(Provisional)

Supplementary Explanation on the Themes for the Impulsing Paradigm Change through Disruptive Technologies (ImPACT) Program

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I. The Council for Science and Technology Policy (CSTP) determined themes for the ImPACT program in terms of these considerations:
1. To bring quantum advances in competitiveness for Japanese industry and contribute greatly to a prosperous life for the people of Japan through science, technology and innovation that bring about paradigm shifts by means of disruptive change; or
2. To overcome the serious social issues faced in Japan by means of groundbreaking science, technology and innovation that overturn the conventional wisdom.

The matter was examined from these two perspectives, with reference also to views expressed by concerned organizations in business, academia, and government, and the five following themes were defined:

- Release from constraints on resources and innovation in "*monozukuri* (manufacturing)" capabilities
  (Japan-style value creation for the new century)
- Realization of an ecologically sound society and innovative energy conservation that changes lifestyles
  (Living in harmony with the world)
- Realization of a society of highly advanced functionality that surpasses the information networked society
  (Smart community that links people with society)
- Provide the world's most comfortable living environment in a society with a declining

birthrate and aging population
(Realize healthy and comfortable lives for everybody)

- Control the impact and minimize the damage from hazards and natural disasters that are beyond human knowing
  (Realize a resilience that is keenly felt by every individual Japanese)

2. The themes provide foundations for the conceptualization of research and development (R&D) program by a PM. They are therefore formulated very broadly and expressed concisely so that they can enable a wide variety of technical approaches, promote the generation of dramatic innovation, and also fit with original proposals for dramatic advances.
Meanwhile, it is important to explain, in terms that are as readily understandable as possible, the significance and the anticipated substance of the ImPACT program using specific case examples like those in the attachment. This will include, for example, the background of the themes, or in other words, the awareness of the issue by CSTP and an image of the social and economic impact that should be sought, as well as the disruptive innovation that is called for in realizing that impact.
The broad public dissemination of this kind of ImPACT program substance can be anticipated to have various results. It will encourage applications from a wide range of promising, innovative PMs and researchers, and bring together the wide range of talented people and technologies that is necessary for the assembly of original and challenging ideas and the realization of disruptive innovation.

3. When a specific program concept is constructed by individuals who seek to become PM, and by R&D institutions that want to participate, they are required to take into consideration that it is for themes:

- That require high-risk, high-impact R&D
- That require initiatives coordinating Japan's highly talented researchers with Japan's outstanding research resources (that are not perceived as extensions of existing R&D)
- That do not adhere to existing fields and research areas but rather call for collaboration among different fields and areas (that do not simply designate a particular field or area)
- That will contribute to the creation of innovative advances, new value, and new markets, that will evoke a spirit of challenge, and that will contribute to the formation of an entrepreneurial climate
- That will gain public understanding and support, or in other words, is not something that only specialists can understand

The above features of the ImPACT program are to be taken into consideration.

Theme 1. Release from constraints on resources and innovation in manufacturing capabilities
“Japan-Style Value Creation for the New Century”

Awareness of Issues

・Effective utilization of limited resources, highly advanced functionality without the use of expensive resources, and the use of substitute rare resources is difficult.
・There are no realistic methods for making use of unutilized and undiscovered maritime and other such resources.
・If there is no innovation in production technology, the production of high value-added products will rapidly become obsolete.
・The quality, constituents, and production volume of agriculture, forestry, and fishery production are difficult to regulate in response to changing weather conditions. And other such issues.

Examples of Disruptive Innovation Called for	Envisioned Forms of Socioeconomic Impact
Take air or some other such common resource, or sludge, waste, or other such valueless material, and, using only small amounts of energy and labor, convert or reform it into a useful resource, a high value-added material, or other such substance of value.	Not only is Japan freed from resource constraints, but Japan's presence in the world is enhanced as a new resource-rich nation.
Realize quantum improvement in performance as well as cost reduction (performance increase by a factor of 10 or more, cost decrease to one-tenth or less, etc.) by freely arranging elements to achieve advanced functionality, nano-sized manufacturing, or other such innovative production technologies.	Using technologies that other countries cannot emulate, achieve low-cost production of high value-added materials and high-precision processing, take a leading position in the world by strengthened production competitiveness, and sustain superiority over the long term.
Freely control the production of functional and medicinal components, allergens, and other such useful components of agriculture, forestry, and fishery products even in the natural environment.	Create new markets around a core of functional products in agriculture, forestry, fisheries, and so on (evidence-based dietary practices that change notions of the relationships between medicine, agriculture, manufacturing, and commerce, with medicine and food as agricultural products from the same source).

Theme 2. Realization of an ecologically sound society and innovative energy conservation that changes lifestyles
“Living in Harmony with the World”

Awareness of Issues

・There are no effective methods of achieving large-scale energy conservation while also improving the quality of life (mobile infrastructure, lighting, heating and cooling, information appliances, etc.).
・There are no methods for drastically reducing the volume of waste, which is trending always upward. And other such issues.

Examples of Disruptive Innovation Called for	Envisioned Forms of Socioeconomic Impact
Realize innovative energy-saving lighting by means of new light-generating technology that reduces power consumption to 1% or less or that does not use electricity.	Street lighting that does not need electric power will achieve dramatic energy-saving impact while also enabling illumination at locations that lack sufficient electric power infrastructure, thus realizing a quantum improvement in social infrastructure as well as major reductions in electric power consumption.
Windows, walls, and other such structural elements capable of automatically regulating temperature in response to changes in the outdoor environment without using electric power, thus not only reducing utility bills for office buildings, residences, vehicles, greenhouses, and so on, but also reducing power outage risks.	The ability to make major reductions in electric power consumption while also maintaining comfortable living and working environments with respect to the major environmental changes (temperature, humidity, etc.) in the distinctive four seasons of Japan.
Achieve innovative ecologically-sound electronic devices that allow recycling or reuse of 99% or more of their parts at reasonable cost, and that also reduce power consumption to 1% or less.	Achieve an innovative energy-conserving and ecologically-sound society by innovations in the electronics technology that supports the increasingly advanced functionality of society as well as by freeing society from the constraints of rare resources and waste reduction.

Theme 3. Realization of a society of highly advanced functionality that surpasses the information networked society
“Smart Community that Links People with Society”

Awareness of Issues

Issues involved in making the transition to an information-based society and an increasingly sophisticated information society:
・The vast amounts of information available near-at-hand are not yet effectively utilized in the lives of the people or in the activities of the economy.
・The present telecommunications and information networking environment is subject to security vulnerabilities and is exposed to many risks.
・IT infrastructure in its present state will not be able to keep up with the explosive increases in information volume that are expected to occur in the times ahead. And other such issues.

Examples of Disruptive Innovation Called for	Envisioned Forms of Socioeconomic Impact
Achieve a highly robust information security environment that cannot be deciphered even by supercomputer, and is in principle limitlessly undecipherable.	With advances in the conversion to fully electronic forms of personal information in ordinary households and other domestic contexts as well as in government and public systems, realize smart communities that are safe, secure, and convenient.
Using advances in information telecommunications technology itself that could not be realized by expansion of conventional infrastructure, make it possible for stable, high-speed information telecommunications like that available in urban areas to be provided even in suburbs, remote mountain areas, isolated islands, far underground, at sea, and in high-speed mobile bodies.	Achieve highly advanced functionality in society and advanced applications of knowledge in industry by the construction of a truly seamless IT environment.
Measure and transmit data on feelings of stress and of comfort that are not apparent from consumer tastes in products and services, from counseling, or from other such sources.	Significantly expand domestic consumer consumption by providing low-priced, attractive products that are what consumers actually want.

Theme 4. Provide the world's most comfortable living environment in a society with a declining birthrate and aging population "Realize Healthy and Comfortable Lives for Everybody"

Awareness of Issues

・Health problems of elderly people, inconveniences of everyday life, and concerns about the healthy growth of children have not been resolved.
・There are no effective ways for people to be freed from the din of motor vehicles, railways, and so on, and to lead lives that bring them healing relief.
・There are no simple, convenient, effective ways for people to protect themselves from the toxins and hazardous substances (viruses, bacteria, explosives, substances impacting food safety, etc.) they find close at hand in their lives.
And other such issues.

Examples of Disruptive Innovation Called for	Envisioned Forms of Socioeconomic Impact
By means of total management of road traffic through the use of big data and other such means, achieve zero traffic accidents, dramatically relieve congestion, and realize on-demand shopping that can shorten home delivery time to minutes.	Concepts of transportation and physical distribution will change because of the realization of mobility infrastructure that is truly secure, safe, and convenient for children and elderly people.
Innovative interfaces that instantly reflect what the users intends in the equipment without the use of hands or voice, and operation-free systems that implement everything from everyday health management to near-at-hand care.	Realize secure, comfortable lives and expanded social activity for elderly and disabled people by the achievement of free communication tools that transcend language.
Provide free control of light, sound, heat, and other such factors that affect people's lives by blocking off the noise from motor vehicles, trains, and other such sources using sheets that let light through but block sound, and insulating homes, office buildings, and other such places from sound without blocking windows.	Realize a living environment that is the world's most comfortable and the most free from noise, tumult, feelings of psychological oppression, and other such negative factors, in the society with the world's most highly advanced functionality.
Taking lessons from the superior functionality of living organisms, detect and identify various trace toxins and hazardous substances that are found near at hand at once and non-destructively, non-invasively, at ultra-high speed, and with ultra-high sensitivity.	Realize a society in which the public at large can truly feel prosperous, safe, and secure by assuring safety in the home, in public places, and in other life spaces, and by providing a sense of security in people's dietary practices, wellbeing maintenance, and other such areas of their lives.

Theme 5. Control the impact and minimize the damage from hazards and natural disasters that are beyond human knowing
“Realize a Resilience that is Keenly Felt by Every Individual Japanese”

Awareness of Issues

・There is insufficient capability for prediction of natural phenomena, control of their effects, rapid search, rescue, and transportation when disasters occur, restoration of bridges, roads, and other such infrastructure, and assuring access in times of emergency, dealing with toxic substances, hazardous substances, and other such substances generated by disasters, accidents, or other such events by decontamination or preventing their spread, and other such readiness for dealing with natural disasters.
・There are impediments to advanced mobility in rainstorms, windstorms, nighttime, and other extreme environments, and to increasing the safety and speed of remote demolition of structures and other such heavy work. And other such issues.

Examples of Disruptive Innovation Called for	Envisioned Forms of Socioeconomic Impact
Effectively utilize energy and minimize damage by means of technology for ultra-precise prediction of the impact of natural disasters and for localized weather forecasts that focus more finely than on the size of cities or towns using the dramatically increased capabilities of rockets and satellites (one-tenth the weight or less, observation capabilities increased by a factor of 10 or more, etc.).	Control the impact and make active use of the effects of natural disasters that are beyond human knowing by making ultra-precise predictions of natural disasters, minimizing their damage, making use of the enormous energy in natural disasters, and other such means.
Decontamination of toxic chemicals, bacteria, viruses, and other such hazards that have spread over wide areas by methods that are rapid, simple, and convenient, and that have no harmful effects on the human body.	Implement ultra early-stage decontamination to minimize the spread of infectious diseases that cause diarrhea, fever, and other such symptoms, using these and other such methods to achieve the rapid restoration of a secure, safe living environment.
Placement of bridges and other such large structures without foundation work, rapidly, and regardless of location.	Realize a secure, safe society capable of dealing with a variety of disasters by such means as assuring the security of disaster victims by ultra-rapid restoration of infrastructure when disasters or emergencies occur.
Observation and monitoring systems that can be used in bad weather, at night, or under other unfavorable conditions, and in rubble or in other such extremely confined spaces, and robots that autonomously and cooperatively conduct rapid search and rescue activities.	Take steps such as greatly increasing the speed of rescue and relief operations, dramatically raising the rescue and relief success rate, and minimizing the highly dangerous work performed by human workers, to build truly safe social infrastructure while also realizing a prosperous society by such means as securing useful resources through autonomous maritime and seafloor surveys.