3. Survey results in “Information”

3.1. Trends in noteworthy domains

In the fifth survey in 1992, the “information” field was combined with “electronics”. But the progress of information technology over the past few years has been nothing short of remarkable, and today it has become a fundamental part of our information-hungry society. There is hardly an area where this technology has not had a substantial impact. So in this light, in this survey “information” has been handled as an independent field.

Broadly classifying the information field into ‘basic technology’ and ‘applied technology’, we drew up 79 topics. In the basic technology domain, we devised the topics from the viewpoints of (1) computers and related equipment, (2) networks, and (3) software and algorithm; while in the applied technology domain, we looked at (1) lifestyle, medical care, welfare and disaster prevention, (2) society, work, and the local community, and (3) education and entertainment. In each of these domains we arranged the topics according to the objectives of (a) search for new principles, (b) high integration and miniaturization, (c) large scale, wide area, (d) high reliability and safety, (e) intelligence and flexibility, (f) low environmental load, and (g) high productivity.

In this survey, we gave particular attention to forecasting the development of leading information technologies connected with (I) the internet, (II) multimedia, and (III) intelligent agents.

By domain topics, those in the “network technology” classification have the highest degree of importance index, and by topic objectives, “high reliability and safety,” “low environmental load” and “high productivity” attracted the highest interest among the respondents. Of the top 20 topics in degree of importance to Japan among all1,072 topics, three are in the “information” field, indicating that the progress of information technology is a driving force for social change.

(Hideo Aiso)

3.1.1. Computers and related equipment

Advances in computers and peripheral equipment have been remarkable over recent years with systems becoming smaller, more powerful and cheaper as the functions of semiconductor devices improve. And along with this, how the systems are used has also undergone a substantial change. The relative importance of general-purpose computers has dropped dramatically, and before workstations had the chance to establish themselves at the top of the computer tree, personal computers forced their way in and now play the key role among the various computer types. Online business applications that were previously the domain of the large general-purpose computers are now set up through server client systems using PCs. Applications that were once only found on mainframe computers are often now able to be run on PCs.

We still need to further improve the functions of computers and related equipment and make them even more user-friendly. And we have to devise entirely new functions for computers. For example, applications that search traditional databases are quite common, but what users need are applications that search, store and process multimedia. This is tied in with the explosion of the internet, and demands for this are growing stronger. Topic “01: Practical use of biocomputers based on a new algorithm” is seen as a theme of the future, rather than something that can be tackled fairly soon; however topic “14: Practical use of face, voice, and other personal recognition technology in the area of security management” contains much that users would welcome in the short term.

There is no limit to user demands for cheaper and smaller computers, and we have to keep heading in this direction as far as technology allows. Topics “05: Practical use of systems which facilitate multimedia communication from anywhere in the world using pocket-size computers” and “15: Widespread use of low-energy personal computers capable of running for one full year on a single button-type battery” would be on every computer users’ wish list, and these are areas where we should keep our attention focused.

Topic “13: Widespread use of portable electronic notebooks that offer the same level of flexibility as paper” is one theme that is viewed in the long term, and if a device that can rival paper and its thousands of years of history can be developed, its impact on society as a whole will be incalculable.

(Hiromu Hayashi)

3.1.2 Networks

All eight topics in the networks domain are forecast to be realized by 2010. The earliest is topic "19: Completion of networks enabling interconnection from anywhere through pocketbook-size telephones" at 2005, while the remaining seven topics are forecast between 2007 and 2009.

The topic with the highest percentage of respondents who indicated that it would not be realized with 19% is "23: Development of technology capable of automatically detecting harmful viruses and automatically producing vaccines." Similarly, 7% of respondents indicated that topic "16: Practical use of administration systems that do not require network administrators" would be difficult to achieve. In all other topics the corresponding percentage is less than 5%. The topic with the highest importance index with 91 is "22: Widespread use of highly reliable network systems capable of protecting privacy and secrecy." This topic is also rated the most important among the experts with an index of 94.

As for expected effect, in all topics "contribution to socioeconomic development" and "response to people's needs" are ranked the highest. Expectations for "contribution to socioeconomic development" are especially high at 95–96% in topics 16 and "18: Realization of an environment in which the utilization of high-capacity networks for around 2,000 yen/month is possible."

As for leading country, an overwhelming majority of respondents indicated that the United States is supreme in all eight topics, and the only topic in which Japan is ranked at anywhere near the level of the United States is topic 19.

As for measures the government should adopt, about 60% of respondents indicated "foster human resources" for topics 16, 22 and 23, and more than 60% of respondents indicated "adjust regulations (relax/toughen)" for the remaining, excluding topic "21: Widespread use of computer networks in which a virtual space can be shared in real time by a large number of unspecified persons."

In all topics in the network domain, at least 30% of respondents indicated some concern about an "adverse effect on safety" or an "adverse effect on morals, culture or society." In particular, concern about an adverse effect on safety exceeded 40% for topic 22, while more than 50% of respondents indicated concern that topic 21 could have an adverse effect on morals, culture or society.

General comments for the domain overall indicate that demand and other aspects of economic efficiency and laws and regulations have more of an impact on realization time than do technological difficulties. Some respondents stated that there is no such thing as completed technology, for every time we believe we have gone as far as we can with a technology, new technological themes emerge to force us to rethink our viewpoint and direction. In other words, technological progress is like a circle: it has no ending.

(Jun-ichi Mizusawa)

3.1.3. Software and algorithm

Similar to the cases in the two preceding domains, over the past five years the development of technology related to the internet and multimedia has been an important theme in the software and algorithm domain, and substantial progress has been made. On the other hand, while the themes of artificial intelligence and intellectual processing are just as important as ever, they no longer command center stage as much as they have in the past.

These trends can be seen in the high importance given to software standardization, re-utilization and security, and especially topics "44: Widespread use of software libraries which facilitate the re-utilization of software" and "45: Realization of software inspection and verification technology that enables quick development of error-free, large-scale software."

In network-related software, respondents consider topics "25: Practical use of OS capable of operating as a single system in a dispersed system" and "26: Development of equipment for automatic preparation of summaries and abstracts of books and other documents" to be of high importance.

As for intellectual processing, topic "35: Elucidation of human creative mechanism to such an extent that it can be applied to computer science" is considered highly important, but its forecasted realization time is a somewhat pessimistic 25 years away.

A similar trend can be seen with topic “38: Realization of technology that enables computers to read through electromagnetic data information recorded in the human brain.”

An example of multimedia-related software is topic “39: Practical use of intelligent robots capable of judging their environment and making decisions autonomously,” and while its degree of importance is not considered to be low, it is not expected to be realized for at least another 15 years.

Software for super-parallel computers is one technology that should attract considerable interest in the future. Topic “43: Development of compilers that can efficiently execute the applications operated on super-parallel computer systems” is assessed as being fairly important, and its forecasted realization time is generally the same as that for the parallel computer topic 03 in the computers and related equipment domain.

Although agent technology is currently attracting considerable attention in the software field, this keyword was not directly included in any of the topics in this survey. But in the realization of topic 39 touched on before, highly intelligent agents will be essential.

(Makoto Arisawa)

3.1.4. Lifestyle, medical care, welfare and disaster prevention

The spread of IT into family life over the past five years has been remarkable. Respondents other than the experts have only moderately high expectation of topic “53: Widespread use of computer systems in the home,” but the personal computers that we have become accustomed to in our offices and schools are becoming central to the information environment in our homes as well. OA systems such as word processors and fax machines are being replaced by computer software packages, and these days with the proper hardware set-up, we can even watch TV through our computers.

Backing this up are the de facto standardization of CPU/OS, upgraded functions of the computer, peripheral equipment and memory components, and falling prices. As PC use increased, especially among business people and students, standardization of browser terminology and trial network services virtually guaranteed the explosive growth of the internet.

One change that is readily noticeable on our streets is the growing use of cellular phones and PHS. While the use of these telephones in trains is frowned upon, it is nonetheless quite a common sight, and more than a few vehicle accidents can be attributed to inattentive drivers engaged in a phone conversation.

The use of portable computers on the way to work, a growing trend among business people in the United States, is still quite uncommon in Japan, but it is probably only time before the trend is embraced with gusto by Japan’s white-collar workers.

With the tremendous growth of the internet, telephone calls and TV broadcasts can now be made through this medium. Unlike in the U.S. where cable TV started off with the sole aim of TV viewing, in Japan CATV is seen as creating a popular regional information environment that is faster and cheaper than existing networks. If the information environment continues to evolve in this way and if the data format becomes standardized, topic “58: Online provision of public procedures and services,” a forward step in administrative reform, will also gain momentum. In this survey, respondents forecast the topic will be realized relatively early at 2004.

As the value of the yen rose and the number of Japanese travelers heading overseas increased, the “borderless” concept steadily took hold in our general living environment; but the popularization of the internet has given an added boost to this trend. Like semiconductor and PC technology, technologies associated with the internet have been developed in a climate of fierce competition, resulting in an evolutionary pace that is astonishing, and the day when multimedia functions are fully incorporated into these technologies is thought to be just around the corner. In particular, expectations are high regarding the development of information filtering technology, which is expected to solve the information flood, and information agent technology, which is premised on the opening of public information, as core technologies that will further hasten the evolution of the internet culture.

It was against this backdrop that online shopping services through the internet began. But the public has not warmed to these services to the extent that initial predictions would have led us to believe, in part due to security concerns, and the bulk of online sales is through information providers backed up by advertising revenue.

In this survey many respondents viewed topic “52: Realization of virtual shopping systems” as important, so the high interest in topics “67: Enhancement of security functions that guarantee contracts over the network,” “64: Establishment of social rules regarding multimedia copyrights,” “16: Automatic network connection” and “18: Realization of an environment in which the unlimited utilization of high-capacity networks (150 Mbps) for around 2,000 yen/month is possible” will create an environment that can stimulate need and promote this kind of business.

In medical care and welfare, nursing and medical care for the elderly has become an imperative theme for the nation as Japanese society, which has been able to boast of the highest life expectancy in the world for more than the last ten years, continues to age at an increasing rate, advances in digital imaging equipment have qualitatively revolutionized surgical procedures, and an increasing amount of medical data is being transmitted and stored electronically.

Data format/protocol for network-based remote area medical information systems that facilitate quality regional medical care is becoming increasingly standardized, and microsurgery techniques that promote speedier recovery with less injury to the body are being put to practical use. Both have been made possible through the development of advanced camera and imaging technology.

In medicine, emphasis is being placed on quality of life, and the medical system is looking at the significance of home care in a new light. In line with this, advances are being made in the development of home care support structures, and in the use of portable multimedia terminal technology to assist in that care. The high expectations for topic “54: Robots which provide medical care support” is probably related to this situation.

In the disaster prevention domain, the inadequacies in Japan’s information gathering structure especially during a disaster has been a constant target of criticism, so local governments across Japan have worked to upgrade their regional information systems and disaster prevention facilities, making full use of multimedia equipment. Such a situation would explain in part why many respondents placed importance on topic “48: Widespread use of systems that provide emergency information at the time of a disaster.”

It is worth mentioning that during the Great Hanshin Earthquake, in addition to the normal information disseminated through public bodies, a substantial amount of important information was disseminated directly from the disaster site by the private sector through the internet, and this became an significant catalyst for action by volunteer groups.

What has stood out over the past few years during oil spills and the hostage crisis at the Japanese embassy in Peru is the extensive use of the internet to provide information. Such an evolution and enhancement of the information environment will also make it possible to share information on global level pollution and provide cooperation not constricted by national borders in such countermeasures as developing satellite communication functions, improving image monitoring systems, and developing damage forecast systems.

Although expectations of topic “49: Practical use of robots for rescuing humans involved in a disaster” are high, respondents are aware of the technological difficulties, and do not expect this technology to be realized before 2015.

Improvements in supercomputer functions and simulation technology have advanced weather forecasting, and weather consultation services as a part of the disaster prevention structure have taken root as a commercial business. Such developments could explain why, even considering the difficulties inherent in the theme, the forecasted realization time for topic “47: Capability to forecast weather up to one week in advance with at least 95% accuracy” is quite early at 2012.

This is also why respondents are looking forward to improvements in computer performance, as reflected in topics 02, 03 and 04, and advancements in parallel processing and super-parallel processing technology, such as topic “43: Development of high-performance compilers for super-parallel computer systems.”

(Masana Minami)

3.1.5. Society, work, and the local community

In this domain, it is forecasted that the internet will make an expanding world of information more available to more people, while the growing use of multimedia information and intelligent agents will generate a range of entirely new and readily accessible services. Services raised in this survey include information

provision, information management, electronic transactions, and electronic verification, and many of these topics are forecasted to be realized in the next five to ten years.

Topics that are between 15 and 20 years away are "56: Widespread use of automobiles which drive automatically" and "62: The passage of bills (acts) through electronic voting by the citizenry." But even though these topics may become technologically possible at an earlier stage, their actual application will require proper legislative foundations and a thorough social assessment of their merits, and this is expected to take considerable time.

As for the services that are five to ten years away, although some of these functions have already been realized and are being used to a degree, it will take 5–10 years before the functions are consolidated and used widely. In particular, topics "64: Establishment of social rules regarding multimedia copyrights," "66: Widespread use of electronic money to settle monetary matters" and "68: Widespread use of systems to handle information management uniformly among related companies" are ranked high in both importance and expected effect, and are expected to be realized in the next ten years. Respondents also pointed out that the government should establish appropriate regulations for topics "61: Realization of in-home electronic voting in elections," "58: Realization of applications, registrations, and other official public procedures and services over networks" and "57: Computerization of the foreign exchange, stock and other financial markets to enable the widespread use of fully automated rapid trading systems that do not require dealers or traders."

(Satoshi Goto)

3.1.6. Education and entertainment

The education and entertainment domain is attracting considerable attention as an important application of the sophisticated information systems that make up our information-based society. The growth of this domain is one of the most important factors in the rapid expansion of information equipment and software in the home. Important in this domain are topics dealing with the development or widespread use of systems that facilitate the acquisition of high-level information or knowledge. In the two decades between 2000 and 2020, respondents forecast we will see network-based remote education support systems, advances in the development of educational and entertainment software as systems become more intelligent, and greater and easier access to these systems from the home or office.

One characteristic of this domain, and especially topics connected with education, is the special attention given to the "adverse effect on morals, culture or society" that could arise from realization. This is thought to indicate the respondents' concern that because education is such a critical domain that will have a long-term impact on morals, culture and society, any developments in this domain have to take any potential effect fully into account.

Topic "71: Emergence of robots capable of acting as opponents to humans in sports activities" displays high-level functions, and is expected to be realized in 2014.

As large-scale technology over a wide area, network-based topics "72: Widespread use of two-directional, multi-point, remote education support systems in homes" and "73: Realization of an electronic school system that enables students who cannot commute to and from primary and middle school to graduate" are assessed as highly important, and are forecasted to be realized in 2008. Respondents also believe that the government should "adjust relevant regulations (relax/toughen)" as an effective means of facilitating the realization of these two topics.

In the aspects of high reliability, safety and ease of use, topics with a high degree of importance are "75: Widespread use of multimedia encyclopedias that enable the search and retrieval of text, sound, images and video," "76: Widespread use of science museums capable of fostering scientific skills of children through play," "78: Widespread use of advanced expert systems capable of utilizing teachers' knowledge and experience etc." and "79: Development of support systems to assist students in learning on their own via networks," indicating the respondents hold great hopes and expectations about the acquisition of advanced specialist information or knowledge. All topics are expected to be realized between 2004 and 2010.

(Yasushi Kiyoki)

3.2. Forecast topic framework

In the course of compiling forecast topics, a framework representing the organization of technologies in tabulated matrix form was drawn up for each field, with objectives and technological domains defining the rows and columns of the table, respectively. The framework is designed to present an overall picture of technological development in each field in terms of future prospects, importance, etc. as seen from the present perspective, and is also used as a working framework for future reviews of forecast topics.

Table 3.2-1 Forecast Topic Framework for Information Field

Domain / Objective	Technology			Application		
	Computers and related equipment	Networks	Software and algorithms	Lifestyle, medical care, welfare and disaster prevention	Society, work, and local community	Education and entertainment
Pursuit of new principles	01	16	24			
High integration, miniaturization, high capacity, high speed, super-parallel processing, high performance, high output (including high performance) and low price	02 03 04 05 06 07 08 09 10 11 12 13	17 18	25 26 27 28 29 30 31		56 57	71
Large scale and wide area		19 20 21		46	58 59 60 61 62	72 73
High reliability and safety		22 23		47 48 49	63 64	
Intelligence and flexibility (including fuzzy technology) Ease of use (human interface)	14		32 33 34 35 36 37 38 39 40 41 42	50 51 52 53 54 55	65 66 67 68	74 75 76 77 78 79
Low environmental load (low pollution, resource conservation and energy conservation)	15				69	
High productivity			43 44 45		70	

* Figures appearing in the table represent topic numbers.

3.3. Topics with high degree of importance

Degree of importance index scores (Note 1) averaged at 62.4 for topics in the information field as a whole. Topics considered of particular importance to Japan (top 20 topics in terms of degree of importance index score) are listed in the table below. Only 22. Widespread use of highly reliable network systems capable of protecting the privacy and secrecy of individuals and groups, the topic rated most important, received a score greater than 90.

Table 3.3-1 Top 20 Topics in Terms of Degree of Importance Index

Topic	Degree of importance index	Forecasted realization time (year)
22 Widespread use of highly reliable network systems capable of protecting the privacyand secrecy of individuals and groups from the intrusion of ill-intentioned hackers.	91	2007
18 Realization of an environment in which the unlimited utilization of high-capacity networks (150 Mbps) for around 2,000 yen/month is possible.	90	2008
64 Establishment of social rules regarding multimedia copyrights, and expanded production and distribution of multimedia information.	89	2005
48 Widespread use in all areas of security systems capable of providing emergency information to the general public in the case of a disaster.	87	2007
05 Practical use of systems which facilitate multimedia communication from anywhere in the world using pocket-size computers.	85	2003
45 Advances in software inspection and verification technology, enabling quick development of error-free, large-scale software.	83	2012
68 Widespread use of systems to unitarily handle information management (orders, design, manufacturing, maintenance) among related companies.	82	2005
66 Widespread use of electronic money to settle monetary matters.	81	2006
44 Separation of developed software into components, and widespread use of software libraries which facilitate the re-utilization of those components.	81	2006
54 Practical use of robots which provide medical care support in homes, hospitals, etc.	81	2010
67 Become possible to verify the counterparty to a contract concluded over a network with the use of database systems.	78	2004
19 Completion of networks enabling interconnection from anywhere in Japan through pocketbook-size telephones.	78	2005
69 Creation of a global multimedia network to disseminate global environmental information on-line, and utilization of global environmental information on a worldwide basis.	77	2007
46 Widespread use of systems facilitating on-demand acquisition of multimedia information dispersed on networks around the globe.	77	2005
15 Widespread use of low-energy personal computers capable of running for one full year on a single button-type battery	75	2012
49 Widespread use of systems facilitating on-demand acquisition of multimedia information dispersed on networks around the globe.	74	2015
06 Widespread use of hand-held, motor-less (all silicone) multimedia devices capable of operating for about 3 hours.	73	2005
16 Practical use of administration systems which conduct network connection and operation automatically and without a network administrator.	73	2007
23 Development of technology capable of automatically detecting viruses and automatically producing corresponding vaccines.	72	2009
35 Elucidation of human creative mechanism to such an extent that allows to apply to computer science.	71	2023

Note 1: Degree of importance index = (number of "high" responses × 100 + number of "medium" responses × 50 + number of "low" responses × 25 + number of "unnecessary" responses × 0) ÷ total number of degree of importance responses

3.4. Forecasted realization times

Forecasted realization times were distributed as shown in the diagram below.

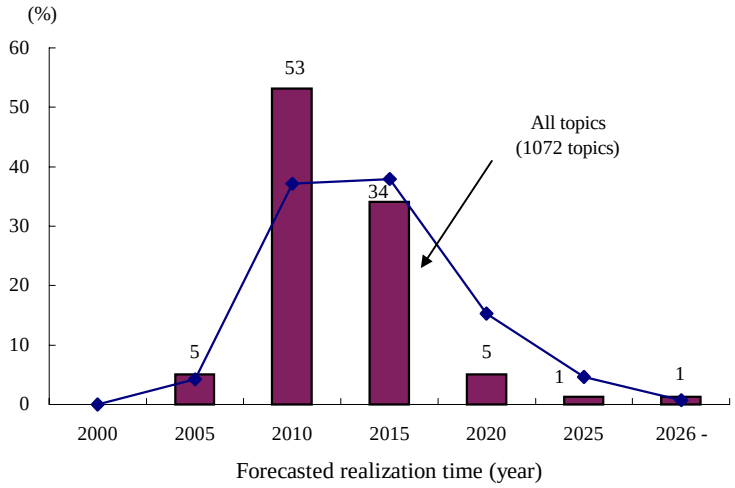


Fig. 3.4-1 Trends in Forecasted Realization Times

With more than half the topics in the information field forecasted to be realized between 2006 and 2010, the distribution of forecasted realization times peaked earlier than the general trend covering all topics.

3.5. Current leading countries etc.

Responses to the question concerning current leading countries etc. were as shown in the diagram below. Named by 77.6% of the respondents, the U.S. is dominant in the information field as a whole, with Japan trailing at 50.9%. The score of the third-ranking EU was less than half of Japans.

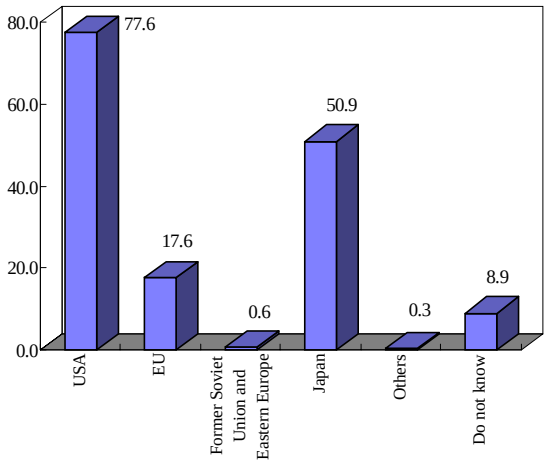


Fig. 3.5-1 Current Leading Countries etc. (%)

3.6. Comparison with the 5th Survey (previous survey)

Of the 79 topics included in the latest survey, 14 (18%) were identical to the previous survey, 15 (19%) were modified, and 50 (63%) were newly introduced. For identical topics, the results of the latest survey were compared with those of the previous survey in terms of degree of importance index scores and forecasted realization times, as shown in the table below.

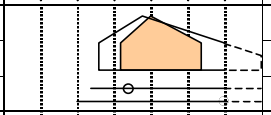
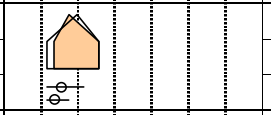
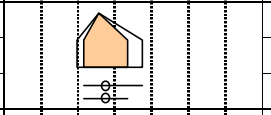
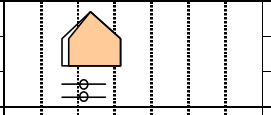
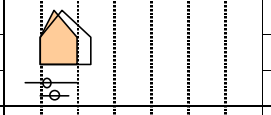
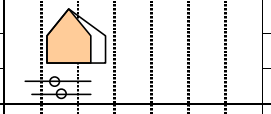
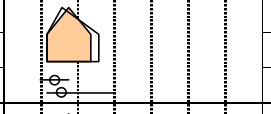
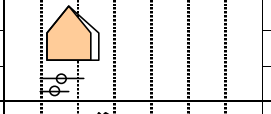
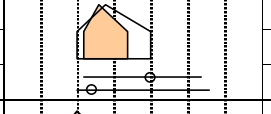
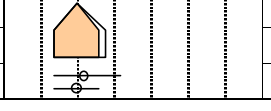
Degree of importance index scores rose for 6 topics, fell for 6 topics and remained the same for 2 topics. 53. Widespread use of integrated home computer systems saw the greatest jump in the degree of importance index score, up 13 points, while 04. Practical use of computers with computational speed exceeding 10 TFlops saw the greatest drop, down 9 points.

From the 4th to the 5th Survey, forecasted realization times were pushed back for all but one topic. Likewise, from the 5th to the 6th Survey, forecasted realization times were pushed further into the future for 13 of the 14 topics.

Table 3.6-1 Comparison with 5th Survey for Identical Topics

Topic	Degree of importance index/forecasted realization time (year)	
	6th survey	5th survey
03 Practical use of parallel computers with one million or more processors.	64/2009	71/2007
04 Practical use of computers with computational speed exceeding 10 TFlops	70/2008	79/2005
14 Practical use of face, voice, and other personal recognition technology in the area of security management.	67/2005	59/2002
19 Completion of networks enabling interconnection from anywhere in Japan through pocketbook-size telephones.	78/2005	75/2002
26 Development of equipment for automatic preparation of summaries and abstracts of books and other documents (degree of condensation can be adjusted as necessary).	60/2009	60/2010
27 Widespread use of voice word processors in which Japanese text can be input by voice (continuous speaking by unspecified speakers).	56/2011	61/2008
33 Widespread use of three-dimensional image processing technology capable of detecting moving objects and recognizing moving patterns and changes in shapes.	61/2010	63/2003
34 Development of robots capable of identifying and repairing their own faults by themselves.	58/2016	58/2011
35 Elucidation of human creative mechanism to such an extent that allows to apply to computer science.	71/2023	78/2020
39 Practical use of intelligent robots with visual, auditory, and other types of sensors, capable of judging their environment and making decisions autonomously.	68/2014	65/2012
40 Development of technology for quantitatively measuring comfort sensations such as wearing, riding, and coziness.	46/2010	45/2004
45 Advances in software inspection and verification technology, enabling quick development of error-free, large-scale software.	83/2012	86/2009
53 Widespread use of home computer systems which can be used to control equipment in the home, manage household finances and health, and provide interactive learning.	64/2007	51/2004
76 Spread of science museums capable of fostering scientific skills of children through play based on the applied use of natural history and science education techniques.	57/2006	53/2001

Note: Up until the 5th Survey, realization meant realization in Japan unless otherwise specified. However, this was changed to mean realization somewhere in the world in the 6th Survey, so realization now means realization somewhere in the world. Therefore, care should be taken when comparing forecasted realization times from the two surveys.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)					Expected effect (%)				Forecasted realization time			Leading countries (%)						Measures the government should adopt (%)							Information Potential problems (%)			
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026	Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
Computers and related equipment	1	Practical use of bio-computers based on a new algorithm which takes into account the organic information processing system.	1	171	6	30	63	62	36	43	19	2	54	13	22	69		8	8	77	12	2	25	0	19	61	49	20	21	42	2	1	5	4	27	2
			2	141	4	27	69	60	29	57	12	2	54	9	16	76		7	9	75	8	1	21	0	22	65	45	18	16	47	2	1	4	6	34	1
			X	6	100	0	0	83	67	33	0	0	100	33	33	67		0	17	100	0	0	67	0	0	100	67	17	0	67	0	0	0	0	17	0
	2	Practical use of high-performance supercomputers for vector calculations, priced at one million yen or less.	1	189	17	43	40	64	35	50	14	1	78	18	15	28		3	4	89	2	1	73	0	1	40	38	17	1	36	4	4	2	7	6	2
			2	153	10	49	41	63	31	59	10	1	88	13	11	23		1	3	88	1	1	73	1	1	47	40	9	0	39	3	3	1	6	5	1
			X	16	100	0	0	77	56	38	6	0	88	13	6	19		0	13	69	0	0	88	0	0	31	50	13	0	38	0	6	0	6	6	0
	3	Practical use of parallel computers with one million or more processors.	1	197	18	45	37	63	35	47	16	1	68	33	11	50		7	6	93	10	1	53	1	3	53	46	20	2	43	4	3	2	6	7	2
			2	160	14	49	37	64	34	54	12	0	79	27	6	42		7	3	96	7	0	55	0	1	63	44	18	0	45	2	2	1	4	6	1
			X	22	100	0	0	68	45	36	18	0	77	36	0	27		5	5	91	5	0	73	0	0	59	59	18	0	36	0	0	0	5	5	0
	4	Practical use of computers with computational speed exceeding 10 TFlops.	1	186	18	38	44	71	47	45	8	0	74	34	13	39		0	5	90	6	0	64	0	2	53	37	21	2	45	5	2	1	9	6	2
			2	151	13	45	42	70	43	51	6	0	82	31	9	34		0	1	91	5	0	64	0	0	66	33	17	0	48	2	1	0	8	5	1
			X	20	100	0	0	80	65	25	10	0	80	50	5	25		0	0	80	0	0	70	0	0	70	35	15	0	40	5	0	0	5	5	0
	5	Practical use of systems which facilitate multimedia communication from anywhere in the world using pocket-size computers.	1	228	27	42	31	80	63	32	5	0	88	11	76	12		0	0	87	15	0	75	1	0	35	36	8	1	21	47	7	0	43	38	1
			2	183	25	48	27	85	71	25	3	0	89	6	78	10		1	0	88	12	0	83	2	1	38	41	5	0	20	60	5	0	46	44	0
			X	45	100	0	0	93	87	13	0	0	84	11	89	16		0	0	91	18	0	89	4	0	49	38	7	0	24	64	4	0	53	47	0
	6	Widespread use of hand-held, motor-less (all silicone) multimedia devices capable of operating for about 3 hours.	1	174	18	44	37	68	45	39	15	1	77	10	67	10		2	3	69	8	1	73	1	4	35	32	9	2	23	18	3	1	17	21	1
			2	148	16	45	39	73	52	37	11	0	81	3	69	9		1	1	70	5	0	86	2	1	45	41	4	1	24	18	1	1	16	24	0
			X	24	100	0	0	90	79	21	0	0	92	4	79	13		0	0	71	4	0	96	0	0	58	29	8	0	21	25	0	0	25	21	0
	7	Development of 5,000 dpi high-quality color printers.	1	145	8	27	65	55	26	44	29	1	71	1	36	6		0	8	50	7	0	88	0	3	32	28	7	1	15	5	3	6	4	10	1
			2	121	4	25	71	53	20	54	25	1	77	0	40	4		0	7	52	2	0	94	0	1	46	32	4	0	15	3	1	3	2	13	0
			X	5	100	0	0	60	40	20	40	0	60	0	60	20		0	20	40	0	0	100	0	0	40	40	0	0	40	0	0	0	40	0	0
	8	Widespread use of multipurpose ID card system with wireless communication capability.	1	189	13	35	52	66	38	49	12	1	83	8	75	6		1	2	79	29	1	65	1	6	31	26	8	2	22	48	4	2	59	30	2
			2	159	9	35	57	66	36	59	5	1	84	6	83	4		0	1	84	30	0	78	2	3	35	26	3	1	18	62	2	2	55	29	1
			X	14	100	0	0	91	86	7	7	0	100	29	86	14		0	0	100	57	0	93	7	0	50	36	0	0	29	64	7	0	79	29	0
	9	Widespread use of sound field shielding technology capable of isolating a specific spatial area from the surrounding noise.	1	83	7	20	72	52	23	43	33	3	39	13	64	14		7	10	42	12	0	42	0	30	37	20	20	1	27	8	2	6	16	16	2
			2	69	7	16	77	52	21	49	29	1	38	9	72	7		7	9	51	4	0	54	0	23	43	16	17	0	35	9	1	6	13	16	0
			X	5	100	0	0	100	100	0	0	0	80	20	40	0		0	0	60	20	0	100	0	0	40	20	40	0	60	20	0	20	20	40	0
	10	Practical use of portable computers powered primarily by solar cells.	1	162	6	27	67	67	41	45	14	0	69	59	49	5		2	4	50	9	1	72	1	13	37	35	15	2	38	4	2	13	7	5	2
			2	130	5	21	74	66	38	50	13	0	67	57	50	2		2	2	55	3	1	81	1	8	45	37	10	1	49	2	1	11	6	4	0
			X	7	100	0	0	79	57	43	0	0	71	43	29	0		0	14	43	0	0	86	0	14	57	57	0	0	71	0	0	29	29	0	0

(Note) See page 7 for the interpretation of the graphs.

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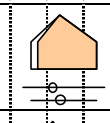
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026	Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
Computers and related equipment	11	Development of complete solid angle 4π dome-shaped three-dimensional display (for space exploration simulation, etc.).	1	89	12	17	71	42	11	40	43	6	55	11	44	25		1	9	71	7	1	47	0	11	30	26	18	1	29	3	6	1	3	10	3
			2	75	8	9	83	40	8	41	47	4	53	5	49	19		1	4	76	3	1	57	0	8	44	25	20	1	37	3	5	0	5	17	1
			X	6	100	0	0	75	50	50	0	0	67	17	67	17		0	0	83	0	0	83	0	0	33	17	17	0	50	17	17	0	0	17	0
	12	Widespread use of three-dimensional television sets that can be viewed without special glasses.	1	143	14	15	71	49	17	47	34	2	57	1	55	11		5	10	59	8	1	62	0	13	36	33	10	1	27	3	2	1	6	21	2
			2	117	9	16	74	46	12	50	35	3	51	0	64	9		4	5	62	5	1	79	0	9	44	28	9	1	25	1	2	0	9	21	1
			X	11	100	0	0	73	45	55	0	0	82	0	55	9		0	9	82	0	0	91	0	0	45	45	18	0	45	9	0	0	9	36	0
	13	Widespread use of portable electronic notebooks that offer the same level of flexibility as paper (thin and pliable).	1	150	15	23	61	68	44	40	16	0	73	21	56	9		6	11	51	8	0	55	0	22	44	36	9	3	35	6	2	5	9	13	2
			2	129	9	21	71	67	41	48	12	0	74	12	65	6		5	7	54	5	0	63	0	17	51	31	5	1	39	4	2	4	5	13	0
			X	11	100	0	0	82	64	36	0	0	91	27	64	9		9	9	64	0	0	82	0	0	55	45	0	0	45	18	0	18	0	36	0
	14	Practical use of face, voice, and other personal recognition technology in the area of security management.	1	202	17	35	48	68	41	47	11	1	75	2	67	9		2	2	82	22	1	67	0	8	53	35	15	2	35	17	2	0	54	31	1
			2	163	15	33	52	67	38	57	6	0	78	2	70	6		2	1	88	17	1	69	1	6	57	30	13	2	36	17	2	1	53	32	0
			X	24	100	0	0	87	74	26	0	0	79	4	79	17		4	4	92	29	8	79	0	4	50	33	13	8	33	25	4	0	67	38	0
	15	Widespread use of low-energy personal computers capable of running for one full year on a single button-type battery.	1	135	7	28	64	70	46	41	12	1	64	47	49	3		10	9	58	4	1	70	0	15	42	33	11	4	32	3	1	10	4	7	1
			2	114	5	24	71	75	55	36	9	0	71	42	50	4		9	4	61	1	1	79	0	10	53	32	9	1	32	3	1	13	6	7	1
			X	6	100	0	0	92	83	17	0	0	67	17	33	0		17	0	67	0	0	83	0	0	33	17	33	17	17	17	0	33	17	17	0
Networks	16	Practical use of administration systems which conduct network connection and operation automatically and without a network administrator.	1	206	26	37	36	70	45	45	11	0	89	5	40	9		8	5	92	20	0	36	0	2	49	32	14	2	27	18	1	0	30	16	1
			2	172	24	31	45	73	49	45	7	0	95	2	40	4		7	3	92	15	0	37	0	2	60	29	8	1	23	15	1	0	37	16	0
			X	42	100	0	0	83	66	34	0	0	95	5	52	5		5	2	98	19	0	48	0	0	62	36	12	0	38	19	2	0	33	14	0
	17	Widespread use in Japanese households of next-generation cable TV capable of transmitting programs on over 300 channels by means of data compression technology.	1	174	18	29	53	61	34	46	19	2	74	4	69	8		2	5	92	21	1	34	0	2	25	31	11	1	24	50	2	2	10	35	1
			2	145	14	29	57	60	27	57	15	1	74	2	74	5		3	3	94	14	0	32	0	1	22	25	7	1	19	63	0	0	7	40	1
			X	21	100	0	0	73	48	48	5	0	86	10	76	10		5	5	95	33	0	52	0	0	24	19	0	5	24	71	0	0	10	43	5
	18	Realization of an environment in which the unlimited utilization of high-capacity networks (150 Mbps) for around 2,000 yen/month is possible.	1	199	24	37	39	87	75	22	3	0	94	14	70	15		4	3	93	28	1	48	1	3	22	23	16	2	33	61	9	0	23	28	1
			2	164	23	37	41	90	80	17	2	0	96	9	73	11		2	1	93	23	0	52	1	3	20	21	7	1	34	73	2	0	22	38	1
			X	37	100	0	0	93	86	11	3	0	97	22	81	16		0	0	95	30	0	70	0	3	22	14	11	3	46	73	0	0	27	46	0
	19	Completion of networks enabling interconnection from anywhere in Japan through pocketbook-size telephones.	1	198	18	31	52	76	54	39	7	0	79	8	84	3		3	3	79	29	1	70	0	5	21	18	14	2	26	49	8	2	21	21	1
			2	159	18	35	47	78	58	38	4	0	80	4	88	4		1	0	86	26	0	79	0	3	19	14	5	1	23	72	3	1	24	25	0
			X	28	100	0	0	79	57	43	0	0	79	7	89	7		0	0	86	36	0	96	0	0	18	7	4	4	29	79	4	0	25	25	0
	20	Widespread use of mobile terminals capable of transmitting and receiving data at 10 Mbps, even from a moving train.	1	184	18	30	52	66	39	46	15	0	82	5	61	7		1	4	83	25	1	64	1	4	34	24	11	1	29	53	3	2	30	18	1
			2	159	16	30	54	66	36	56	8	0	87	3	65	5		1	2	89	26	0	69	0	3	35	18	4	0	27	67	1	0	38	19	0
			X	25	100	0	0	67	36	60	4	0	96	8	60	12		0	4	88	40	0	72	0	0	32	12	8	0	36	64	0	0	40	16	0

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)					Expected effect (%)				Forecasted realization time			Leading countries (%)						Measures the government should adopt (%)							Information Potential problems (%)			
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026	Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
Networks	21	Widespread use of computer networks in which a virtual space can be shared in real time by a large number of unspecified, geographically dispersed persons.	1	205	29	34	37	60	31	49	20	0	77	12	63	21		1	4	94	17	0	47	0	2	44	44	22	3	32	26	0	1	36	46	1
			2	166	29	33	39	60	26	60	13	0	82	10	61	19		1	1	96	13	0	53	0	1	50	41	17	1	33	28	1	0	33	53	1
			X	48	100	0	0	69	42	50	8	0	81	13	69	17		0	0	100	17	0	58	0	0	46	42	21	0	48	27	2	0	40	52	0
	22	Widespread use of highly reliable network systems capable of protecting the privacy and secrecy of individuals and groups from the intrusion of ill-intentioned hackers.	1	209	21	35	44	85	71	28	1	0	78	4	60	11		7	5	91	19	1	33	0	5	53	34	15	1	37	27	1	0	41	25	1
			2	168	20	34	46	91	81	19	0	0	87	4	67	7		5	2	95	15	0	35	0	2	60	31	10	0	38	31	2	0	43	26	0
			X	34	100	0	0	94	88	12	0	0	79	12	71	3		9	0	97	6	0	32	0	0	71	29	9	0	53	26	3	0	32	26	0
	23	Development of technology capable of automatically detecting viruses and automatically producing corresponding vaccines.	1	157	11	31	58	69	45	44	9	2	69	6	53	10		24	19	85	17	3	20	0	8	55	31	9	3	31	7	2	0	31	13	0
			2	125	10	25	65	72	47	48	5	1	78	5	54	7		19	15	91	17	2	22	0	4	63	24	2	2	30	4	2	0	36	12	0
			X	13	100	0	0	73	58	25	8	8	54	8	62	15		23	8	85	15	15	15	0	0	54	15	8	15	31	15	0	0	46	31	0
Software and algorithms	24	Development of software capable of using sensory and learning functions to rewrite itself into an even more advanced program.	1	187	23	43	34	64	35	51	14	0	65	5	21	53		13	11	81	24	1	30	0	10	72	27	17	5	39	4	1	0	13	22	2
			2	151	21	41	38	64	34	52	13	0	74	3	17	58		11	7	87	17	1	28	0	7	76	21	9	1	42	4	2	0	17	25	3
			X	31	100	0	0	67	39	52	10	0	77	0	19	58		10	3	84	26	3	35	0	3	81	23	6	0	45	6	3	0	16	29	0
	25	Practical use of OS capable of operating, in distributed environment on an area network, without cognizance of position as if the systems were a single system.	1	192	27	39	34	69	42	48	9	0	88	8	39	20		2	3	95	14	0	28	0	2	58	36	18	1	40	8	2	0	20	12	1
			2	159	25	38	38	67	36	60	4	0	91	6	38	14		2	1	94	11	0	26	0	1	67	30	13	2	43	6	1	0	20	12	0
			X	39	100	0	0	76	54	41	5	0	87	10	44	26		5	3	92	21	0	41	0	0	74	31	15	3	51	3	3	0	18	15	0
	26	Development of equipment for automatic preparation of summaries and abstracts of books and other documents (degree of condensation can be adjusted as necessary).	1	191	20	41	39	63	34	49	17	0	70	6	53	37		8	4	76	19	1	47	2	14	56	32	16	15	37	7	2	0	11	19	2
			2	155	15	43	43	60	27	57	16	0	67	2	56	31		7	1	82	14	0	45	1	10	63	28	12	9	37	5	3	0	6	19	2
			X	23	100	0	0	76	52	48	0	0	65	9	61	35		0	9	100	13	0	65	0	0	87	30	9	13	43	13	13	0	4	22	4
	27	Widespread use of voice word processors in which Japanese text can be input by voice (continuous speaking by unspecified speakers).	1	194	14	39	47	59	31	43	26	1	58	1	86	13		10	4	53	14	1	82	1	6	54	37	10	10	41	3	1	0	8	16	0
			2	157	13	36	51	56	25	49	25	0	55	1	87	11		10	3	47	9	0	92	1	3	62	32	7	7	45	2	3	0	4	17	1
			X	21	100	0	0	64	33	57	10	0	43	5	95	10		14	5	67	0	0	100	0	0	52	19	5	10	48	5	10	0	0	19	5
	28	Practical use of portable translation devices (translates simple, common phrases in both directions) using voice input.	1	182	16	35	49	65	36	52	10	1	64	6	80	18		5	4	60	25	0	77	1	9	57	40	11	9	38	2	2	0	5	15	1
			2	148	15	32	53	63	31	61	9	0	57	4	86	14		7	1	64	18	0	82	0	7	65	41	7	6	39	1	3	0	3	18	1
			X	22	100	0	0	64	32	59	9	0	59	5	91	18		9	0	73	14	0	100	0	0	82	32	5	14	41	5	9	0	5	14	0
	29	Development of systems capable of recognizing and understanding expressions which use metaphors to express information.	1	168	18	33	49	46	15	43	39	4	40	1	44	38		15	11	59	23	1	48	1	21	63	27	10	10	27	1	0	0	2	14	1
			2	133	17	29	54	40	7	45	45	4	41	0	55	38		16	6	71	21	0	54	0	17	67	28	8	4	26	2	2	0	2	14	1
			X	23	100	0	0	40	4	48	48	0	39	0	30	70		17	9	91	13	0	65	0	4	74	30	4	4	26	4	4	0	4	22	0
	30	Practical use of knowledge bases which consolidate their knowledge in a consistent manner through automatic learning.	1	182	20	40	40	61	31	53	15	1	65	3	42	48		18	11	79	28	1	40	1	11	67	33	13	10	39	3	0	0	8	18	1
			2	145	18	34	48	58	23	62	14	1	70	1	36	48		13	7	85	26	1	48	0	10	73	30	8	4	43	2	1	0	3	21	0
			X	26	100	0	0	67	40	48	12	0	65	8	27	58		8	4	85	31	4	50	0	4	77	27	8	15	58	8	4	0	0	31	0

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					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026	Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
Software and algorithms	31	Development of multipurpose assessment methods for taste, smell, etc., which do not depend upon the physical senses of humans.	1	84	4	23	74	48	15	50	34	1	48	6	56	27		7	15	31	19	2	29	0	43	42	31	10	15	29	6	2	4	1	20	2
			2	73	3	16	81	45	11	46	41	1	42	4	64	19		8	7	32	15	1	37	0	36	45	33	3	10	22	3	3	1	5	29	3
			X	2	100	0	0	75	50	50	0	0	50	0	50	50		0	0	50	50	0	50	0	50	50	50	0	0	100	0	0	50	0	50	50
	32	Widespread use of portable conversation devices which convert the volition of disabled individuals into speech.	1	133	6	24	70	63	37	41	22	0	25	1	95	8		1	10	66	32	0	34	0	20	47	40	14	8	65	5	2	0	11	18	2
			2	113	4	18	78	60	31	48	22	0	22	0	94	7		0	6	73	32	0	43	0	17	57	35	8	4	73	4	3	0	10	18	0
			X	5	100	0	0	75	50	50	0	0	20	0	60	40		0	20	100	40	0	60	0	0	40	20	0	0	60	40	0	0	0	60	0
	33	Widespread use of three-dimensional image processing technology capable of detecting moving objects and recognizing moving patterns and changes in shapes.	1	165	16	32	52	63	30	60	9	0	85	2	57	19		1	4	89	24	2	55	0	4	63	40	18	2	40	1	1	0	5	9	1
			2	130	15	28	57	61	25	71	5	0	87	0	54	15		1	2	89	15	1	59	0	4	68	36	10	1	52	1	2	0	8	9	0
			X	19	100	0	0	67	37	58	5	0	84	0	58	32		0	0	89	11	0	79	0	0	58	32	16	0	58	0	5	0	16	11	0
	34	Development of robots capable of identifying and repairing their own faults by themselves.	1	138	10	33	57	63	34	54	11	1	79	15	44	20		9	9	74	17	5	56	0	14	62	41	14	3	42	3	1	4	9	12	1
			2	111	5	25	69	58	21	70	8	1	86	13	41	13		6	5	80	12	2	63	0	9	68	37	8	2	50	2	1	0	12	14	1
			X	6	100	0	0	54	33	33	17	17	67	33	0	33		17	17	67	0	0	67	0	17	67	33	0	0	83	17	0	0	17	33	0
	35	Elucidation of human creative mechanism to such an extent that allows to apply to computer science.	1	144	14	35	51	69	47	37	15	1	43	3	17	84		19	14	69	33	5	31	1	20	65	42	16	10	46	1	1	1	6	33	1
			2	123	8	29	63	71	50	35	15	0	47	1	9	89		21	9	72	28	3	30	0	18	72	37	9	5	60	2	2	1	4	40	0
			X	10	100	0	0	90	80	20	0	0	60	0	10	100		10	0	90	40	10	90	0	0	100	50	0	0	80	0	0	10	0	70	0
	36	Development of visualized systems which facilitate the easy comprehension of very complex cause-effect relationships such as juridical cases.	1	154	13	33	54	53	20	55	22	3	62	5	40	41		1	5	62	23	0	36	0	24	58	36	12	10	35	4	1	0	10	21	0
			2	132	11	28	61	51	15	64	19	2	67	2	39	35		1	5	70	18	0	42	0	19	64	39	9	6	44	2	2	0	9	29	0
			X	14	100	0	0	59	21	71	7	0	86	0	43	57		0	7	93	21	0	79	0	7	71	43	0	7	64	7	7	0	14	36	0
	37	Development of technology capable of distinguishing over 10,000 different human beings from images recorded with a video camera.	1	156	16	24	60	54	22	51	25	1	69	8	55	13		7	10	73	21	2	54	1	12	57	31	15	9	37	4	1	0	39	19	1
			2	127	13	24	62	53	17	60	23	0	77	6	60	8		6	3	84	16	1	67	0	8	69	28	12	5	43	1	2	0	45	22	0
			X	17	100	0	0	61	31	50	19	0	71	12	76	18		6	0	88	12	0	76	0	0	76	12	6	6	53	6	0	0	47	18	0
	38	Become possible for computers, using electromagnetic data, to read the information recorded inside the human brain.	1	113	7	21	72	55	31	36	24	9	37	3	42	67		35	14	50	20	4	25	0	29	44	22	13	14	33	8	1	1	42	58	0
			2	92	5	15	79	55	26	46	21	7	33	1	39	75		39	5	60	17	2	22	0	23	59	22	9	11	37	7	2	0	41	67	0
			X	5	100	0	0	70	40	60	0	0	60	0	60	80		40	20	100	40	0	60	0	0	80	40	40	0	60	20	0	0	80	80	0
	39	Practical use of intelligent robots with visual, auditory, and other types of sensors, capable of judging their environment and making decisions autonomously.	1	161	17	25	58	68	41	47	11	0	76	17	66	27		6	8	78	20	5	57	1	10	59	44	22	2	45	5	1	1	21	28	1
			2	128	16	21	63	68	41	49	10	0	80	13	71	21		6	6	84	12	2	59	0	5	66	41	16	2	54	2	2	0	24	31	0
			X	20	100	0	0	68	42	47	11	0	80	20	80	25		5	5	95	10	0	95	0	5	85	30	20	5	75	5	5	0	20	30	0
	40	Development of technology for quantitatively measuring comfort sensations such as wearing, riding, and coziness.	1	109	11	17	72	50	18	48	33	1	50	1	77	13		4	14	40	21	0	39	0	33	44	42	14	6	28	3	1	0	6	18	0
			2	86	9	14	77	46	10	55	35	0	41	0	85	8		2	8	52	12	0	51	0	26	49	42	8	5	31	2	2	0	8	22	0
			X	8	100	0	0	50	13	63	25	0	63	0	88	0		0	0	75	25	0	75	0	0	63	38	0	25	75	0	0	0	13	38	0

(Note) See page 7 for the interpretation of the graphs.

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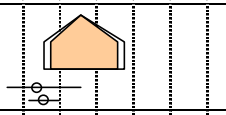
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026	Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
Software and algorithms	41	Development of sensation information systems capable of selecting music which corresponds to the perception of a given image.	1	132	11	32	58	35	5	32	54	9	39	2	57	26		8	12	52	16	1	45	0	20	47	32	9	6	33	2	2	0	2	19	1
			2	111	8	27	65	34	5	26	61	7	36	1	64	23		6	7	65	17	1	56	0	16	52	34	5	4	39	1	3	0	2	20	2
			X	9	100	0	0	69	44	44	11	0	78	0	78	33		11	0	56	0	0	67	0	0	67	78	11	0	33	0	0	0	0	33	0
	42	Practical use of systems capable of understanding the content of image data, in order to filter out information traveling on a network which may, for example, be unsuitable for children.	1	171	16	32	53	53	22	49	27	2	47	4	65	11		12	7	70	14	0	30	1	20	44	30	9	6	29	13	1	0	39	47	0
			2	140	13	31	56	51	17	56	24	3	46	3	72	9		9	3	84	9	0	39	2	9	52	28	4	2	38	7	1	0	36	52	1
			X	18	100	0	0	72	50	39	11	0	67	0	61	6		0	0	94	22	0	61	11	0	56	33	6	6	61	6	0	0	33	61	0
	43	Development of super-parallelizing compilers which efficiently execute the applications operated on super-parallel computer systems.	1	163	16	38	46	62	32	54	13	1	75	17	12	37		5	7	90	20	1	43	1	5	64	33	27	2	47	2	1	0	1	8	1
			2	141	14	40	46	61	28	59	12	1	80	11	7	33		5	3	94	16	0	46	0	1	72	28	18	1	52	1	1	1	1	7	0
			X	20	100	0	0	63	37	47	11	5	65	10	5	45		0	0	90	0	0	55	0	0	65	15	20	0	40	10	0	0	0	10	0
	44	Separation of developed software into components, and widespread use of software libraries which facilitate the re-utilization of those components.	1	195	27	39	34	79	61	32	6	1	90	7	19	23		2	4	90	26	1	43	1	4	57	40	14	12	34	10	3	0	8	11	2
			2	157	27	38	34	81	63	34	3	0	92	4	17	22		1	1	93	20	1	46	0	1	62	45	6	10	34	7	3	0	5	10	1
			X	43	100	0	0	86	74	24	2	0	88	5	16	23		0	2	86	23	0	53	0	2	65	44	7	5	44	7	2	0	5	9	2
	45	Advances in software inspection and verification technology, enabling quick development of error-free, large-scale software.	1	187	26	41	33	78	61	31	9	0	83	9	17	24		21	8	80	26	2	34	0	9	63	29	14	5	39	2	2	0	6	7	2
			2	148	22	43	35	83	68	28	3	0	90	5	12	18		22	3	89	21	1	34	0	5	67	26	9	3	41	3	1	0	5	6	1
			X	33	100	0	0	86	75	19	6	0	79	9	6	21		24	3	88	36	3	48	0	3	67	30	9	0	36	3	3	0	3	9	3
Lifestyle, medical care, welfare and disaster prevention	46	Widespread use of systems facilitating on-demand acquisition of multimedia information dispersed on networks around the globe.	1	213	29	38	34	74	52	43	6	0	82	13	69	23		1	1	93	25	0	39	0	2	37	35	13	9	29	38	4	0	28	32	2
			2	169	29	37	34	77	56	41	3	0	83	9	69	20		1	1	94	20	1	40	0	2	43	37	7	5	31	44	2	0	29	36	1
			X	49	100	0	0	88	78	20	2	0	82	18	71	27		0	0	98	29	2	63	0	0	47	37	6	2	39	39	6	0	37	39	2
	47	Weather for up to one week in advance will be able to be forecasted with at least 95% accuracy.	1	90	4	14	81	69	43	48	8	1	50	49	64	13		17	14	57	23	3	49	1	20	47	18	26	14	42	3	2	7	4	10	0
			2	71	1	13	86	67	39	51	10	0	54	39	65	7		18	4	62	15	4	59	0	10	54	13	18	11	52	4	1	6	3	11	0
			X	1	100	0	0	100	100	0	0	0	0	0	0	100		0	0	100	0	0	100	0	0	100	0	0	0	100	100	0	0	0	100	0
	48	Widespread use in all areas of security systems capable of providing emergency information to the general public in the case of a disaster.	1	149	13	21	66	85	71	27	2	0	36	19	91	3		0	3	59	16	1	47	1	20	27	36	21	4	54	29	6	1	29	15	1
			2	120	12	19	69	87	75	23	3	0	36	13	88	3		0	2	70	11	2	56	0	15	27	33	13	3	72	31	3	1	36	13	0
			X	14	100	0	0	100	100	0	0	0	29	14	79	7		0	7	86	7	0	64	0	0	29	29	14	14	86	36	0	0	36	14	0
	49	Practical use of robots capable of recognizing, finding, and rescuing humans involved in a disaster.	1	119	8	26	66	72	48	42	10	0	36	11	86	7		8	7	68	22	3	50	1	16	48	39	18	3	53	9	0	1	25	13	1
			2	94	9	20	71	74	53	38	10	0	31	4	90	3		4	6	79	18	3	59	0	12	55	35	11	0	68	4	1	1	29	11	0
			X	8	100	0	0	81	63	38	0	0	63	0	88	13		0	13	88	0	0	75	0	13	63	25	38	0	88	13	0	0	63	25	0
	50	Widespread use of portable terminals from which electronic newspapers can be purchased at information kiosks (information sales outlets established at train stations) through radio connection.	1	179	16	29	55	50	19	45	34	2	70	11	61	7		6	6	72	21	1	59	1	11	31	30	8	3	23	32	3	1	9	30	1
			2	151	17	30	53	49	15	53	30	1	68	5	66	4		4	3	78	17	0	67	0	7	32	30	3	1	25	42	2	0	5	38	0
			X	26	100	0	0	63	35	50	15	0	73	4	85	4		0	4	81	27	0	88	0	0	38	35	4	0	35	42	0	0	8	50	0

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Lifestyle, medical care, welfare and disaster prevention	51	Widespread use of electronic newspapers or electronic museums which can be compiled to match the specific interests of each individual.	1	207	20	37	43	56	22	56	22	0	67	6	78	14		0	2	88	22	0	44	0	6	33	32	14	15	25	33	3	0	20	31	1
			2	164	21	34	45	55	19	65	16	0	65	7	85	9		1	1	94	19	0	53	1	2	38	30	11	13	24	41	2	0	18	36	1
			X	35	100	0	0	67	37	57	6	0	71	11	91	9		0	0	100	14	0	77	3	0	43	31	17	14	40	43	0	0	23	46	3
	52	Widespread use of in-home shopping via networks, by means of virtual shopping systems.	1	215	26	33	40	63	33	53	14	0	78	7	88	3		1	0	93	29	0	46	0	1	19	33	11	3	13	58	4	0	44	36	1
			2	174	26	33	41	61	27	65	9	0	79	5	91	2		1	0	96	24	1	49	1	0	11	31	5	3	9	72	2	0	53	41	2
			X	45	100	0	0	70	43	52	5	0	82	7	96	4		0	0	98	24	0	62	0	0	7	27	11	2	18	69	2	0	47	38	2
	53	Widespread use of home computer systems which can be used to control equipment in the home, manage household finances and health, and provide interactive learning.	1	202	18	36	46	64	36	51	14	0	67	4	88	6		1	2	84	22	0	46	0	7	27	31	8	2	21	28	4	0	33	25	0
			2	165	18	30	52	64	31	61	7	1	66	2	88	4		1	1	90	16	0	51	0	4	23	35	2	2	22	36	3	0	45	27	1
			X	30	100	0	0	80	61	39	0	0	70	7	93	3		0	0	97	10	0	57	0	0	27	37	7	0	33	37	7	0	43	20	0
	54	Practical use of robots which provide medical care support in homes, hospitals, etc.	1	131	10	27	63	75	54	40	5	1	40	2	95	4		4	4	67	26	2	56	0	14	46	46	14	2	60	16	2	0	21	27	2
			2	111	7	21	72	81	64	30	5	1	42	0	95	3		2	5	76	20	3	66	0	8	46	48	5	0	70	14	0	0	25	29	1
			X	8	100	0	0	82	71	14	14	0	38	0	75	13		0	13	88	13	0	75	0	0	50	13	0	0	75	25	0	0	13	38	0
	55	Become possible for virtual operators with dialogue comprehension capabilities to converse with humans and operate information equipment.	1	177	18	33	50	54	20	54	25	0	58	3	81	8		5	5	79	17	0	50	1	8	52	34	9	3	36	8	3	0	15	16	1
			2	145	18	26	56	52	15	63	23	0	61	1	86	4		6	2	83	13	0	57	0	8	61	34	4	1	48	3	1	0	19	19	0
			X	26	100	0	0	61	27	62	12	0	73	0	85	4		8	0	85	8	0	58	0	4	69	42	0	4	54	8	0	0	27	23	0
Society, work, and local community	56	Widespread use of automobiles which drive automatically.	1	115	6	17	77	62	35	43	21	1	74	14	83	3		10	8	71	36	1	50	0	10	33	41	10	2	43	40	3	4	42	16	0
			2	94	4	16	80	61	33	47	21	0	81	7	86	2		6	4	78	36	1	59	0	6	28	45	6	0	54	56	1	2	62	12	0
			X	4	100	0	0	83	67	33	0	0	100	0	50	0		0	25	100	50	0	25	0	0	25	50	0	0	75	100	0	0	50	50	0
	57	Full computerization of the foreign exchange, stock and other financial markets, and widespread use of fully automated rapid trading systems that do not require dealers or traders.	1	150	12	23	65	69	46	40	13	1	88	4	33	2		0	7	88	37	0	39	1	5	19	27	9	1	21	68	3	0	52	35	0
			2	121	9	18	73	68	40	52	7	1	89	3	33	1		2	2	90	36	0	40	1	3	12	17	7	0	17	83	2	0	64	37	1
			X	11	100	0	0	91	82	18	0	0	82	9	45	0		0	0	91	55	0	64	0	0	27	9	18	0	9	82	9	0	73	36	0
	58	Realization of applications, registrations, and other official public procedures and services over networks.	1	201	12	29	58	70	44	47	9	1	45	2	92	2		0	6	66	25	0	31	1	19	13	19	8	4	30	72	3	0	58	24	0
			2	161	12	26	61	69	42	52	6	0	43	2	93	2		0	2	79	22	0	34	1	14	8	14	6	2	30	83	2	0	62	26	0
			X	20	100	0	0	86	75	20	5	0	65	10	90	5		0	0	95	35	0	60	0	0	20	15	20	0	35	80	5	0	45	25	0
	59	Formation and widespread use of a dynamic information market (including auctions) based on information provided by individuals.	1	187	20	38	42	63	34	48	17	1	71	4	75	11		1	4	89	32	0	34	0	3	17	23	12	4	14	55	3	0	52	39	0
			2	150	20	36	44	58	22	65	13	0	75	3	80	5		0	1	95	30	0	41	0	1	12	21	8	2	11	70	2	0	58	41	1
			X	30	100	0	0	69	45	41	14	0	73	10	87	3		0	0	93	33	0	53	0	0	27	27	20	7	20	57	10	0	47	40	0
	60	Formation of virtual communities, and realization of cultural interchange over wide areas.	1	183	20	38	42	62	32	51	16	1	61	15	80	22		2	4	86	33	1	44	0	6	19	30	17	4	23	42	3	0	34	50	1
			2	150	21	32	47	58	24	63	13	1	60	10	83	18		1	1	90	30	0	50	1	3	17	27	10	3	25	57	2	0	35	58	0
			X	32	100	0	0	67	41	47	13	0	63	13	91	19		0	0	94	25	0	59	0	0	28	25	19	6	41	44	6	0	28	56	0

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Society, work, and local community	61	Realization of in-home electronic voting . (elections)	1	180	13	27	60	53	25	38	33	3	32	5	74	5		8	18	52	18	0	23	0	34	11	13	7	2	22	71	3	0	53	47	1
			2	148	12	24	64	51	22	44	30	4	28	4	82	3		7	9	61	13	0	24	0	28	9	10	3	0	21	84	3	0	53	55	1
			X	18	100	0	0	81	67	22	11	0	44	6	89	6		6	6	78	22	0	56	0	11	28	28	0	0	33	78	11	0	33	33	0
	62	The holding of electronic parliamentary sessions (electronic prefectural council meetings) in conjunction with television broadcasts of parliament, and the passage of bills (acts) through electronic voting by the citizenry.	1	155	10	28	61	54	30	34	31	5	36	6	64	6		20	22	43	14	0	17	1	38	9	12	7	2	17	68	4	0	42	58	1
			2	127	9	25	65	52	24	40	30	6	35	2	74	3		21	13	44	11	0	14	0	39	6	7	4	0	14	79	2	0	44	64	3
			X	12	100	0	0	80	64	27	9	0	42	8	92	8		17	0	67	17	0	42	0	17	25	17	0	0	25	75	8	0	8	33	0
	63	Practical use of automatic security surveillance systems using robots equipped with crime prevention functions and information.	1	149	9	30	62	58	25	55	19	1	58	5	84	3		1	5	74	13	2	48	0	13	36	40	10	2	26	22	2	0	47	24	1
			2	121	7	25	68	58	23	64	13	0	60	3	81	2		0	2	82	8	0	46	0	7	40	40	7	1	22	25	2	0	54	27	0
			X	9	100	0	0	75	56	33	11	0	78	11	78	11		0	0	67	0	0	67	0	0	22	56	22	0	44	44	11	0	22	22	0
	64	Establishment of social rules regarding multimedia copyrights, and expanded production and distribution of multimedia information.	1	193	17	36	47	85	71	26	3	0	86	4	46	27		1	8	85	32	1	35	1	8	22	34	4	8	18	73	3	0	35	48	2
			2	160	16	33	51	89	79	19	1	0	91	3	44	26		0	4	91	28	1	32	0	4	17	31	3	6	11	83	3	1	38	54	0
			X	26	100	0	0	90	81	19	0	0	92	8	65	35		0	4	96	46	0	50	0	0	27	19	4	4	19	92	12	4	27	50	0
	65	Widespread use of paper-less processing for the majority of office work.	1	210	20	42	38	67	40	51	10	1	69	58	32	6		14	9	74	26	0	38	0	16	19	21	8	2	16	45	3	7	19	27	0
			2	170	20	41	39	67	38	54	8	0	76	64	30	5		11	6	86	24	1	45	0	8	14	19	6	2	14	66	1	5	20	34	0
			X	34	100	0	0	82	65	35	0	0	82	47	44	9		6	6	88	29	0	47	0	12	21	15	3	6	15	65	0	3	24	21	0
	66	Widespread use of electronic money to settle monetary matters.	1	206	17	34	49	76	55	40	4	0	91	9	67	5		1	4	88	64	1	32	1	3	23	34	6	2	24	78	1	0	63	44	1
			2	166	15	31	54	81	63	35	2	0	95	4	67	4		1	3	90	65	1	35	1	1	19	33	2	1	23	84	1	0	67	46	1
			X	25	100	0	0	90	80	20	0	0	92	16	80	8		0	4	80	84	0	52	0	0	32	44	4	0	52	80	0	0	64	52	0
	67	Become possible to verify the counterparty to a contract concluded over a network with the use of database systems.	1	198	22	33	45	73	51	39	9	1	88	3	57	6		0	4	89	38	1	40	1	5	32	26	9	8	26	62	2	0	61	31	0
			2	163	18	31	50	78	60	33	7	0	93	2	58	2		0	2	92	36	1	43	1	3	30	20	6	1	25	77	1	0	66	34	0
			X	30	100	0	0	92	83	17	0	0	93	10	73	7		0	0	93	57	0	63	3	0	27	20	3	0	47	70	3	0	63	23	0
	68	Widespread use of systems to unitarily handle information management (orders, design, manufacturing, maintenance) among related companies.	1	191	24	34	43	76	56	37	7	0	96	12	20	3		3	3	83	27	0	37	0	7	26	40	9	7	21	49	3	0	36	22	1
			2	158	20	35	46	82	66	31	4	0	98	8	19	1		2	4	88	22	0	41	1	5	20	42	3	2	20	68	1	0	46	22	0
			X	31	100	0	0	92	84	16	0	0	94	19	39	0		0	3	94	23	0	45	0	0	35	39	3	0	35	68	3	0	35	29	0
	69	Creation of a global multimedia network to disseminate global environmental information on-line, and utilization of global environmental information on a worldwide basis.	1	185	16	29	55	73	52	37	10	1	49	81	37	15		1	3	80	37	2	35	1	12	26	30	24	23	39	24	3	16	19	21	1
			2	152	13	28	59	77	61	29	9	1	48	80	32	9		1	3	86	35	1	38	0	9	21	33	15	18	49	25	1	13	17	18	0
			X	19	100	0	0	94	88	12	0	0	53	58	53	16		0	5	100	42	0	63	0	0	32	37	26	11	58	26	5	5	5	32	0
	70	Formation of open communities via area networks, and performance of multimedia creative activity through collaboration within them.	1	191	27	32	41	63	33	51	16	0	72	13	54	43		1	5	87	29	1	38	0	7	31	40	19	6	26	30	3	0	23	43	1
			2	155	23	32	45	61	28	60	12	0	75	8	55	43		1	3	90	30	1	45	1	3	30	44	10	4	26	34	4	0	20	50	0
			X	36	100	0	0	69	44	44	11	0	72	14	61	44		0	3	94	39	0	64	0	0	31	39	19	8	42	25	3	0	22	50	0

(Note) See page 7 for the interpretation of the graphs.

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Education and entertainment	71	Emergence of robots capable of acting as opponents to humans in sports activities (such as Sumo Wrestling, etc.).	1	101	8	20	72	33	6	24	61	9	26	0	69	8		7	11	45	15	1	35	0	24	29	32	14	4	22	3	3	0	13	19	4
			2	83	8	16	76	32	6	16	73	5	18	0	72	8		7	8	52	13	0	36	0	22	27	33	8	2	22	4	2	0	13	28	1
			X	7	100	0	0	46	29	0	71	0	29	0	86	14		14	0	100	14	0	71	0	0	57	29	14	14	57	14	14	0	0	29	0
	72	Widespread use of two-directional, multi-point, remote education support systems in homes.	1	203	21	32	48	64	36	51	13	1	62	7	82	17		2	5	76	21	1	47	1	12	26	36	19	7	35	38	2	0	16	49	1
			2	162	22	27	52	64	33	57	9	1	57	5	83	16		2	3	81	17	0	52	1	7	19	34	12	3	40	54	2	0	15	52	1
			X	35	100	0	0	84	69	29	3	0	71	6	94	20		0	3	89	20	0	54	0	0	23	34	14	3	60	57	3	0	9	46	0
	73	Establishment of electronic primary and middle schools, making it possible for students who cannot travel to and from schools to take courses and obtain graduation diplomas.	1	171	12	26	62	57	30	44	23	4	26	4	84	9		5	8	52	17	1	23	1	28	12	22	16	5	26	63	2	0	15	46	1
			2	139	13	21	66	55	24	53	22	2	21	3	86	6		4	4	65	17	1	31	1	20	9	17	9	4	24	75	1	0	12	56	0
			X	18	100	0	0	76	56	39	6	0	28	6	83	11		0	6	78	17	6	50	0	11	11	17	17	0	39	67	6	0	0	56	0
	74	Development of computer program which beats professional Shogi (Japanese Chess) champions.	1	162	7	27	65	28	3	16	68	13	10	0	14	64		9	13	35	12	2	66	1	7	31	14	4	1	16	2	3	0	0	14	1
			2	131	8	23	69	28	5	12	69	15	7	1	10	69		13	9	28	8	2	78	0	3	34	9	2	1	11	1	3	0	0	16	0
			X	10	100	0	0	47	33	0	56	11	10	10	10	70		10	10	30	10	0	80	0	0	20	0	0	0	0	10	0	0	0	10	0
	75	Widespread use of multimedia encyclopedias that enable the search and retrieval of text, sound, images and video (e.g. search using the sound of a bird singing or a sketch).	1	210	21	39	40	54	20	58	22	0	57	3	74	25		0	2	89	27	1	48	0	4	33	27	15	18	23	19	2	0	9	25	1
			2	161	22	35	43	53	15	65	20	0	58	2	77	19		1	2	92	24	1	50	0	2	35	24	11	19	26	14	3	0	6	26	1
			X	35	100	0	0	62	29	63	9	0	71	6	83	14		0	0	97	26	0	51	0	0	49	17	9	29	29	11	9	0	3	37	3
	76	Spread of science museums capable of fostering scientific skills of children through play based on the applied use of natural history and science education techniques.	1	167	11	33	56	58	28	50	22	0	37	4	66	37		2	3	78	34	1	34	1	13	25	28	28	13	40	11	2	0	2	22	1
			2	137	10	28	62	57	25	53	22	0	34	2	77	33		1	2	85	32	1	34	0	7	21	25	26	10	56	10	1	0	1	25	0
			X	14	100	0	0	70	43	50	7	0	43	7	71	29		0	7	93	43	0	57	0	0	29	14	14	7	57	7	14	0	7	43	0
	77	Development of an entrance exam system in which comprehensive skill assessment is conducted using networks.	1	131	11	21	67	41	13	37	36	14	31	2	44	12		27	21	31	9	2	22	1	38	18	16	5	2	18	31	6	0	28	38	2
			2	112	10	15	75	39	10	38	41	11	29	3	59	11		23	15	30	5	2	25	1	41	16	11	4	1	18	46	2	0	29	47	0
			X	11	100	0	0	68	50	20	30	0	45	18	55	36		9	9	55	18	0	55	9	18	36	27	18	0	36	45	9	0	55	64	0
	78	Widespread use of advanced expert systems capable of utilizing tutorial examples etc. where the knowledge experience and performance of teachers has increased.	1	176	14	29	57	51	19	51	26	4	44	3	59	28		6	15	65	20	1	32	1	18	41	32	13	14	32	11	3	0	7	34	2
			2	139	13	24	63	48	13	57	25	5	45	2	67	27		9	9	74	19	1	33	0	14	47	31	4	13	37	9	2	0	6	42	0
			X	18	100	0	0	68	44	44	6	6	67	11	67	33		6	6	100	17	0	56	0	0	61	33	6	11	50	22	11	0	11	39	0
	79	Development of support systems to assist students in learning on their own via networks.	1	195	16	34	50	60	28	54	18	0	46	4	78	24		1	4	77	25	1	48	1	13	31	33	18	9	37	19	1	0	11	31	2
			2	156	15	29	56	57	22	64	14	0	43	6	81	20		1	1	85	27	1	60	0	6	35	38	10	8	52	18	1	0	8	36	1
			X	24	100	0	0	82	67	29	4	0	54	13	75	25		0	0	92	29	0	79	0	0	42	38	13	4	58	17	4	0	17	42	4

(Note) See page 7 for the interpretation of the graphs.

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