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ENHANCEMENT OF CAPABILITY FOR SCIENCE & TECHNOLOGY DRIVEN INNOVATION

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ABSTRACT

The innovation we should pursue in the 21st century can be categorized into two. 1. National sustainable innovation. 2. Global sustainable eco-system. Japan's challenge to the national innovation is to keep the sustainable development under the predicted declining population and rapid aging. Japan's challenge to the global sustainable innovation is to contribute to the sustainable development of the world with the technologies to solve the global scale crisis, such as environment, energy and economy.

Learning from the innovations originating in Japan, all discoveries were made by the long term patient basic research, and took more than 20-30 years incubation for the socio-economic value creation; innovation. Incubation of the diversified technical seeds based on the basic research, followed by the application research & development with the integration of the wide range of knowledge creation are the vital

elements and the process for the creation of innovation.

The lesson we should learn through the history of innovation is that the science & technology innovation is the key to the sustainable national & global innovation eco-system, and the importance of the innovation pipeline network. The innovation pipeline network, having knowledge creation stage with wide range of academic disciplinary diversity and stage of objective basic research followed by the application R&D stage before the market stage, can be defined as non-linear & stochastic value creation as is shown in Fig.1.

The issue on the capability of science & technology driven innovation is the combination and integration of variety of value creation covering wide range of the academic value, application value and socio-economic value creation. Originality, interface, coordination and integration are the key words for the innovation. The issue for the sustainable innovation capability is how to strengthen the interactive bridge between the knowledge creation and the socio-economic value creation. We have to confront with the difficulty of the innovation in 21st century, which can be called as creation of the large-scale-complex socio-economic system having wider spectral of technologies and also the higher performance & reliability required as is shown in Fig.2.

Innovation capability for the front runner requires both the creation of core technologies and integration of the knowledge and technologies for new socio-economic value creation.

The issue is the required human resources to be nurtured for the front runner type innovation, who can be categorized into four types; Type-D having the capability of creating differentiator technology, Type-E having the capability of creating enabler technology, Type-B having the basic technologies for MONOZUKURI (high value added manufacturing), and Type-Σ having the capability of integrating the science & technology driven innovation architecture as are shown in Fig.3. Current science & technology policy tends to put the policy focus on nurturing Type-D and Type-E human resources due to the diffusion of the scientific disciplinary and active international academic competition. It should be strengthened to nurture Type-B and Type-Σ human resources in parallel in order to assure the investment to the science & technology to be bridged to the socio-economic value creation; innovation. Especially, Type-Σ human resource is indispensable to the science & technology driven innovation, for the innovation we have to create in the 21st century is so called the large-scale-complex socio-economic systems such as nuclear power systems, internet systems and financial systems.

The issue is how to foster Type-Σ human resource, or is it possible to foster Type-Σ human resource under the current higher education system ? Type-Σ human resource shall have the capability of engineering, management of technology and the meta-national capability as is shown in Fig.4.

It is proposed to conduct so called the trinity like promotion of the engineering education and research coupled with the innovation. From this view point, the higher engineering education is needed to be reconstructed with the collaboration of the industries and the government. This is the key for enhancement of sustainable capability for the science & technology driven innovation in the 21st century.

Reference

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Fig. 1 Innovation Pipeline Network

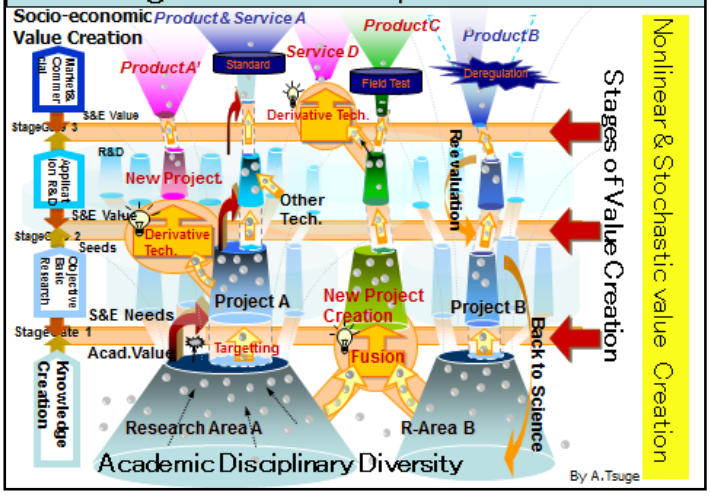


Fig. 3 Required Human Resources for Innovation

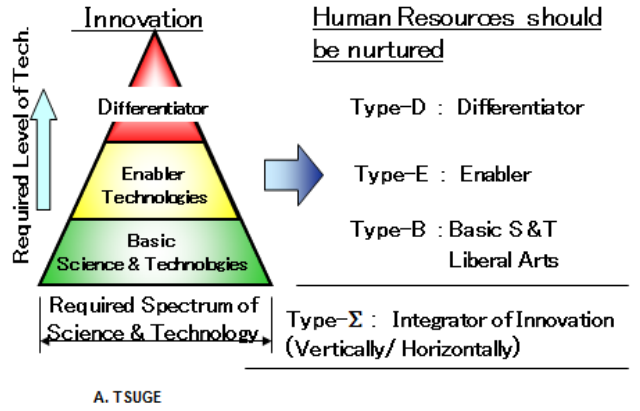
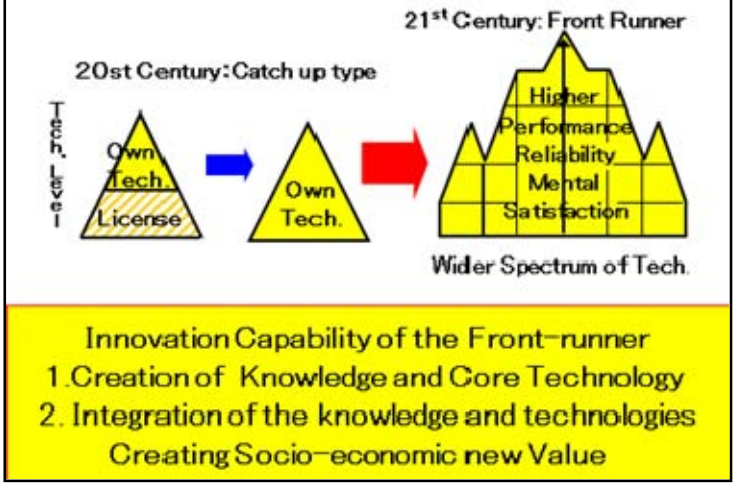


Fig. 2 Difficulty of Innovation in 21st Century



Innovation Capability of the Front-runner
1. Creation of Knowledge and Core Technology
2. Integration of the knowledge and technologies
Creating Socio-economic new Value

Fig.4 Σ-type Human Resources are indispensable to the Science & Technology Driven Innovation