Executive Summary

System and Information science and technology (SIST) is a fundamental general purpose technology. It affects various fields in science and technology by accelerating problem-solving and new industry creation in many ways. It improves social infrastructures such as energy and transportation, as well as social systems such as administrative and civil services. It also influences manufacturing, agriculture and service industries in terms of efficiency and high added value. Furthermore, it contributes greatly to the progress of science and technology disciplines in general; environment, energy, nanotechnology, material science, life science, clinical research, as well as social sciences.

In this panoramic view report, we took a birds-eye view picture of the research and development activities from the viewpoint of both the following three visions and three technology trends in the SIST field. Those visions are namely "advanced integration of the cyber and physical worlds", "data-driven and knowledge-intensive value creation", and "solving social issues and realizing a human-centric society", and the trends are "digitalization and connection of everything", "smartization and autonomization of everything", and "aligning with social needs and ensuring human autonomy.".
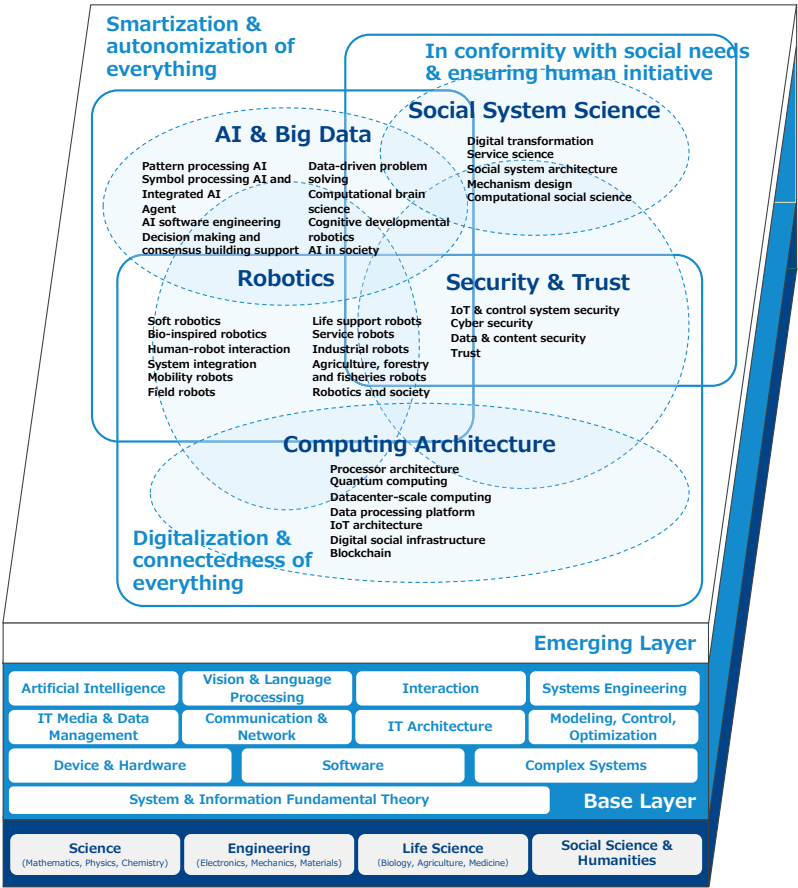

Figure   A panoramic view map of SIST.

We identified strategically important 36 R&D areas under the consideration of criteria such as "emerging technology", "social needs and vision", and "impact on society". As shown in Figure, after mapping these 36 R&D areas to the above-mentioned three technology trends, we categorized them into 5 divisions of "Artificial Intelligence and Big Data", "Robotics", "Social System Science", "Security and Trust", and "Computing Architecture".

A major update from "Panoramic View Report (2019)" is the reform of the strategic R&D areas (we increase the number of divisions from 4 to 5). In addition to the update of the static panoramic view map of each division, we also created a new map in the time series so that readers can understand historical backgrounds more easily and grasp technology trends more clearly.

The national R&D investment strategy with a persuasive scenario to maintain global competitiveness is needed, away from just following the global trend of R&D, given Japan's current social and economic situation and R&D efforts, and position in the global competition. In this report, we proposed four basic ideas of "strengthening the advantage of technology", "strengthening the advantage of internationally competitive industries", "solving social problems prior to the other countries", and "securing the fundamental technologies to support the social infrastructure". We chose 21 important themes that Japan should promote as a nation, based on those four ideas (see Table).

In planning R&D strategies in this field, it is necessary to understand not only technology trends but also interactions between society and SIST in various forms. In particular, we should always be aware of the relationship between technological progress and employment, the impact on the gap between rich and poor, ELSI (ethical, legal and social issues) in science and technology. In order to build a sustainable society with the appropriate development of SIST, various viewpoints from stakeholders are essential. This panoramic view report provides some of those viewpoints necessary for that based on a neutral survey and analysis.

Table 21 important theme based on 4 basic ideas.

Important theme（relevant section）	4 basic ideas of strategy*			
	Tech	Ind	Soc	In-fra
4th Generation AI（2.1.1、2.1.2、2.1.7、2.1.8）	○			
Trusted quality AI（2.1.4、2.1.5）		○		○
Coevolution of AI and human（2.1.9）	○		○	
AI architecture to support social systems（2.1.3、2.1.5、2.3.3、2.3.4、2.5.1、2.5.4）				○
AI and Science（2.1.6）	○			○
AI-robot fusion（2.1.8、2.2.3）	○	○		
Socially growing robots（2.2.11）		○	○	
Telepresence（2.2.3）		○	○	
Team robotics（2.2.2）	○	○		
Society digital-twin（2.3.2、2.3.3、2.3.5）			○	
Cognitive security（2.1.5、2.4.3）			○	○
Trust platform（2.3.4、2.4.4）				○
Society5.0 platform（2.3.1、2.5.6）			○	○
Blockchain（2.5.7）		○	○	
Data-center-scale computing（2.5.3）				○
Non-Von Neumann processor architecture（2.5.1）	○			
Quantum computing（2.5.2）		○		○
Realtime systems（2.5.5、2.5.6）		○		○
A platform for data distribution and sharing（2.3.3、2.5.4）				○
Mathematics and informatics	○			
New normal and DX			○	○

*Tech: "strengthening the advantage of technology", Ind: "strengthening the advantage of internationally competitive industries", Soc: "solving social problems prior to the other countries" and Infra: "securing the fundamental technologies to support the social infrastructure"