

## **DEVELOPMENT OF EARLY WARNING SYSTEMS TO ALERT GOVERNMENTS TO MAJOR CHANGES IN RESOURCE USE**

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### **Summary**

Natural resources include renewable and nonrenewable resources and nonrenewable resources can be further divided into two categories: recoverable and non-recoverable. Market failure and government failure have been introduced as the main social and economic reasons for environmental degradation and unsustainable resources use. Although government fails to correct market failure in many cases, there has been widespread agreement as to environmental protection policy. The need for indicator development has been emphasized to make environmental data more useful for policy

makers. Some examples are given to reflect international progress in development of indicators of environmentally sustainable development, including the Indicator Programs of OECD and CSD, environmental indicators set for Nordic countries, green national accounts, weak sustainability indicators, and genuine saving and wealth of nation developed by the World Bank.

## 1. Categories of Resources

Almost all issues of modern social development are radically related to rational allocation of resources. Generally, resources include all assets useful for human beings in nature and society. In other words, in nature and society, whether something is useful or useless is regarded as the criterion to distinguish resources from non-resources. Resources include all physical substances people need, such as sunshine, air, water, minerals, soil, plants, and animals and all human-made products also, such as buildings, equipment, and other products for consumption. In addition, information, knowledge, technology, and people's muscle and intelligence are also special resources. In this context, we would like to limit our discussion to resources economics.

Economists divide resources into two main types: *renewable resources* and *nonrenewable resources*. Living resources, such as fisheries and timber, are renewable; they grow in time according to biological processes. Some non-living resources are also renewable, the classic example being the sun's energy that reaches the earth. Nonrenewable resources are those for which there are no processes of replenishment; once used they are gone forever. Classic examples are petroleum reservoirs and non-energy mineral deposits. Nonrenewable resources can be further divided into recoverable (for example, metals) and non-recoverable (for example coal, oil, and natural gas). Certain resources, such as many groundwater aquifers and soil, have replenishment rates so low that they are in effect nonrenewable when a relatively short period is considered.

The differentiation between natural resources and non-resources is changing dynamically. With increase of our knowledge and advances of technologies, more and more physical substances once regarded as of no economics value are being exploited commercially as natural resources. Human beings extract resources greedily from the tank of nature ignoring natural principles. When harvest rates exceed growth rates for renewable resources, or when depletion rates exceed compensation through technological advance for nonrenewable resources, the resources stocks will decline, which is usually accompanied by environmental degradation.

Some examples of unsustainable use of resources and their consequences are:

- Over consuming and wasting resources, which results in shortages of resources.
- Utilizing scarce resources for little benefit and unsustainable purposes rather than

those with high benefit.

- Overexploiting renewable resources that could be sustained.
- Using multi-purpose resources for mono-purposes.
- Driven by interests, overlooking species conservation, which results in biodiversity losses or even species extinction.

Market failure and government failure, two main social and economic causes, lead to the unsustainable use of resource and environment degradation. Therefore it is necessary to investigate how markets and governments work to allocate resources efficiently.

## **2. Market Failure: When the Invisible Hand Doesn't Work**

Adam Smith, in his famous work *The Wealth of Nations*, describes why markets lead to a socially efficient allocation of resources at different times or spatial points for a variety of usage. The invisible hand works under the following conditions:

- Property rights of all kinds of resources are clearly defined
- Scarce resources are available in the market and their prices are decided by the relationship between supply and demand
- Markets have perfect competition
- Human behaviors have no visible externalities with few public goods
- There are no short-term behaviors, uncertainties, or irreversible policy making

Of course, such an ideal market does not exist in practice. An inability of the market to allocate resources efficiently is called market failure, which may create a divergence between private costs and social costs. There are several categories of market failure, all of which have some importance for environmental and natural resources.

### **2.1. No Market, Thin Market, or Market with Imperfect Competition**

Some resources have *no market* and the prices will be zero. Some, such as fishery, forestry, or water resources, have markets but the prices represent only labor and capital costs, giving no signal for the opportunity costs of resources consumed in the process of production. In other cases, *thin market* refers to the weak competition caused by few competitors in the market. *Imperfect competition* is the term used for markets where the individual actions of particular buyers or sellers have an effect on market price. In such markets, the marginal revenue of the firm becomes different from market price, and this tends to generate equilibrium where marginal social cost is not equal to marginal social benefit. It is important in the study of environmental and natural resources, as many extractive industries may be characterized by imperfect competition. Some industries, such as electric power and natural gas distribution, are regulated monopolies. Other industries, such as oil and coal, are regarded by the general public as oligopolistic.

## **2.2. Imperfect Information**

Imperfect information means that some segment of the market—consumers or producers or both—does not know the true costs or benefits associated with the good or activity. If this were the case, then one would not expect the forces of supply and demand to equate marginal social benefits with marginal social costs. For example, if workers do not adequately understand the health consequences of exposure to toxic substances, they will require too much or too little compensating payment and the market for risk will not achieve an optimal level of on-the-job safety.

## **2.3. Public Goods**

Public goods are distinguished from private goods by two primary characteristics: non-rivalry and non-excludability in consumption (or jointness in supply). Non-rivalry means that one individual's consumption of the public good does not diminish the amount of the public good available for others to consume. Non-excludability means that if one person has the ability to consume the public good, then others can't be excluded from consuming it. Climate is an example of environmental resources that have pure public good characteristics. All people in a geographic location experience the same climate, and none can be excluded from experiencing it. Some of what we think of as public goods are not pure public goods, as they have some degree of exhaustibility and excludability, such as town beaches or fish in a lake.

## **2.4. Externalities**

Externalities are perhaps the most important class of market failure for the field of environmental and resource economics. Externalities are usually described as spillover costs or benefits, unintended consequences, or unintended side effects (either beneficial or detrimental) associated with market transactions. Pollution is probably the most often cited example of externality. In this case, the marginal private cost function will be below the marginal social cost function generating a market failure. Many externalities having public good characteristics are called non-depletable externalities characterized by the public good property of non-rivalry in consumption; for example, pollution of drinking water supplies. A special class of externality is called open-access externality when property rights are insufficient to prevent general use of a resource and when this uncontrolled use leads to destruction or damage of the resource; for example, fishery or forestry management.

## **3. Government Failure**

### **3.1. Potential Threats of Government Failure**

Government failure results from inappropriate government intervention. The aim of

government intervention is to correct market failure through implementing command-and-control regulations, economic incentives, and other institutional arrangements. Market failure is not the necessary precondition but provides opportunity or cause for government intervention. Government intervention must be based on the following two prerequisites, without which it is not necessary:

- Government intervention must be effective in overcoming or avoiding the negative impacts of market failure.
- The costs of government intervention must be lower than the costs incurred in formulating and implementing policy and the losses of other economic sectors involved due to the intervention.

It should be noted here that government intervention often fails to correct market failure, in some cases leading to an even worse situation. Government failure may occur for the following reasons:

- Government intervention should mainly focus on things such as national security, social equity, and macroeconomic control. Some governments go even further to intervene unnecessarily.
- The negative impacts of government intervention often cannot be avoided.
- Policies may not be implemented properly due to misunderstanding or resistance of some interest groups.
- Different policies may interfere with each other, reducing outcome effectiveness.
- Policies not related to the environment may have much more significant impacts on the environment than do environmental policies.

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**Dr. Ying Chen** was born in April 1969 and is now an associate researcher with the Institute of World Economics and Politics, Chinese Academy of Social Sciences. Dr. Chen graduated from the Chemical Engineering Department of Tsinghua University, Beijing, in July 1997 and she is now engaged in research of environmental and natural economics. Her areas of interest include global environmental problems, climate change economics, and sustainable development indicators.