International Symposium on Tracking Careers of Doctorial Graduates,
Ministry of Education, Japan, 2013.2.27,

Enhancing Quality of Doctoral Education

-Fostering Innovative Leaders for Sustainable Development-

博士課程教育の質の向上を目指して

～持続可能な発展を牽引するイノベーションリーダーの育成を～

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Innovation: Creation of new socio-economic value combining new discovery and inventions coupled with social systems.

The Innovation every country should pursue in the 21st Century

1. National & Regional Sustainable Innovation
2. Global Sustainable Innovation

Issue1: To nurture human resources for the sustainable innovation eco-system

Need to enhance higher education including doctorial course based on the design concept of "Integrating education, research and innovation"

Issue2: To build up global sustainable innovation networks

Need to enhance the competence of post-graduates with " Meta-national capability " in higher education including doctorial education

Tracking Careers of Doctorial Graduates should be conducted coupled with these issues and competence the doctorial graduate has.

Learning from the Innovation of the Solar Battery

Contribution to the World — **Renewable Energy**

砂漠での発電

地下水の汲み上げ

海水の真水化

ソーラータウン

太陽光発電所

携帯用電源

Creation of Innovation in 21st C.

Application R&D with integration of wide range of science and technology knowledge creation (Sun-shine Pj Japan, 1979)

Incubation of diversified seeds & technologies

Basic Research

Nano-Science

Chemical

Material

Knowledge Creation

Basic Tehnologies

Electical Engineering

Micro Machining

Invented at Bell Laboratory USA,1954

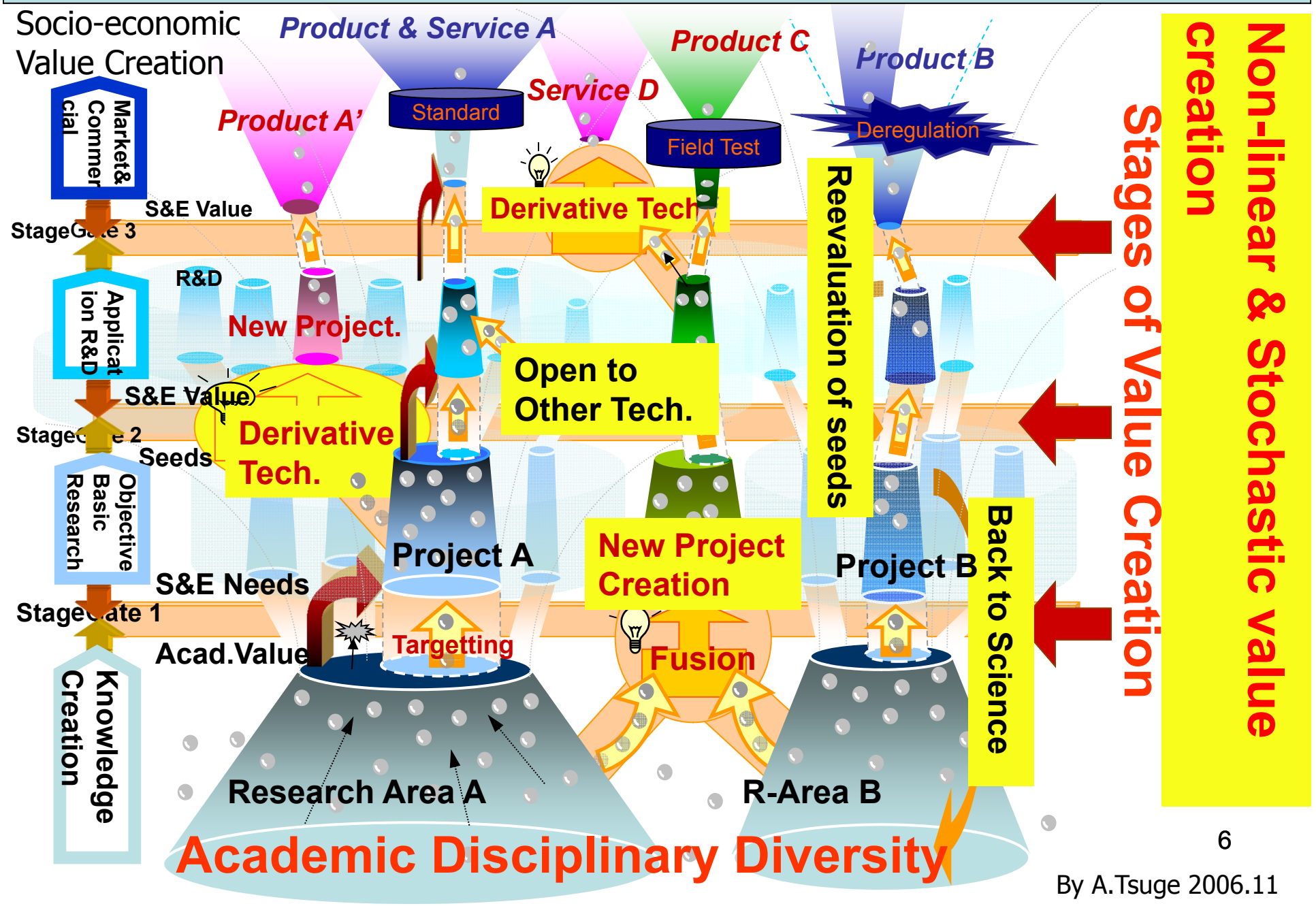
Lesson learned from the innovation history

"Science & Technological evolution" and "Integration of various knowledge through Innovation Pipeline Network" connecting academia, industry & government are the key to the sustainable innovation eco-system.

Innovation needs multi-disciplinary PhDs with the base of own speciality!

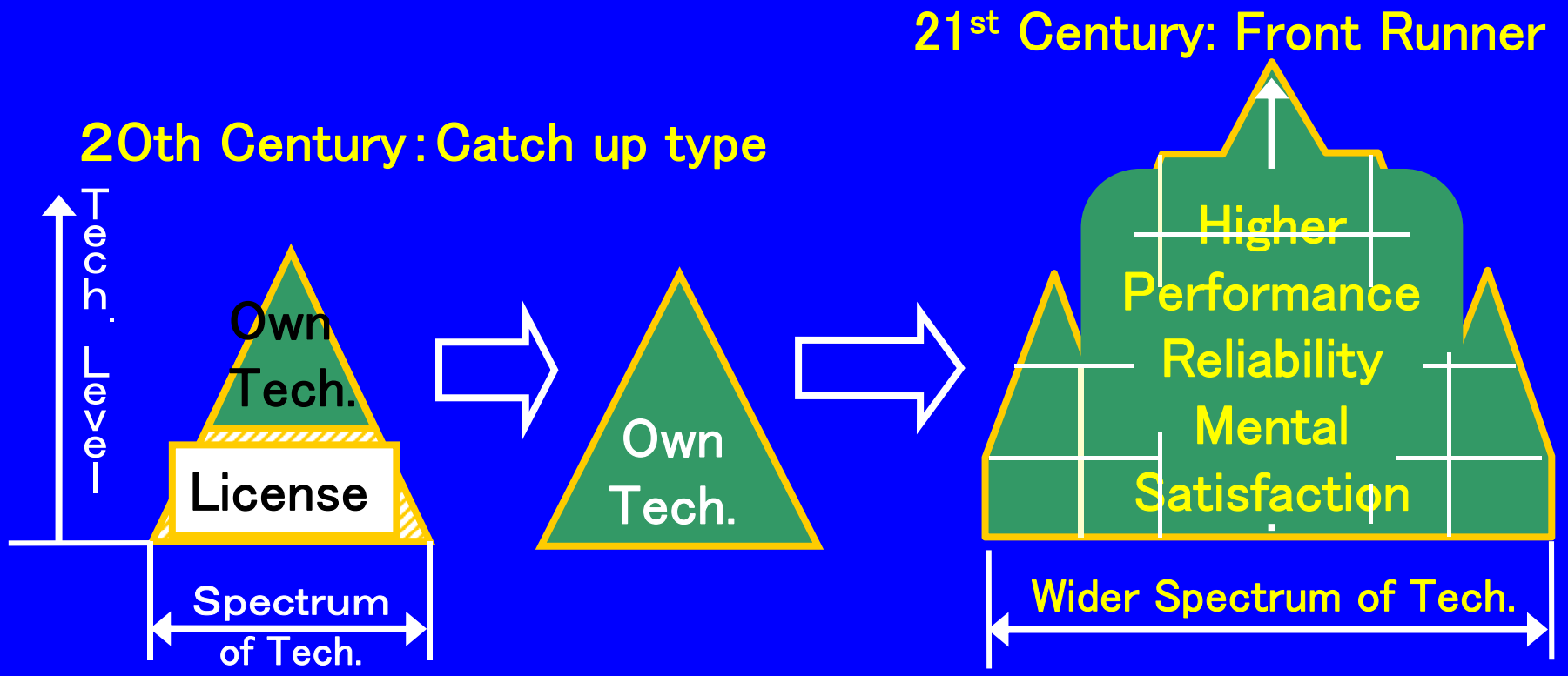
"Their social mission is to form the Innovation Pipeline Network domestically and globally"

Innovation Pipeline Network



By A.Tsuge 2006.11

Difficulty of the Innovation in 21st Century

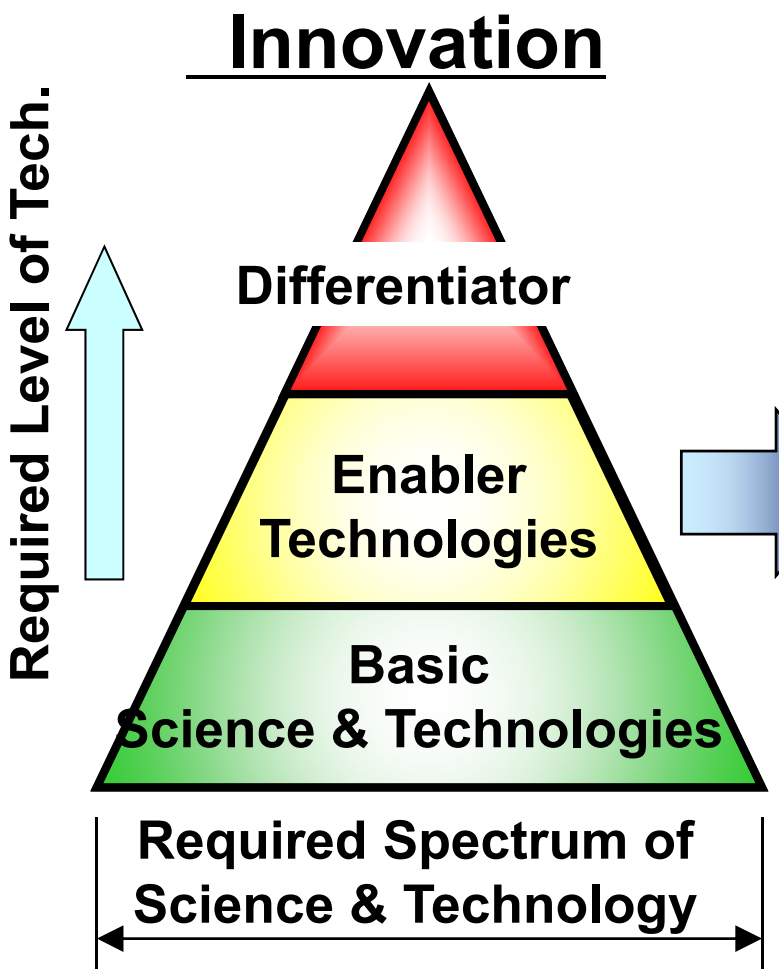


Required Capabilities for Innovation

1.Creation of Knowledge and Core Technology

2. Integration of the knowledge and technologies Creating Socio-economic new Value

Human Resources Required for the Innovation



Human Resources should be nurtured

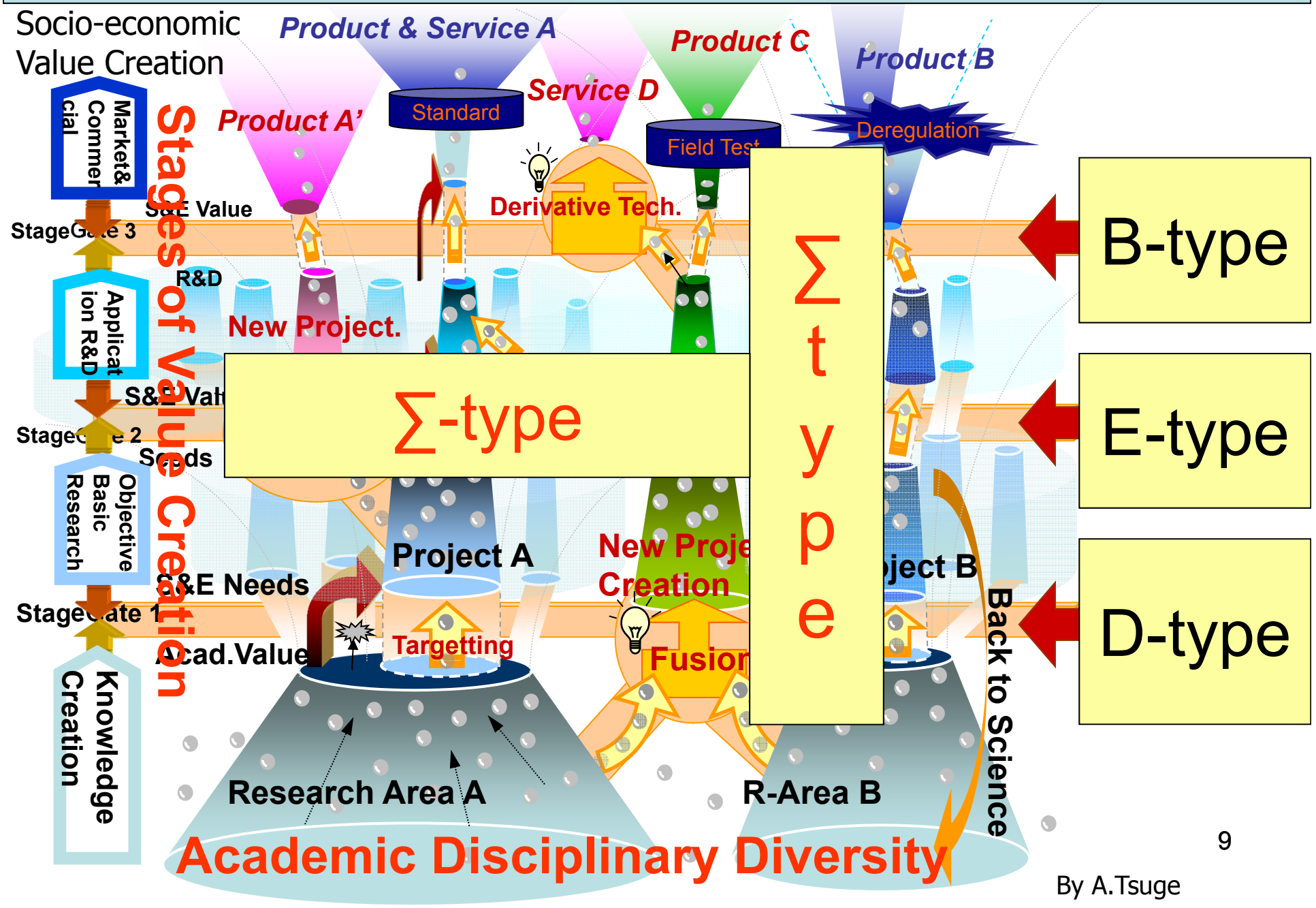
Type-D : Creation of differentiator technology

Type-E : Creation of enabler tech.

Type-B : Basic tech. & skill for high value added manufacturing and services

Type-Σ : Integrator of Innovation structure vertically & horizontally creating socio-economic value

Human Resources Creating Innovation Pipeline Network



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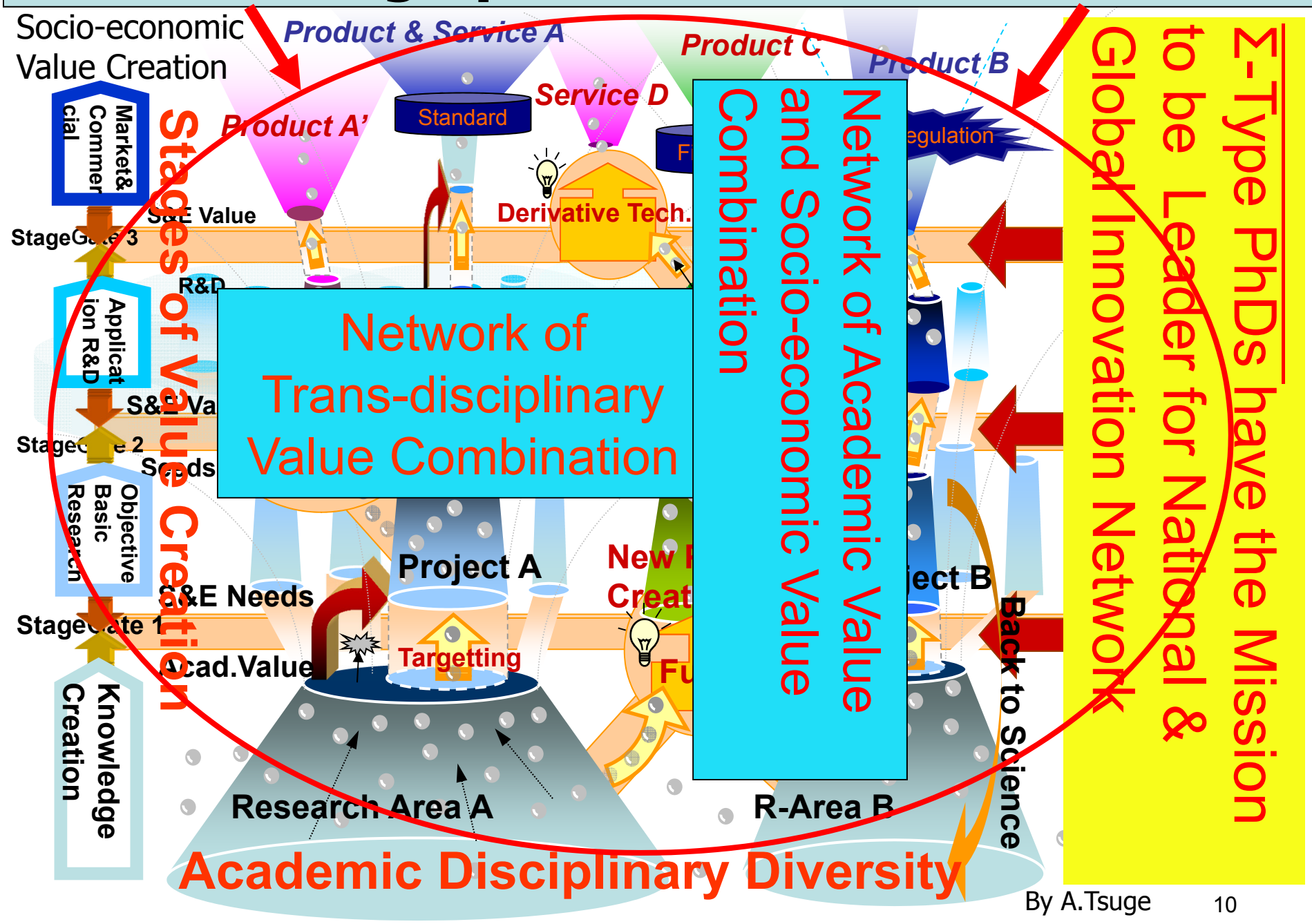
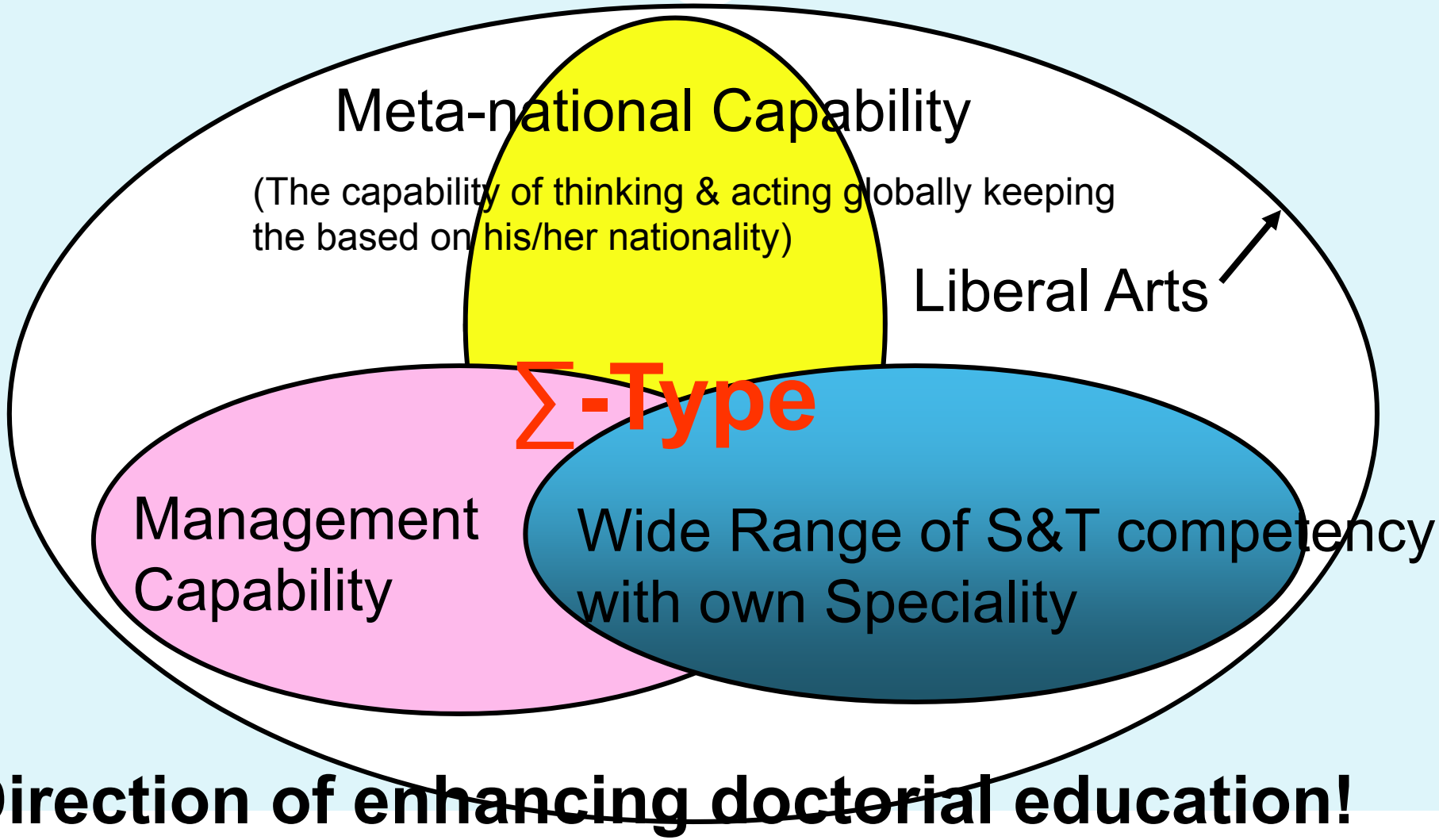
Building up Innovation Networks



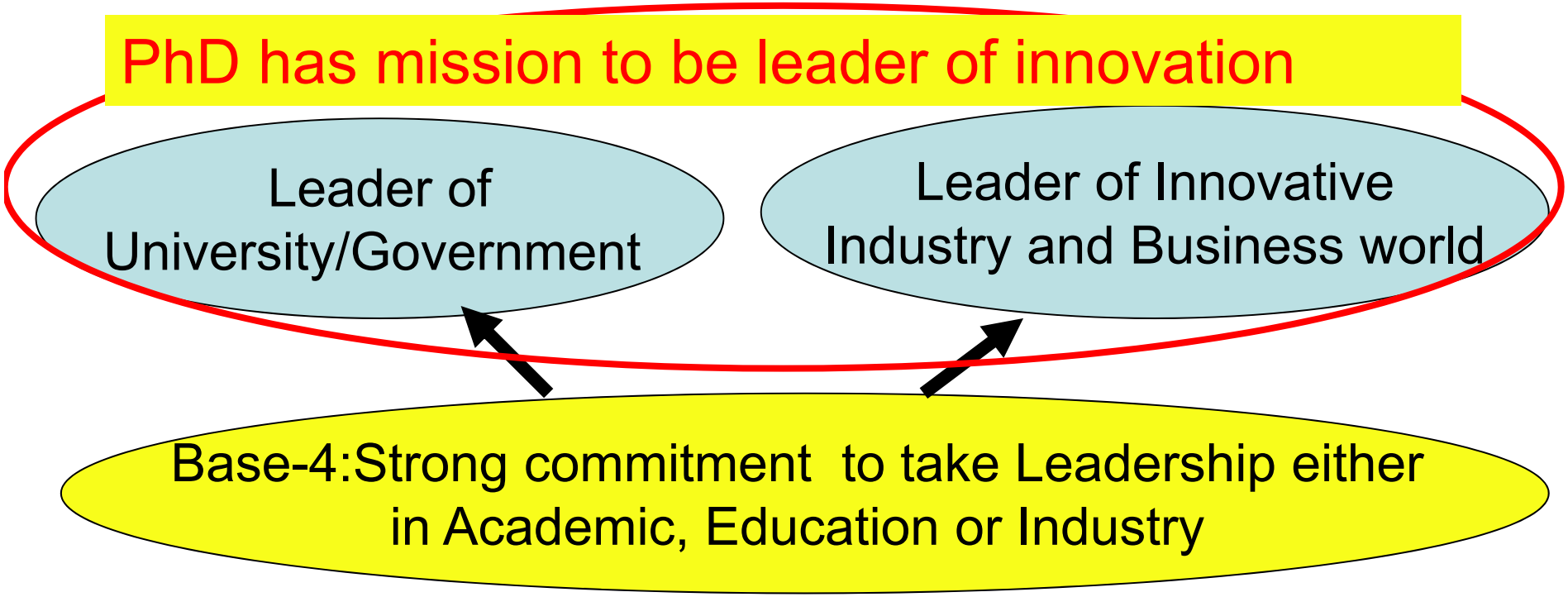
∑-type Human Resource is indispensable for the Innovation



Direction of enhancing doctorial education!

By A. Tsuge

Nurturing Σ-type Capability



Base-3:The Capability of Global Communication, Team Working and Collaboration

Base-2:The Capability of Defining the Issues and Designing Approach for the Solution

Base-1:Wide Spectral Knowledge with One or More Specialtis (Natural, Social Science)

Enhancing Quality of Doctorial Education

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Summary

1.Innovation is not a simple technological revolution, but the creation of socio-economic value with the new combination of technological & social breakthrough

2. Learning from INNOVATION case studies
(1)Non linear & Multi-disciplinary Uncertain & Stochastic process (2)10-30 years incubation

3. Importance of National & Global innovation pipeline network, being integrated by Σ-type human resources

4. Importance of nurturing Σ-type human resources for the innovation eco-system with the base competency Type-D or Type-E or Type-B

Tracking Careers of Doctorial Graduates must cover these aspects with eyes what are missing!