Renovation of Environmental Technology
The Key: Open Innovation

By Masahiko OZAKI

Climate Change & Innovation of Environment Technology

People the world over are becoming increasingly aware of the need to cut greenhouse gas (GHG) emissions as problems of climate change assume serious proportions day by day. Governments have begun making initial moves to follow the example of US President Barack Obama's Green New Deal policy. It is still fresh in our memory that Prime Minister Yukio Hatoyama received a roar of applause when he told a UN General Assembly session that Japan will seek to reduce carbon dioxide (CO_2) emissions by 25% below their 1990 level by 2020.

The battle against global warming is gaining momentum, indeed. In reality, however, it is difficult to render GHG reduction into action. At this writing, press reports were predicting that the COP15 climate change conference scheduled for December 7-18 in Copenhagen to discuss a new treaty to succeed the Kyoto Protocol will probably fail to set any specific numerical goals for CO_2 emission reduction. The reports are likely to prove right. Should COP15 agree on some target levels, those would either be lukewarm or come with shackles in all probability. Businesspeople ideologically understand the necessity to cut GHG emissions, but they are strongly reluctant to abandon the freedom of economic activities.

Environmental technology can ease the difficult trade-off relationship between GHG emission cuts and the freedom of business activities. New production processes that can save energy consumption, the innovation of energy supply systems, the invention of low-carbon new materials and alternative energy sources, and the development of CO_2 recovery/storage technologies will greatly contribute to easing various constraints on economic activities. And according to a report by economist Nicholas Stern, the quicker these new technologies are put to practical use, the lower the cost of dealing with the damage caused by climate change over a long time will be. Hence, the quicker the progress of technical levels is, the better the result will be.

Environment Version of Malthusian Trap

Humankind in the past was saved by striking technological advances. About two centuries ago, Thomas Malthus theorized that as population increases at a geometrical rate while food production increases only at an arithmetical rate, any policies aimed at enhancing people's material living standard will end up in poverty because their effect will be canceled out by population growth. This is what is known as the Malthusian trap. Economic historian Gregory Clark wrote in his book, *"A Farewell to Alms,"* that income per person will settle at the equilibrium level where the birthrate (upward-sloping line) that goes up as income rises meets the death rate that declines as living standards increase (downward-sloping line). Through the work of the law of diminishing returns, the population that can live at the equilibrium income level is plotted into a downward curve *(Chart),* which is called a "technology schedule" as it is considered to shift in accordance with technological levels. Clark expounds that people were unable to see the economic scale and population expand until around 1800 because a temporary increase in income per person was eroded by subsequent population growth brought by a higher birthrate and a lower death rate and also because technological advances were too slow. It was the Industrial Revolution that helped mankind escape from the stagnant Malthusian economy, he says, arguing it accelerated the advance of technological levels to the extent that income per person would increase faster than the speed adjusted by population growth, giving birth to society where both the economic scale and population could rapidly expand without being restrained by demographic changes.

As we think of environmental factors today, we fear we may have been caught again in the Malthusian trap. Let us replace the variable on the horizontal axis in the *Chart* with permissible GHG emission volume per person. When the volume changes transiently, the population allowed to live at the equilibrium level by changes in the birth and death rates brought through economic processes will be determined by technological levels. When we are required to reduce the permissible volume over the years, we will be forced to accept a tragic option of population shrinkage unless technological levels advance fast enough. Even if technological levels progress fast enough to prevent the population from declining, the total volume of GHG emissions – represented by the permissible volume multiplied by the population – may increase rather than decrease. We may call this a recurrence of the Malthusian economy where economic activities were restrained by population changes.

However, we have learned from history how to avoid being caught in the Malthusian trap. If we can start innovation of environmental technology that can match the Industrial Revolution both in scale and speed, we might be able to prevent mankind from running into a dead end.

Possibility of Open Innovation

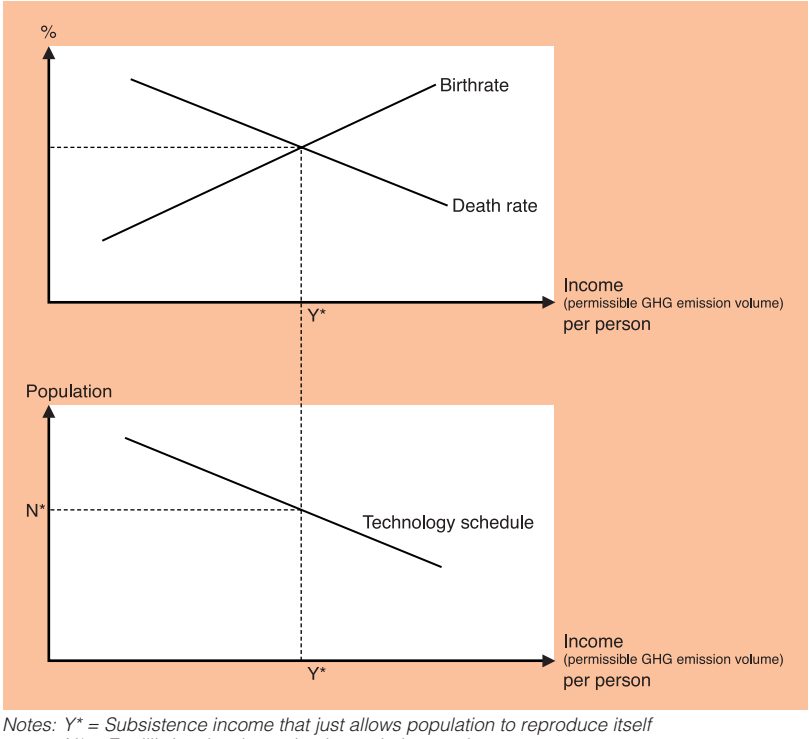
Wasn't the Industrial Revolution in the 18th century a large-scale open innovation? What does open innovation means? It means innovation that will allow a nation to utilize ideas both at home and overseas beyond individual corporate frameworks to create values a single company can hardly do both in terms of quality and quantity. During the Industrial Revolution, this process diffused at an astonishing velocity, given the quality and quantity of the communication networks available in those days. Coming back to the present day,

businesses today are preoccupied with the need to address an ever shortening life cycle of their products and services amid diversifying consumer inclinations. They tend to seek short-term returns out of consideration for their shareholders. They are aspiring more than ever to develop new technologies efficient in terms of time and cost. They are keen to find new possibilities in open innovation. The Japanese government is preparing legislation and subsidies in a bid to promote open innovation. For now, however, chances of another Industrial Revolution look rather remote. The main hurdles are possible risks which businesses may face when participating in open innovation such as a technology drain and difficulties pertaining to ownership of intellectual property and distribution of the outcomes.

Inventors in the 18th century might have had similar risks. Nonetheless, technological innovation worthy of being called a revolution occurred because there was no need to think of the inventors' interests. Although a patent system was in place, little consideration was given to who should own the intellectual property and how the outcome should be distributed. John Kay (who invented a flying shuttle), James Hargreaves (a spinning jenny) and Richard Roberts (a self-acting mule), all well-known in world history, died in poverty without being rewarded with patent fees. Samuel Crompton (a spinning mule) and Edmund Cartwright (a power loom) were known to have been cited by the government with a token amount of bounty. At the present time, how many corporate managers and shareholders are prepared to prioritize or tolerate the spread of their newly developed technology at the expense of their future returns? We must overcome those problems of benefits to inventors and realize open innovation that leads up to what can be called a new Industrial Revolution.

CHART

Long-run equilibrium in Malthusian economy



Notes: Y = Subsistence income that just allows population to reproduce itself*
N = Equilibrium level premised on subsistence income*
Source: Prepared from "A Farewell to Alms" (Gregory Clark, 2007)

Roles to Be Played by Government

In order to realize renovation of environmental technology through open innovation, roles to be played by the government will be crucial in a situation where companies are hesitant to take risks. Specifically, the government needs to prepare the ground in the form of institutions and systems and implement policies that will allow companies to anticipate returns. No matter how excellent a vessel prepared by the government may be, it will be useless unless there are some fruits to be put there. The possibility of open innovation can be enhanced if the government procures environmental facilities and instruments in competitive tenders contingent on specifications that require high technological levels (which are hard to obtain without collaboration among firms). Companies will see greater incentives, particularly at times of recession, since successful bidders can surely expect to make bigger sales and profits. Furthermore, if the government puts procured facilities and devices to practical use as environmental aid to businesses at home and abroad, their operation and upkeep may give birth to secondary open innovation.

Government procurement funded by fiscal expenditures may often be apt to distort the market and generate inefficiency. At the same time, however, it could prove effective in promoting environmental policies, countering recession and fostering new industries. It can also give both industry and people in general an early chance to experience large-scale open innovation, triggering a shift in their patterns of behavior to a new stage. Viewed in this perspective, government procurement may be a worthwhile option to take as investment in our future. JS

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