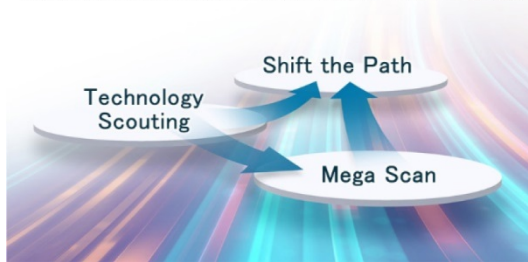


The Business Direction of MHI Group through “MHI FUTURE STREAM”

Promotion of **MHI FUTURE STREAM**
Creative expansion of added value and entering into new business domains



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Mitsubishi Heavy Industries, Ltd. (MHI) Group has been contributing to the society and people through the provision of machine systems, and is determined to play this role in the future by expanding its capabilities to capture rapid changes in the social agenda, people’s values, and technological innovations, which are essential for sustainable growth.

MHI FUTURE STREAM is an activity for setting MHI Group’s business direction according to several possible scenarios that are formulated based on the big picture of a medium- to long-term changes in the political, economic, social and technological situations surrounding our business. This report mainly focuses on social agenda issues such as decarbonization and describes our challenges to realize speedy social implementation.

1. Introduction

In recent years, complicated social issues, the diversification of people’s values, technological innovations such as digitization and biotechnology and, moreover, changes in people’s behavior due to the COVID-19 pandemic, have been piled on top of each other. This causes the business environment surrounding MHI Group to change uncertainly and discontinuously.

To continue to contribute and provide value to all the stakeholders under such circumstances, we need to draw a picture of the future society we are aiming for, reaffirm the role we should play and continue to make changes theretoward.

MHI FUTURE STREAM is an activity to discover the direction in which our group’s business should travel through the aforementioned approach.

2. MHI’s role in society and MHI FUTURE STREAM projects

Since its foundation in 1884, MHI Group has expanded its business together with Japan’s advancing modernization. Many of our current businesses originally started as providers of machine systems that are fundamental to social infrastructure, against the backdrop of post-war reconstruction.

In developing these businesses, we assimilated the latest technologies from outside the company and accumulated our expertise through co-creation. The history of our company is indeed based on the co-creation and implementation in society with our aspirations for making a social contribution.

Our recently-renewed mission is to “address solutions to the changing social agenda issues and realize better lives, by integrating cutting-edge technologies into our expertise built up over many years”⁽¹⁾. This is actually the very spirit we have held with perseverance and, therefore, a reaffirmation of our determination to continue to do so.

The goal of the MHI FUTURE STREAM approach is to plan and implement in society the products/services that can contribute to social progress, by understanding the correlation between social agenda issues from a broad, comprehensive perspective. This has to be done against a background in which the social agenda is becoming increasingly complicated and intense, while

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technological innovation is taking place with unprecedented speed. The goal is, therefore, nothing less than the fulfilment of MHI Group’s mission for the future.

The approach of MHI FUTURE STREAM involves the following three steps: “Mega Scan,” “Shift the Path” and “Technology Scouting” (Figure 1).

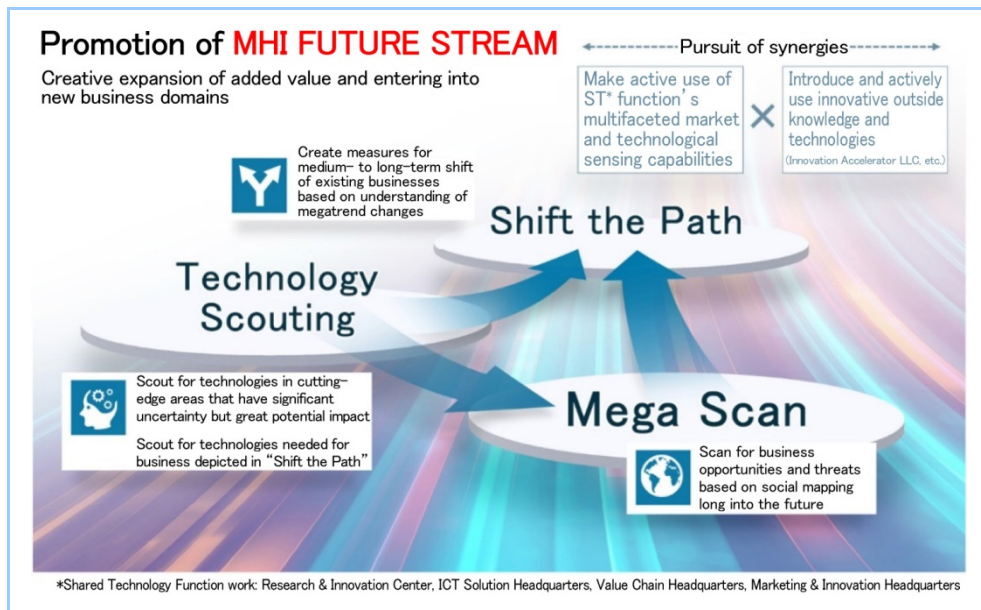


Figure 1 Three approaches of MHI FUTURE STREAM

In “Mega Scan,” each change in society is not regarded as a single, independent phenomenon. Instead, the overall picture of individual changes is taken into consideration to gain insight.

“Shift the Path” generates innovation hypotheses of market and technologies based on the insights and perspectives from “Mega Scan,” and “explores” the business opportunities found from the hypotheses. “Shift the Path” deals with subjects that are difficult to find and deepen under the current business functions, such as new businesses unrelated to the existing businesses or business opportunities crossing multiple domains, in addition to developing business adjacent to the existing business. Led by MHI’s Shared Technology Function and also together with external partners such as startups, the agile business development team conducts prototyping and trials to verify the business hypotheses, and hands the results over to the “deepening” process (Figure 2).

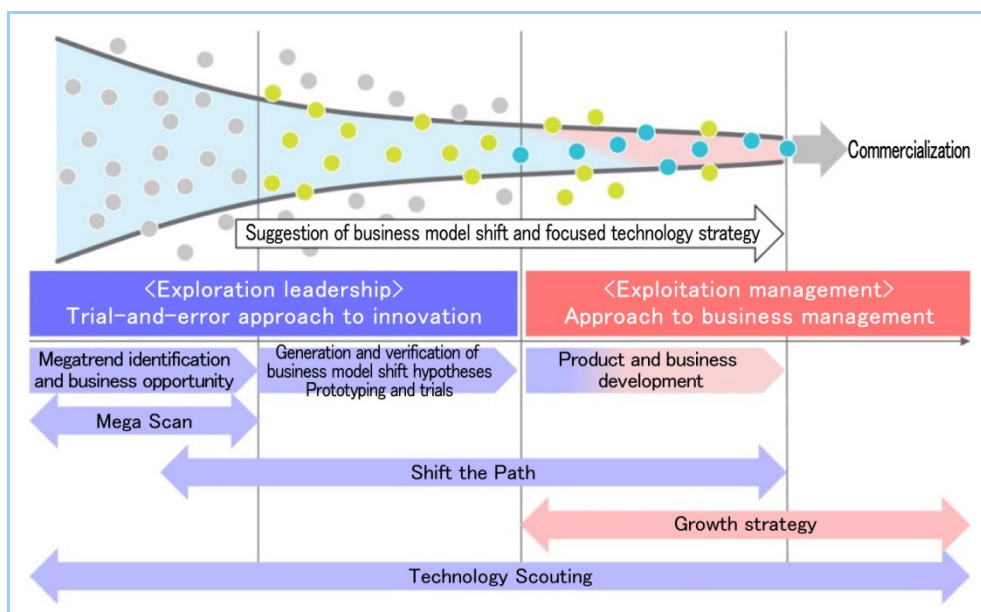


Figure 2 Development of growth strategy from business model shift/new business conception initiated by MHI FUTURE STREAM (Blue: led by Shared Technology Function, Red: led by Business Function)

“Technology Scouting” has two key concepts. One is finding disruptive technology seeds that may have a significant impact on the medium- to long-term insight/vision obtained in “Mega Scan.” The other is to find technologies needed to realize the innovation hypotheses generated through “Shift the Path”. MHI grows these technologies together with external partners.

3. Medium- to long-term changes in society and provision of value as a machine manufacturer

The world is in the middle of a great transformation. The magnitude of changes in society is unprecedentedly large, because multiple changes are occurring simultaneously in a variety of fields such as economic activities and international affairs.

MHI classified these changes in society based on the perspectives of global capitalism and technological advancement (**Figure 3**).

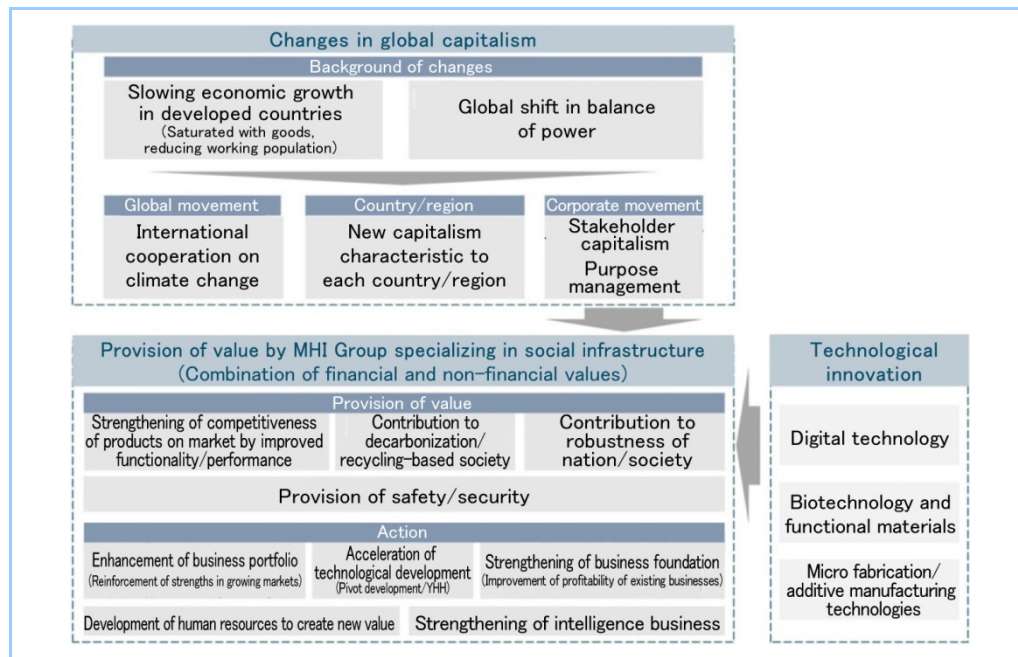


Figure 3 Medium- to long-term changes in society and provision of value as MHI Group

3.1 Changes in global capitalism

In the conventional society of global capitalism, corporate activities were optimized under the banner of economic efficiency and reasonableness along with the flow of goods and services. In recent years, however, the stance of companies (i.e., the corporate purpose) has come into question, that is, what will be achieved through corporate activities. The two factors are primarily considered to underlie this new trend.

(a) Underlying factors for bringing about changes in global capitalism

The first factor is sluggish economic growth in developed countries. According to the United Nations, the working-age population has started decreasing in not only Japan but also in other developed countries, except for the U.S. This falling trend in the working-age population is directly connected to the slowing of economic growth. When considering manufacturing, every corner of the world—including developing countries—is now saturated with goods. Coupled with widely-introduced digitalization, the commodification of manufacturing has accelerated, replacing the main players in this field with manufacturers from emerging countries that have cheap labor as a competitive advantage.

Under such stagnant economic growth, the middle class workers who have worked in the manufacturing industry are decreasing and the polarization of society between rich and poor is taking place. This polarization has become a cause of social instability including the radicalization of people’s opinions. Many countries have recently started discussing a policy for the protection of the manufacturing industry.

The second factor is the global shift in the balance of power. Having emerged as the world’s factory since the 1990s, China now boasts the world’s second largest GDP, further

increasing its presence. However, the COVID-19 pandemic has exposed the vulnerabilities of such a centralized supply network, which is still fresh in our minds. When looking into the movement of decarbonization, for example, China also has a 70% global share of solar panel production, and the production of mineral resources such as rare earth elements is also concentrated in China.

(b) Solving social agenda issues and facilitating economic growth

In contrast, momentum is increasing toward international cooperation to solve social agenda issues such as climate change. At COP26, more than 150 countries pledged carbon neutrality with a deadline year. The countries accounting, as a whole, for about 90% of the world's CO₂ emissions have set themselves on the path to decarbonization.

With common global goals, the formulation of relevant rules is underway mainly among the developed countries in Europe. The ideas behind this include enabling the realization of sustainability and economic activities to be compatible with each other, leading to the creation of new opportunities for economic growth.

On the other hand, the situation that each country or region faces differs in terms of available resources, energy/social infrastructure, economic growth status, industrial structure and energy security. Therefore, economically reasonable means for decarbonization and priorities vary by country or region. Being deeply linked to the attributes of each country such as possessed resources and industrial structure, it is necessary for individual countries including Japan to decide what path is suitable to take for bringing growth.

3.2 Technological innovation and advancement of machine systems

Another major factor spurring change in society is technological advancement such as digitalization. The previous report described the evolution of intelligence to be the direction of machine system sophistication, as digital, communications and control technologies further advanced⁽²⁾. To MHI Group, the intelligence of a machine system does not simply mean the system's autonomy and automation, but denotes a machine system and related services that can collaborate with people using business and operational intelligence. With this evolution of machine system intelligence, the following are expected to happen: (1) machine autonomy will transfer some functions from humans to machines and lead to collaboration between humans and machines, (2) the system will be designed based on unattended operation or as a group of machines with segmented functions and (3) some of the human/organic functions will be integrated with those of machines and human capabilities will be enhanced.

3.3 Provision of value as MHI Group

So far, we have described (1) the balancing of economic growth and solving social agenda issues and (2) the advancement of machine systems through digitalization. In particular, the manufacturers of machine systems for social infrastructure like our group are expected, more than ever, to provide value that also encompasses the aspect of non-financial value such as a contribution to decarbonization or the creation of a recycling-based society and national/social robustness through evolved machine systems with intelligence, while also pursuing financial value such as the enhancement of the competitiveness or profitability of the products on the market by improving their functionality/performance. Now let us return to the mission stated at the beginning of this report; we are a company that "address solutions to the changing social agenda issues and realize better lives, by integrating cutting-edge technologies into our expertise built up over many years". That is, we consider social agenda issues from a medium- to long-term perspective through Mega Scan, assimilate the latest technologies and findings through Technology Scouting and picture a new business through Shift the Path. Our challenge of MHI FUTURE STREAM will become more important to expand our corporate value.

4. Prospect of change in social needs and provision of new value

Being faced by various issues, both the world and Japan are in need of reformation. We are taking on various challenges by leveraging our technologies to facilitate reformation and contribute to progress in society.

4.1 Challenges of energy transition toward realization of a decarbonized society

At COP26, the countries pledged net zero CO₂ emissions by the middle of this century and a

framework for international trading of emissions was agreed upon. Investment in infrastructure for decarbonization are expected to increase in the coming years. In particular, the commencement of decarbonization businesses and credit trading between developed countries—which have difficulty in achieving the goal by themselves because of the costs incurred in switching from currently operating infrastructure—and developing countries, which are in need of investment to improve domestic infrastructure against the backdrop of economic development, will become active.

In the midst of this movement toward decarbonization, each company also needs to make efforts to help themselves. In order to bring about decarbonization based on a long-term point of view from 2030 to 2050, our role in the process will become increasingly important, because of our capability of designing whole systems by comprehensively handling heat, energy, etc.

In addition to the development of hydrogen-fired gas turbines as an energy component on the supply side, we hold the world's top share of CO₂ capture technologies. Moreover, projects on the demand side for the use of decarbonized energy are also being undertaken.

Examples include a small data center equipped with a liquid immersion cooling system in which the server is cooled using a liquid. Against the backdrop of the expansion/acceleration of digitalization, the development of technology for controlling power consumption and reducing environmental load is in progress.

When it comes to CO₂ reduction efforts, the measurement and verification of their effects are required. Our group is working on the visualization of CO₂ distribution using digital technology in the form of CONNEX. This makes it possible to provide society and customers with our equipment with the new added value of contributing to decarbonization, in addition to the existing value of functionality.

4.2 Challenges toward a recycling-based society

With increasing awareness of climate change, efforts toward the decarbonization of society have become a pressing global agenda item. However, that does not simply mean the reduction of greenhouse gases such as CO₂. Multiple problems involving other concerns such as the finite resources of the earth and biodiversity have to be tackled at the same time. Under such circumstances, the movements in the fields of resources and economy are expected to be directed toward decentralization or local production for local consumption.

Having many relevant products, businesses and technologies that can contribute to recycling-based economy, MHI Group is proceeding with the prototyping and verification of recycling-based businesses, mainly conducted by the Shared Technology Function.

Although the 3R (Reduce, Reuse and Recycle) concept has been considered important, it is not always fully implemented in society because of the lack of sufficient economic efficiency in terms of recovery/recycling costs in the venous industry. These days, however, more consumers are making purchase decisions on the grounds of human rights or impact on natural resources, etc., without being limited by the conventional preconceptions of the values of functionality and economic reasonableness. The key lies in noticing such changes on the demand side, adding new value—however small—and leading it to recognition by end-users; that is to say, the development of businesses with an emphasis on speed.

5. Demonstrate value creation and social implementation through small-scale and swift approach and co-creation – Yokohama Hardtech Hub and FUTURE STREAM CONNECT –

5.1 Evolution of Yokohama Hardtech Hub: a place for taking on the challenge of the small-scale and swift business creation

To bring business ideas into implementation through a small-scale and swift approach and solve social agenda issues, it is important to verify product/business hypotheses by conducting prototyping/trials within a short period of time. Yokohama Hardtech Hub (YHH), which was established in Honmoku, Yokohama city in 2020, serves as a place for organically connecting people and technologies in various fields and is strengthening its network every day, as previously reported⁽³⁾.

From this year, in addition to such connections with startups other innovation players, YHH has also started functioning as a place to accelerate our own or joint business projects, from PoC* to

implementation in society. The wide-ranging demonstration of cutting-edge technologies and ideas such as the aforementioned small data center with a liquid immersion system and intelligent logistics systems, all of which were formulated through co-creation, are underway (Figure 4). (*PoC: Proof of Concept)

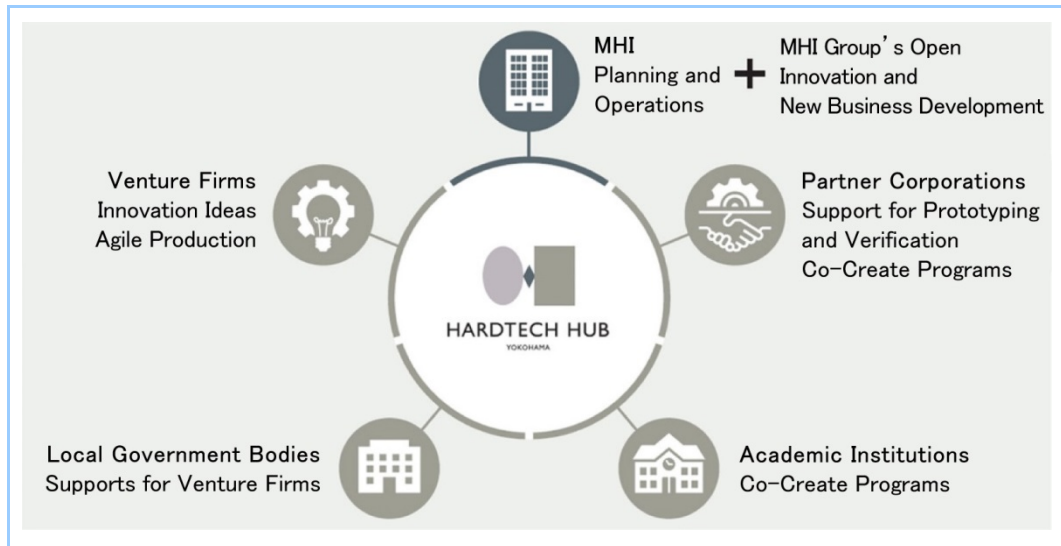


Figure 4 Conceptual image of co-creation platform that Yokohama Hardtech Hub aims for

5.2 FUTURE STREAM CONNECT to accelerate implementation in society by interconnecting “individuals” with advanced ideas

In creating value for future society, it is important to cultivate a corporate culture in which any small perceptions or inspirations felt in the field—where we are always engaged in dialogue with customers—are noticed and tried without delay on a small scale. While YHH helps to cultivate such a culture through dialogue and collaboration with outside innovators, we have further launched “FUTURE STREAM CONNECT” this year to build a network of individuals with advanced ideas.

FUTURE STREAM CONNECT enables: (1) the formulation of Mega Scan’s perspectives and the mission of MHI Group, (2) the sharing of prior examples related to “small-scale and swift business development,” (3) the sharing of the knowledge required to understand and overcome each other’s challenges through discussions about concrete actions necessary to advance ideas to the stage of execution and accelerate commercialization and (4) the building of a network beyond the boundaries of organizations (Figure 5).

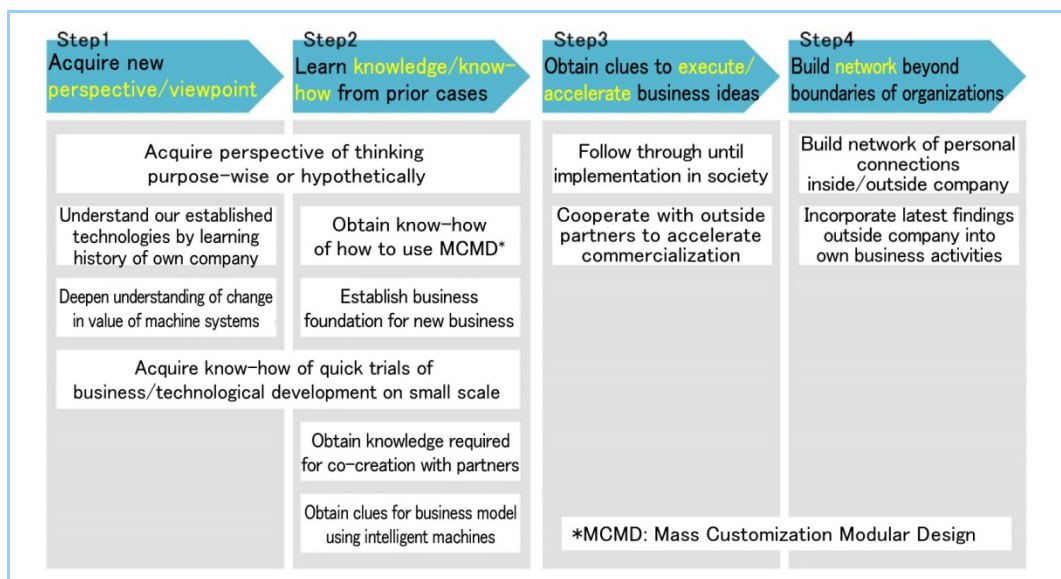


Figure 5 Key issues in “Future Stream Connect” of networking ideas from individuals to lead to implementation

6. Conclusion

This report focuses on the framework of MHI FUTURE STREAM with a medium- to long-term perspective to create value for future society, the challenges we have taken on under the banner of decarbonization and the formation of a recycling-based society, as well as the creation of a place to build a network of individuals with ideas and conduct swift trials on a small scale.

To confront the uncertainties of the business environment surrounding MHI Group and contribute to the sustainable growth of society in harmony with nature, the projects of MHI FUTURE STREAM are of increasing importance. We will always keep changing through co-creation and exploration by making use of wide-ranging networks inside/outside our group, without being constrained within current business domains.

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