

Collaboration with Tsinghua University in China



Signing ceremony related to the establishment of the Tsinghua University - IHI Research Center

**Technology Planning
Department,
Technology & Intelligence
Integration**

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Conclusion of a comprehensive agreement for collaborative research and commissioned research

During the 1990s, China began undergoing rapid economic development. Tsinghua University, the top educational institute of science and technology in Beijing, was steadily increasing its influence as a driver of industrial development through its research, educational, and managerial capabilities, as well as its capital strength and its network of graduates in various fields. Meanwhile, IHI (known as Ishikawajima-Harima Heavy Industries at the time) was exploring potential collaboration with Tsinghua University for the purpose of advancing fundamental technologies through collaborative research, responding to the Chinese market, and conducting researcher exchanges.

Negotiations on the framework for collaborative research between Tsinghua University, IHI's Corporate Research & Development, and the Beijing Overseas Representative Office began in 1998. In January 1999, a comprehensive agreement on collaborative research was signed, and four collaborative research projects were started. The topics were

① vibrations of cylinders in fluid, ② water treatment technology, ③ coal combustion, and ④ char combustion. The goal of each of these projects was to solve technological problems from a basic science perspective.

Establishment of the Tsinghua University - IHI Research Center

Due to the steady progress made through the collaborative research, we agreed that it would be better to build and operate the research center within Tsinghua University in order to continuously conduct collaborative work. Consequently, the Tsinghua University - IHI Research Center was established in September 2001. Since then, workshops have been held twice a year, by alternately Tsinghua University and IHI, to engage in discussions on the topic of each project from the perspectives of both science and technology. This system helps foster a mutually beneficial relationship. For young researchers from IHI, visiting Tsinghua University provides a valuable opportunity to engage in scientific discussions, and for researchers from Tsinghua University, visiting IHI helps them gain a deeper understanding of the scientific and technological issues that

are connected to industrial products. Furthermore, in 2002, IHI launched a scholarship and endowment system to award scholarships to outstanding students who have participated in the project. Every year, IHI holds a scholarship award ceremony to honor the diligent work of students and to promote the project.

Collaborative research and commissioned research projects

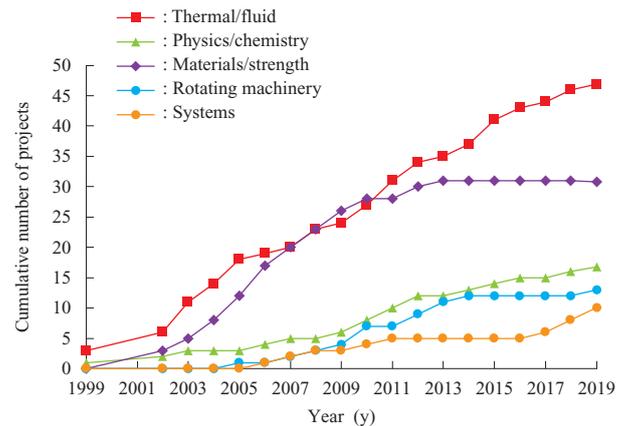
As of 2019, the number of collaborative research and commissioned research projects exceeded 120. The figure on the right indicates the transition of the cumulative number of projects for each technical field in the past 20 years. Initially, the projects focused on thermal, fluid, and structural technologies, which support IHI's products and businesses, in order to advance IHI's fundamental technologies. Since 2005, projects in the fields of rotating machinery and systems have been added. Currently, collaborative work is being conducted in a wide range of technical fields, such as biotechnology, concrete, processing, tribology, turbocharger, and robot control.

Initially, the departments at Tsinghua University that were participating in the projects were mainly the Department of Thermal Engineering, the Department of Engineering Mechanics, and the Department of Environmental Engineering. However, as a result of the advancement of the projects in a wide range of technical fields, more collaboration work was conducted with other departments, such as the School of Materials Science and Engineering, the Department of Hydraulic Engineering, and the Department of Computer Science and Technology. As for the researcher exchanges, four faculty members of Tsinghua University stayed at the Corporate Research & Development over the medium-to-long term to work on projects. We have made efforts to build better relationships through mutual understanding not only in science and technology, but also in cultural matters.

Illustrative successful cases of research projects through collaboration

The following covers two successful cases related to the advancement of fundamental technologies and the successful response to the Chinese market, which were set as goals of the collaboration with Tsinghua University.

A project related to turbocharger aerodynamics that started in 2008 has led to the advancement of fundamental technologies. This research focused on surging in centrifugal compressors for turbochargers, as well as on the turbulent flow and aerodynamic heating in compressor disk cavities rotating at high speeds. These research efforts yielded valuable results for IHI in terms of understanding fluid phenomena and discovering new design methods. The results showed potential for application not only in turbochargers, but also in many turbomachinery products. Furthermore, as a testament to the results of this advanced research, the paper published in IMechE (the Institution of Mechanical



Transition of the cumulative number of projects for each technical field

Engineers) was awarded the SAGE Best Paper Award in 2010, and had a significant impact on the industry.

A project with the Department of Environmental Engineering (State Key Laboratory), with which we started cooperation from the first collaborative research effort in 1999, is on the way to becoming commercialized in the Chinese market. The research related to water treatment helped advance solutions addressing water pollution in rivers, lakes, and marshes, which has become a serious problem in China. The most challenging and cutting-edge research was related to the decomposition of persistent substances in effluent. After laboratory-level basic research and actual scale pilot plant design, manufacturing, and testing, the Research Institute for Environmental Innovation (Suzhou), Tsinghua, which was established for the purpose of putting environmental technology into practical use, joined the research effort, with the aim of commercialization in the early 2020s.

20th year of collaboration

In 2011, a commemorative ceremony was held to celebrate the 10th anniversary of the research center. In 2018, Tsugio Mitsuoka, the then President of IHI, and Guo Yong, Deputy Chairman of the University Council, met at Tsinghua University to discuss the further strengthening of the collaboration. Then, in 2019, the 20th anniversary of the collaboration between Tsinghua University and IHI was celebrated.

At least two students participate in each collaborative research or commissioned research project. A total of more than 200 students have engaged in discussions with IHI from both scientific and technological perspectives. These projects have not only yielded many successful results, but also helped foster outstanding students through mutual learning to succeed in China and the world.

In China, various industries including the mobility business are evolving at an accelerating pace, and are driving global changes. In order to respond to these changes, the IHI Group aims to pursue an ambitious vision by building on its collaboration with Tsinghua University, as well as through the extensive network of researchers.