

The Future of CTC

IT has transformed our lives and will continue to change our future.
The CTC Group continues to look to the future and take on challenges.
We will continue to refine our technical capabilities, imagination,
and creativity as the driving force of our organization.

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Mirai

Exploring ways for creating business for “CTC of the future”

MIRAI Design Laboratory

The MIRAI Design Laboratory was established in April 2024, calling together a group of “explorers looking to the future” led by General Manager Naohiro Fujie. As the CTC Group takes on the challenge “Into Unprecedented Territories,” activities are underway for creating new markets with an eye to the future 20 to 30 years from now.

For expanding CTC’s future areas of business

To date, we have mainly been engaged in the business of providing solutions following requests from our customers. Business comes about when we receive inquiries, and both our company and other companies alike are focusing efforts on activities that will draw in more inquiries. Yet engaging in business solely with specific markets and customers ends up being competitive as everyone seeks a portion of the same pie in developed markets—in essence, this becomes a zero-sum game, where some companies end up profiting, and others end up losing, resulting in a net-zero situation overall. We need to focus on just how much we are able to increase the size of that pie in existing markets to achieve the company’s targeted growth curve—given that human resources make the core of business for Slers like our company, business will eventually reach a plateau as the shortage of engineers intensifies. A different approach needs to be devised in order to keep up with our objectives.

And this is why we have focused on the creation of future markets. We established the “MIRAI Design Laboratory” to not only analyze current markets, but to also consider how markets will grow in the future, and to search for ways of creating a business market for the “CTC of the future.” Other sections of the pie that make up the current market may emerge, and markets may also be created in sectors that could never have been imagined. Rather than competing with only existing technologies and services, we are exploring ways of expanding our areas of business from a future perspective, in order to research how we will be able to create new markets and identify potential.



Naohiro Fujie
CRO Group
General manager,
MIRAI Design Laboratory

From imagination and dialogue about 2050, to the future

How could we go about exploring ways of creating business for the “CTC of the future”? We have set “Future of Society” as one of our key policies. This focuses on how a single market will be created, and how existing markets will change. Rather than trying to see that future from where we are now, we are thinking of looking ahead 20 to 30 years and doing backcasting. We have therefore set 2050 as one of our goal-posts, and working on imagining what society would look like at that time, by conversing with experts with extensive insight and researchers with specialized knowledge in various fields.

I think that 2050, a quarter of a century from 2024, is now in the realm of science fiction and fantasy. Conventional methods of predicting the future are mainly centered on the Delphi technique, which aggregates the opinions of experts to predict the future, and is also based on advances in hardware. This method forecast how hardware had advanced since the Industrial Revolution and what types of businesses would emerge as a result. An example in recent times is the battery. Just like the significant improvements made to the performance of storage batteries and rechargeable batteries has enabled the flying of drones and operation of electric cars, the advances in hardware are easy to foresee, and manufacturers around the world are working on development with an eye to 10 to 15 years ahead.

On the other hand, while everyone is moving toward a pre-established harmony, we are also noticing signs of a different system evolving around the world today. That is where software comes in. Services are being created to change society in a world that has no relation with how hardware is evolving, such as online markets for private lodging and delivery services. Services such as accommodation and delivery services that were weakly connected with IT are creating a new future when combined with IT. When these factors are taken into consideration, accurate predictions of how circumstances will be in 2050 cannot be made, even when looking at hardware as a guide.

In contrast, trying to predict the future from advances in software is also likely to be difficult. At the MIRAI Design Laboratory, we believe it is crucial to freely imagine and enjoy the unpredictable future that will be coming in 2050, and approach the future that we all want to achieve—to this end, we are increasing the number of opportunities for engaging in dialogue about the future.



What we can do to create an empathetic and supportive society?

The MIRAI Design Laboratory has established a set of six values that serve as the key decision criteria for its activities. "Strong partnerships with universities and research institutions" is one of these. This is related to the priority policy of the MIRAI Design Laboratory, "joint research with academic institutions," and we are working to provide our recommendations to the government and industry. We are currently taking part in the "Inochi Forum" for Expo 2025 Osaka, Kansai, Japan, together with Osaka University and three economic organizations in the Kansai region. After presenting measures for achieving a society pledging "leave no one behind" and the role of science and technology, discussions are being held on the topic of an "empathetic and mutually assistant society" as a venue for discussing the goals humanity should be aiming for after achieving the SDGs (beyond 2031).

Set of six values



The social structure surrounding us is from the perspective of the "strong" side, in which those who are "strong" and capable of producing wealth and knowledge should create opportunities for the "weak" to participate in economic activities by helping those who are unable to do so. At the Inochi Forum, we talk about the fact that the society of the future will not be like this, but rather an empathetic and mutually assistant one. Those of us working in the IT industry are utilizing technology to support the development of a society where those who require help and those who can provide help empathize with each other, and assist each other from an equal footing.

The MIRAI Design Laboratory has only just started out, so specific initiatives are still being finalized, but the details of some of these initiatives are starting to become clear. When examining what avenues are available to IT companies for contributing to a mutually

assistant society, the potential of communication and commercial activities that go beyond physical limitations, like MR (mixed reality) and VR (virtual reality) can be explored. An example is if a virtual society exists wherein an avatar is able to work in place of oneself by utilizing the metaverse, people with physical handicaps will then be able to take part in economic activities. We will be taking on the challenge of visualizing a future never experienced before, by through various combinations of IT and a mutually assistant society.

Exploring future markets while taking on the challenge of resolving immediate problems

While development focusing on people and society is important, the planet and environment are equally important factors. It is not only people that Inochi resides in, but also the planet and communities. In light of this, we are actively involved in projects toward achieving a recycling-oriented society. In March 2024, we began "Supporting the livestock industry using KET catalysts*" in collaboration with LIFULL Agri Loop Co., Ltd., which is supporting the agriculture and livestock sector with the aim of achieving a recycling-oriented society (see image below).

We launched a demonstration project on Ishigaki Island, where KET catalyst is mixed in with cow manure to turn it efficiently into compost—this is then spread out on sugarcane fields. Doing so is anticipated to have the effect of boosting sugar levels and improving the growth of sugarcane. By using KET catalysts, the amount of nitrogen in the soil of fields that turns into water-soluble and easily leachable nitrate is reduced, thereby reducing the amount of nitrate runoff into the ocean, which is a major cause of coral death. Moreover, cattle raised in good environments like this can be then be viewed as branding, creating a cycle that has a positive impact on agriculture, the livestock industry, and the environment. We are cooperating in this project by taking measurements of emissions and analyzing data.

Another immediate challenge we are focusing on addressing is achieving a safe and secure digital society. The trust of data is indispensable for utilizing AI. With the recent rapid pace of developments in generative AI, the number of people falling victim to Internet spoofing and forgery is on the rise, making ensuring the identity of account holders and the authenticity of data a challenge. We have expertise in building ID infrastructure services, and have started the joint research project "Trust Knots" with Keio University in June 2024. If we are able to elucidate the mechanism by which trust is formed, and incorporate a framework for ensuring trust into existing IT systems, the market for online transactions and communications, as well as the current security market, will most likely change significantly. Just what type of business seeds will we be able to uncover next, as we take part in projects toward a



Digital SPHERE: Created by specified non-profit organization ELP (Earth Literacy Program)

recycling-oriented society and implement efforts for creating a secure digital society while looking ahead to the future? We view this as one of the efforts that will lead to this.

Considering the future together, and creating markets

The MIRAI Design Laboratory engages in discussions on the future of 2050 on a daily basis. Asking 100 people would come up with 100 different future, so the current stage is arranging the various scenarios of the future that a broad range of people have. I have a vision of the future that I would personally like to see become a reality, but of course that would not be the correct answer. There will also be some aspects of the future that everyone envisages that we can empathize with, and some that we cannot. Given that we can only envisage one part of the whole, we are seeking a broad range of opinions and create a vision for the future together. We have only just started holding discussions that will form the first step toward this objective.

While creating new markets is our goal, we are not seeking to monopolize those markets. We believe that forging friendly relations that transcend the boundaries of corporations and positions, thinking about the future together, creating markets, and competing fairly within those markets will help to resolve the entirety of social problems and create a prosperous future that "leaves no one behind."

Specific initiatives of the MIRAI Design Laboratory



Exhibit "Inochi Forum"

Project with Osaka University and others "Inochi Forum"

Through collaborative efforts involving various stakeholders from industry, government, academia, and civil society on a global scale, the Inochi Declaration will be issued at Expo 2025 Osaka, Kansai, Japan. With the view to achieving a "Society where all lives shine brilliantly," the project takes part in discussions for compiling the declaration that will serve as the agenda for achieving the SDGs by 2030, including what is important to achieve.



Nitrogen circulation project on Ishigaki Island "Supporting the livestock industry using KET catalysts"

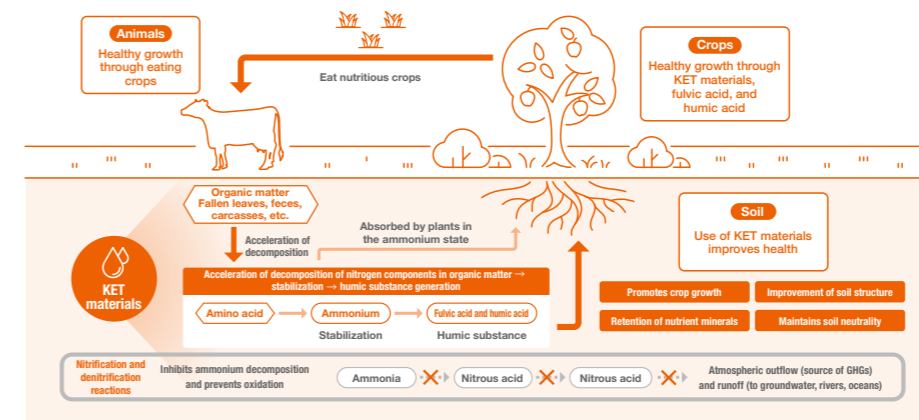
Leveraging our business tie-up with LIFULL Agri Loop, we are aiming to create a new business model and achieve a recycling-oriented society in the agriculture and livestock sector through verification of the effectiveness of "Poop Loop," a catalyst for conversion into fertilizer. To resolve issues in the agriculture and livestock industry, a demonstration project using the KET catalyst was started on Ishigaki Island.



Project with Keio University "Trust Knots"

We have embarked on joint research to improve trust in data distribution with the aim of developing a secure digital society. Research will be conducted on verifying the trust that individuals and corporations have when conducting online digital transactions, resulting in safety online services for users.

Supporting the livestock industry using KET catalysts*



Created by LIFULL Agri Loop Co., Ltd.

* A technology that accelerates and stabilizes the recycling of organic matters into inorganic matters through a physicochemical reaction using a special catalyst. Returning organic matter to the soil in a condition that is beneficial to plants and the environment makes it possible to rectify the material cycle that has become unbalanced due to the spread of industrial agricultural and food processing technologies, and thereby quickly grow healthy, nutritious crops.

Message from

CTO

Chief Technology Officer

Exploring technologies that lie a decade ahead



Eiji Haraguchi
Senior Managing Executive Officer
CTO, COO, CTO Group

Visualizing governance and guidelines for technical areas

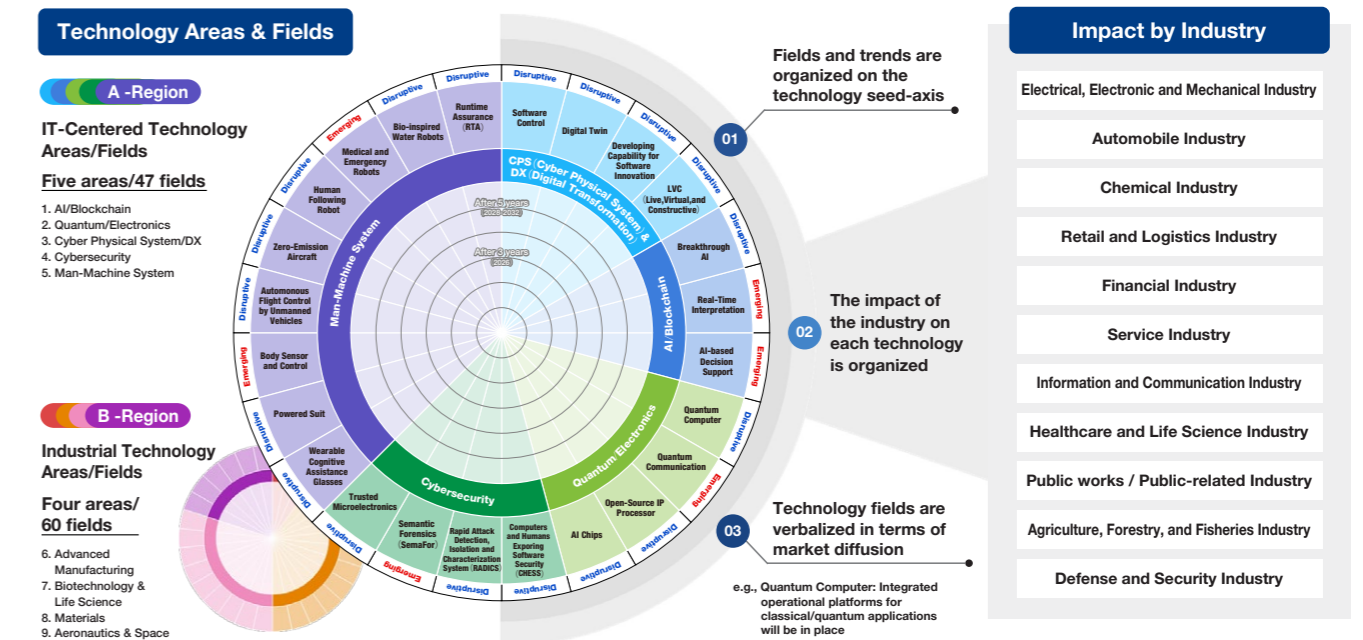
There are two major roles that I cover in my position as CTO. The first of these is exercising governance for the technical areas of the entire CTC Group, in my capacity overseeing the technical areas of the CTC Group. This includes “Project Management” to ensure that projects conducted by the CTC Group are done so in an appropriate and smooth manner. “Quality Management” related to maintenance and improvement of the quality expected by customers. And “Program Management” for integrating and managing multiple projects in a coordinated manner. Governance needs to be strengthened through these activities, and systems established as necessary. Other efforts also include reviewing the ethical principles for AI and guidelines for using advanced AI, promoting domestic and international partner strategies, and training engineers.

The second role is to cast our gaze five to ten years into the future and visualize and verbalize guidelines for technological development in the future. Advancements in technology throughout this industry have been progressing at a rapid pace, and we need to set out a unique roadmap for our group for taking on the challenges ahead, while keeping objectivity and completeness in mind as what changes may occur to the technological areas that our company is involved in. I believe that is essential to achieving sustainable growth and ultimately continuing to meet the expectations of society and the market.

Roadmap for future technologies “Future of Technologies”

Rather than the Medium-Term Management Plan every three years, what types of technological areas will society be demanding in five to ten years from now? Naturally, this will be impossible to predict with perfect accuracy, but CTC has visualized, for the first time, a potential future technology roadmap as it is conceivable at this point in time: “Future of Technologies” (hereafter, “FoT”). We have arranged a discussion map, or a guide, for promoting studies of “which technological fields to focus on,” as we are aiming to become a top group of Slers. To make objective and comprehensive decisions, this map is not limited to just Japan, but also focuses on which technological fields other countries around the world are investing in, like the technological areas that the U.S. government is investing as a national policy and has been compiled to

Future of Technologies Overview



provide a totally overview of the technological areas defined around the world.

FoT is categorized into five areas with IT as the core focus, and four industrial technology areas where IT is not the core focus, such as advanced manufacturing and biotechnology. In total, there are 107 technical fields available nine areas. To gain an understanding of which technological fields will impact which industries in the future, we have visualized the technological fields that will impact each of the 11 industrial areas, such as the “electrical, electronics, and machinery industry” and the “defense and security industry.”

However, one point to note when utilizing this roadmap is that it is not yet a completed works at this time. Given that the roadmap visualizes the correlation between current technologies and industries, it is crucial to ensure that it is repeatedly and continuously upgraded in short cycles while incorporating various findings and information on new technologies that are undergoing change and evolving over time.

“Quantum computers” and “diamond semiconductors” are key technological areas of focus

There are two examples of technological fields being focused on described in FoT. The first of these is quantum computers^{*1}. High-precision and high-speed computing infrastructure is essential for achieving a better social life. While the information-processing capacity of existing computers has grown exponentially, improvements to performance are approaching an upper limit. In areas such as weather, finance and new materials fields, there are countless problems that can only be resolved

with higher performance computers. Thus, there is demand for new hybrid, easy-to-use platform that combines existing computers and quantum computers. Given that we are unable to come up with high-precision solutions without a more thorough understanding of quantum circuits, or qubits, and creating a software environment, software improvements need to along with advances in hardware. In light of this, CTC is focusing on the development of a quantum computing platform (QAPP) equipped with software and libraries to facilitate utilization of quantum computers. Meanwhile, there is growing concern that the development of quantum computers will disrupt current encryption technologies, and this is leading to the development of a new security model—quantum cryptography—that anyone is able to use with confidence.

The other area of focus is diamond semiconductors^{*2}. Current semiconductor chips made of silicon have reached their limits in terms of high-power, high-frequency, high-radioactive, high-heat, and high-band gap capabilities. Diamond semiconductors are drawing attention as semiconductors that are capable of withstanding such environments and are anticipated to be implemented in various fields such as 6G communications, non-ground-based communications, nuclear reactor decommissioning, high-performance EVs, space industry, and communications infrastructure in areas affected by disasters.

While CTC does not produce quantum computers or diamond semiconductors itself, we believe it is our role to take on the challenge of acquiring knowledge from the research stage and developing IT systems and providing services that utilize next-generation

computers and semiconductors more effectively.

In closing, finding answers to the question of what types of technologies we will contribute to society in ten years from now is a challenge into unprecedented territories, and we hope to cultivate FoT as a light houses for approaching this challenge.

*1 A technology that utilizes characteristics of the “quantum” what makes up atoms and other matter to perform calculations at a level that cannot be achieved with conventional computers. This technology is anticipated to be used for genome analysis, financial engineering, and materials science.
*2 Compared to the current mainstream silicon Si-based semiconductors, efforts are being made into the practical applications and research of higher performance silicon carbide SiC, gallium nitride GaN, and germanium dioxide GeO₂ semiconductors. Diamond semiconductors are expected to achieve an even more significant improvement in performance.

