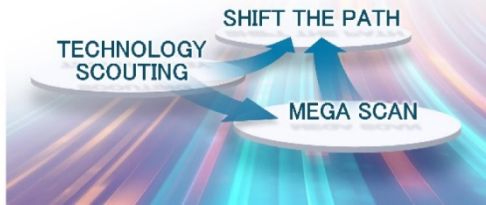


Megatrends Identified by “MHI FUTURE STREAM” and Our Group's Initiatives for Sustainable Social Contribution

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 setting Mitsubishi Heavy Industries, Ltd. (MHI) Group’s business direction according to the megatrends in the surrounding political, economic, social and technological situations, and accelerating our business transformation. This report reviews major trends around the world surrounding our group, based on the critical changes happening dizzyingly in the world such as international situation of regional conflicts and technological innovations, and presents our initiatives in line with the megatrends.

1. Updating of megatrends in MHI FUTURE STREAM

In recent years, key developments that could affect future society are simultaneously happening in an interrelated manner. Such developments include global environment conservation such as climate change, undertakings for sustainable growth of society with the awareness that natural resources for use are in finite amounts, advancement of materials and digital technologies, geopolitical trends, and reconstruction of supply chains based on these trends.

Having been introduced in 2018, MHI FUTURE STREAM is an activity for setting up a beacon for our group’s business direction in the circumstances defined by the term VUCA* based on major trends that remain unaffected by daily changes, and constantly promoting reform. The purpose is to continue to contribute and provide value to all stakeholders.

*VUCA: Volatility, Uncertainty, Complexity and Ambiguity

The activity of 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. Potential business opportunities are then conceived. In this activity, numerous dialogues are held with experts and innovators both inside and outside our group, and insight into the future and visions are created from multiple perspectives on markets and technologies. “MEGA SCAN” thus enables us to gain insight not by considering them as a set of individual phenomena, but by capturing their overview as a flow.

“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 therein. “SHIFT THE PATH” deals with business opportunities that are difficult to start and develop under the current business functions, such as new businesses unrelated to the existing businesses or business opportunities crossing multiple domains. Led by the agile business development team together with external partners such as startups, prototyping and trials to verify the business hypotheses are conducted.

“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

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“MEGA SCAN.” The other is to co-create technologies needed to realize the innovation hypotheses generated through “SHIFT THE PATH” together with external partners.

As part of the MHI FUTURE STREAM activity, “MEGA SCAN” was updated recently. Based on the results, this report presents the megatrends that we should be aware of and our initiatives to provide value to society in a sustainable manner.

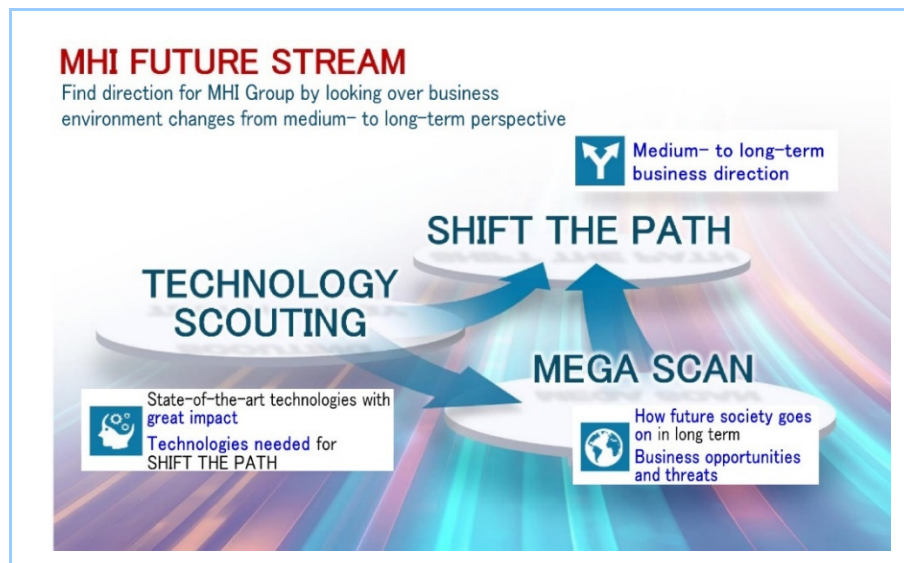


Figure 1 Three actions of MHI FUTURE STREAM

2. Megatrends framework remaining unchanged even in VUCA era

In MEGA SCAN, the business environment surrounding MHI Group is viewed structurally and is systematized into megatrends to identify the problems and challenges that we should hurdle and overcome to approach our vision.

As mentioned at the beginning of this report, the business environment surrounding us is changing at dizzying speed. When compared with the list of megatrends made five years ago, however, the new one has essentially the same framework despite some of the individual items on the list having been accelerated because of multipolarization of international relations and etc. (Figure 2). Although the megatrends framework remains the same, a variety of daily events are accelerating some of the items on the list. Paying attention to these items allows us to identify what issues we should focus on.

Figure 3 shows the items of the megatrends whose importance is on the increase because of their recent acceleration, in comparison with 2018.

One of the major changes in the international community is multipolarization. While protectionism for a country’s own industries is prevailing in the U.S. and others, regional economic blocs are growing to facilitate trading with allies and friendly countries. The importance of economic security is increasing mainly against the backdrop of the U.S.-China trade conflict. For example, since China is a predominant supplier of some of the mineral resources, their supply risk is increasing. Under such circumstances in which confrontation between the East and the West intensifies, the countries of the Global South, which belong to neither side, play a key role in terms of both politics and economy.

On the economic front, developing countries are growing economically in contrast to the mature economies of developed countries. Certain issues have arisen in developed countries, including a declining middle class, aging infrastructure, aging population and serious shortage of human resources in companies. While decarbonization and a circular economy are expected to bring mature economies an opportunity to create new markets, some, like European countries, are taking the lead in creating rules for their own country/regional advantages as a competition strategy, aside from technological development.

From an industrial point of view, the markets, especially mature ones, place more value on solutions rather than products themselves. There is a growing need for solutions which solve problems faced by individual customers, instead of simply selling products only.

Information availability is the key to strong competitiveness in selling solutions. Therefore, the information that is obtainable through business such as customer information will be withheld from competitors, thereby widening information disparity.

In order to provide higher-value-added solutions to individual customers with different problems under these circumstances, it is important to gain insights into their situations based on available relevant information and, make a proposal combined with product knowledge to deliver value according to the insights.

The development of digital infrastructure has also an influence on the values of individuals. As online communities such as social media (SNS) are expanding, the public can now get in real time the information about various problems happening around the world, from armed conflicts to natural disasters. People’s awareness of social issues is growing.

As a result, demands that companies should be socially responsible are also gaining momentum. Having programs to address social issues as creation of non-financial value can lead to enhancing the corporate value.

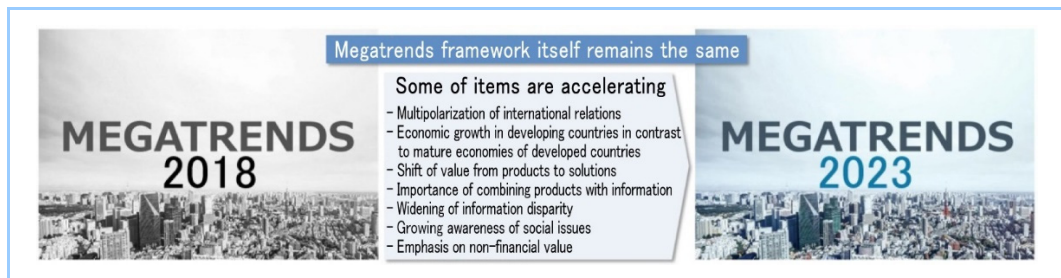


Figure 2 Updating of megatrends in 2018 to new ones

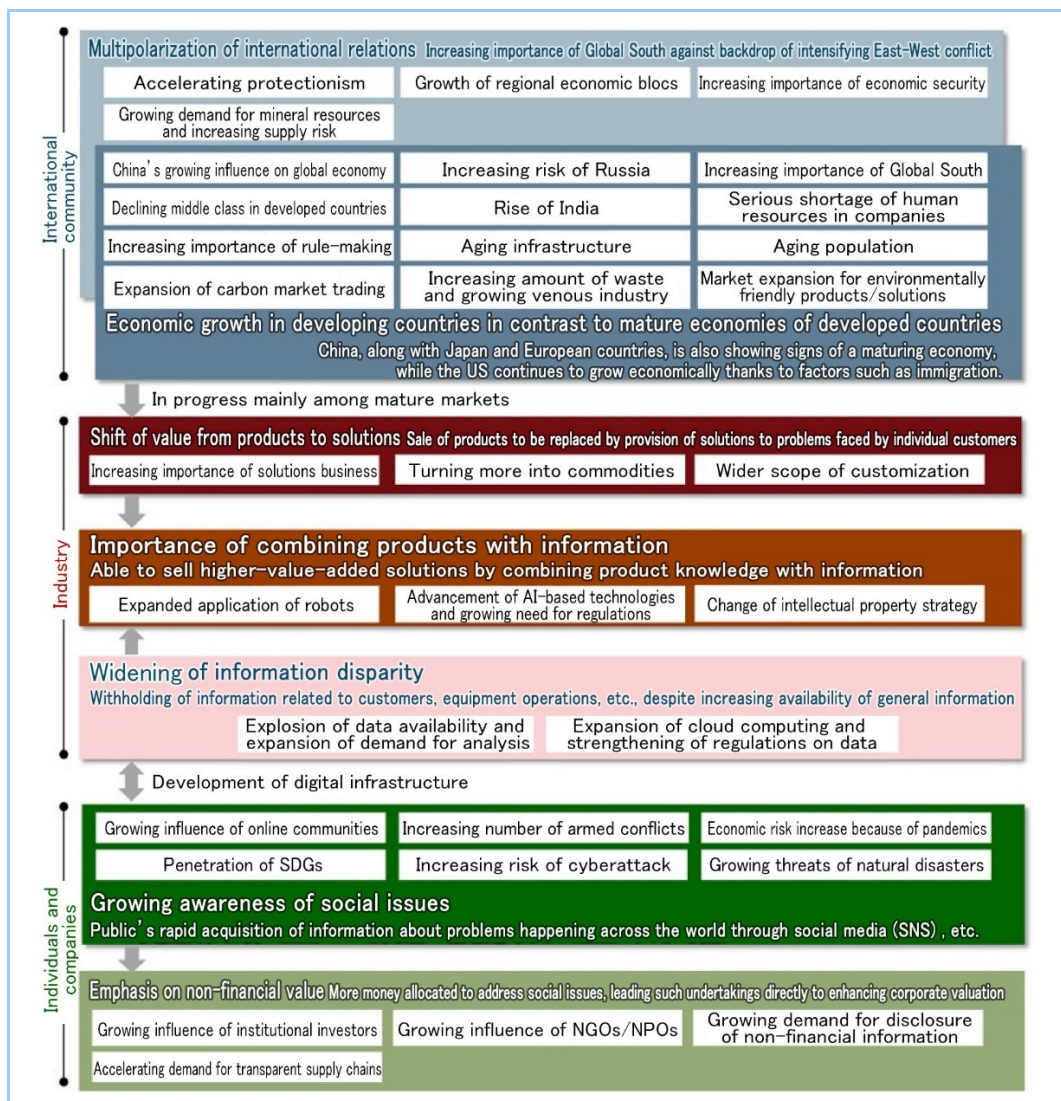


Figure 3 Accelerating megatrends in comparison with those in 2018

3. Issues that MHI Group has decided to address after consideration of megatrends

Based on these megatrends, MEGA SCAN enables us to identify the issues that we should address to contribute to society in a sustainable manner (Figure 4).

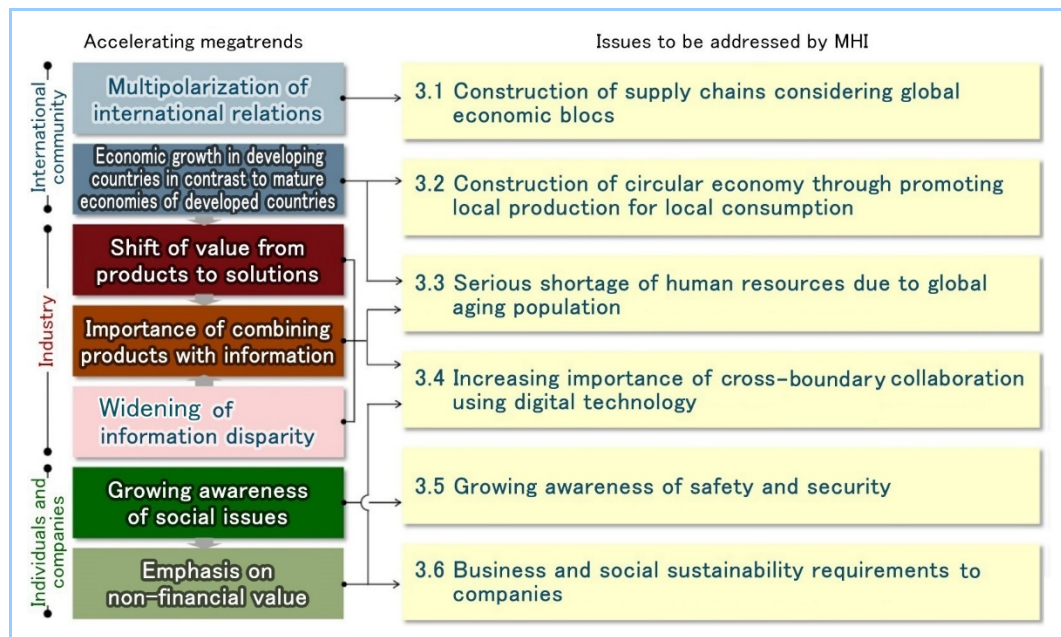


Figure 4 Issues that MHI Group has decided to address after considering accelerating megatrends

3.1 Construction of supply chains considering global economic blocs

International relations are getting more multipolar, as exemplified by the deepening of intensified East-West confrontation and increasing importance of the Global South. Under these circumstances, the risk of strategic items such as semiconductors, resources, food and medicine being used as a diplomatic tool is increasing. Companies are therefore required to review their supply chains to ensure safe and secure procurement.

3.2 Construction of circular economy through promoting local production for local consumption

Japan and European countries are faced with the issue of energy/food self-sufficiency rate while the market is maturing with post-peak economies/populations. In these countries, a circular economy is attracting attention as a measure to grow while maintaining economic sustainability. Its implementation is becoming common especially in food, clothing and housing industries, which have affinity with environmentally conscious customers. Accentuating the story and the design of resource reuse as value added, companies minimize costs by recycling the collected items on a small scale. Thus, social implementation of a circular economy is approached as a profitable business even if there is concern about the circular-economy products from a cost-effective point of view, when compared with the conventional products for mass production and mass consumption.

3.3 Serious shortage of human resources due to global aging population

Developed countries are also faced with the issues associated with mature societies. Especially Japan is seeing a progressive decline in the working-age population because of the aging population with fewer births. With more skilled staff leaving their jobs, an increasing number of companies and industries are having a hard time maintaining the quality of their current work, let alone securing personnel to create a new business. Whereas, the markets related to automation with the use of industrial robots, etc., and robotic exoskeletons for worker assistance are expanding.

3.4 Increasing importance of cross-boundary collaboration using digital technology

Unlike conventional advancement such as improvement of equipment efficiency, the new challenges faced by companies such as decarbonization are complex and are often difficult to solve with the use of a single product. The key therefore lies in finding a solution for overall optimization, which is enabled by incorporating products across industry boundaries using digital technology.

3.5 Growing awareness of safety and security

In our lives, there are human factor risks such as armed conflicts and cyberattacks and natural factor risks such as natural disasters and epidemics. As their frequency is increasing, their impact on economic losses is also increasing every year. Measures against risks are therefore required more than ever, mainly by the companies responsible for critical infrastructures such as energy, transportation and logistics. Especially in recent years, more local government bodies conduct natural disaster damage assessment using simulation and discuss how to make fast recovery possible.

3.6 Business and social sustainability requirements to companies

While requirements that social issues should be addressed are increasing, there is also a backlash from citizens against decarbonization costing society too much (e.g., the Yellow Vests movement in France). It is therefore extremely important to have a sense of socio-economic rationality. Even if there are various requirements from society, companies would feel hesitant to make a large and uncertain investment. In the case of decarbonization, for example, it is practical to suggest implementation in stages with a minimum investment through reuse of existing equipment.

4. MHI Group's challenge to solve issues

The issues listed in Section 3 need to be addressed, as MHI Group strives to contribute to society and provide value to stakeholders in a sustainable manner. In our challenge to solve these, it is important to bring together our business foundations such as technologies, resources and experience and enable agile co-creation with stakeholders such as customers (Figure 5).

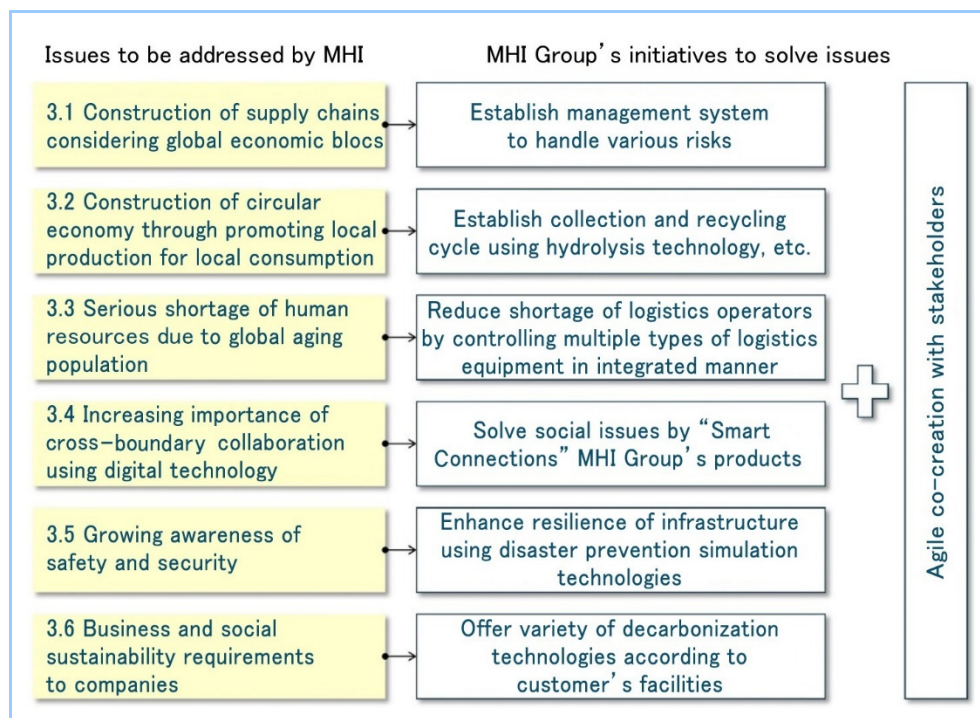


Figure 5 MHI Group's challenge to solve issues

4.1 Examples of our efforts to address issues

Examples of our efforts to address the issues listed in Section 3 are described below. MHI Group's business foundations are made use of in these initiatives.

With regard to "3.1 Construction of supply chains considering global economic blocs", MHI Group has established a management system to handle various risks including business strategies, corporate culture and business risks⁽¹⁾. With this system, risk information is comprehensively understood and shared by all business participants at operational and management levels, and actions are made based on it. Through this process, we will also respond to the increasing risk of supply chain disruption because of unstable international relations.

For "3.2 Construction of circular economy through promoting local production for local consumption", we help establish a collection and recycling cycle, which is indispensable to a circular economy. This will be achieved by providing a processing system that can easily separate and recover biomass resources from municipal waste, which were previously incinerated because of the difficulty

separating them, and convert them into substances with properties suitable for recycling such as methane gas⁽²⁾.

One of the solutions to “3.3 Serious shortage of human resources due to global aging population” is automation of picking operations in which many warehouse workers are involved. While still in development, this solution will be enabled by allowing multiple types of logistics equipment to work together in a coordinated manner, aiming to reduce the shortage of logistics operators⁽³⁾.

Our brand of digital innovation for “3.4 Increasing importance of cross-boundary collaboration using digital technology” is Σ SynX^{®*}, which is based on the concept of “Smart Connections.” We help address a variety of social issues by combining the technologies and knowledge available across the world, with our group’s portfolio of products in wide-ranging fields and various types of data/know-how from development to operation/maintenance⁽⁴⁾.

* Σ SynX[®] is a registered trademark of Mitsubishi Heavy Industries, Ltd. in Japan and other countries.

In relation to “3.5 Growing awareness of safety and security”, MHI Group has disaster prevention simulation technologies, which are backed up by the know-how accumulated through disaster damage assessments conducted for power plants, chemical plants, bridges and wind farms⁽⁵⁾. Utilizing these technologies, we will enhance the resilience of domestic and overseas infrastructures and take part in social and corporate activities for safety, security and sustainability.

Having the capability to provide various technologies according to the customer’s facilities or financial conditions is important in “3.6 Business and social sustainability requirements to companies”. As our main base for technological development of energy decarbonization, the Nagasaki Carbon Neutral Park facilitates the development of key technologies such as hydrogen production, biomass synthetic fuel production, ammonia combustion and CO₂ capture⁽⁶⁾. In the Takasago Hydrogen Park, demonstration tests are going on regarding a series of technologies from hydrogen production to power generation, including hydrogen-fired gas turbines (which are expected to be made available commercially soon), hydrogen production, hydrogen storage and power storage⁽⁷⁾. Through these projects, MHI Group is preparing itself to provide a variety of decarbonization technologies tailored to customers.

4.2 Example of our methods to solve issues: agile co-creation with stakeholders

As the technological foundation, MHI Group has expertise in nearly 700 technological fields, has more than 500 products and several thousands of mechanical modules, and operates in about 35 business fields. However, when a new, unprecedented issue comes about, we must try out everything to find a solution. To be successful in this regard, working on our own or working only with customers is not good enough. It is indispensable to cooperate with various stakeholders and bring all the knowledge together.

MHI Group therefore is working a co-creation platform called Yokohama Hardtech Hub (YHH) with manufacturing at the core⁽⁸⁾. At YHH, our co-creation is taking place by the initiatives of the companies residing in this co-creation space of 20,000 m² in cooperation with various stakeholders such as customers, startups, manufacturers and academic institutions (**Figure 6**). Discussing with these stakeholders in person from the very beginning of our business development, we enable agile prototyping and verification in a small, rapid cycle with minimum redoing and misunderstanding. Through YHH’s co-creation platform, we find a solution even for a new problem to which no one has the answer in the process of co-creation with our customers and partner companies.

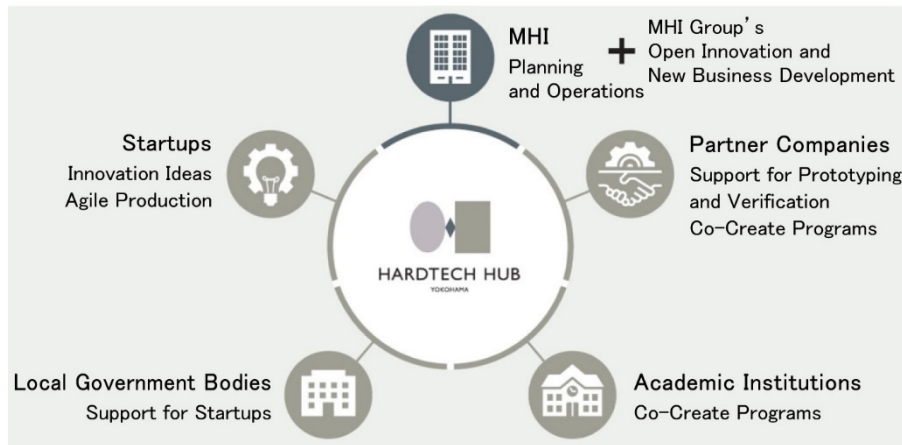


Figure 6 Conceptual image of co-creation platform that YHH aims for

5. Conclusion

This report describes our MEGA SCAN activities, through which the critical changes happening in the surroundings are systematized into megatrends to determine the direction of our business under the VUCA business environment. The challenges that we have decided to undertake to solve the issues after considering megatrends are also presented.

MHI FUTURE STREAM will bear increasing importance, as MHI Group strives to contribute to society for its sustainable growth while facing uncertainties in the surrounding business environment. Using MEGA SCAN to identify the megatrends that remain unchanged even in the VUCA business environment and the issues faced by MHI Group and customers, we will continue to take on the challenge to find solutions for them.

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