

International Conference “SDGs × Appropriate Technology × Asia”

A Comprehensive Framework on Appropriate Technology Choice for Sustainable Development



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1. Unsustainability of The Modern World and The Need for Comprehensive Framework



Problems Now We are Facing

Poverty and Inequality



In 2017, 2.2 billion people lacked access to safely managed drinking water services

“Progress of household drinking water, sanitation and hygiene 2000-2017” UNICEF et al. 2019

In 2017, 4.2 billion people lacked access to safely managed sanitation services

Ibid.





Power Generation by Charcoal Gasification in off-grid area (APEX)

In 2017, ca.1 billion people lived without access to electricity

“World Energy Outlook 2018” OECD/IEA,

1.6 billion people live in inadequate housing.

”Dialogue on the special theme for the twenty-sixth session of the Governing Council” UNHABITAT, 2017



The Global Inequality Crisis



“In 2018, the richest 26 people in the world owned the same wealth as the 3.8 billion people who make up the poorest half of humanity”

“Public Good or Private Wealth ?” OXFAM, 2019

Problems Now We are Facing

Environmental Problems and Natural Resource Depletion



Global mean surface temperature for 2006–2015 was 0.87°C higher than pre-industrial times

Additional $1.0 \sim 3.7^{\circ}\text{C}$ increase is expected in 2081-2100

“Global Warming of 1.5°C ” IPCC, 2018

“the Fifth Assessment Report” IPCC, 2014

Over the period 1901 to 2010, global mean sea level rose by 0.19 m

Additional $0.40 \sim 0.63$ m rise is expected in 2081-2100

“the Fifth Assessment Report” IPCC, 2014





of an estimated 8 million animal and plant species, around 1 million are threatened with extinction

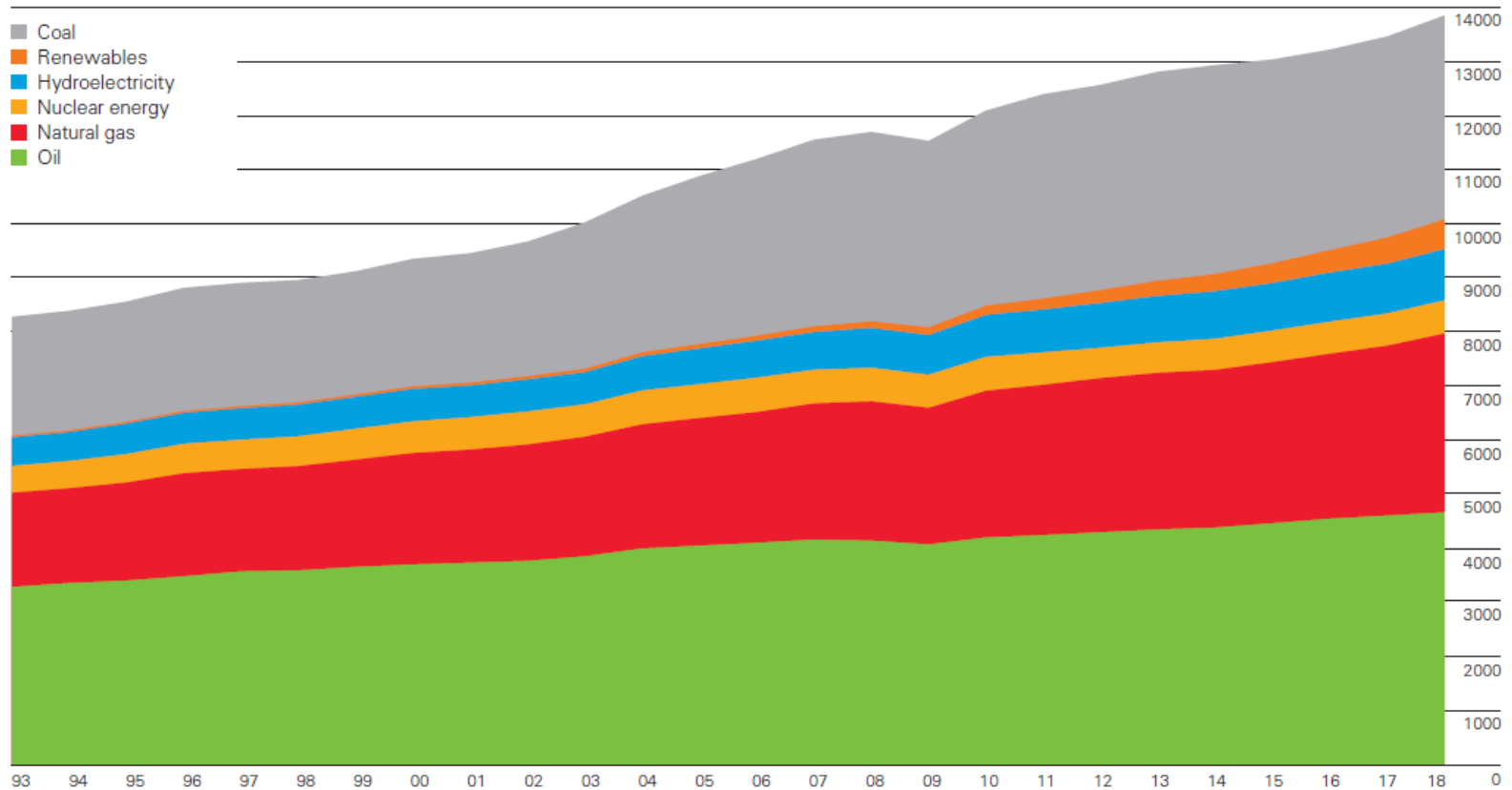
IPBES, Summary for policymakers of the global assessment report on biodiversity and ecosystem services, 2019

Fish stocks at biologically unsustainable levels increased from 10 percent in 1974 to 33.1 percent in 2015

FAO, The State of World Fisheries and Aquaculture, 2018



However, Global Energy Consumption is Still Increasing Constantly



BP Statistical Review of World Energy 2019

Problems Now We are Facing

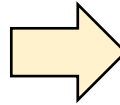
Dehumanization



What is Dehumanization ?

Significance of Human Work

- Produce necessities of our lives
- Develop our potentials and creativity
- Be of help to others
- Develop cooperative relationships with others

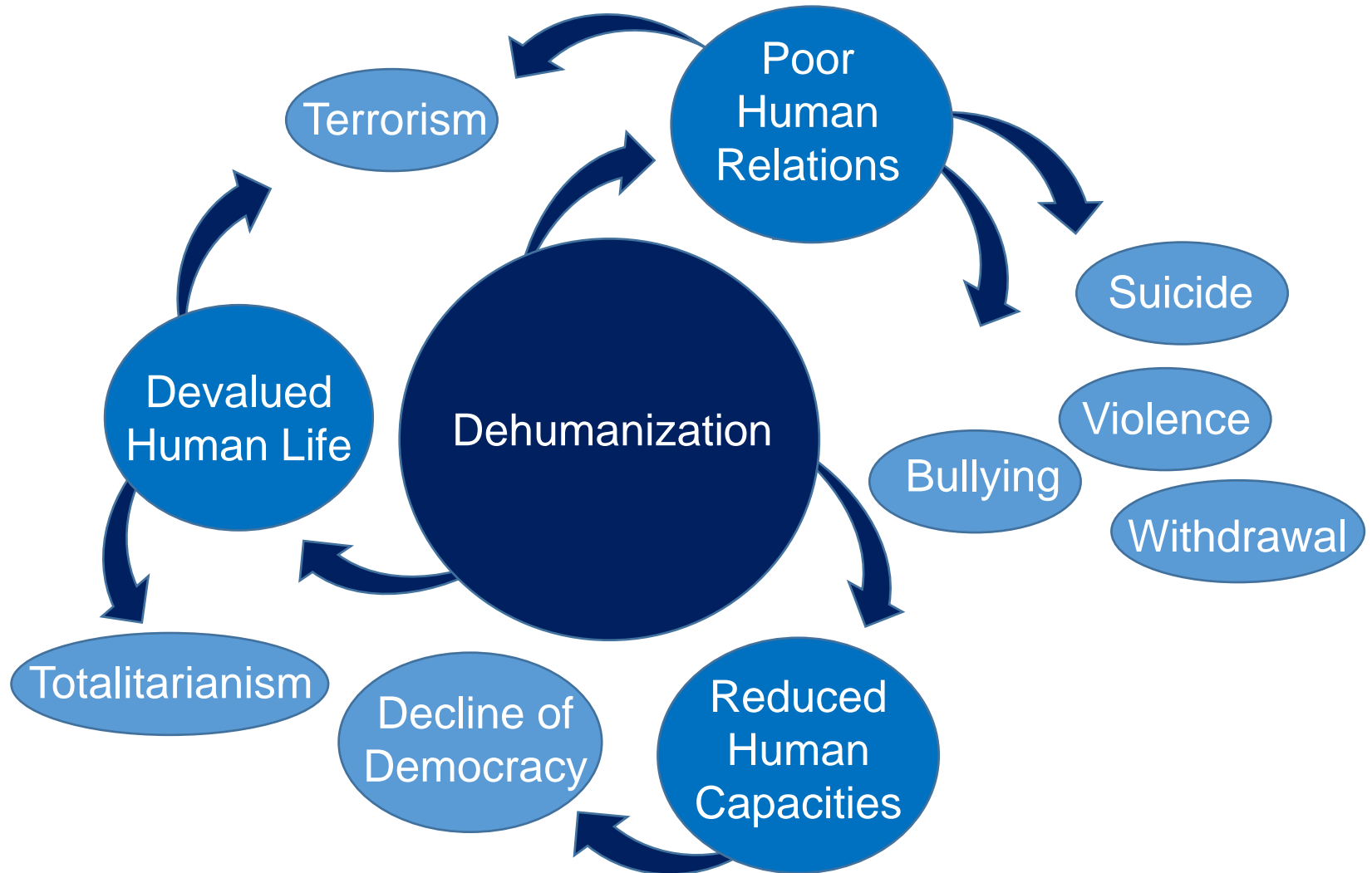


Dehumanized Work

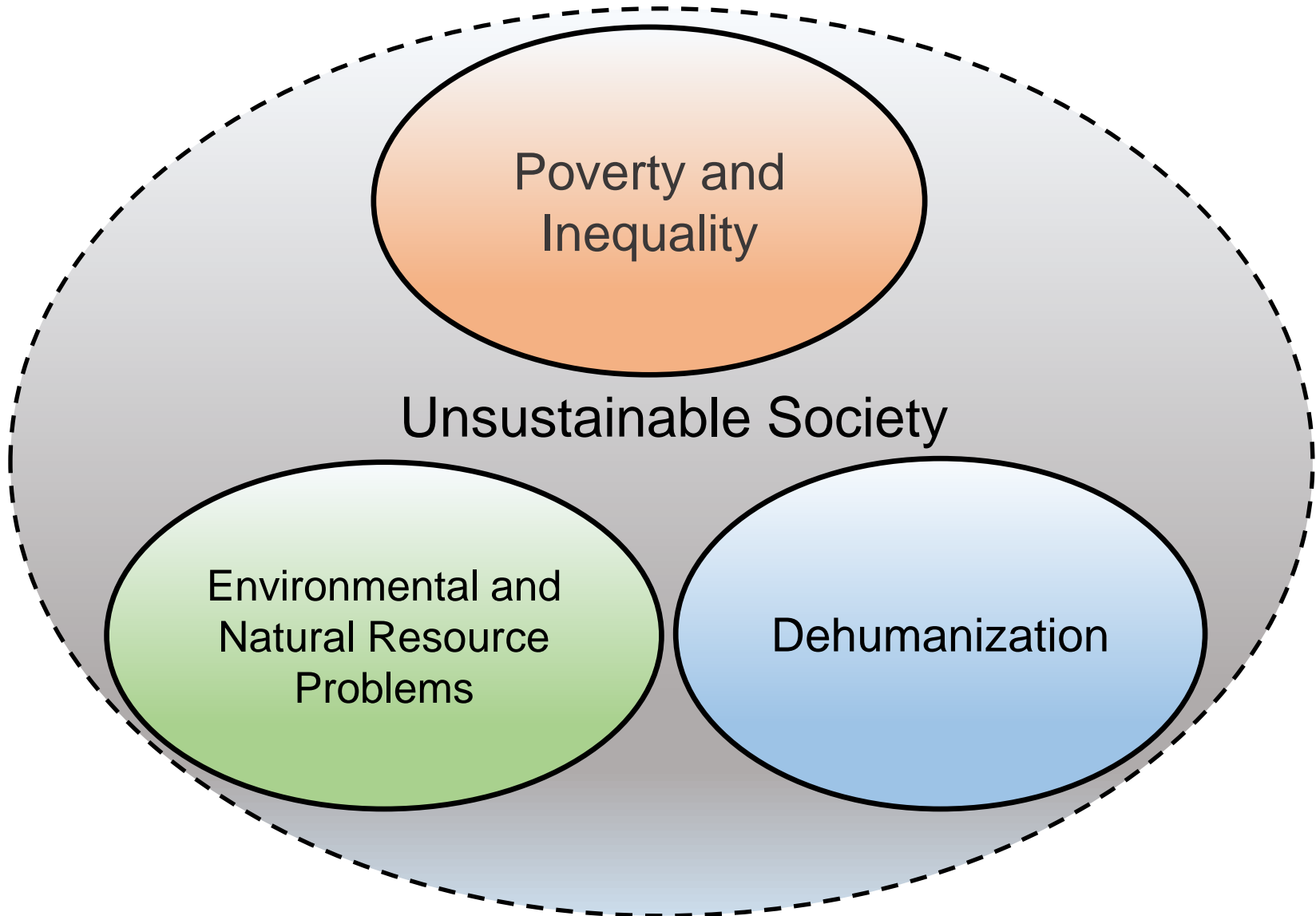
- Means for receive wages
- No/very limited human capacities developed
- Not assured to be of help to others
- Only poor human relationships established

In modern industrialized society, dehumanization prevails to our whole life not only wage labor

What Will Be Brought About by Dehumanization ?



Our Unsustainable World



Mainstream R&D Field Today



Artificial Intelligence



Autonomous Vehicles



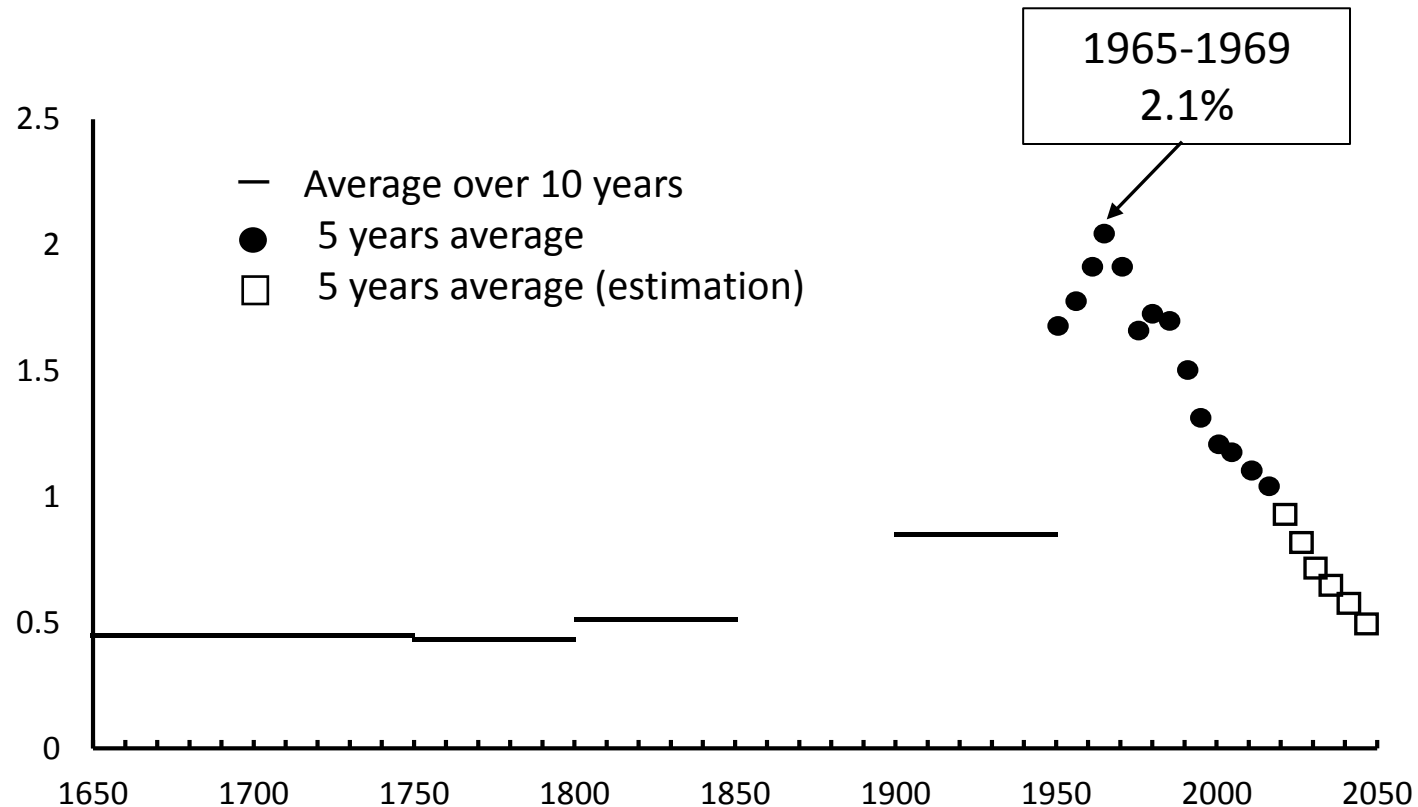
IoT



Life Science ~ Advanced Medicine

Really Consistent with SDGs ?

A Long Term Trend of The World Population Growth Rate



U.S. Census Bureau, International Data Base (Data Updated Aug.2017)
✂After Mita, M. 2018

At the middle of 1960s, the growth rate began to decrease making the turning point throughout the human history

Radical Criticism to Modern Technology and Effort to Create Alternatives In 1960s-1970s

1962 Carson, R., *Silent Spring*.



1967,1970 Mumford, L., *The Myth of The Machine*.



1971 Nakaoka, T., *Philosophy of Factory*.



1972 Meadows, D.H. et al., *The Limits to Growth*.



1973 Schumacher, E.F., *Small is beautiful*.



1973 Illich, I., *Tools for Conviviality*.



1974 Dickson, D., *Alternative Technology*.



1977 Lovins, A.B., *Soft Energy Paths*.



Poverty and Inequality



Environment and Resource



Dehumanization

Appropriate Technology Movements

Primarily Active: Mid 60's to Mid 80's

(1) Development Context

Appropriate to Local Conditions

People's Needs Oriented

Create Job Opportunities

Environmentally Friendly

(2) Alternatives to Modern Technologies

Save Natural Resources

Ecological

Decentralized

Human-Scale, Controllable

Appropriate Technologies are Nothing But
The Technologies to Attain SDGs !

Effective Way~Short-pass to Develop the Concepts of Technologies for Attaining SDGs

Learn from Appropriate Technology Movements
(Primarily Active: Mid 60's to Mid 80's)



Consider the Reason Why the Movements
Were Declined



Make up for the Weak Points

Why the Appropriate Movements Declined ?

The End of Cold War → The Dominance of Capitalism & Modern Technology Enhanced

Absence of Practical Business Management

Shortage of Related Human Resources

Lack of Political Support

The Lack of Framework Widely Approved and Supported

Scope of the Framework

A Framework on “**Appropriate Technology Choice**”,
not on “Appropriate Technology”

Learn from Appropriate Technology Movements: those philosophy, significance, technologies and practices

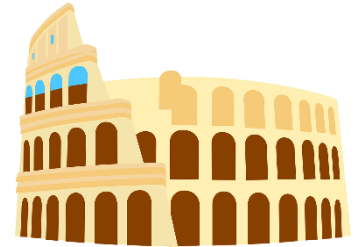
but

Wide variety of definitions as for “Appropriate Technology” already exist, making the meaning vague

⇒ Redefining is difficult and ineffective

To avoid misleading: “There exists a group of technologies called ‘Appropriate Technology’ with special property”

By using the term “Appropriate Technology Choice”, new arena for considering and discussing freely as for technologies really necessary for attaining sustainable development will be opened.



Show the direction of technologies for sustainable future
not only to developing countries but also to developed countries

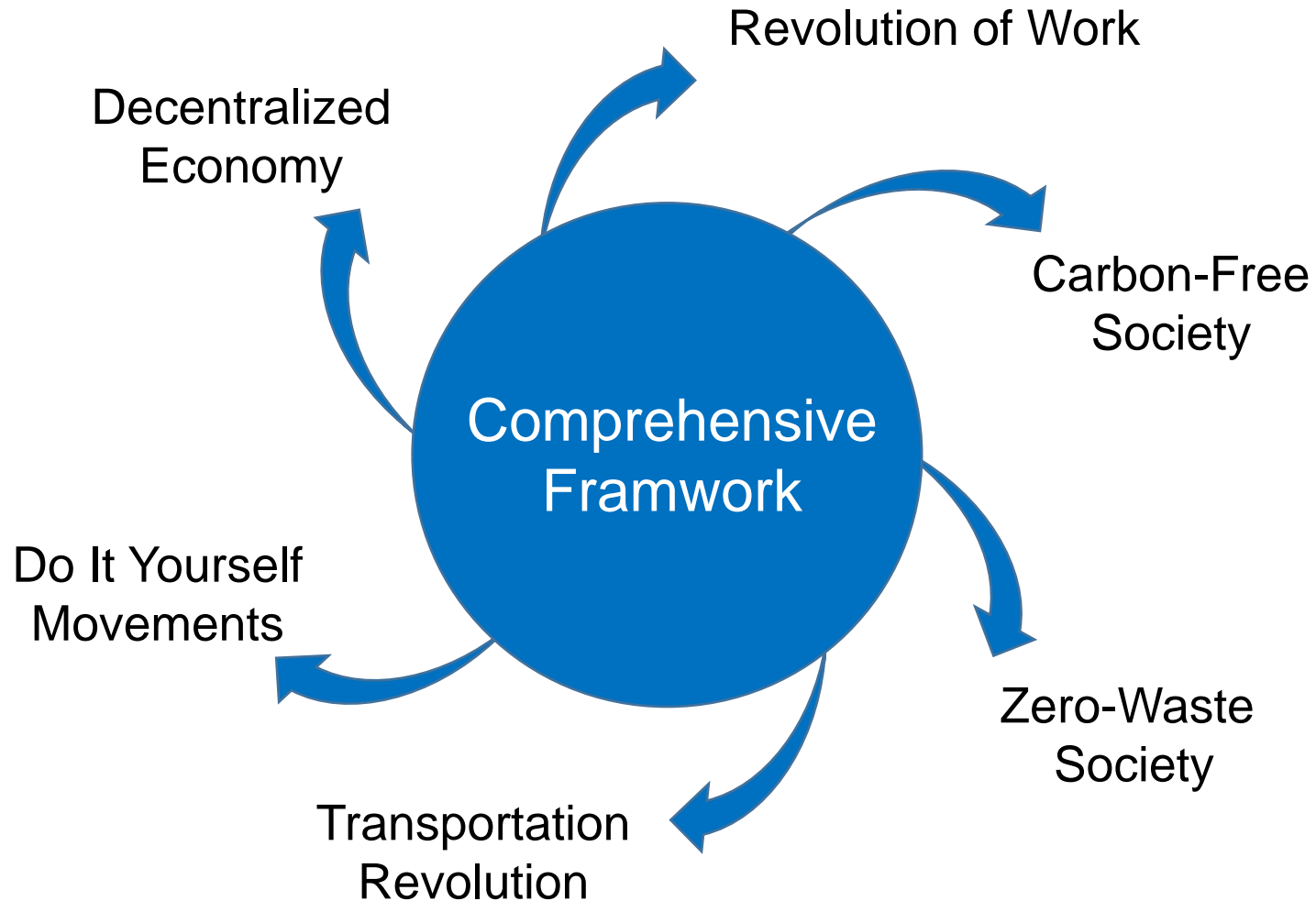
Question “self-evident” assumptions

“Economic Growth is an indispensable requirement” ?

“It is highly advanced new technologies that will create new frontiers of industrial society” ?

“We must constantly increase productivity to strengthen competitiveness” ?

Expected Spin Off



2. Appropriate Technology Choice for Solving Poverty and Inequality Problems



What is Poverty ?

World Bank

People living on less than US\$1.9 a day (736 million on 2015)

UNDP

MPI (Multidimensional Poverty Index, updated:2018)

- § Health (Nutrition, Child mortality)

- § Education (Years of schooling, School attendance)

- § Living standards (Cooking Fuel, Sanitation, Drinking water, Electricity, Housing, Assets)

Cf. Amartya Sen's Capability Approach

Poverty: deprivation in the capability(*) to live a good life

*Capability: the set of valuable functionings that a person has effective access to



Proposal in this Framework

Poverty: deprivation of the conditions that assure people's freedom to pursue the life they wish.

✕Respecting Amartya Sen's definition evaluating freedom as the basic value, focus on the conditions to assure the freedom, to be more tangible



What Mechanism Brings about Poverty and Inequality ?

It isn't the matter of “Backwardness” of developing countries.

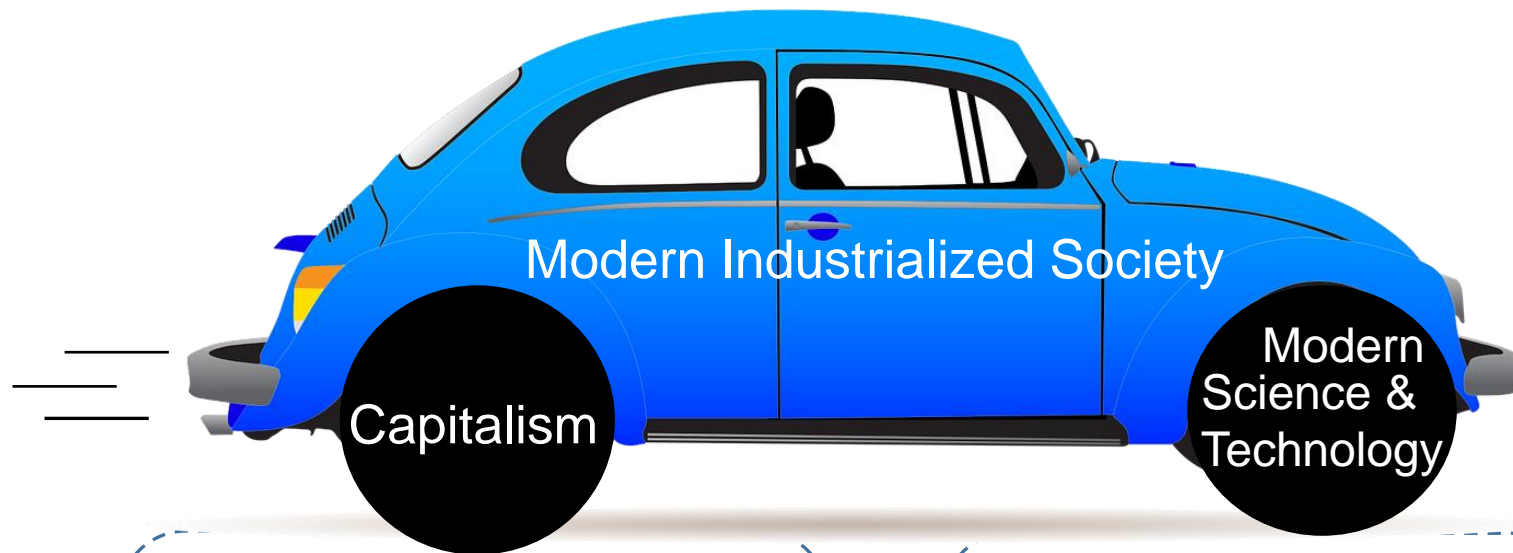
The problems occur when traditional society caught up in the wave of modernization^(*)

* Nishikawa, J., 1974; George, S., 1977; Tsurumi, Y., 1982

The problems also occur when the private sector aims to increase production efficiency despite limited room for economic growth



Capitalism and Modern Science & Technology as Main Drivers of Modern Industrialized Society



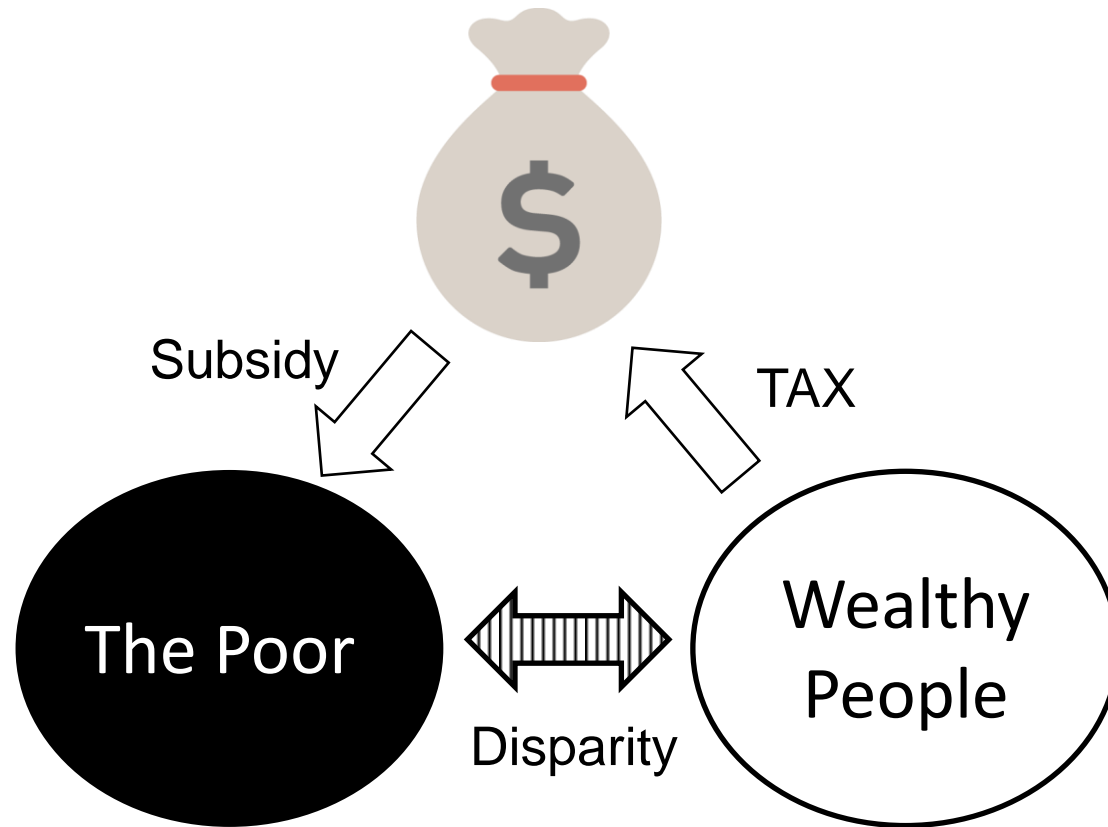
Seek Profits and Economic Growth without Limits

Advantageous to Capitalist

Enables higher production efficiency, higher speed and scale-up

Develop new products & services

Effectiveness of Redistribution is Limited



Structures causing poverty and inequality remain unchanged

Appropriate Technology Choice to Solve Poverty and Inequality Problems

P-1. Appropriate to Local Conditions and Contribute to Poverty Reduction Directly

Choose or develop technologies which fit local socio-economic as well as cultural conditions

Effectively fulfill basic needs of people such as clean water, sanitation, electricity, housing and food.

P-2. Create Job Opportunities Properly

E.F. Schumacher defined “Intermediate Technology” based on “equipment cost per workplace”.

The essential solution of the poverty problems is to create worthwhile job opportunities

3. Appropriate Technology Choice for Solving Environment and Natural Resource Depletion Problems



Lessons not Learned

“Silent Spring” 1962

Outlined the harmful effects on the natural ecosystem from indiscriminate use of pesticides

⇒ Today, a wide range of chemicals, plastics, metals etc are being discharged in much larger amounts in our environment.

“The Limits to Growth” 1972

Raised a significant warning regarding industrialized societies, which were seeking never-ending growth of economy

⇒ Most countries are still seeking limitless economic growth, and climate change has become reality.

Origin and Cause of Environment and Resource Problems

Tragedy of The Commons

Garrett Hardin

Egoistic and uncontrolled access to open access resources causes depletion of the resources

Christianity

Lynn White Jr.

Christianity justify the dominance of humanity upon nature

Population Growth

Paul Ehrlich

The population growth and human desires have brought about the problems

Modern Technologies

Barry Commoner

Economic inequality and unsustainable technologies have brought about the problems

These discussions can be integrated into:

Impact of modernization under the pressure of population growth

is the cause of environment and natural resource depletion problems



Appropriate Technology Choice To Solve Environment and Resource Problems

E-1. Limited Things Should Be Treated as Limited Things

“One of the most fateful errors of our age is the belief that ‘the problem of production’ has been solved.” E.F. Shumacher

E-1.a Refrain from using non-renewable resources as much as possible, and get rid of using fossil fuels.

E-1.b Refrain from discharging wastes, wastewater and exhaust gas without proper treatment, and avoid greenhouse effect gas emission.

E-2. Develop a Society Based on Resources Which Can be Supplied in Sustainable Way

Replacement of current excessive use of fossil fuels with renewable energy is unreasonable.

E-3. Do Not Disturb the Balance and Cycling Process of Natural Ecosystem

Distinguish materials (N) which can be safely returned to natural ecosystem and materials (A) which cannot be.

N should be recycled or reduced to nature after use, whilst A should be used in systems separated from the nature so as not to disturb the natural ecosystem

E-4. Give Priority to Small Scale Decentralized System

Natural energy is suited to small scale decentralized energy supply systems

In harmony with the energy supply system, development of decentralized socio-economic and technology system ought to be given priority.

The system is highly self-sufficient in basic needs supply, at the same time open to interact widely with other regions and countries

E-5. Recognize the Limits of Modern Science and Technology and Respect Nature

Modern Science and technology are based on a mechanical view of the world, which knowledge can be systematically accumulated in large quantities and added to exponentially.

The accumulation of knowledge has led to a tendency to misunderstand that human beings have clarified a large part of the world.

We should recognize that what we know about the nature is very limited and human beings' capability is also limited. We need respect nature with deep and irreplaceable value.

4. Appropriate Technology Choice for Solving Dehumanization Problems



Dehumanization in Classical Context



New Types of Dehumanization (Possibly Arise)



Megamachines (by Lewis Mumford)

Ancient Megamachines



BUILDING A PYRAMID.

ODominated by Great Power

OLarge Scale Work

OHuman became its components and absolutely subordinate to the system

OStrict Standardization and Precise Design

Revival of Megamachines in the Modern World



The Same Characteristics
with Ancient Megamachines

○ Dominated by Great Power

○ Large Scale Work

○ Human became its
components and absolutely
subordinate to the system

○ Strict Standardization
and Precise Design

+

○ Expansion of Capacity without Limits by
Replacement of Human Factors to Machines

What Happens with Introduction of Automation ?

Tetsuro Nakaoka's View

Supporters of Automation

Automation will liberate laborers from monotonous work and enables them to do more sophisticated work

Opponents to Automation

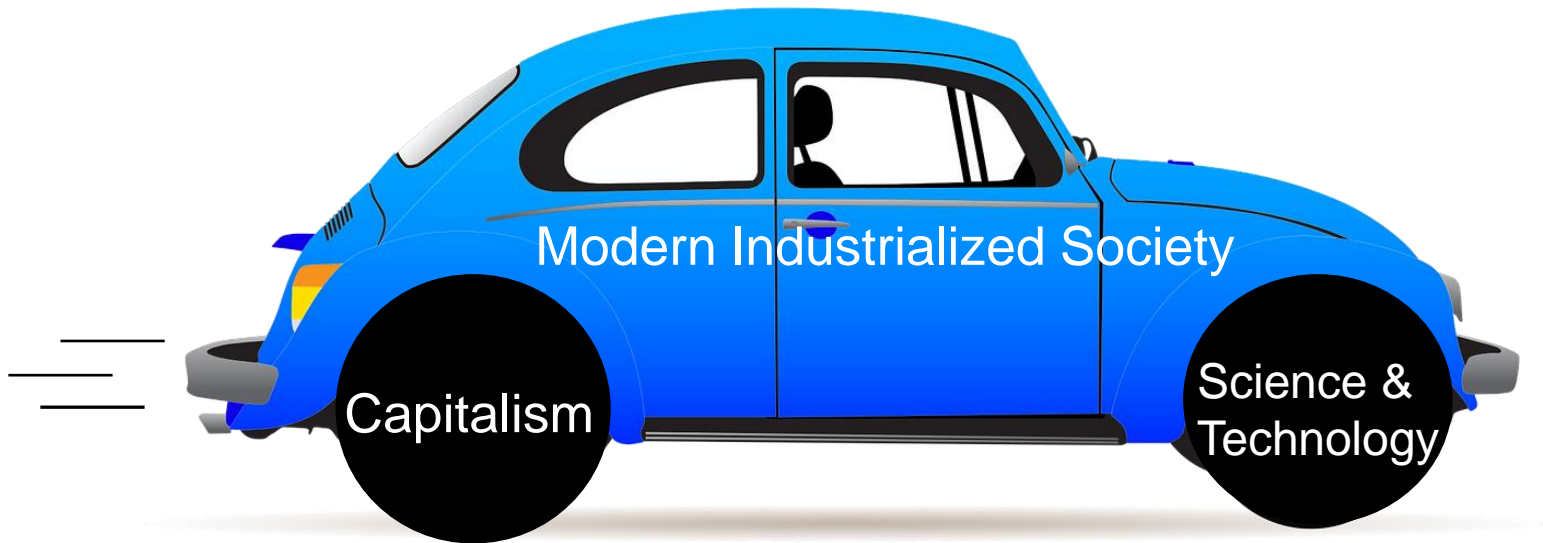
Automation will deprive capabilities/skills from laborers and cause unemployment

Observations of Nakaoka

Automations do not liberate laborers from monotonous work but bring about reorganization as for the division of labor where new monotonous work as well as new skilled works (the new skills are more dependent to machines) appears, and enlarge disparity between elite and non-elite.

Origin and Cause of Dehumanization Problems

Development of Modern Industrialized Society seems to be origin and cause of dehumanization problems



Appropriate Technology Choice To Solve Dehumanization Problems

D-1. Appreciate and Extend Non-Commercial Production/Work

Recover our initiatives and capabilities lost by the development of the commodity economy and the capitalist economy

Do it myself/ourselves

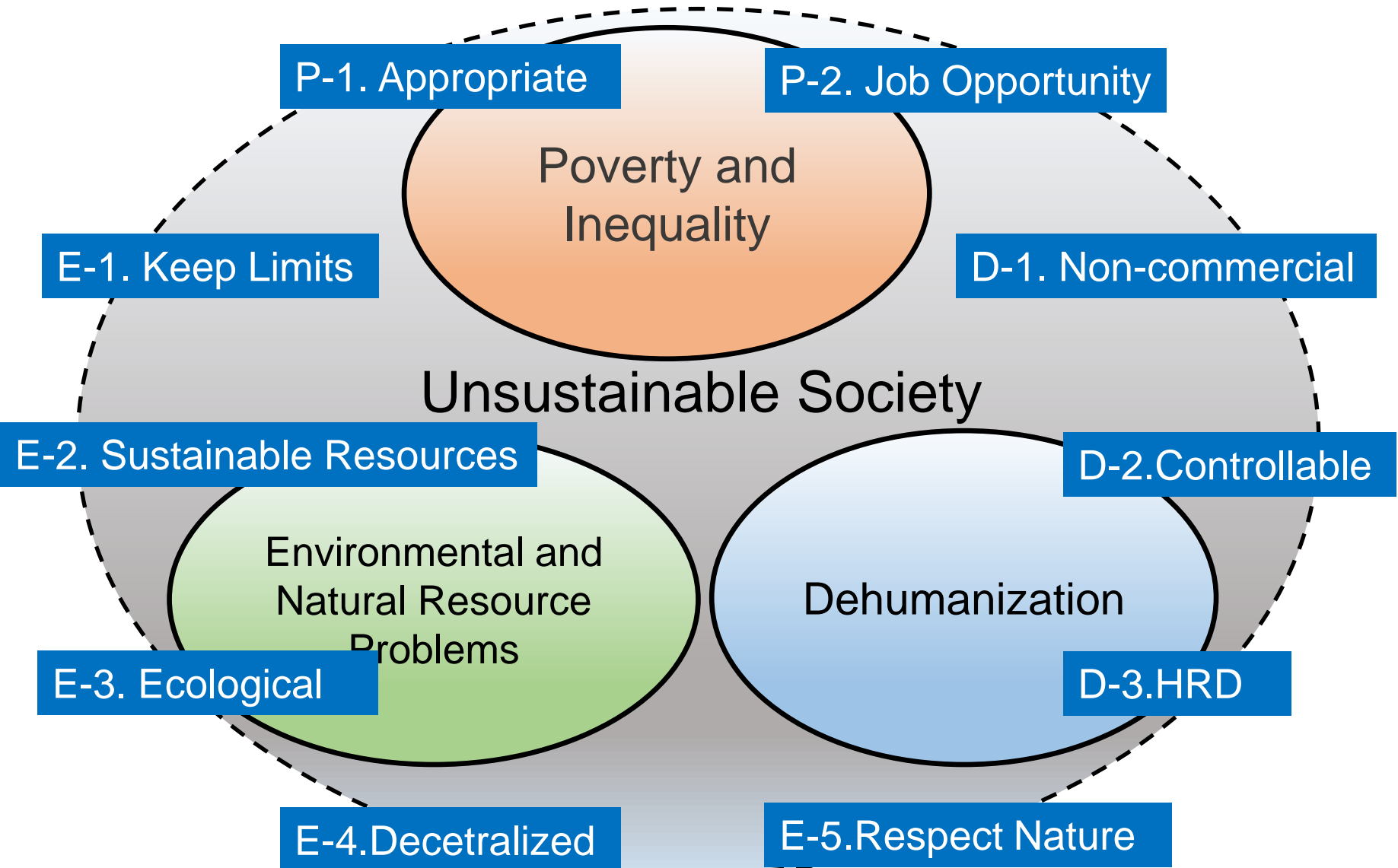
D-2. Make Use of Controllable Technologies by People

Give priority to technologies which do not bring about human subordination to machines and are controllable by people

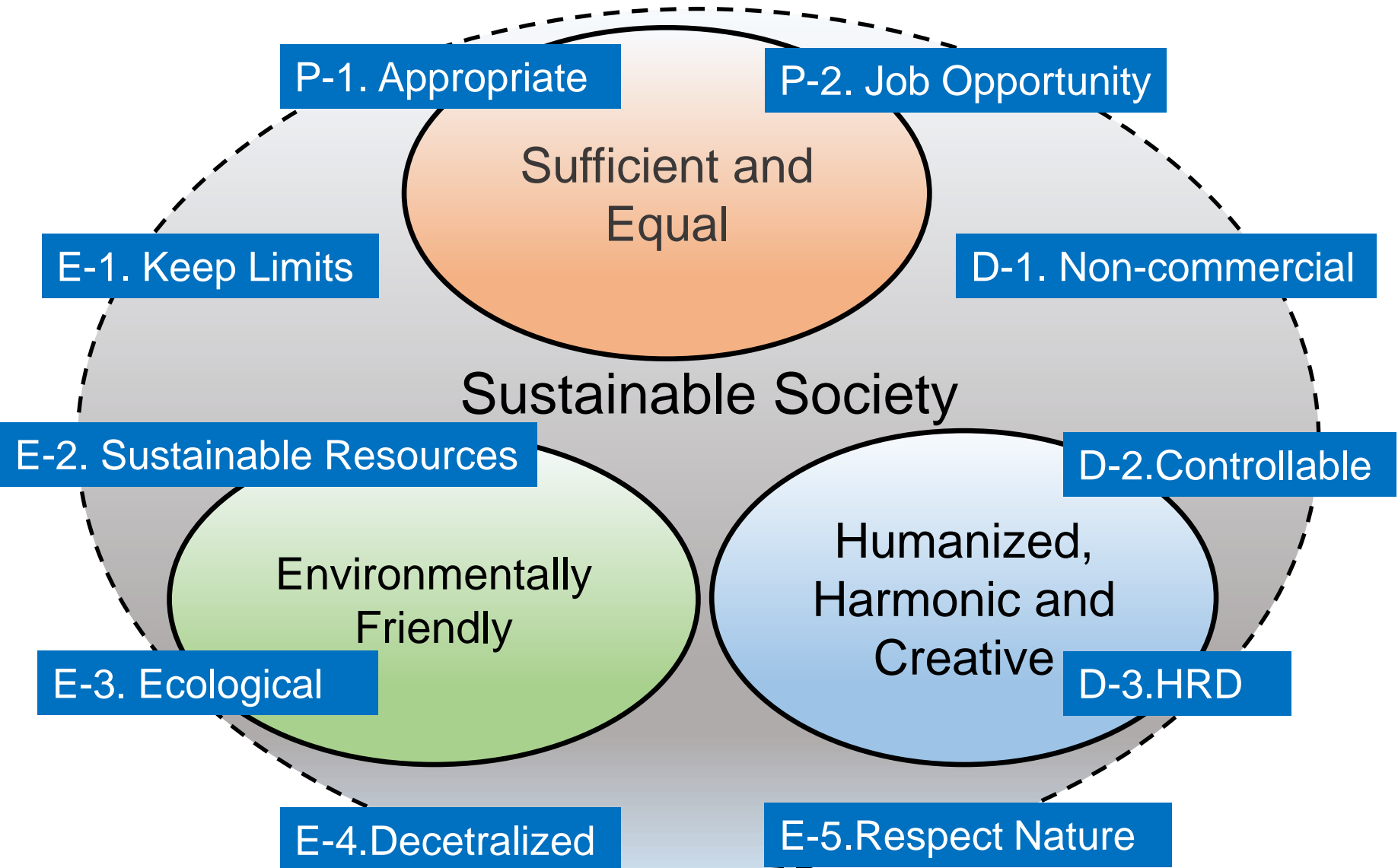
D-3. Make Use of Technologies Which Develop Human Resources

Work gains value and significance when it enables people to demonstrate and develop their capabilities.

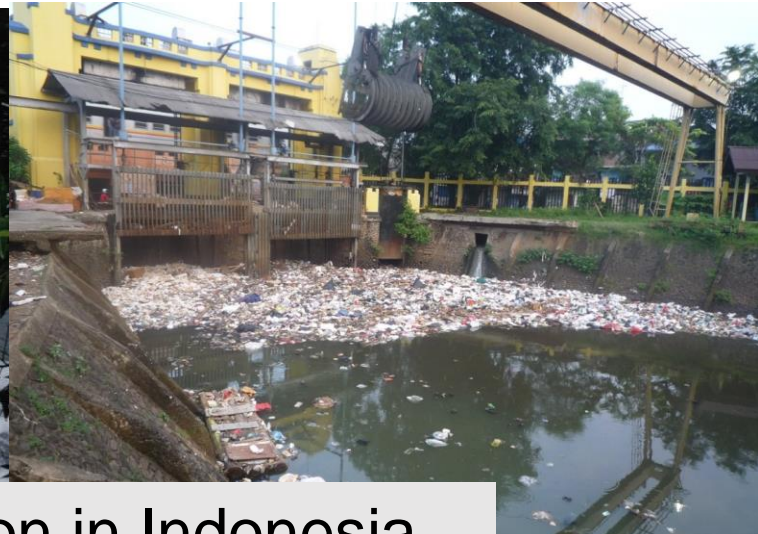
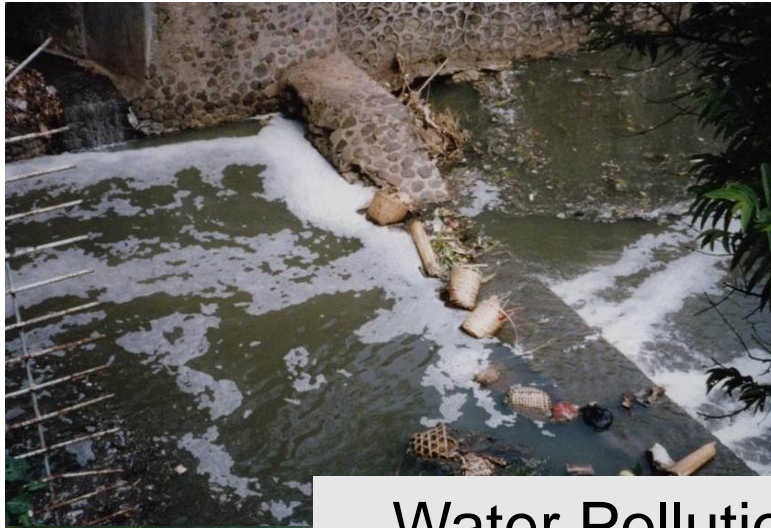
Change Unsustainable Society to Sustainable One



Change Unsustainable Society to Sustainable One



Application of 3-D Lattice Rotating Biological Contactors For Communal Domestic Waste Water Treatment in Indonesia



Water Pollution in Indonesia





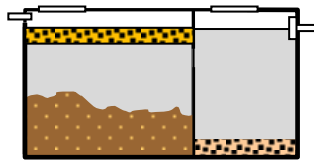
Poor Sanitary Conditions in Indonesia



Necessity of Communal Waste Water Treatment

[Background]

Urbanization → bad sanitary conditions, water pollution



Too densely populated
for individual treatment

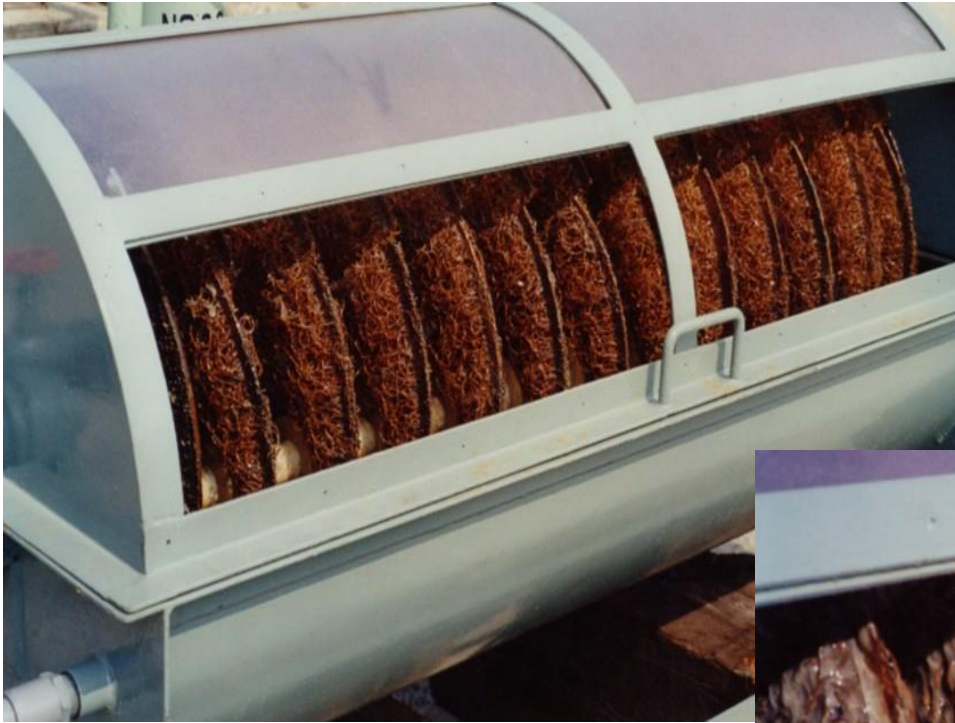


Centralized Sewage
System is too costly



Communal Waste Water Treatment
as practical solution

RBC (Rotating Biological Contactors)



Before Operation

Easy Operation/Maintenance

Energy Saving

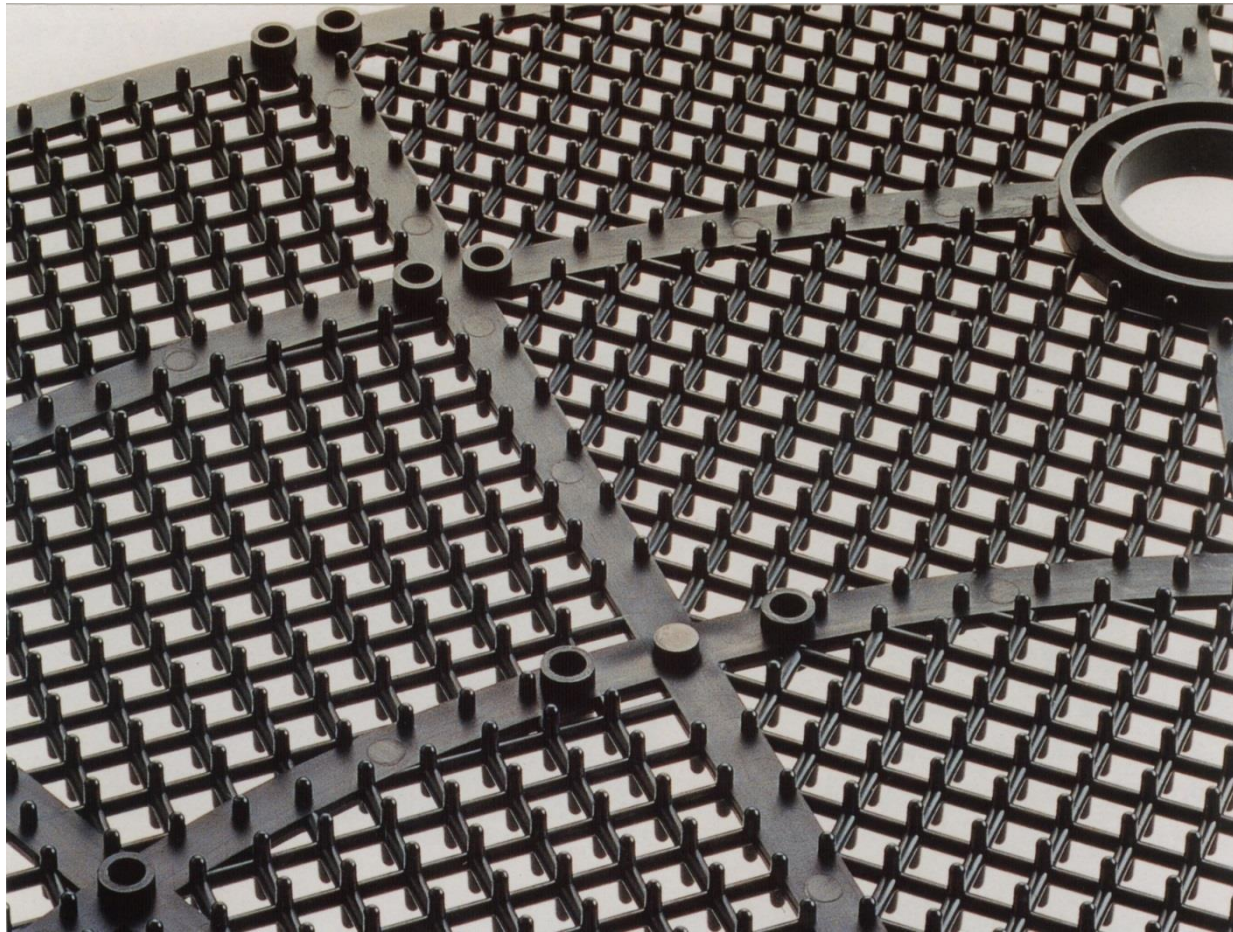
In Operation



In principle, RBC is considered to fit well to Asian countries. However conventional RBCs available in developed countries are costly and difficult to be produced in Indonesia



Then, APEX had come up with a innovative concept of new contactors, which is highly efficient, durable and easy to be produced in Indonesia, that is,
Three-Dimensional Lattice Contactors

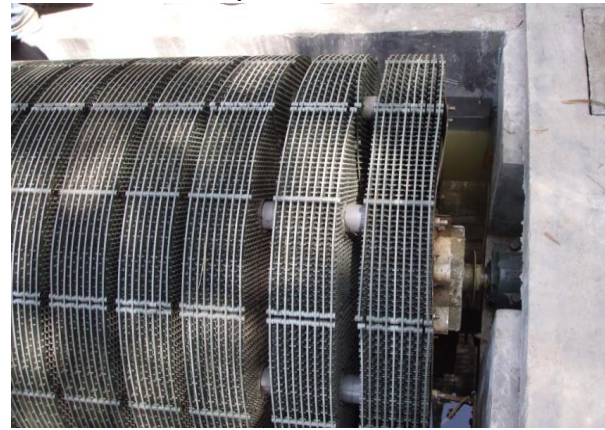


Collaborating with a Japanese Private Company and Dian Desa Foundation, RBC with Three-Dimensional Lattice Contactors was developed

Made in Japan (Sekisui Environment)



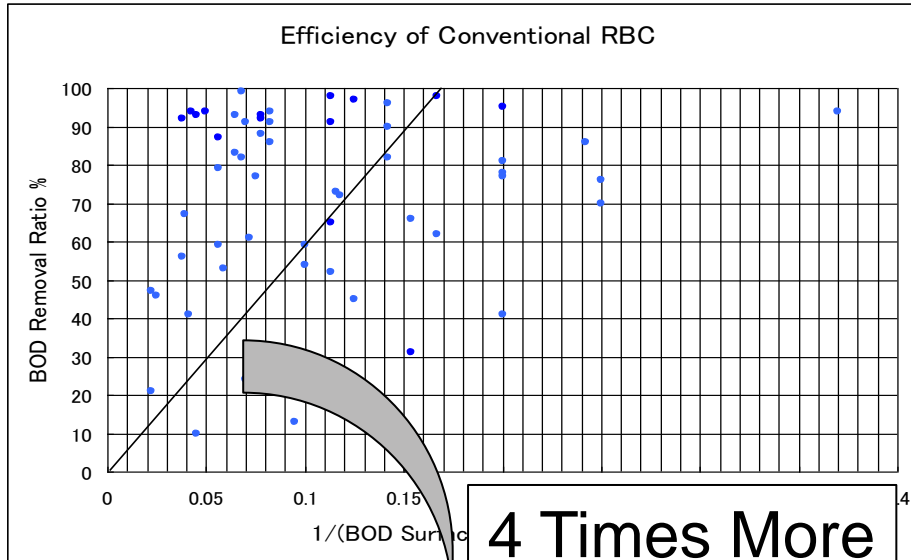
Made in Indonesia (Dian Desa Foundation)



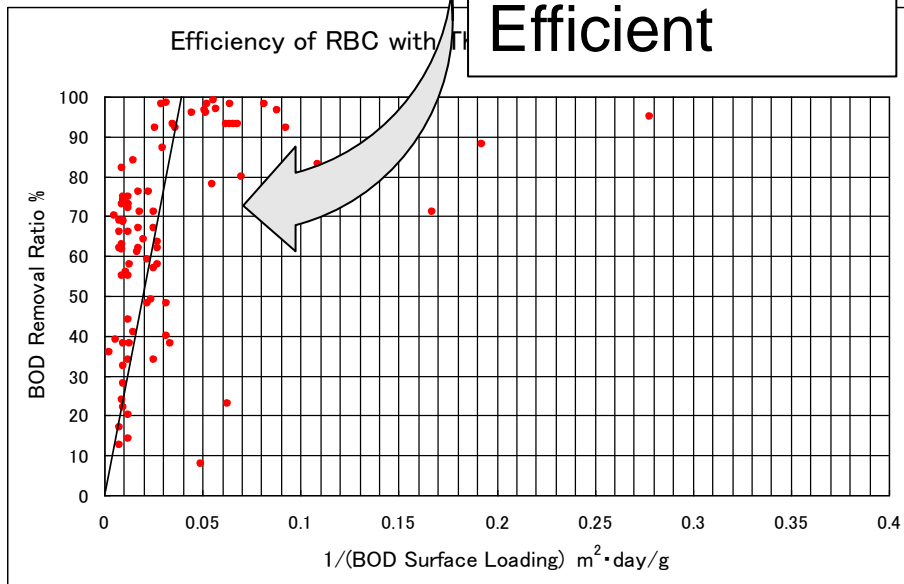
Three-Dimensional Lattice RBC is totally producible in Indonesia



Comparative Study as for Efficiency



4 Times More Efficient



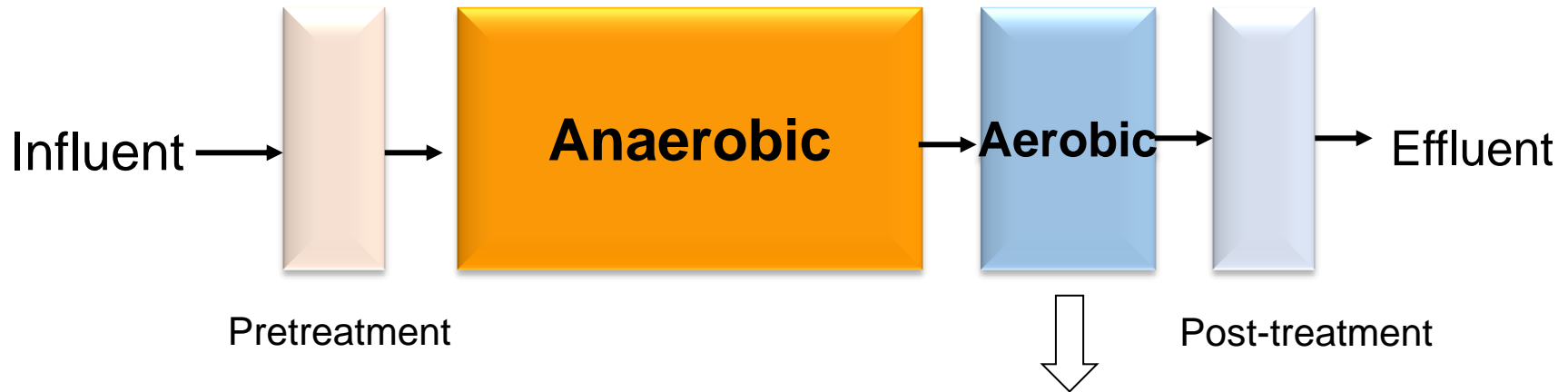
Conventional RBC



Three-Dimensional Lattice RBC



Recommended Communal Domestic Waste Water Treatment System in Indonesia



- High treated water quality
- Easy operation & maintenance
- Energy saving
- Space saving



Meeting with Community People



Slerok District
Tegal City



Landunsari District
Pekalongan City



Semanggi District
Solo City



Pasekan Belodan District
Tabanan Regency

Construction



Training on Operation and Maintenance



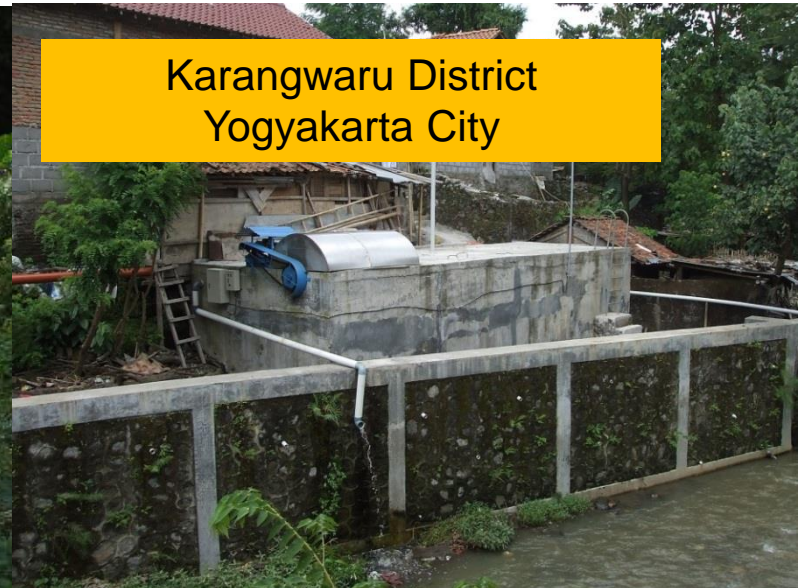
Communal Waste Water Treatment Systems



Kricak Kidur District Yogyakarta City



Kricak Lor District
Yogyakarta City



Karangwaru District
Yogyakarta City

40 Units have been constructed and being operated
(12 units will be added in 2019)

Slerok District
Tegal City



Landungsari District
Pekalongan City



Pasekan Belodan District
(Tabanan Regency)



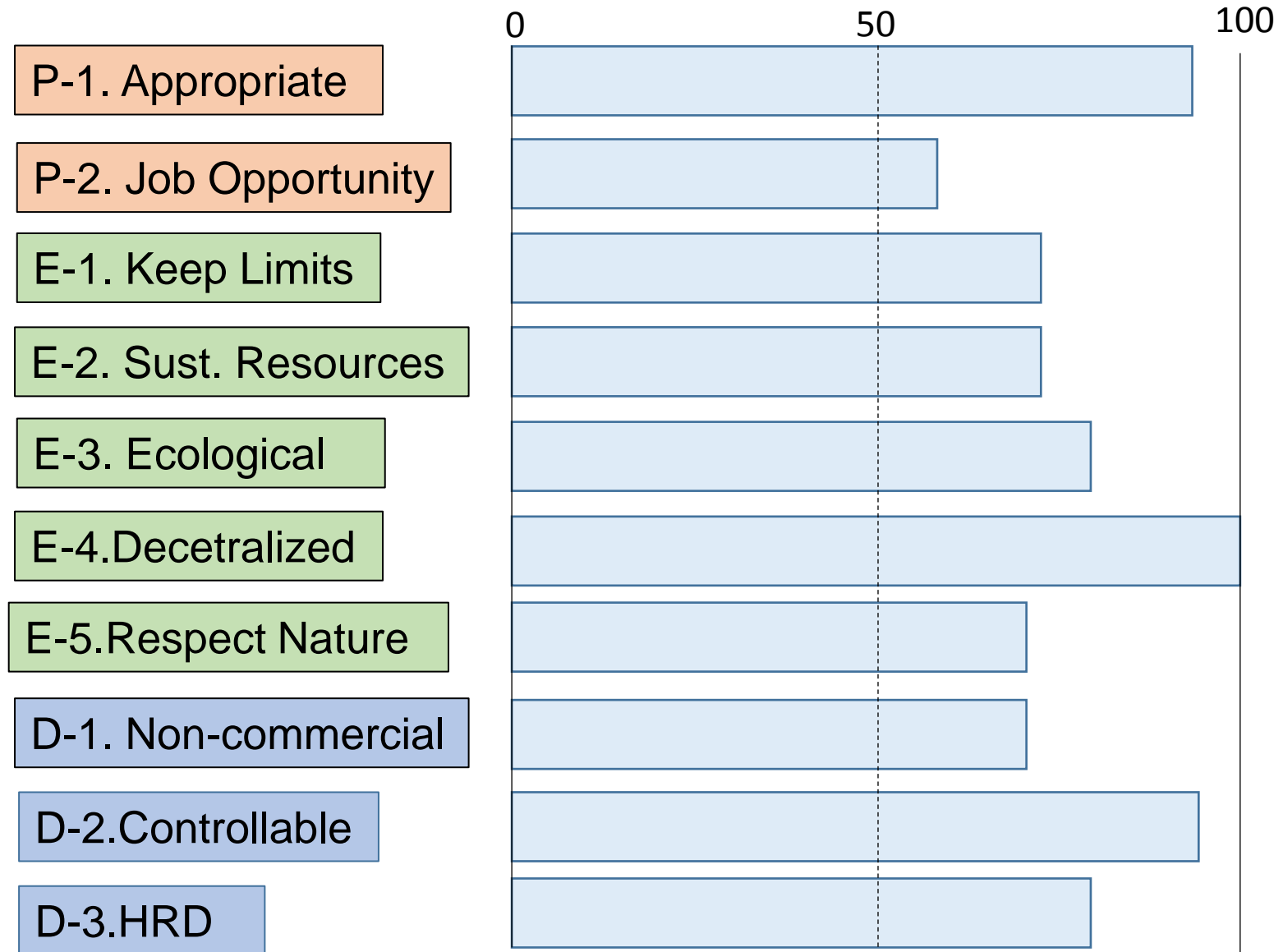
Other than domestic waste water, 3-D Lattice RBC have been used in 39 units system for Hospital and Small Industries' waste water treatment in Indonesia

Other than Indonesia & Japan, RBC with Three-Dimensional Lattice Contactors is now being diffused in China



Photo:Sekisui Aqua System Co.,Ltd.

Evaluation of Technology Choice in This Case



Let us Attain Our Sustainable Future
with Appropriate Technology Choice !

