research Infrastructure (support for introduction of the new	
	sharing system)	294
Figure 2-4-15	The geological map of Mt. Fuji volcano completely revised for the first time	
	in about 50 years (second edition)	295

Figure 2-4-16	Examples of functional enhancement by improvement of aged facilities	297
Table 2-4-17	List of competitive funds	304
Figure 2-5-1	Transition in achievements of joint research at universities	308
Figure 2-5-2	R&D taxation system	310
Table 2-5-3	Award winners for contributions to industry-academia-government	
	collaboration	311
Figure 2-5-4	List of projects being implemented under the Creation of Innovation Centers	;
	for Advanced Interdisciplinary Research Areas	314
Figure 2-5-5	COI sites	315
Figure 2-5-6	Regions in which Innovation Promotion Strategies have been supported:	
	List of regions selected in FY 2016	326
Figure 2-7-1	Trends in Government-financed R&D Costs in Major Countries	347
Case Studies		
1	Enhancing planning and proposal capabilities by collaborating with	
	other universities, etc.: Efforts of the Union of the Four Universities	
	in the Northern Tokyo Metropolitan Area (4u)	92
2	Cross-appointment from Ritsumeikan University to Panasonic Corporation	99
3	Efforts for organizational conflict of interest management	
	at Tokyo Medical and Dental University	105
4	Personnel evaluation and provision of incentives with an eye to	
	industry-academia-government collaboration: Okayama University	115
5	Initiatives for full-scale interorganizational industry-academia-government	
	collaboration – Shibaura Institute of Technology	121
6	Initiatives for full-scale interorganizational industry-academia-government	
	collaboration – Nagoya University	122
7	Initiatives of R&D Agencies - Designated National Research and	
	Development Agencies -	123
8	Universities and University-launched Startups Play a Pivotal Role in	
	Cooperation between SMEs- Muroran Institute of Technology-	130
9	Startup launched by the University of Tokyo that Believed in the Growth of	
	Kyushu University-launched Startup -Kyulux and Euglena	136
10	Hokkaido University	160
11	Okayama University	161
12	The University of Tokyo	162
13	Keio University	168

Col	lumns



2-1	Efforts to create innovation promoted by international competitions	201	
2-2	Investigating hitherto unknown cause of itching of atopic dermatitis	229	
2-3	Security and Science & Technology	252	
2-4	Release of "Japan 100 years from now if warming progressed at the current pace		
	- Global Warming Prediction Information Vol.9"	259	
2-5	The 113th element was formally named nihonium	285	
2- 6	Success in increasing the capacity of lithium-ion battery		
	using a new molecular material "holey graphene"	286	
2-7	Commemorating the 100th anniversary of the foundation of RIKEN	299	

Scientific and Technological Achievements Which Contribute to Daily Life

1 Technologies to observe and forecast localized heavy rain	349
② R&D related to ingredients with health claims	350
③ Development of ergonomic products	351
④ Disaster response technologies	352
⑤ Satellite utilization	353
⑥ Insulation materials and solar power generation technologies	354
7 Technologies to alleviate the symptoms of Japanese cedar pollinosis	355
® Technologies enabling early cancer detection	356
Aircraft materials	357
1 Technologies to protect people from heat waves	358
① Display and screen technologies	359
2 Results of experiments performed in the KIBO module of the International Spirits 2	pace Station
	360
Automobile technologies	361

The maps in this white paper do not include all the territory of $\ensuremath{\mathsf{Japan}}$.