Innovative Design/Manufacturing Technologies

New Production 2020 Project

Delightful Manufacturing — Upstream Delightful Design Methodology and Innovative Manufacturing Technologies

International competition has diminished the prestige of Japan's manufacturing industry.
The goal of this SIP program is to reinvigorate Japanese industry, and to create new markets—markets for which Japan can secure the dominant position, by developing "Upstream Delightful Design methodology" and "Innovative Production and Manufacturing technologies" and making the methodology and technologies spread. In this context, "delight" refers to delightful quality and satisfaction. This program offers consumers completely new and unprecedented products and services by exploring the value of delight in addition to quality and function.

Program Director

Naoya Sasaki

Hitachi, Ltd.
Corporate Chief Engineer, Research & Development Group

Profile

Dr. Naoya Sasaki joined Hitachi, Ltd. in 1982. He assumed the duties of corporate chief engineer in 2014. Throughout his career, Dr. Sasaki has been engaged in the development of mechatronic products and the development and spread of mechanical systems technologies and molecular simulation technologies. He holds a Ph.D. in engineering, and has been named a fellow of the Japan Society of Mechanical Engineering. He serves as secretary with the Japan Society for Computational Engineering and Science, as well as a member of the Japanese Society of Tribologists. Dr. Sasaki is an executive board director of the Japan Society of Mechanical Engineering.

Research and Development Topics

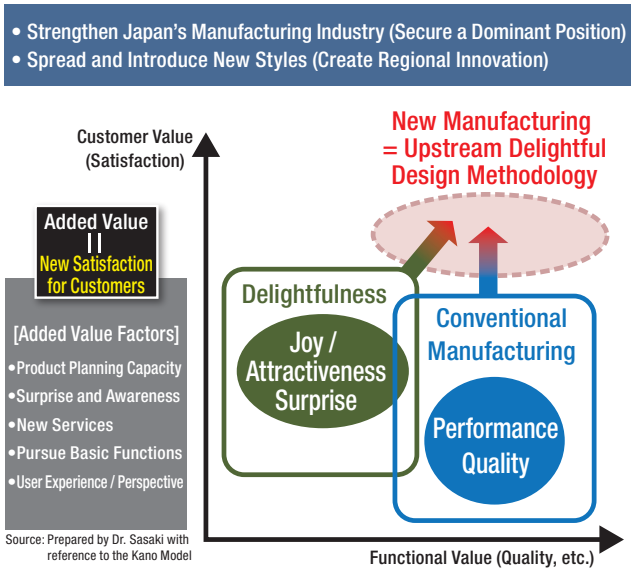
1 Research and develop Upstream Delightful Design methodology

Research and develop Upstream Delightful Design methodology which realizes high-quality, comprehensive system design incorporating a variety of functional design considerations, manufacturing conditions, and relevant data. This methodology should be driven by needs, value, performance, delight (delightful quality), and satisfaction.

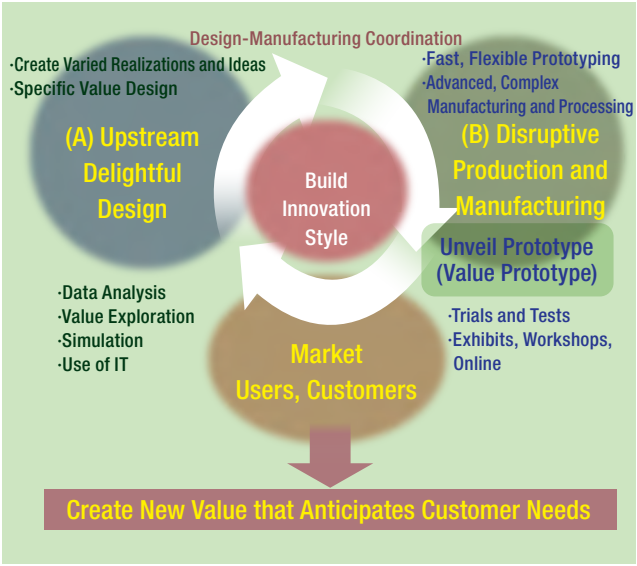
2 Research and develop disruptive production and manufacturing technologies

Research and develop disruptive production and manufacturing technologies that make it possible to new structures, complex shapes, greater function, better quality, and lower cost.

•Approach to Delightful Manufacturing



Source: Prepared by Dr. Sasaki with reference to the Kano Model



Exit Strategies

Build a system of delightful manufacturing

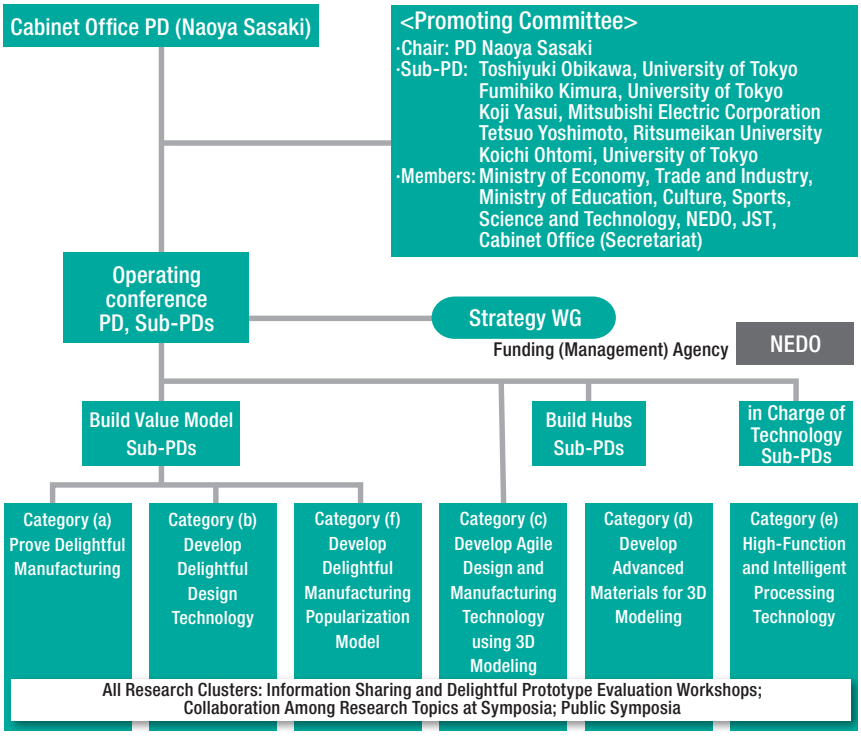
Propose value to the customer. Analyze and assess value based on the customer's reaction. Accumulate feedback and assessments as a value model. Build a delightful manufacturing system to re-propose to the customer new value created through value analysis. Accomplish this through design technology which is possible to put the new value into a product, and processing technology for rapid prototyping

Build delightful manufacturing platforms (including hubs)

Build platforms (including hubs) capable of running sustainably delightful manufacturing systems. Extend the use of these platforms to small and medium-sized companies to create new industries. Publicize examples of successful commercialization by local enterprises through using these platforms, to encourage small and medium-sized companies in other regions and product fields to adopt successful cases, aiming to quickly create new industries. Improve adoption and promotion of research results among public-sector research and development institutions.

Implementation Structure

The Promoting Committee is chaired by the Program Director (PD), who makes decisions on and promotes research and development. The Cabinet Office serves as secretariat. The Committee is composed of relevant ministries, agencies, and experts who provide overall coordination. This committee uses funds and management capacity offered by the New Energy and Industrial Technology Development Organization (NEDO). The Committee selects the best research and development personnel as needed through open recruitment. Changes are made in the implementation structure during FY2016, advancing initiatives to move the project closer to an exit. (The accompanying chart shows the organization as it is to be structured in FY2016.)



Progress to Date

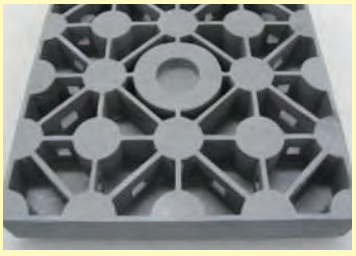
Successes in Basic Technologies/Systems Under Each Topic

Research into Upstream Delightful Design methodology is attempting to develop a value model to quantify sensory value (e.g. pleasure and delight). Researchers are building a methodology to visually compare and evaluate the degree of the sensory value.

Research on the disruptive production and manufacturing technologies focuses on materials technology (ceramics, rubber, etc.) and manufacturing technology. Processing technologies to realize complex shapes, to give products high functions and properties have been researched by combining technologies such as new materials and 3D modeling. .

From the third year of this project, results from different topics will be joined to create delightful manufacturing prototypes. The project will focus on proving and refining the prototypes through a process of validation, feedback, and restructuring. The ultimate aim is to achieve practical application and commercialization of delightful manufacturing.

•Exposure Stage Model



•Spring (ceramic)

Program Director **Naoya Sasaki** Interview

Using Prototypes to Validate Delightful Manufacturing

Delightful manufacturing promises to create new value for Japanese manufacturing. From the third year of this project, we start to create prototypes that lead to practical application by combining each research outcome from the topics of the design and manufacturing processes. At the same time, a platform concept that includes hubs for innovative manufacturing across industry, academia, and government is considered.

Stimulating Manufacturing, Creating New Markets

By building a system linking businesses, universities, and public agencies, the program aims to create markets supporting local economies. In our project, there are many researches that small- and medium-sized enterprises are able to use.

The project's research into Upstream Delightful Design methodology is attempting to quantify sensory value (e.g.pleasure and delight). The techniques developed here can be used in the design process. Specifically, the project is creating a value model through value inquiry and simulations based on data from user questionnaires. As one example, researchers have already proved how to quantify pleasing sounds. Going forward, these researchers will establish techniques to visually compare and evaluate the degree of delightful value in new and old products. These might include, for example, the pleasantness of light/illumination or the pleasantness of touch for a product.

Initiatives in the disruptive production and manufacturing technologies are looking at innovative manufacturing technologies. These advancements will take advantage of the specialized and unique technologies owned by participating businesses and universities. In particular, this project is focusing on non-ferrous materials and production technologies (ceramics, rubber, etc.) in which Japan already has a competitive advantage. Here, researchers are creating products with unprecedented complex shapes, high functions and properties by combining 3D modeling technologies and materials that offer new value.

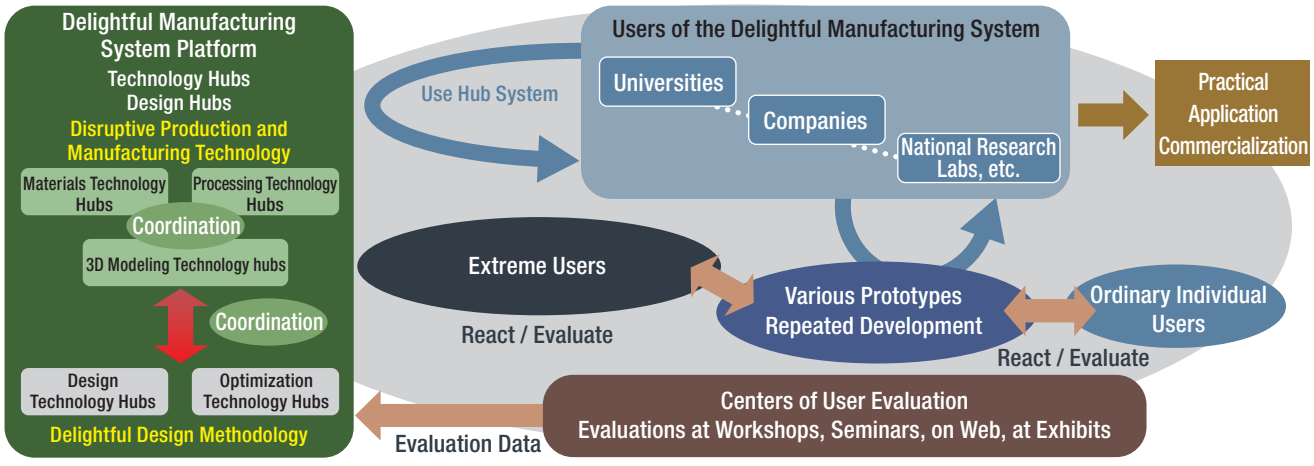
For example, modeling a filter with numerous spiral pores would result in greater surface area, leading to more compact, higher-performance water filtration devices. Other potential applications of 3D modeling include the production of artificial teeth or shoes custom-fit to the individual.

Prototypes Bridging Design and Manufacturing

Since its launch two years ago, this program has made consistent progress in developing basic technologies and systems in each research topic. In year three of this program, we will create a delightful manufacturing prototype that combines advancements in innovative design and manufacturing. The prototype will then be subject to a process of validation, feedback, and refining. To accomplish this goal, we have decided to focus on researches that realize our goal through selection and concentration in order to create prototypes.

The program also intends to launch new working groups concerned with delightful value inquiry and manufacturing platforms. These working groups will work as mechanisms to advance delightful manufacturing efficiently, sharing knowledge and technology.

•Develop a Platform using Delightful Manufacturing System



Innovative Design/Manufacturing Technologies

New Production 2020 Project

Japanese materials and components makers possess highly specialized technologies, as well as high-quality, high-efficiency production techniques. However, more than a few specialize in custom-manufacturing due to divisions of labor. Delightful manufacturing requires the ability to think beyond the boundaries of design and manufacturing. Designers must understand the production floor, while producers must be able to provide suggestions to designers. Here, the addition of advanced expertise from universities and public institutions will lead to new methods and techniques, including Delightful Design methodology and 3D modeling. Testing on prototypes will ultimately result in the commercialization of actual products. This program is using prototypes to prove Delightful Manufacturing methodology. Ultimately, the program will establish innovative design and manufacturing technologies that will reinvigorate manufacturing and create new markets in which Japan can secure a dominant position.

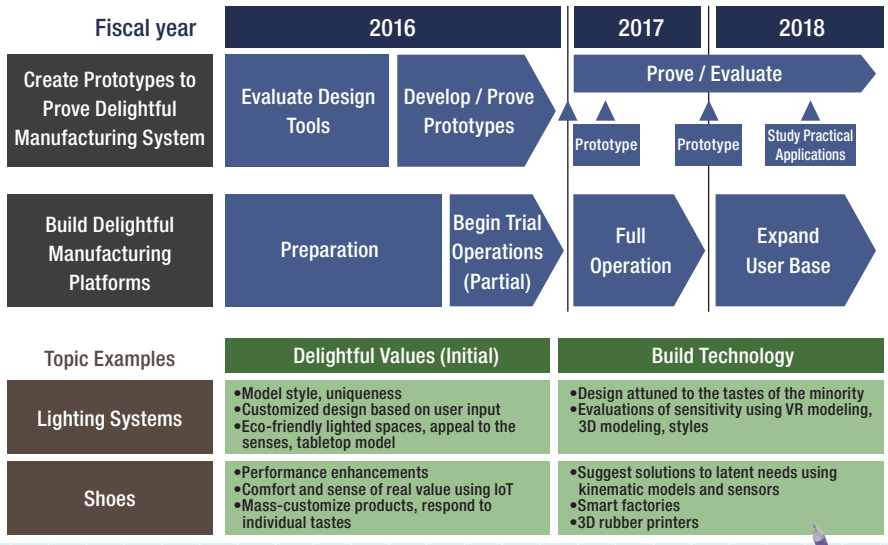
Building Greater Potential for Japanese Manufacturing

Going forward, we plan to recruit new participants to strengthen support for research topics and deepen delightful manufacturing.

This program has yielded innovative design and manufacturing technology with building industry-academic-government networks. SIP's vision for the future is to make a more attractive method of manufacturing in Japan by forming platforms of innovative manufacturing. "Society 5.0" drawn in the government's Fifth Science and Technology Basic Plan points out the importance to improve industrial productivity and create new markets, and our vision accompanies with what "Society 5.0" heads for.

Future Plans

In FY2016 and beyond, this program plans to develop lighting systems, shoes, and other products as prototypes to bring together design and manufacturing. Through a process of validation, feedback, and rebuilding, we expect to see actual equipment and facilities forming the basis of delightful manufacturing.



We are establishing delightful manufacturing, leading to the discovery of new markets.