

Mitsubishi Heavy Industries' Challenge: Strategies and Practices for Sustainable Value Creation

MHI FUTURE STREAM

Find direction for MHI Group by looking over business environment changes from medium- to long-term perspective



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MHI FUTURE STREAM is an activity for promoting the transformation of Mitsubishi Heavy Industries Group by setting its business direction based on the medium- to long-term changes in the political, economic, social and technological situations surrounding the Group. This report describes megatrends whose changes have been materialized and accelerated by recent international situations and technological innovations, and describes the challenges of MHI Group based on these megatrends.

1. Introduction

In recent years, the rapid development and wide application of AI technologies are causing critical changes in society. Happening on the other side of such technological advancement are the deepening global divisions and the recurring regional conflicts. They have once again exposed the vulnerabilities of our economic security and energy/food supply networks; every country has plunged into a rush to enhance their resilience. In addition, realistic energy transitions that are economically viable are becoming increasingly important. As such, a series of major movements that can determine the course of our society are simultaneously occurring in an interconnected manner.

For Mitsubishi Heavy Industries, Ltd. (hereinafter referred to as MHI) Group to continue to contribute and provide value to all the stakeholders even in this rapidly changing world, it is important to (1) continuing to catch the big trends in the world, and (2) envision a future society based on these major trends and set the business direction. Since 2018, MHI FUTURE STREAM has been practiced as an activity to promote constant business transformation.

MHI FUTURE STREAM involves the following three actions: "MEGA SCAN," "SHIFT THE PATH" and "TECHNOLOGY SCOUTING" (**Figure 1**).

In "MEGA SCAN," the scenarios of likely changes are formulated considering wide-ranging possibilities in markets and technologies from a broad, comprehensive perspective of megatrends in the political, economic, social and technological situations surrounding MHI Group, before potential business opportunities are conceived. In this activity, numerous dialogues are held with experts and innovators both inside and outside the Group, and insight into the future and vision are created from multiple perspectives on markets and technologies. "MEGA SCAN" thus enables MHI Group to gain insight into changes not by considering them as a set of individual phenomena but by capturing the overview of changes as a flow.

"SHIFT THE PATH" generates innovation hypotheses for markets and technologies based on the insight/vision from "MEGA SCAN," and explores the business opportunities found therein. "SHIFT THE PATH" deals with themes that are difficult to sprout and nurture in current business divisions, such as new value creation by connecting our existing businesses and new businesses that are not related to the existing businesses. Led by the agile business development team in cooperation with external partners such as startups, prototyping and trials for verification are conducted.

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"TECHNOLOGY SCOUTING" has two key concepts. One is to find disruptive technology seeds that may have a significant impact on the medium- to long-term insight/vision obtained by "MEGA SCAN." The other is to co-create, with external partners, technologies that are needed to realize the innovation hypotheses generated through "SHIFT THE PATH."

As part of the MHI FUTURE STREAM activity, the impact of megatrends on MHI Group was reassessed recently. Based on the results, this report presents the medium- to long-term changes that MHI Group should be aware of and the challenges to be undertaken for the continuous provision of value to society.

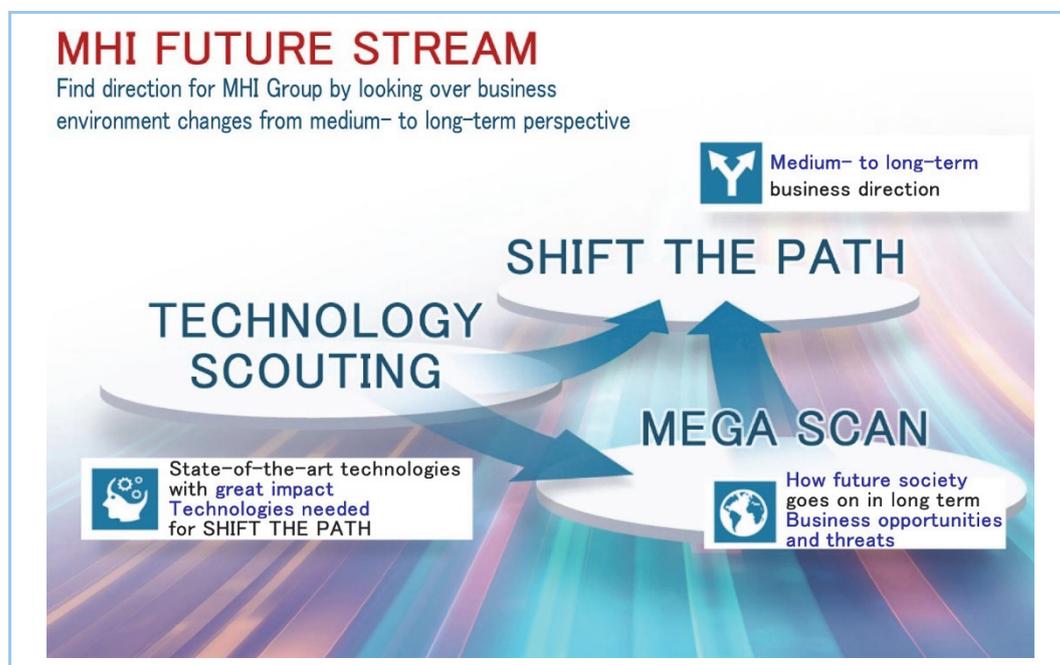


Figure 1 Three actions of MHI FUTURE STREAM

2. Megatrends producing clear, strong impact

In MEGA SCAN, if a change is expected to continue in a certain direction in the medium to long run under the given business circumstances, it is identified as a megatrend. The issues and challenges needed to cope with to keep MHI Group relevant are then extracted. With regard to some of the megatrends shown in 2023,⁽¹⁾ their impact is taking a clear form, as the expected changes have become apparent and gained momentum from various daily events. Focusing on the factors behind these accelerated megatrends enables MHI Group to understand which issues should be dealt with.

The megatrends whose changes have been realized and accelerated in recent years and whose impacts have been strongly manifested are shown below.

As a major political and economic development, disruption in the international order is evident. Against a backdrop of ongoing tensions between China and the United States, China's GDP growth has slowed; however, its high degree of self-sufficiency in resources such as rare earths and the emergence of globally competitive companies and products in industries such as electric vehicles, renewable energy equipment, robotics, and AI have enhanced its economic autonomy. The United States, meanwhile, is showing reduced leadership in the international arena, reflected in measures such as restrained funding for international organizations amid domestic pressures including a shrinking middle class. With mechanisms for deterring conflict proving insufficiently effective, the conflicts between Ukraine and Russia and between Israel and Hamas have continued for extended periods, contributing to increased interest among states in strengthening their defense capabilities.

Such disruption of the international order has also affected trade between countries. Instead of continuing to be an advocate of free trade, the United States opted for protectionism, taking measures such as the imposition of higher tariffs to protect its own industries. China countered with the announcement of rare-earth export restrictions. The global economy is fragmenting. While the

United States-China rivalry can be a constrain on business activities, some companies in the United States and Europe are pursuing the China+1 strategy. The importance of Global South is also increasing from both standpoints of market and production base.

Moreover, the unstable world order has led each country to spend more on defense, increasing financial burden. One of the consequences that the developed countries should cope with is an issue of maintenance/repair of aging infrastructure within a limited budget. The noticeably increasing frequency/severity of natural disasters worldwide also necessitate risk management.

The observed economic/technological trends include the expansion of generative AI applications in industries. In the manufacturing value chain, the range of processes that can be automated is expanding (e.g., product design). Especially in the field of materials development, the advancement in generative AI technology is very likely to enable materials to be designed reversely from the desired functionality. Also in development are working robots that can operate continuously over a long period; such working would be difficult for humans.

Meanwhile, the growing use of AI technology is leading to more data centers being constructed that serve as the infrastructure that supports society. It is necessary to conserve resources consumed at data centers such as electricity and water. This makes the challenge to conserve energy more important than ever.

3. Issues that MHI Group should address in line with megatrends

In MHI Group, the megatrends are combined with each other and, with the addition of MHI Group's interpretations, are reorganized into "undercurrents." These undercurrents are regarded as the issues to be tackled by MHI Group to continue to contribute to society in a sustainable manner. Following the recent events such as escalating United States-China rivalry and rapid advancement of AI, the undercurrents also show some changes in terms of the impact on MHI Group and the degree of urgency. According to the reassessment results based on these changes, the undercurrents that have a particularly elevated impact are as **Figure 2**.

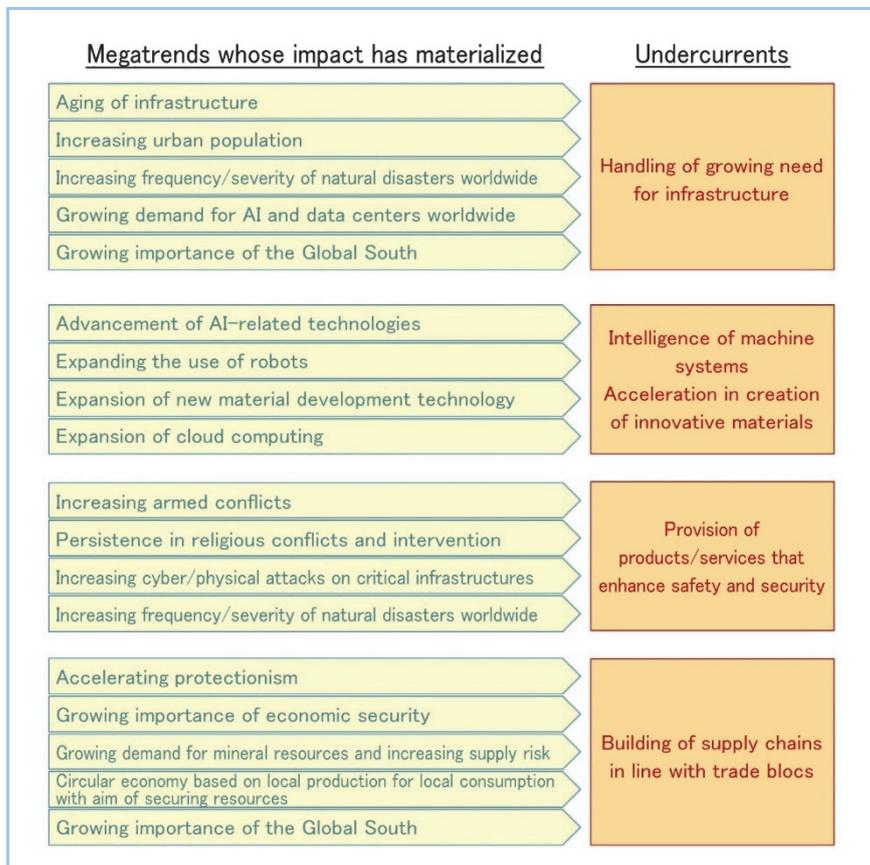


Figure 2 Undercurrents that have particularly increased their impact on MHI group

3.1 Handling of growing need for infrastructure

In emerging countries, the population is concentrated in convenient urban areas with economic development, and the improvement of infrastructure to support life and industry is required. On the other hand, in advanced countries, the aging of infrastructure requires longer life and renewal. In addition, the global demand for AI and data centers increases, and the demand for infrastructure such as electric power, cooling and communication expands.

3.2 Intelligence of machine systems

Against the background of improved accuracy of sensors, enhanced computing capabilities, and the progress in AI-related technologies, automation and autonomy without human intervention are moving forward in factories and on-site. In addition, it is difficult to solve newly manifested social issues such as manpower saving and decarbonization by a single machine, and it is required to optimally cooperate various machine groups by integrated control.

3.3 Accelerated creation of innovative materials

The development of materials informatics through advances in AI and the introduction of robots into research work have expanded the range of materials development that can be automated. The difficulty of materials development is increasing to meet diversifying industrial needs. Against this background, material manufacturers are accelerating the reduction and shortening of development costs.

3.4 Provision of products/services that enhance safety and security

Geopolitical risks and contingency risks are rising due to intensifying conflicts between countries (US/China, Russia/Ukraine, Middle East). Against this background, it is necessary to strengthen resilience and introduce countermeasures against cyber and physical attacks on critical infrastructure of countries and companies. In addition, as human damage and economic damage are increasing due to the increase and intensification of natural disasters worldwide, there is a growing need to improve resilience and cope with risks of corporate activities against natural disasters, and related businesses such as infrastructure resilience will advance.

3.5 Building of supply chains in line with trade blocs

Protectionist economic policies, such as the strengthening of tariffs and import regulations to protect domestic industries, are strengthening again worldwide. Companies are required to build supply chains and introduce risk diversification measures that take economic security into consideration.

4. MHI Group's challenges to resolve issues

For MHI Group to contribute to society in a sustainable manner and continue to provide value to stakeholders, it is necessary to resolve the issues described in section 3. Presented below are some examples of the challenges to be undertaken for this purpose.

4.1 Handling of growing need for infrastructure

In the context of "3.1 Handling of growing need for infrastructure," MHI Group can provide the data centers as a social infrastructure facility with the following: on-site power supply enabling stable operation while meeting decarbonization needs, advanced cooling systems for high-output, high-temperature GPUs/CPU's, and their optimal operation⁽²⁾. A smart patrol inspection system developed for industrial plant/factory facilities is also available in the product portfolio of MHI Group⁽³⁾. These technologies are utilized to extend the life of aging infrastructures inside/outside Japan.

4.2 Intelligence of machine systems

The possible proposals related to "3.2 Intelligence of machine systems" include interconnecting MHI Group's products with each other to reduce operating costs through optimal control of multiple devices, whose effects will go beyond simple data linkage.

4.3 Accelerated creation of innovative materials

In relation to "3.3 Accelerated creation of innovative materials," the adoption of materials informatics for structural metal materials has enabled the establishment of a technology that can promptly predict material strength characteristics. The outcomes include the technological advancement of life assessment of power plant parts, improving the facility availability rate and reducing maintenance costs⁽⁴⁾. As indicated by a large number of testing equipment products and

technical platforms, including the Adverse Weather Automated-driving Research Environment⁽⁵⁾, MHI Group can help customers with their materials development in terms of performance assessment.

4.4 Provision of products/services that enhance safety and security

When it comes to "3.4 Provision of products/services that enhance safety and security," MHI Group offers technologies to hedge against risks from both human and natural factors. Typifying the former, cybersecurity technology was developed from extensive experience in engineering control systems for critical infrastructures (e.g., defense facilities) and plants⁽⁶⁾. The latter technologies include disaster prevention simulation/experiment techniques backed by years of experience in assessing the impact of disasters on power generation plants, chemical plants, bridges and wind farms⁽⁷⁾. These technologies are utilized to improve the resilience of domestic/overseas infrastructures against various risks, thereby helping society and companies with their safe, secure and sustainable activities

4.5 Building of supply chains in line with trade blocs

For "3.5 Building of supply chains in line with trade blocs," MHI Group focuses on providing against economic security risks for materials or commodities that are procured only from specific countries or companies. Specifically, the measures include (1) securing of alternative suppliers and diversified sourcing in the event of an emergency, (2) evaluation of alternative items in advance, and (3) design preparation for the use of alternative materials or parts.

5. Conclusion

This report structurally captured important changes surrounding MHI group as megatrends in the business environment accompanied by rapid changes in the environment. Then, it describes the activities of MEGA SCAN to find the direction of our business and the issues that MHI group should address in order to solve problems based on megatrends and increase the value provided.

Amid the uncertain business environment surrounding MHI group, it is important to continue working on MHI FUTURE STREAM in order to contribute to the sustainable growth of society. Through MEGA SCAN, MHI group will take on the challenge of solving customer issues and increasing the value provided by MHI group while grasping the broad trends in society.

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