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Visions and Scenarios of People and Science and Technology Development to 2030

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Visions and Scenarios of People and Science and Technology Development to 2030

Abstract

In the next 10 to 15 years, scientific and technological progress will change the industrial structure and global economic growth, and will profoundly change people's needs for food, clothing, housing, transportation and their forms of the needs to meet. Based on the foresight analysis data of economic, social, and technological development from major countries and international organizations or big enterprises, with the method of information and knowledge element analysis, this study describes humanbased vision from the following five aspects, life, work, health, information, and safety. For each aspect, we put forward some social development trends, visions, specific scenarios, and key future technology groups. All of these provide references for drawing up China's future development vision and technological innovation demands.

Keywords

vision, scenario, social development trend, human-based vision, technology group

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Visions and Scenarios of People and Science and Technology Development to 2030

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Abstract: In the next 10–15 years, scientific and technological progress will change the industrial structure and global economic growth, and will profoundly change people's needs for food, clothing, housing, and transportation as well as the ways of meeting these needs. Based on the foresight data of economic, social, and technological development from major countries and international organizations or big enterprises, this study performed information and knowledge element analysis to describe human-based vision from the following five aspects: life, work, health, information, and safety. For each aspect, we predict some social development trends, visions, specific scenarios, and key technology groups in the future. All of these provide references for drawing up China's future visions of development and technological innovation demands. **DOI:** 10.16418/j.issn.1000-3045.20201027002-en

Keywords: vision; scenario; social development trend; human-based vision; technology group

The next 10–15 years will be a pivotal period for the change of new and old momenta of the world economy, global scientific and technological revolution, and industrial transformation. The development of science and technology (S&T) will present new trends and characteristics. Scientific and technological progress is changing the way of human production and life with unprecedented strength. On one hand, it impacts all industrial forms and changes the global industrial structure, directing the global economic growth. On the other hand, it profoundly changes people's needs for food, clothing, housing, and transportation as well as the ways of meeting these needs. People-centered scientific and technological progress will become the main theme of the times, which evokes the strong desire for people-serving technologies and applications in all countries and even the industrial circles.

In recent years, major countries and international organizations have carried out foresight activities to depict the future development vision of human society with scientific and technological progress. The strategic planning of large enterprises also depicts the vision of S&T innovation and the scenario of S&T application in the future. Vision planning has become an important way to promote enterprise development.

1 Research contents and methods

With the foresight of major countries on the vision and scenarios of human and social development as reference, this paper describes the vision and scenarios of future-oriented and people-centered social development through strategic scanning, case analysis, and comparison, and then summarizes the key technology groups supporting the realization of future vision, so as to provide reference for relevant strategic planning. Vision refers to a scene expected by countries and formed on the basis of human social demand and behavior theory and social development trend. Key technology groups refer to some key techniques or technologies that are not realized or broken through to meet people's needs in specific scenarios. Scenario refers to a series of real cases that use technologies to realize future vision.

Research methods and processes: (1) Strategic scanning and information selection. With the data from long-term (over 10-year) study of S&T strategies and policies of major countries and international organizations, we selected over 30 related documents and reports issued by major countries, international organizations and large-scale research and development enterprises after 2010 according to the authority, coverage, and appropriateness of the contents. (2) Extraction of knowledge elements of vision and scenarios. Knowledge elements supporting in-depth analysis are extracted from the above documents and reports, including the publishing organization, publishing time, planning/forecasting time period and theme, development trends, technical requirements, vision, scenarios, and key technology groups. (3) Trend and vision summary based on knowledge element analysis. Through comparison of the knowledge elements and related

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attributes, the contents that are widely accepted, clearly described, and have reference value for China are extracted and synthesized. The trends, people-centered vision descriptions that conform to the development trend, and representative social life scenarios driven by S&T are summarized for each field. (4) Sorting of key technology groups. We analyzed the extracted knowledge elements of key technologies to screen out the key technology topics with a consensus among the plans or technology predictions and coupling the technology requirements of the above vision and scenario. Further, we summarize the key technology groups that need to be broken through to realize people-centered social development in the future.

This study describes human-based vision from the following five aspects: life, work, health, information, and safety. For each aspect, we put forward some social development trends, visions, specific scenarios, and Key technology groups (Table 1).

2 Vision of future life

In the future, the production activities that meet the needs of food, clothing, housing, and transportation will be mechanized, automated, and intelligentized to a great extent, which will enable people to enjoy life in an easier and happier manner. This section depicts the specific life scenarios including shopping, travelling, food, home, energy production and utilization, and entertainment in the future.

2.1 Trend, vision, and key technology groups

(1) Social development trend. The application of new technologies has changed the concept and ways of human life. People's increasingly high requirements for healthy and comfortable quality of life have led to the upgrading of products and services. Entertainment will experience a multi-terminal and diversified trend, and the electronic entertainment industry will usher in a new wave of development. Besides, the future will undergo increasing energy demand, improving oil and gas exploitation capacity, decreasing renewable energy prices, and growing utilization of nuclear energy. The synchronization between physical human and virtual human will face challenges, and virtual human, with strong learning ability, will challenge physical human in technology, safety, ethics, growth, and learning.

(2) Future development vision. People will enjoy excellent, practical, affordable, and personalized products and services, use clean and efficient energy, and build a beautiful natural environment. Human will coexist with machines to create a convenient and comfortable living environment.

(3) Key technology groups. The key technology groups involve robot and autonomous system, high-efficiency battery, high-performance energy-efficient network, quantum, power and energy collection, mixed reality, and man–machine interaction.

2.2 Specific scenarios

2.2.1 Low-carbon intelligent home life

(1) Intelligent house. Instead of producing just simple consumer goods, manufacturers of household appliances can leverage sensors to learn the machine operation conditions in time, replace faulty components, and install and upgrade machines remotely, and further analyze the potential needs of consumers [1]. Intelligent house can be connected with applications (APP) to realize not only the coordination between the routine of human and nature but also independent control of household appliances anytime and anywhere, thus improving the living comfort of users. For example, users can be awakened by sunlight because of the new shutter that automatically rises at sunrise and falls at sunset [2]. The intelligent system can adjust the temperatures of room and water at any time according to the activity route and physical condition of people. The wearable devices can monitor the heartbeat and blood pressure of residents in real time, and analyze the human excrement and body fluids. The association of these data with the hospital health management system can help predict the risk factors of diseases and protect human health [3]. People live together with intelligent equipment such as robots. Wearable intelligent devices eliminate the gap between disabled people and normal people. Service robots will undertake all the housework from parenting to cleaning. Athletic robots can play tennis and basketball with people. With the help of multilingual translators, people can communicate with anyone in the world without barriers and fully understand each other's culture.

Table 1 Vision and scenario description of future people and technology development

	Life	Work	Health	Information	Safety
Vision	Convenient	Innovative	Longevous	Intelligent	Reliable
Scenarios	Family life Energy utilization Logistics and transportation Entertainment experience	Data environment work Remote automated office Application of robots Application of advanced materials Green agriculture	Disease diagnosis and treatment Preventive treatment Electronic medical care Care for disabled person	Information acquisition and processing Information utilization and protection Information diffusion and exchange Education	Safety prevention and control Network security Biosafety.

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(2) Shopping. Online shopping is more convenient and considerate. Consumers can leverage 3D system to personalize and simulate favorite products with the same size as real objects online, and place orders after pre-experience with virtual technology. Residents can choose the customized service launched by "Intelligent Farm" at home, and check the growing and pesticide spraying of fruits and vegetables in real time through remote system. Home robots can cook automatically with the available ingredients according to family tastes, and detect pesticide residues in advance [3]. Virtual human in virtual space can replace users to complete simple daily business such as shopping and banking affairs independently, which will greatly increase the private leisure time [4]. The 3D augmented reality room allows customers to design living areas according to their own wishes, and then enter the virtual model of space to obtain the intuitive impression of the design [5].

2.2.2 Clean and efficient energy production and utilization

(1) Energy use of public facilities. New digital technology allows two-way communication between public facilities and users, and fusion technology will reduce the storage cost of renewable energy. New materials will significantly improve the use efficiency of energy and the safety of photovoltaic cells and nuclear batteries. Intelligent power grid can support power distribution and various power generation technologies [1]. Each company or family can achieve power self-sufficiency through its own solar power generation system and sell surplus power to electric power companies. Office buildings active during the day and entertainment centers active at night can coordinate peak power consumption and improve efficiency [3].

(2) Home energy use. Each house will become an "energy plus" system, which can manage heat energy and electricity according to the needs of residents. Electric vehicle is a part of "energy plus." Through controllable two-way charging, the surplus power generated by electric vehicle during driving can be used to supplement the house electricity in shortage and vice versa [2].

2.2.3 Intelligent and fast logistics, transportation, and travel

(1) Transportation infrastructure. Transportation infrastructure will become more intelligent. New materials and embedded sensors will converge on vehicles such as automobiles, trains, airplanes, and ferries, and provide people with safe, convenient and fast travel with big data. For example, the road system will include a dynamic system, which can charge electric vehicles during driving. The automatic driving system can be combined with the omnibearing road image warning system to timely discover and respond to dangerous situations such as sudden entry of pedestrians, and minimize the rate of road traffic accidents [1]. Autonomous vehicles and machine intelligence will change mass transport and logistics. Autonomous transportation technology can improve the efficiency of transporting passengers and products within and between cities.

(2) Personal travel. Semi- or fully-automatic commercial aircraft, buses, and taxis enable people to travel safely while reducing congestion and pollution [5]. Open sharing of dispatching data helps people plan their trips to avoid traffic congestion and delays, and traffic autonomy is expanding from transportation systems (such as docks and light rails) to personal travel [1].

2.2.4 Entertainment experience with high fidelity and reproduction of five senses

In the future, there will be neural game products based on brain-computer interface, and products based on biometric analysis to change functions and psychological and emotional states, so as to realize highly realistic entertainment experience with reproduction of five senses (vision, hearing, smell, taste, and touch) [6]. The new large-scale game platform with user interaction will continuously monitor physical ability and psychological state of users, and evaluate current activities cognition and physiological data of users. Based on the obtained data, users will be non-invasively stimulated to achieve entertainment experience.

2.2.5 Blended world and eternal life

In the future, people will enter a blended world. That is, human will break through the physical life limit and form dual citizenship in physical world and digital world and even a digital country. In order to solve the contradiction between physical and virtual human, people will use information and communication technology (ICT) to improve the learning and capability of natural people via virtual human instead of becoming puppets of virtual human.

3 Vision of future work

Work and production, as the basis for individuals to embody their social value and self-value in the social division of labor, are the activities and processes for people to create new knowledge and social wealth. In the future, human labor and work will mainly focus on creative fields, and the people-centered concept will be embodied as S&T supporting the creative activities.

3.1 Trend, vision, and key technology groups

(1) Social development trend. The connotation of work will be redefined as the relationship between people and work will change. Specifically, self-employment will be more convenient; task outsourcing and freelancers will increase; the working environment will be supported by energy-efficient high-speed data processing. Digital technology will support the new industrialization, drive the development of the Internet of Things and robot platforms, and set standards

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and norms for new industrial forms and labor organization forms. Intellectualization and automation will promote personalized manufacturing to become a trend, and the large market scale and market return density will provide sufficient profits. Traditional information science, Maxwell's equation, and Newtonian mechanics all use local ideas to find approximate solutions in the case of Gauss, linearity, convexity, or stability, which, however, is impossible for the real world. New digital technology will push the future into a new era.

(2) Future development. The trend of online celebrity and the fragmentation of work will give birth to autonomous working methods and intelligent, green and adaptive industrial forms.

(3) Key technology groups. The key technology groups concerns module software development, environmental perception and intelligent planning, 5G and more advanced communication, big data and supercomputing, automation equipment and mechatronics, nano and other advanced materials, additive manufacturing, weather forecast, and green agriculture.

3.2 Specific scenarios

(1) Work with high-performance networks and massive data. Technology changes the relationship between individuals and work. The network market and collaboration tools have increased the job opportunities and made them more accessible, and increase the number of freelancers. With new technologies, network market, and collaboration tools, people can improve work efficiency by telecommuting and satellite offices (i.e., decentralized offices and branches), and reduce work costs such as travel time and distance consumption to help build a low-carbon society.

(2) Robot application and human–machine interaction. With the advent of an aging society, the reduction of labor force will become a social problem, which can be solved by the development of robot industry. Voice commands will greatly replace text input commands, so that people, especially the elderly, can use intelligent devices conveniently. Robots will become the main tool to assist production and logistics, and more robots will work with people to protect people from dangerous work.

(3) Application of advanced functional materials. With the development of multifunctional nano-materials, it is possible for people to wear simple clothes to work in extreme environments. The light manufacturing and building materials with hardness greater than steel make it feasible to construct super tunnels and buildings, ultra-fast vehicles and ultra-strong equipment. Superconducting materials and flexible materials at normal temperature will make maglev trains, foldable mobile phones and computers practical, and intelligent materials will enable automobiles to detect and repair damage themselves [4].

(4) Remote, automatic, and network office. Home office and network office reduce people's travel to serve low-carbon society. People can remotely operate robots and automatic devices to complete office affairs, and the green printing system will greatly reduce the consumption of office resources [4]. Work will be distributed, screened, concluded, and paid in a similar way as "Didi Call". There will even be a platform of "Didi Work", which can accurately match the fragmented work requirements and the labor population with sufficient free time.

(5) Green agriculture and water resource management. Through green planting, new agricultural technology can realize the self-sufficiency of food and animal products [7]. Vertical farm in high-rise buildings will be popularized, in which the sunshine and temperature will be automatically adjusted and managed by computer. The aquatic plants using biomass energy can be cultivated in the urban center and around buildings, to which the water resources can be uniformly allocated by intelligent system [4].

4 Vision of future human health

Health is the prerequisite for all-round development of people, economy, and society, which faces new challenges brought by aging population, diseases, and changing environment and lifestyle. In the future, people are expected to realize the disease prevention, control, and treatment in a timely and effective manner through ubiquitous monitoring and nursing of physical conditions.

4.1 Trend, vision, and key technology groups

(1) Social development trend. The accelerated aging of population leads to more and more patients with chronic and epidemic diseases and the increasing incidence of emerging infectious diseases. The surge in the demand for healthcare brings new opportunities for the development of healthcare services. The progress of medical technology will aid in a new health system and improve the quality of life. The signs that life and health will become the leading industry are becoming more and more obvious.

(2) Vision of future development. As the life expectancy of human beings is prolonged, the advanced medical system can maximize the independence of the healthy life of the elderly. With the advancement of medicine, an accurate treatment system for incurable diseases, an infectious disease prevention system, and an intelligent human health management system will be built.

(3) Key technology groups. The key technology groups involve regenerative medicine, automatic monitoring and treatment devices, cloning and gene editing, prediction/prevention of and responses to emerging infectious diseases and climate disasters, personalized treatment, human capacity recovery and enhancement, and synthetic biology.

4.2 Specific scenarios

(1) Treating incurable diseases with advanced medical technologies. Although the aging society inevitably comes,

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the elderly can enjoy a high quality of life thanks to the progress of medical technology. As medical robots are becoming practical, the new technologies for cleaning blood vessels, assisting muscle movement, and cancer cell-targeted therapy make it possible to treat some incurable diseases. With the complete disclosure of brain cognitive function, brain nerve cell repair technology has been developed, which facilitates the treatment of Alzheimer's disease and Parkinson's disease. The development of artificial blood eliminates the need of blood donation, and the organ regenerated from stem cells can gradually replace the aging and sick organs [4]. Compliance monitoring can be improved using tools such as wireless drug manager, electronic packaging and digital drugs, which can be combined with smart wearable devices such as mobile phones to provide real-time health management [8].

(2) Creating a new prevention and treatment system for emerging infectious diseases. New diseases are appearing and their spread is accelerating. Therefore, the new disease prevention and control system in the future should be improved, and the "safe zone" of infectious diseases should be created. Computer models should be built with artificial intelligence technology to accurately predict the transmission trajectory and high-risk areas of infectious diseases, guiding the government's prevention and control of infectious diseases. To be beneficial for ordinary people, rapid and accurate gene detection technology should be developed for the diagnosis and treatment of diseases and customized vaccines and preparations should be developed at low cost in a timely manner. Biotechnology such as toxic genomics will be used to explore the relationship between toxicity of environmental hormones and environmental diseases [4].

(3) E-health and health management. The data collected by wearable devices can be analyzed in combination with relevant software to help users understand their health conditions in detail. Sensors will be used to remotely monitor the health conditions of patients for diagnosis, treatment, and nursing [9]. The government will establish interdisciplinary health centers and sets up digital special lines. Patients will analyze their test results first through automatic diagnosis systems, check symptoms on mobile phones and home monitoring devices, and then contact the health center. The high-performance network can support the implementation of different health tasks, such as the video conversations between patients and general medical practitioners and the tracking and controlling of their own health through digital personal assistants [10].

(4) Nursing disabled and elderly people. Because the elderly and the disabled have difficulty in moving, they cannot go to the toilet and have a bath independently. A series of automatic equipment will be designed for these people, such as the automatic sanitary equipment for the safe and regular bathing and the automatic tooth-cleaning equipment for oral health [8]. The automatic monitoring and treatment system can provide regular services such as measurement and simple routine treatment for the elderly with chronic diseases at home [10]. Through intelligent access control, hospital will immediately notify the medicine delivery and emergency personnel to provide on-the-spot help and rescue according to the corresponding situation. Intelligent entertainment and nursing robots or automatic devices can talk and play with the elderly, alleviate the feeling of loneliness, and assist nannies and nursing workers to engage in heavy physical nursing work and record various physiological data of nursing objects, providing reference for doctors to modify treatment plans [3].

5 Vision of future information acquisition and utilization

The information behaviors of people include information acquisition, retrieval, utilization, and diffusion. In the intelligent information environment, the information behaviors and social forms of people will change dramatically, as manifested in the increasingly rich contents, acquisition of knowledge and skills, and instant perception and interaction.

5.1 Trend, vision, and key technology groups

(1) Social development trend. A large number of devices will be connected with the Internet and generate massive data. In the era of interconnection of all things and pervasive computing, block chain technology will make the Internet more open and transparent. The development of S&T will break through the biological limits to improve the cognitive and analytical abilities of human beings, which will promote the updating of the content, ways, and forms of education. Learning is no longer necessary for survival, which will gradually blur the role boundaries between teachers and students and generalize the places of knowledge learning. Social media will continue to change people's access to information and obscure the bound between producers and consumers.

(2) Vision of future development. People can acquire and process information ubiquitously, seamlessly and intelligently, and use data to support agile and wise decisions. They can increase knowledge and improve skills in a relaxed and pleasant manner. Moreover, they can communicate and express their thoughts smoothly while protecting their privacy.

(3) Key technology groups. The key technology groups cover artificial intelligence and machine learning, sensors and control systems, natural language processing, human–machine interaction and brain–computer interface, block chain, and identity and reputation management.

5.2 Specific scenarios

(1) Information acquisition and processing of everything connected and pervasive computing. A large number of devices will be connected with the Internet, including mobile and wearable devices, household appliances, medical equipment, industrial detectors, surveillance cameras, auto-

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mobiles, and clothing. These devices generate and share massive data which possess high analysis and utilization value [3]. New sensors connect all objects and spaces through the network, with which people can acquire and process information at any time, in any place, and in any way. Through biological information and built-in chips, people can quickly check out when purchasing goods, and obtain customized information services. Real-time analysis of surrounding information can provide users with appropriate services, so that the pervasive computing can benefit people of a wider range [4].

(2) Information utilization and protection with the Internet of things and big data. The combination of the Internet of things, data analysis, and artificial intelligence will create a huge intelligent network for the globe, which will realize commercial transactions in the absence of excessive human intervention [5]. Insurance services will be redefined. Since the sensors can continuously track individual behaviors in detail, the insured will require personalized insurance services or negotiate the due insurance interest rate with the insurance company through self-assessment [9]. Privacy protection will become a new service and has a broad market. With the application of new technologies such as the Internet of things and big data, people will be more transparent in public and thus will pay more attention to privacy protection. People hope to have "offline" space, and make personal life and travel information away from sensors [5].

(3) Information diffusion and socializing with new technologies. Using 3D remote communication system and emotional communication robot, families who are thousands of miles away can interact and communicate with each other at any time. Moreover, each other can convey feelings more truly through the simulation of expressions and body movements during dialogue and the reproduction of five senses [3]. Social technologies enable people to shape personal micro-cultural circle. The network world based on technology will influence and even bring challenges to the traditional rights structure [5]. Enterprises can directly contact consumers through the new social channels, and consumers can use social platforms to break through marketing interference, which can make enterprises responsible for their products and behaviors.

(4) Knowledge learning in the context of extensive data utilization and enhancement of human functions. Relevant information will be transmitted to human senses through wearable devices. Contact lenses, permanently-implanted sensors and calculators will bring people hearing through walls, natural night vision, and the ability to be embedded in virtual and augmented reality systems. Intelligence-enhancing drugs will expand human cognitive ability and change the way of learning knowledge. Ubiquitous learning with virtual reality will become the normal state of school education. Every school is a part of virtual school, and the seamlessly integration of virtual school and physical school will enable people to learn at anytime and anywhere. An education system based on neurocognitive mechanism will be created. With this system, people can acquire new knowledge, learn and memory. Leveraging individual tendency and brain plasticity data, neurocomputer interface, and virtual and augmented reality elements, mixed intelligence will provide people with new teaching places and educational methods [6].

6 Vision of future safety

The future safety needs are not limited to personal and environmental security, but also include digital security and privacy security in ubiquitous network and artificial intelligence environments. The development of biotechnology leads to bio-safety threats while bringing convenience in all aspects. Only by realizing all-round safety in the future can people ensure their safety while enjoying the fun of life.

6.1 Trend, vision, and key technology groups

(1) Social development trend. In the future, the safe environment will be a game between the overall safety system and the communication system. Unmanned systems will be used to collect more information and perform substantive tasks, so as to ensure the security of physical systems. Artificial intelligence and automation technologies will be on trial in large quantities in the security domain to quickly obtain the pertinence and flexibility of supporting decision-making and actions, which will expose the security problems of people and society in the network environment.

(2) Vision of future development. The safety system will integrate people, machines and things to realize the social eco-safety with quick perception, response and reply.

(3) Key technology groups. The key technology groups involve new energy power action and control, firefighting and police robots, monitoring system, network security, aerospace, user authentication, and next-generation encryption.

6.2 Specific scenarios

(1) Monitoring and prevention of crime and terrorism. A video surveillance system is to be built for urban public security to service the fighting against crime, public security guard, social management, and people's livelihood. The activities of people in urban public areas will be recorded. The technologies related to identification and comparison, data storage, special extraction, and comprehensive analysis will be developed to track criminals and suspects in real time, improve the detection and prevention of crimes, and strengthen the deterrent effect, which will help achieve the goal of building a safe society.

(2) Network security protection. With the development of the technologies for information security and public opinion monitoring, security defects and hot issues will be actively searched and dealt with, such as phishing websites, identity recognition, malicious eavesdropping and secret-stealing,

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counterfeit hotspots, telecom fraud, network attacks, and ransomware. In this way, network illegal activities and terrorism can be prevented and the security of virtual space can be greatly improved.

(3) Biosecurity protection. The technologies for information monitoring, emergency prevention, and biosecurity will be developed to actively detect and timely respond to bio-invasion, emerging zoonotic infectious diseases, and outbreaks of epidemics. These technologies will help strengthen the research on the construction of detection and protection net as well as the design of response mechanism, protection tools, and recovery mechanism. Thus, we can deal with the social problems that may occur in large areas in the future.

References

1 Government Office for Science. Technology and Innovation Futures 2017. [2019-10-10]. https://assets.publishing.service.gov.uk/government/ uploads/system/uploads/attachment_data/file/584219/technology-innovation-futures-2017.pdf.

2 Hightech Forum. Fachforum Autonome Syestem Chancen und Risiken für Wirtschaft, Wissenschaft und Gesellschaft. [2019-10-10]. http://www.hightech-forum.de/fileadmin/PDF/autonome_systeme_abschlussbericht_kurzversion.pdf.

3 Ministry of Education, Culture, Sports, Science and Technology. 平成 28 年版科学技術白書「超スマート社会」の到来. [2019-09-05]. http://www.mext.go.jp/b_menu/hakusho/html/hpaa201601/detail/1371168.htm. (in Japanese).

4 한국과학기술평가원. 과학기술미래비전. [2019-07-17]. https://www.kistep.re.kr/c3/sub2_2.jsp?brdType=R&bbIdx=993.3 (in Korean)

5 Office of the Deuty Assistant Secretary of the Army (Research & Technology). Emerging Science and Technology Trends: 2016–2045. [2019-09-02]. https://community.apan.org/wg/tradoc-g2/mad-scientist/b/weblog/posts/emerging-science-andtechnology-trends-2016-2045.

6 Агентствостратегическихинициатив. ПланМероприятий (“дорожнаякарта”) “Нейронет”Национальнойтехнологическойинициативы. [2019-10-09]. http://nti2035.ru/markets/neuronet.

7 National Institute of Science and Technology Policy. 地域の特徴を生かした未来社会の姿～2035 年の「高齢社会×低炭素社会」. [2019-09-05]. http://doi.org/10.15108/stih.00079. (in Japanese).

8 National Science & Technology Council: Emerging Technologies To Support An Aging Population. [2019-10-11]. https://www.whitehouse.gov/wp-content/uploads/2019/03/Emerging-Tech-to-Support-Aging-2019.pdf.

9 Antton Achiary. Dominique Auverlot: Internet: Prospective 2030. [2019-09-06]. https://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/2013-06-27-internet2030-na02-v2_0.pdf.

10 Norwegian Board of Technology. Scenarios for the future of health and care in Norway 2030. [2019-09-02]. https://teknologiradet.no/wp-content/uploads/sites/105/2017/03/Scenarios_ENG.pdf.

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