S&T Strategy and Foresight Activities in Japan

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Outline

Political Backgrounds of S&T
Review of Past Foresight
STFC of NISTEP
Future project

S&T Budget



MEXT

Political Structure



Government's Share of R&D Expenditure



Basic Research by Sector



R&D Expenditure by Fields (2001)



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Japanese Technology Foresight in 1970s and 1980s

- Japan was on the catch up process
- To form common vision/consensus on future priority and perspective
- To lead industry through "long term visions"
- Moderate link to government's S&T policy
 - Indirect effects to R&D resources allocation

Structure of National Foresight



NISTEP

Macro-level Ministries

◆<u>Meso-level</u>

Groups of companies



institutes

Individual companies and research

History of Japanese Delphi Survey

NO.	Survey Year	Fields	Topics	Experts
1	1970-1971	5	644	2482
2	1976	7	656	1316
3	1981-1982	13	800	1727
4	1986	17	1071	2007
5	1991	16	1149	2385
6	1996	14	1072	3586
7	2000	16	1065	3106

Evaluation of First Survey (1971)



Japanese and German Time of Realization (Japanese 92 & German 93)



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Examples of Delphi Topics

			Time of realization								
Topics	Number of respondent	Importance Index	200	1 200	6 201 ⁷	1 2016	6 202 [.]	1 202	6	Never	Don't know
Elucidation of carcinogenic mutation mechanisms.	113	88				\checkmark				2	6
Development of drugs capable of preventing the occurrence of certain types of cancer.	212	87]			2	5
Development of technology capable of forecasting the occurrence of major earthquakes (magnitude 7 or above) several days in advance.	102	92							and a second and	29	14
Practical use of a highly secure next-generation internet that allows the transmission of real-time information, leading to the implementation of internet-based telephone services and motion video broadcasts.	232	92								0	1
Practical use of large-area amorphous silicon solar cells with a conversion efficiency of more than 20%.	144	91								1	7
Widespread use of non-fossil energy sources (wind, geothermal, solar (photovoltaic/solar thermal) and waste heat) in all areas of life including household, industry and transportation.	93	94								1	10

Development in Life Science

Genome science

Regenerative medical treatment

Brain science

Bioinformatics

2005							
	Development of methods for surmising new functions of proteins from DNA base sequence data.(2009)						
2010	It becomes possible to determine the entire base sequences of an individual including genetic structure and SNP (single nucletide polymorphism) promptly and cheaply,	Establishment of technologies for predicting bioactivity and functional domain of proteins from their higher-order structures.(2012)	Development of food capable of supporting a healthy aging society from a nutritional perspective by preventing a decline in anti- oxidation, brain and chewing functions.(2012)	Development of bioinformatics capable of			
	leading to widespread use of such methods for diagnosis and tailor-made treatment.(2012)	Identification and classification by the molecular etiology of the genes related to diabetes, hypertension, and arteriosclerosis,		genetic background etc.(2013)			
2015	Practical use of systems for the genetic diagnosis and treatment of cancer and incurable diseases based on genome analysis.	which are typical lifestyle diseases that exhibit multiple-factor hereditary traits.(2013)-		Progress in bioinformatics enables integrat and mutual utilization of massive amounts data, leading to widespread practice of life			
	Complete understanding of the factors contributing to stem cell proliferation, and	Development of technology to regenerate targeted organs from differentiated animal cells (2017)	diabetes.(2016) Widespread use of gene therapy for	science research in virtual laboratories established on networks.(2015)			
2020	widespread use of the practice of proliferating stem cells, as necessary, in vitro and using them for medical treatment.(2018) Widespread use of treatment methods capable of completely curing Alzheimer's disease.(2020)	Widespread use of regenerative treatment technology for damaged organs using embryonic stem cells.(2020)	Practical use of a treatment method that promotes recovery from motor paralysis through nerve stem cell transplantation.(2020)	Practical use of methods for designing proteins with molecular recognition funct through the application of bioinformatics .(2019)			
		Practical use of technology that utilizes a computer to monitor motor-related activity of	Practical use of interfaces for linkage between the computer and the brain.(2023)				
2025		control of artificial limbs without the spinal cord or peripheral nerves.(2023)	Development of a brain-like computer with a new logic structure that simulate the brain.(2024)				
			Elucidation of brain mechanisms for logical reasoning.(2028)				
2030							
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Important fields in "coming 10 years" and "after 2010"



Categorization of the most Important 100 topics

Category	7th survey	6th survey	5th survey		
Environment	27	25	28		
Information	19	24	10		
Life Science	28	17	37		
Natural Disaster	8	11	9		
New Energy	9	11	6		
Others	9	12	10		

Trends in National R&D Investment by Area



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Trends in the Delphi Index by Area



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Environment



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Information



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Life Science



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Energy



Science and Technology Foresight Center (STFC)

- Mission
 - To support decision makers in government
- Structure
 - STFC Researchers
 - Various backgrounds
 - From ministry, university and industry
 - Affiliated Fellow
 - STF Network members
 - Various fields and sectors



Science & Technology Trends (J & E)

科学技術動向



No.22

|学技術トピックス|

ライフサイエンス分野 田厳しい原電に基づいたパイオセンサー 一協家検出バイオセンサーー 田グロテアゾール指導剤が挙のがん治療薬になる可能性が示された。

▶ 情報通信分野 ①次世代市準発性メモリに有望な新技術が開発される。

▶ 環境分野 (リバイオマス基金の総合物計 「バイオマス・ニッポン総合物略)が東定される

▶ナノテク・材料分野 (□シリコン県光索子で化合物半導体に低都する効率を達成)

エネルギー分野 (1)米国における高レベル放射性構築物的分研究の動作 (1)総置や田子られるフレキシブルな プラスチック大津電池の内央開発が重要)

▶ 製造技術分野 回半専体デバイスの生産コスト低減をもたらす リングラフィー補助プロセス



11=2 バイオインフォマティクスの技術動向

「第二」「循環型社会の構築を目指した 廃棄物処理の技術開発と研究動向」



Science & Technology Foresight Center of NISTEP Science & Technology Trends Quarterly Review

Life Sciences



- Recent Trend of Cancer Research — Molecular Target Therapy and Translational Research —
- > Trends in Organic Synthesis Chemistry Research
- ➤ Trends in Plant Molecular Biology

Information and Communication Technologies

- ➤ Trends in Research and Development of the Quantum Computer
- Digital Content Distribution and Copyright Management Technology in the Broadband Age

Environmental Sciences

 Trends in the Development of Measures Against Global Warming Centered on CO, Underground Storage

Nanotechnology and Materials

- ➤ Trends in Nanobiology
- ➤ Trends and Problems of High-Level Radioactive Waste Disposal Projects — Technical and Social Aspects—
- ➤ Trends in Distributed Power Sources

Infrastructure

> Trends of Disaster Simulation Technologies

Science and Technology Policy

 Latest Trends in US Science and Technology Policy — Flash Report on 2002 AAAS Annual Colloquium—

 Outline of Drawing up the FY2002 budget for Science and Technology















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Requirements for Next Foresight

- Positive inputs to S&T top-down prioritization
 - Penetration / Consensus
 - Normative View
 - Outlook of S&T and in-depth study of key areas
- Linkage to political process
 - Participatory approach
 - Mission analysis
 - Synchronization to political process

Structure of the Foresight Program



Concluding Remarks

- Accumulation of experiences for 30 years
- Assessed effectiveness and limits of Delphi approach
- Change of S&T backgrounds
- Foresight program to meet political and socioeconomic requirements