

# The economics of sustainability

**Fukushima shows the increasing importance of limiting the risk of rare catastrophic events for society's well-being**

By TOMOKI FUJII

**E**VEN if the worst is already over, the Fukushima nuclear incident, one of the worst nuclear accidents in human history, will have enormous and long-lasting impact. Tens of thousands of people around the power plant have been forced to evacuate. If and when they can return home permanently is still unclear. The radiation fears have negatively affected many industries, including tourism, agriculture and fishery. The direct damage cost alone is estimated to have reached trillions of yen.

The nuclear incident will also force Japan and other nuclear-dependent countries to rethink their energy policies. Now, even the proponents of nuclear energy would find it difficult to argue that nuclear power generation is absolutely safe and clean. Nuclear generation is also going to be more expensive in Japan, because the power companies will have to satisfy more stringent safety standards and pay higher insurance premiums.

What does this have to do with sustainability? There are two possible links. First, nuclear generation will have less public support than before. As a result, nuclear power generation may have to be replaced. If fossil fuel power generation is used instead, the carbon dioxide emissions will increase. Therefore, the Fukushima incident may raise the concerns for climate change and sustainability. The second link is more subtle but nevertheless important. The incident provides lessons for sustainability, which I will focus on here. I will discuss how economists approach sustainability and discuss what to learn from the Fukushima incident along the way.

## Economists' approach to sustainability

Economists have long been concerned about some form of sustainability. As early as 1798, British scholar Thomas Robert Malthus feared that food production could not keep pace with unchecked global population growth. His concern parallels what is at the heart of the concern for sustainability today: that vital natural resources may run out and the environmental capacity be maxed out in the foreseeable future if the current economic activities remain unrestrained.

How seriously should we take such concerns? In a way, we can be optimistic as market forces can help remedy the problem. When a resource is scarce, its market price will be high, so that people make efforts to reduce its consumption. The high market price also creates business opportunities for the technology that saves or substitutes for the resource.

This argument, however, is not without problems, especially when it is applied to the finite environmental capacity. While human ingenuity may continue to create more and better goods and services, it appears too optimistic to assume anything can be substituted with a human-made object. For example, clean air cannot be easily substituted by anything else.

Second, a distorted market will not bring about a desirable outcome. In the absence of regulation, the polluter of the environment may not have to pay for the cost of pollution. In such a case, markets will not be helpful to remedy pollution. However, this problem can be remedied by giving incentives to the polluter. If the polluter has to pay tax for each unit of pollution, or if it receives a subsidy for each unit of pollution it reduces, the polluter will make efforts to reduce pollution. A number of studies have found that the incentive-based approach like tax and subsidy indeed achieves pollution reduction more efficiently than the traditional command-and-control approach.

Incentive-based policies help the market work better, but aren't sufficient for resolving global environmental challenges and achieving sustainability. Global environmental problems such as climate change involve trade-offs between now and the distant future. Carbon dioxide emitted today virtually has no immediate impact on human welfare, but may have significant effects in a century or two.

To compare the costs and benefits that occur at differ-



**Save our kids:** Protesters at an anti-nuclear rally last Sunday in Fukushima, where angry Japanese parents demanded protection for their children from radiation

ent points in time, economists typically express them in today's dollar by discounting. For example, at a one per cent annual discount rate, a dollar and a cent in a year is considered equivalent to a dollar today.

Because of the compounding effect, the choice of discount rate is extremely important when a long time horizon is involved. A dollar in a century from now is worth 37, 5.2 and 0.76 cents in today's dollar at an annual discount rate of 1, 3 and 5 per cent, respectively. Despite this importance, choosing an appropriate discount rate for the society is difficult as the choice is neither obvious or uncontroversial, even if discounting is accepted.

More fundamentally, discounting can be challenged from the standpoint of intergenerational equity, because the welfare of future generations can be almost completely ignored even at a moderate discount rate.

Some economists propose to add some constraints on policy choice to address this issue. If we chose only from those policies which entail no (large) future decline in consumption, some form of sustainability would be ensured.

To see this, consider a country with oil reserves. If the country simply spends all the oil revenue on consumption, its consumption is bound to decline once the oil is exhausted. But if the country invests some of the revenue in machines that can continue to generate output, the country's consumption may be sustained even after the oil runs out.

A similar sustainability criterion may be relevant to

firms. By compromising on safety or environmental standards, firms can immediately cut the costs of business operations and boost profits. However, once the problems surface because of, say, accidents, the existence of the firm itself could be threatened.

One such example is the Tokyo Electric Power Company (Tepco), which operates the Fukushima I Nuclear Power Plant. Tepco has long been considered a blue-chip on the Tokyo Stock Exchange. Within a few days of the earthquake, it became a company with a serious risk of bankruptcy. If Tepco had taken more measures to address nuclear safety concerns, the Fukushima incident may have been less serious and the company may have been more easily able to cope with it.

## Catastrophic event, small probability

More fundamentally, the Fukushima incident highlights the difficulty of dealing with a high-impact event that occurs with a small probability. The tsunami caused by the largest earthquake in Japan's observation history was much larger than what the Fukushima I Nuclear Power Plant was designed to withstand.

The probability of such an extreme event is difficult to quantify because the event is rare and poorly understood. Such a rare event is often ignored in the cost-benefit analysis because the probability cannot be scientifically estimated. This was probably true for the case of Fukushima.

However, ignoring rare events seriously biases the conclusion of a cost-benefit analysis, when they have large impact. The lesson we need to learn from the Fukushima incident is that rare events cannot be assumed away just because they are rare.

This may appear obvious, but it is not so in global climate policy. Consider, for example, runaway climate change, in which positive feedback in the climate system leads to a rapid and possibly uncontrollable climate change. Its probability is considered very low, but the damage is likely catastrophic once it occurs. If such a rare event is ignored, as is the case in a conventional cost-benefit analysis, future generations may be exposed to a non-ignorable risk of catastrophe.

With ever-increasing human impact on the environment, limiting the risk of catastrophic events has become increasingly important for the sustainability of our society. Taking rare catastrophic events seriously will be a first step in that direction.

*The writer is an assistant professor of economics at the Singapore Management University School of Economics.*

*This BT-SMU series on Sustainable Business is a lead-up to a joint conference organised by the SMU Lee Kong Chian School of Business on the theme 'Building Capabilities for Sustainable Business: Balancing Corporate Success and Social Good' on July 21-23*