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(Session 4) Emerging frontiers: evolving STI developments with implications for SDGs

How We Can Respond to Two Different Impacts of Frontier Technological Innovations onto SDGs: Disruptive Emergence and Flexible Focusing

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1. Disruptive Emergence: Emerging Technological Frontiers and Characteristics of Current STI Developments

Current rapid and disruptive technological innovations are bringing a lot of changes in our daily life, and they will also have huge impacts on the achievement of Sustainable Development Goals. The opportunities and obstacles in achieving each SDG will change variously in a way that we have not yet observed or experienced. Such innovations are occurring in every technological part such as AI, biotechnology, new materials, transportations, robotics, and so on.

These new innovations are often called as industry 4.0, or 4th Industrial revolution. Whatever we call, it is not important because everyone knows that the emergence of new technologies and related innovations have started already and they will change a lot of things rapidly around us.

First, I want to make it more clear the definition and characteristic of current technological innovations. I define and identify current rapid technological innovation as **‘Emergence of Disruptive New Combinations between Technology and Market’**.

Traditionally, technologies were separated with each other, and markets were separated with each other also. Information technology and mechanics were separated from each other as different technologies, and electronics and automobile were also separated each other as different markets.

Also, there was a strong connection between a specific technology and a specific market. As example, information technology was usually for electronics industry such as TV, computer, and mobile phone, as mechanics was for automobile industry. IT had not much with automobile industry, and mechanics had not much with electronics industry.

Now, such separations are disappearing disruptively and very rapidly. Technologies and markets are combined each other very fast and unexpectedly.

The disruptive new combinations between technologies and markets are mostly powered by advancement in information technology such as artificial intelligence, big data, and so on. But, involvement of IT is not the most essential part of the innovation. Without IT, such a disruptive new recombination can also arise between technologies and markets.

The most important thing is ‘Emergence’ of new disruptive combinations itself those are occurring between technologies and markets. Emergence means new combinations are voluntary, unexpected, and uncontrollable ones. We may want to expect and forecast them, but it is very hard because the new combinations are emerging. They are voluntary and unforeseeable in nature. Nobody can exactly forecast and control the concrete directions or detailed aspects of the new emerging combinations between technologies and markets.

2. SDGs and Two Different Impacts of New Technological Innovations onto SDGs

The concrete impacts of current technological innovations onto SDGs are not so easy to foresee. But, we can expect the long-term directions of impacts of current technological innovations.

First big impact, we can expect, is the improvement of efficiency. With new emerging technologies, rapid increase in efficiency is possible. With increased efficiency in the process of whole production and consumption, we will need less of production inputs such as labor, materials, and capital. Especially, the input of labors and materials can be reduced dramatically in the future production process with the help of new innovative technologies.

This improvement of efficiency will have two different impacts on SDGs. Reduced necessity of labor force can bring less employment. People may suffer from job loss and consequently loss of their bases of economic survival. The gaps between the rich and the poor, i.e. the inequality, may increase because many physical labors can be substituted by intelligent robots and AI. In the near future, we may find the jobs of truck or taxi drivers have disappeared entirely by the use of autonomous car. Mental labors, or office jobs, will not be exempted from the substitution by artificial intelligence or related new technologies.

But, reduced usage of raw materials and energy in the production process supported by new technologies mean that we can largely decouple economic growth with resource usage and environmental degradation. So, new technological innovations can contribute to achieving many SDGs such as Affordable and Clean Energy (Goal 7), Clean Water and Sanitation (Goal 6), Climate Action (Goal 13), Sustainable Cities and Communities (Goal 11), Responsible Consumption and Production (Goal 12), Terrestrial Ecosystem (Life below Water & on Land, Goal 14 & 15) and so on.

Second big impact is on the capital. The capital part, as one of the major production inputs, will be affected in two different ways at the same time. Advancement of technological

innovations will require more capital investment, so that only global giants and big companies can afford such a huge capital investment. Many traditional enterprises and small companies may lose their ground to compete with giant companies, and go to bankruptcy because they could not afford such a big capital investment.

But, on the other hand, new technologies can open up new possibilities for start-ups, ventures, and small companies. Many new enterprises can be created with relatively less capital because they can be supported by efficient new technologies. So, in the capital aspect of production input, we will observe two different impacts of new technologies onto SDGs arise simultaneously.

3. Flexible Focusing: How Can We Respond to Two Different Impacts of Technological Innovations onto SDGs?

Because it is very hard to expect and control the concrete directions and aspects of the disruptive new combination between technologies and markets, the best way of responding to the revolution is having and keeping 'Flexibility'.

An economy can keep its necessary flexibility by widely opening up free grounds for new businesses that has been started from new technological innovation. Business model promotion and deregulation is the way to keep an economy's flexibility to the technological innovations.

Business model is not technology itself, but it is an idea on how to newly connect technologies and markets. Business model is getting more important in the era of new technological innovations, because the basic character of the innovations is new combination between technologies and markets. Without proper business model, new technological innovations could not be fueled, and could not grow further.

If a government is afraid of unexpected possible hazards from entirely new business and new business model, it will be better for the government to make the business model free first, and then to regulate it later based on actual hazards occurrence. If the government choose to regulate first and then to make business model free later, the possibility of new business may be lost, and the initiative of the new business model and new innovations will goes to other competing countries.

By nurturing new business opportunities and new business model from frontier technological innovations, an economy can cope with undesirable increase in unemployment and sustain its economic vitality to achieve important SDGs such as Decent Work and Economic Growth (Goal 8), Reduced Inequalities (Goal 10), Industry Innovation and Infrastructure (Goal 9), No Poverty (Goal 1), Zero Hunger (Goal 2), Good Health and Well-Being (Goal 3), and Quality Education (Goal 4).

Governments also have to give their sustained efforts to nurture new technologies to reduce resource and energy usage. Increased efficiency from new technologies can be good engine

for reduced usage of resources and energy. A government can support and subsidize to the technologies and the businesses that can create much advanced reduction in resources and energy usage.

Especially, governments need to support these eco-friendly technological innovations through institutional framework such as related laws and regulations to make new businesses and industries, those are eco-friendly and eco-protective, can be evolved and created. For example, zero or low emission cars along with autonomous control, smart grid supported by artificial intelligence, smart factory that are designed to reduce raw material and energy usage, and so on.

Such eco-friendly and eco-protective businesses and industries will give the economy with more sustainable environment and sustainable economic vitality together, and those are our goals, SDGs.

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