Robot Revolution Initiative's Working Group on the IoT-Driven Transformation in Manufacturing

Interim Report

December 25, 2015

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1. Background and Purpose

With the advent of the Internet of Things (IoT), big data, artificial intelligence (AI) and other new technologies, the manufacturing industry is currently about to undergo a significant change that should be deemed as the fourth industrial revolution.

Those new technologies, including the IoT, are expected to have various impacts on the manufacturing industry, such as the radical streamlining and efficiency improvement of manufacturing processes; the reform and creation of new sales methods, operation procedures and business models; and drastic interindustry changes.

The Working Group on the IoT-Driven Transformation in Manufacturing has been established with the purpose of sharing the background among its members and considering what Japanese manufacturers should do by 2030, so that they can win in the new round of international competition. The task force also aims to weigh what the government, industry and academia should accomplish through their cooperation.

In a similar effort, the Japanese Ministry of Economy, Trade and Industry set up its new industrial structure committee inside its Industrial Structure Council in September 2015 to make clear how the fourth industrial revolution, which is being brought about by the IoT, big data, artificial intelligence, and other new technologies, could affect industries and the employment structure. The ministerial committee is also considering how the government and the people should settle various structural and social issues, such as the dwindling birthrate and local revitalization, based on the results of its discussions.

2. Method and Scope of Consideration (Scope and Frame)

(1) Method of consideration

- The working group will
  - ① sort out what to consider in order to identify the common problems (the scope and frame)
  - ② share the perception of what the Japanese industry will be like by 2030
  - ③ identify and consider the common issues based on the results of ① and ②

- We will set up steering subcommittees according to industrial fields and company sizes. Those subcommittees will include panels for industrial machinery, middle-ranking firms, as well as small and midsize companies. Meanwhile, the main working group will use questionnaires and other methods to
  ① consider the common issues for each field,
  ② while sorting out problems common to all fields in terms of information technology (IT), electrical machinery control and other topics at the same time.
- Identified problems will be categorized into short-term issues and medium- to long-term ones, and then carefully considered to find out what each industry should do and what kind of industrial policies the government should adopt.
- Even after the release of this interim report, we will continue to consider the remaining problems at the general meeting, as well as at gatherings of steering subcommittees and sub-working groups, to work out our final report for the first fiscal year in May 2016.

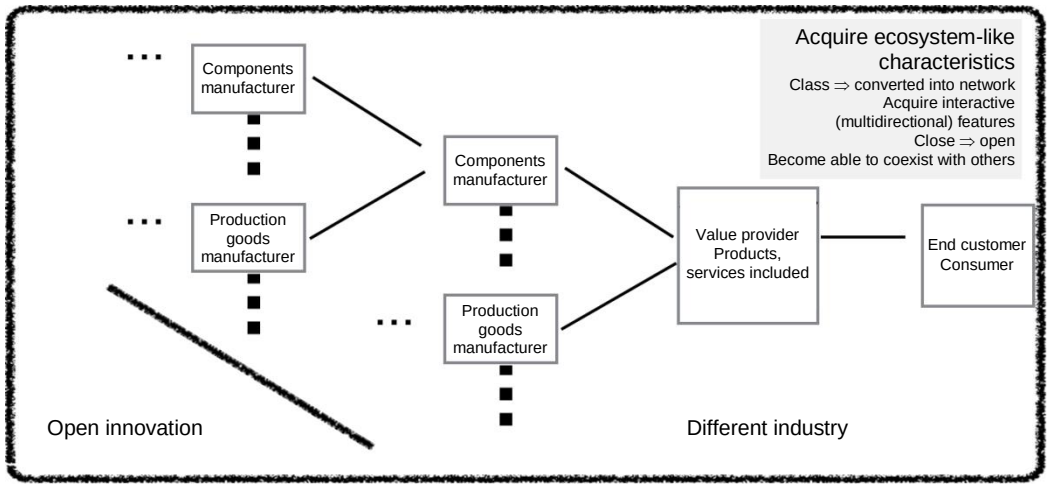
(2) Scope of consideration (scope and frame)

① Scope of consideration (a) - operational reforms

1. Research and development, product development and designing, and manufacturing (development of jigs, tools and production equipment; computer-aided manufacturing [CAM])
   The field known as the product lifecycle management (PLM), which is also called engineering chain, or the whole life cycle of products, is covered.
2. Component supply chain management (SCM), manufacturing, outsourcing, product SCM and business management
   From components, jigs and tools, and production goods (such as equipment, machinery, sensors, actuators, controllers, manufacturing execution systems [MES] and enterprise resource planning [ERP]), to the manufacturing and the delivery of end products
   Production processes and business management are also covered in terms of the management of those factors
3. Operations and maintenance services
4. New services including those concerning different industries

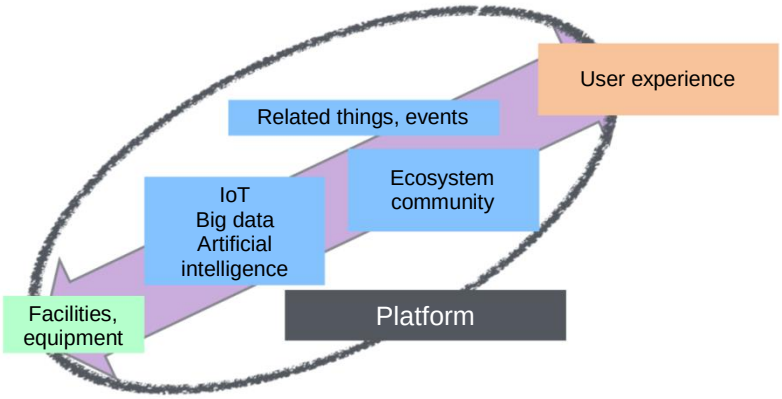
② Scope of consideration (b) - inter-company reforms

Companies have traditionally been engaged in ordering, joint development and other such activities. But they will need to be involved in open innovation in the future. Business operators will also come to be linked to end customers and firms from different sectors via interactive networks to form an ecosystem in which all of them can coexist with one another. We will consider the ecosystem.



③ Scope of consideration (c) - reforms associated with new value created by technology (the IoT)

Corporations can use only their own equipment and machinery now. But a new platform will be established to create new, higher value and offer rich user experience. This will be done by linking equipment and machines of different companies, related materials and processes, as well as communities of relevant people, based on technology (the IoT). We will consider the new platform.



3. Consider What Japanese Manufacturing Will Be Like by 2030

(1) Expected background problems

① Competition with global companies

The global competition among manufacturing firms and other related companies is growing more intense year by year. As the world radically changes due the advancement of the IoT and other technologies, Japanese manufacturers have to continuously win in the future competition by foreseeing and addressing possible changes properly and quickly.

② Globalization of the Japanese manufacturing industry

As the global competition grows more intense, Japanese manufacturers and other related companies have been expanding their production bases overseas and proceeding with the localization of production to realizing globally optimal manufacturing systems. They will also be required to continue to win in the global competition by expanding their businesses flexibly and dynamically. For example, Japanese companies should promote partnerships with foreign firms, while paying due attention to the division of roles between domestic and overseas facilities and the leakage of intellectual property.

③ Use of the IoT

As the drastic change known as the fourth industrial revolution, which is based on the use of the IoT and other factors, captures considerable attention globally, Germany's Industry 4.0 and the U.S. Industrial Internet Consortium (IIC) are currently drawing attention from across the world. Japanese manufacturers have to maintain their strengths despite those changes and need to make full use of the IoT, so that they can settle issues facing the manufacturing industry through the creation of new values and businesses.

④ Structural problems

Given the current overseas situation, the vertical integration model may lose its advantage in some industries. That is because the modularization associated with IT and the IoT now progresses and tacit knowledge is increasingly converted into explicit knowledge, helping promote the horizontal specialization model. The Japanese manufacturing industry is expected to experience such a drastic change in the future, so we need to reconsider how

we should take further advantage of its conventional strengths to maintain and boost competitiveness of Japanese manufacturers.

⑤ Social problems

The Japanese manufacturing industry is exposed to risks amid various social issues arising. Those issues include the shrinking of the nation's overall population, which causes the working population to decline; the decreasing population in rural areas; and the deindustrialization associated with the globalization of companies. As fewer people are currently willing to take over manufacturing businesses, it has become increasingly difficult to pass on the know-how of veteran technicians - a factor that has long been underpinning the Japanese manufacturing industry - to the next generation. Converting tacit knowledge into explicit knowledge based on the IoT could be a solution to the social issue of how to carry on exceptional skills of workers and businesses. Another problem is how to better respond to natural disasters and what measures to take to protect the environment and establish a sustainable society.

⑥ Use of open innovation (focusing on the core competence)

New businesses using the IoT will typically cover fields outside the companies' conventional business domains and expand the value provided for customers. But under the policy of independent management, the expansion of business areas could also lead to an increase in technology development costs and fixed expenses to operate them. Manufacturers need to more efficiently expand businesses while ensuring, maintaining, advancing and enhancing the core competence - a source of competitiveness - and at the same time promoting open innovation and the utilization of open sources. In doing so, they should also pay due consideration to other topics, such as the protection of intellectual property rights and proprietary rights.

(2) What the Japanese manufacturing industry should do by 2030 (process and business reforms)

It is estimated that the Japanese manufacturing industry will experience a radical change associated with the IoT as shown below, while maintaining and boosting Japan's strengths of human resources, excellent technologies and exceptional abilities of workers.

① Fusion of the IoT and Japan's strengths / Spread of IT and the IoT among middle-ranking firms and small and midsize companies

- By 2030, the Japanese manufacturing industry should raise its strengths of human resources, excellent technologies, exceptional abilities of workers, improvement capabilities (speed and careful attention to detail) and good discipline, to the highest level in the world by fusing those advantages with the IoT. Japanese companies will also need to continue to maintain and further enhance such strengths in the future. The Japanese manufacturing industry should continue to achieve a high level of global competitiveness through close cooperation between large firms and small and midsize companies even in 2030. This should be done by converting the know-how of veteran workers into explicit knowledge so that unskilled employees can easily conduct technical operations (the succession of techniques through the IoT) and by spreading IT and the IoT among middle-ranking firms and small and midsize companies. Those relatively small corporations account for about 50 percent of the total amount of added value in the manufacturing industry and have long been underpinning the nation's manufacturing. In short, Japanese manufacturers should continuously maintain and boost the power of Japanese brands by producing the world's best quality products and making them "black boxes" under speedy management and production systems that are based on the IoT.
- Meanwhile, there is a possibility that increased trade between large companies and non-affiliated middle-ranking firms and non-affiliated small and midsize companies could expand the range of trade for those relatively small companies and help them expand sales and profits based on independent, swift decision-making. If middle-ranking firms and small and midsize companies are directly connected to markets via the IoT, they may be able to develop new markets by themselves. Meanwhile, if that happens, they will need to address the new risks associated with intellectual properties, security and other topics at the same time.
- How to spread IT and the IoT among small and midsize companies is a challenge for us to overcome in the future as described above. As various manufacturing processes, ranging from the product design and development to manufacturing procedures, after-sales operational management, trade between multiple supply chains, as well as traceability, undergo change, all parties constituting the supply chain need to take appropriate measures to respond to new production systems using IT and the IoT.

- Even after the IoT comes to be widely used, human workers will still be expected to be involved in operations requiring more advanced judgments. Humans will not become utterly unimportant even after the spread of the IoT, as new technologies are not always aimed at achieving full automation. Thus, we need to seek ways to realize a new society where human beings, machinery, equipment and robots will be able to cooperate and coexist with one another.

② Radical improvement in production efficiency / Maintenance of quality improvement processes (process reforms)

- The operating rate and yield rate will be improved by measuring and integrating the operational status of machinery working on the production line, information on operations, energy consumption and other data with sensors and other devices (visualization) as well as analyzing and utilizing those information. Productivity improvements can be achieved only through veteran technicians' senses to date. But unskilled workers will become able to improve productivity readily, making it easier to pass down sophisticated techniques.
- With the use of the simulation technology, 3-D printers and other devices, the design and production offices and facilities will be linked with one another in a seamless fashion, reducing the lead time and allowing companies to quickly develop and produce items that would meet market needs.
- By mutually connecting machines operating on the production line, the whole manufacturing system can be optimized. That will help reduce the manpower in stock control and help establish the just-in-time system for the component supply process. However, in doing so in Japan, it is currently difficult to link data of machines made by different companies and to operate them in a coordinated fashion. The era is approaching when making a company's products connectable to other corporations' machines and systems could directly help improve the competitiveness of the company. Companies will be required to promote inter-company cooperation so that they can activate joint efforts to develop common protocols as well as application programming interfaces (API) for common interfaces.

  [Instances of cooperation]

  Real-time gathering and analysis of data on production lines

  Operations and improvements of SCM and PLM using digital data

  Form links between processes; facilities within a factory; multiple plants; people and things in a company; and more than one corporation

Open innovation (abandon the policy of independent management, concentrate managerial resources on priority fields and speed up decision-making)

* Note about cooperative fields and competitive fields: Areas that serve as strengths of a company and should be made "black boxes" (competitive fields), need to be separated from areas that should be linked to outside resources openly and aggressively (cooperative fields).

③ Manufacturing more deeply rooted in the market (business reforms)

- Although manufacturers have been required to provide highly reliable products that use advanced technologies, an increasing number of consumers now expect them to offer articles that could provide values the market wants as well as goods that would sell well. Using the IoT, companies will become able to gather information on the use of products and figure out what consumers want and how they act, so that they can appropriately and quickly respond to the needs identified through such processes.
- In proceeding with the small-lot production of a wide variety of products, flexible manufacturing lines and systems will also become necessary to better respond to the small-lot, multiple-model production system. For example, efforts have started to be made to establish a flexible platform known as "Plug and Play," which could modularize production machinery functions and rearrange their order. Not only the manufacturing industry but also all other industries will need to address that trend. In doing so, they should carefully examine to what extent the small-lot, multiple-model production will spread, although the degree of the spread would vary depending on the product and industry.

  [Instances of consideration]

  Real-time gathering and analysis of data on market needs

  Integrated operations of SCM and PLM using digital data

  Form links between processes; facilities within a factory; multiple plants; people and things in a company; and more than one corporation

  Flexible production lines (such as Plug and Play)

  Open innovation (see above)

④ Manufacturing increasingly becoming a service industry (business reforms)

- Manufacturing is increasingly becoming a service industry now, and the IoT has been accelerating the tendency. Due to the change, the meaning of manufacturing is shifting from just making something to adding value. Companies will become able to check how users operate their products, using sensors and other devices. It will also become easier for them to provide operational solutions for customers. More specifically, solutions to be likely developed include a proactive maintenance service to be conducted based on the operational status of the products; an after-sales service designed to propose the optimal way for use; a service that requires extra payment depending on the usage conditions of the products; and other new sales methods and business models.
- To expand those business areas, open innovation must be promoted. The independent management policy should be abandoned, and managerial resources should be concentrated on priority fields. In other words, as the market changes increasingly rapidly, companies have to consider which area to focus on using their strengths and weigh whether to slash costs for the other fields.

⑤ Creation of new businesses encompassing different industries / Fiercer competition (business reforms)

- With the progress of open innovation, the cooperation using technologies from different industries will be promoted, while more competitors from other industries will newly enter the markets. Those trends could be a huge opportunity for Japanese manufacturers to expand into new business fields in different industries.
- Utterly unconventional business domains and competitors emerge now. In such a situation, what is important is to flexibly suggest new ideas and expand the scope of businesses and partners through the use of the IoT and other technologies, without sticking to conventional ideas.
- Meanwhile, it is also important for companies to reaffirm, maintain and strengthen their core competence, so that they can ensure the continuity of their businesses even after entering different markets.

4. Problems common to all industries (identified based on the results of questionnaires)

Based on the findings of questionnaires conducted after the second and third meetings of the working group 1 held on Aug. 27 and Oct. 20, 2015, respectively, we identified major common issues. The identified problems are shown below.

(1) Open innovation

① Competitive fields and cooperative fields

The problem is how to reform companies' existing business models developed under the "corralling strategy," in which each firm's production information could be a source of business competitiveness. To win in the global competition, it is essential to swiftly develop new high-growth businesses and establish a globally-opened standard platform with high scalability. The key to achieving this is to separate competitive fields from cooperative fields and to establish platforms that are attractive and meaningful for member companies and organizations. In doing so, it is also important to acquire needed intellectual property rights. For example, in the development of the technologies that could be common platforms, such as computer aided design (CAD) and CAM connection technologies, companies should establish a win-win business model in which all parties engage in joint development to slash research and development costs.

② Make manufacturing and services more flexible

We need to establish more flexible manufacturing and service systems by enabling companies to conduct transactions and form partnerships with other firms more freely. Companies are currently required to establish a new type of business model through interindustry cooperation. With such a new business model, manufacturers of finished goods, for example, will be able to commission equipment makers to carry out the inspection and maintenance of their devices. Those manufacturers will also become able to continuously provide the latest technologies by taking advantage of their excellent software technologies. In addition, they may tie up with other corporations in various fields, including the hardware, software and services. In the SCM efforts involving large companies as well as small and midsize companies, such a new business model will also allow companies to work with parties other than their conventional business partners and to manufacture the optimal products

at the most suitable locations.

(2) Efforts toward standardization and security improvements

① Standardization

By aggressively joining international meetings to promptly obtain the latest information as well as strategically proceeding with discussions on standardization, we should establish a system under which Japan can increase its presence and take initiative to win global acclaim. Here is an example of that: European standards for a certain area have been accepted as international standards with almost no revisions, because Japanese companies were less interested in the area at the time. As a result, Japan lagged significantly behind Europe in preparation for the global standards. Thus, Japanese manufacturers need to take some countermeasures, such as building a wide network of contacts through continued, globally-accepted activities. The government, industry and academia also need to make joint efforts to propose possible international standards that could be globally recognized. They should make such efforts especially in the fields of robots, machine tools and other peripheral technologies for which Japan currently boasts a high level of competitiveness. The three parties should also work together to win support from other nations for those suggested standards.

Although some Japanese companies are currently cooperating to standardize device interfaces, full-fledged standardization efforts have not been made. In some cases, companies develop new device interfaces every time a new service starts. In addition, Japanese firms often develop their unique interfaces for each application independently, so it is difficult to use those apps on other devices or with other services. Standardization in those fields is essential to reduce production line installation costs and simplify links between different services.

② Security

As cyber-attacks become more advanced and sophisticated, it is strongly required to ensure safety when utilizing gathered data on both machine-to-machine (M2M) and inter-company networks. Japanese companies should, for example, develop guidelines and security policies so that they can introduce a common encryption scheme for the IoT-related business operators, take measures against equipment vulnerabilities and

tackle issues surrounding management systems in an organized manner. Global assessment criteria for security levels are also needed. In particular, data on customers and end customers, as well as information on their usage of the products, are sometimes deemed as confidential personal information. Thus, how to anonymize personal information is a vexing issue for companies. It is also vital to design social, legal and technical systems that would manage, maintain and take responsibility for measures designed to protect the confidentiality of customers. Winning the understanding of related people is essential as well.

③ Consideration of the right to use data and the ownership of information

While digital data is currently a key to creating value, people in society now send and receive information between different organizations and companies. Under that situation, we need to rethink the right to use data and the ownership of information. In doing so, it is important to introduce regulations to prevent a huge amount of processed data and customer information from being leaked, so that concerns about the issue can be erased. It is also essential to establish a system to further increase the mobility of information at the same time, so that a foundation will be established to create new businesses and value continuously.

(3) Assistance for small and midsize companies and firms that have difficulty proceeding with the IoT

① Infrastructure development that would not hamper the spread of the IoT

How to support small and midsize companies, which play a significant role in the development of equipment parts and account for a large portion of all businesses in Japan, is a big problem. While large companies can develop data platforms by themselves, it is typically difficult in terms of technology and the return on investment that small and midsize companies develop such platforms on their own. Even if trying to outsource the work, it is difficult to find contractors because there are fewer system solution firms, line builders and other companies that offer various manufacturing services as a package for small and midsize firms in Japan, compared with in Europe and the United States. Because of that, small and midsize companies need to standardize all-purpose platforms or other systems by region, industry or other categories. The government and outside companies should also provide services for such standardized systems and support efforts by small and midsize companies.

They are required to provide assistance for those relatively small firms as to intellectual property rights and other topics as well.

(4) Changes in awareness among executives and reforms in corporate behavior

① Visualization of investment costs and return

In many cases, how to estimate cost-effectiveness is unclear with regard to IT investment projects and business model reforms. Under such a situation, companies tend to avoid taking risks in their efforts encompassing multiple departments, such as manufacturing and IT divisions, and frequently assume a wait-and-see attitude.

② Management's sense of crisis

Japanese manufacturers have been taking a leading role in the global manufacturing industry by thoroughly improving the production efficiency while maintaining the quality of products. But during the peak period for Japan, Europe and the United States spent more than 10 years trying to contain Japan by making full use of business and other data. Japanese companies need to make inter-company efforts to drastically change their businesses and manufacturing processes, so that they can achieve competitive advantage again. Japanese companies' executives appear to lack a sense of crisis in some respects and seem to be too optimistic about the current efforts by overseas firms.

③ Expansion into the manufacturing service industry

Most Japanese manufacturers have traditionally been selling products alone. But they are currently required to engage in the system solution business, in which companies offer appealing, high-value-added services by gathering data through the whole life cycle of their products and utilizing the collected information. In some business areas, companies may also be required to introduce a new sales system that charges different customers different prices depending on their use of services.

④ Companies' willingness to invest

It is essential to clarify advantages of the introduction of the IoT devices and the merit of the digitization and upgrading of legacy systems. It is also important to slash necessary expenses and make clear what is needed to introduce such devices and facilities. The government should also weigh

offering administrative support, such as introducing a new investment tax relief system and subsidies as well as making revisions to the current depreciation accounting system, so that companies can actively invest in those equipment and facilities.

(5) Human resources development / Measures to deal with the dwindling birthrate and aging of society

① Loss of manufacturing know-how that arises from a lack of young successors

As described above, the dwindling birthrate and aging of society is a big social problem for all industries in Japan. The country's business operators are currently exposed to the risk of the loss of the exceptional techniques of skilled workers, as fewer young people are now willing to learn those techniques. In order to address that situation, it is needed to convert technical information into explicit knowledge through the digitization of data on the whole life cycle of products. By doing so, an environment will be established where workers can easily acquire skills and conduct operations based on the digitized, visualized information.

② Declining productive population

By reducing the manpower required for production lines and simplifying manual labor procedures with the use of the IoT, augmented reality (AR) and robots, various work styles will become available even for elderly citizens, people with disabilities, women and workers from overseas. Those new work styles will, for example, include work-sharing.

The government is also expected to politically promote the mobilization of human resources and operational cooperation between industrial enterprises and universities

③ Development of IT engineers

The lack of IT engineers in companies poses a huge problem in utilizing and promoting the IoT. The key to success is how to nurture skillful professionals, including data scientists who can fully use AI to analyze an enormous amount of data (big data) gathered with sensors and other devices and to propose ideas for high-value-added services and businesses; engineers familiar with manufacturing techniques who can design general information systems covering machinery, electrical equipment, the IoT and other various information; and engineers who can continuously maintain and improve

security systems to better respond to expanding networks.

(6) Utilization of Japan's strengths

① Establish Japanese brands

Japan's unique characteristics that cannot be found in the rest of the world are its technological superiority that ensures the high quality and accuracy of products based on the latest research and excellent techniques; Japanese people's diligence; and their exceptional adaptability. We are currently required to take full advantage of those characteristics.

It is also important to globally publicize Japan-made products and services under Japanese brands by combining advantages of different industries. For example, we should fuse the strengths of the manufacturing industry above with culture (such as food culture) for that purpose.

While robots are now primarily used for industrial purposes in Japan, they can also be used for transportation, service businesses, medical and nursing care purposes, construction, infrastructure projects, disaster management, and the agriculture, forestry and fisheries industries. While Japan currently faces so many social problems compared with other countries, spreading the use of robots could offer a good opportunity for the state to create new markets. What is vital is to suggest solutions to each issue and establish Japanese brands.

We estimate that Japan's manufacturing strategy lies halfway between strategies of Germany and the United States. While Germany is working to connect more products and services to the Internet, the United States is making efforts to link online services with real-world ones. A major challenge for us is how to establish the Japanese version of the IoT by fusing realistic, high quality products and services in network and manufacturing businesses.

5. Problems to be considered

Problems selected based on the findings of questionnaires described in 4 (see above), as well as other issues that we have concluded should be considered more carefully in the light of 3 (2) WHAT THE JAPANESE MANUFACTURING INDUSTRY SHOULD DO BY 2030, are listed below. We will continue to work to closely examine and sort out the following problems.

(1) Individual topics

① Standardization of manufacturing processes and cooperation in and outside companies

Establish systems covering things and people both in and outside corporations so that they can optimize manufacturing processes as a whole and create new services through open innovation.

[Specific instances]

- Standardize communication interfaces for industrial machinery
- When connecting and visualizing production facilities via networks to optimize them, companies should establish an environment (e.g., a common interface) that would require no extra cost for linking additional machines.

- Management models to promote business cooperation
- Establish an environment that would require no extra cost for linking additional operation tools as well as a management model needed to promote cooperation with production facilities.

- Develop standards for business cooperation system introduction processes
- Make it easier to establish business cooperation systems through the development of standard processes for introducing those systems.

- Supply chain cooperation
- Not only the ordering system should be standardized among multiple companies, but also business operators should establish a new model that can, for example, specify information to be shared between multiple supply chains and link multiple firms, so that they can reduce lead time while maintaining the quality of products.

- To settle structural and social issues, a data platform accessible to multiple manufacturers and other companies should be established.

② Standardization and security

The smart manufacturing standardization task force of the Ministry of Economy, Trade and Industry is currently considering related issues, while the IoT Acceleration Consortium is working to compile the IoT security guidelines that cover different industries. We will share information with those bodies by keeping in touch with them, in order to develop and enhance needed measures in line with their efforts.

③ Establish basic infrastructure for small and midsize companies to utilize the IoT

We will identify and prepare environments and tools essential to reduce possible differences in the use of the IoT between large enterprises and small and midsize companies.

[Specific instances]

- Establish an environment where even people with no technical knowledge can easily and readily test the IoT technologies
- Consider systems (such as easy-to-use cloud environments, software tools and system integrators) that would provide platforms on which software programs of more than one vendor are mutually available. Those systems need to be reasonably priced so that even small and midsize companies can use them.

④ Maintain and enhance the strengths of the Japanese manufacturing industry

We will analyze the strengths of the Japanese manufacturing industry more specifically, and establish a system that will help Japanese manufacturers continue taking advantage of those strengths even in the era of the IoT. For example, we will consider concrete measures to convert skilled workers' techniques into explicit knowledge and present such knowledge as solutions to manufacturing issues.

⑤ Verification / Sharing of model cases

As part of the efforts above, we will conduct verification tests as necessary (refer to the Ministry of Economy, Trade and Industry's budget for fiscal 2016 [budget request] "Social system promotion projects to boost the IoT [Manufacturing industry: Japanese-style smart factory]"). In doing so, we will

target not only efforts to establish an advanced production system for a single plant but also attempts to introduce systems that would improve the efficiency of the whole supply chain that covers all factories and firms, as described above. We will also work on a wide variety of attempts, such as a plan to develop an environment where small and midsize companies can use the IoT more easily. In addition to those efforts, we will also work to identify and develop projects that could be model cases of the IoT utilization in the manufacturing industry, through examining specific efforts by companies. Those prospective model cases will be presented to Japanese manufacturers to be shared across the industry. We will consider reforming related systems, regulations and other mechanisms as well.

(2) General topics

① Development of a road map

② Development of key performance indicators for the working group activity

③ Independent efforts by sub-working groups

We will form sub-working groups consisting of member companies of the main working group (including firms from both the same and different industries) to consider cooperative and competitive fields; the possibility of multiple companies being linked; new business areas; and other topics described in (1) (see above). Those subgroups are intended to hold independent discussions and settle various issues through cooperation.

In addition to the subjects above, we may also discuss possible budgets, tax systems and other incentive programs designed to help promote the introduction of the IoT as necessary, although the concreteness and feasibility of the plan is still unclear.

6. Future consideration

(1) The main working group, steering subcommittees and sub-working groups will consider the issues presented here.

(2) Situation facing steering subcommittees (as of November)

① The auto industry steering subcommittee

We once considered setting up the auto industry steering subcommittee, but the auto industry and the Ministry of Economy, Trade and Industry have since decided to discuss the model-based development and the use of telematics for commercial vehicles in a separate effort. Thus, we have shelved the plan to set up the subcommittee for the time being, because doing so may cause confusion for their discussions. The decision not to set up the subcommittee is also in line with the recent industry trends and needs.

② The industrial machinery steering subcommittee

By clarifying conditions needed for production systems and solution services that fully use the IoT, the subcommittee will develop an environment where industrial machinery manufacturers can establish new business models as total manufacturing solution providers. Its first meeting was held on November 5.

③ The steering subcommittee on middle-ranking firms and small and midsize companies

We will set up the subcommittee as early as possible to clarify and prepare environments and tools (such as easy-to-use cloud environments and software tools) with which small and midsize companies can fully utilize the IoT and improve the whole supply chain.

④ The steering subcommittee on cross-sectional topics (such as standardization and security)

The smart manufacturing standardization task force of the Ministry of Economy, Trade and Industry is currently considering related issues, while the IoT Acceleration Consortium is working to compile the IoT security guidelines that cover different industries. We will gather and share information on the progress of their work for the time being to decide whether to set up the subcommittee by ourselves.

7. Relations, division of roles and cooperation between the working group and other organizations

(1) The IoT Acceleration Lab

In specific projects to address PROBLEMS TO BE CONSIDERED that are mentioned in 5 (1) ⑤, we will utilize business matching events, financial assistance as well as support for standardization and regulation reforms provided by the IoT Acceleration Lab as appropriate. We will also share the results of the IoT Acceleration Lab's discussions on security affairs and data distribution rules unique to the IoT.

(2) The Industrial Value Chain Initiative (IVI)

It has been considering the standardization of manufacturing processes, as well as cooperation models in and outside companies, earlier than other organizations. Our working group will promote cooperation with the IVI, such as sharing its findings and tackling the issues identified by it.