The Market Model of Environmental Management: Prospects and Limitations

*Ponlapat Buracom**

Introduction

The purpose of this paper is to present readers with the market model of environmental management. The model gives us an explanation of the causes of environmental problems, along with measures for controlling them. It is argued here that the market model of environmental management has some advantages over the traditional measures of environmental control. Ecology deals with the balance between human beings and nature. We depend on nature for air to breath, soil to grow food, water to drink and to sustain vegetation, and fossil fuels to power the production system. But if nature is our host, we abuse it unmercifully, robbing it of nonrenewable materials, straining its self-restorative capacities.

Any reasonable assessment of policy studies must account for the lag between the escalation of an environmental problem and its recognition by social scientists. Respected textbooks in political science and public administration written before 1970 paid little attention to the issue. However, since the early 1970s social scientists have begun to pay more attention to the environmental problem. One of the most important earlier works on environmental planning and management is **The Social Costs of Private Enterprise** (1975), written by K. William Kapp. The framework used in this study gave us a market model of environmental management which allowed us to detect abuses of nature resulting from prevailing forms of production and consumption. Kapp documents the :

* Assistant Professor, Graduate School of Public Administration, National Institute of Development Administration

"destructive effects of air and water pollution.....the competitive exploitation of both selfrenewable and exhaustible natural wealth such as wildlife, petroleum and coal reserves, soil fertility and forest resources....., The diseconomies of the present transport system." (1975 : 229)

These social costs had gone unnoted and untended, according to Kapp, because they do not enter into the cost calculations of private firms. And economists failed to detect them either, because the phenomena of social costs seem to have no room in the system of price analysis.

The Market Model of Environmental Management.

The market, according to Kapp, is still a sound mechanism for coordinating economic transactions. But there are more and more unpriced effects of market transactions that must be incorporated into the market's pricing system. Air, water, and soil pollution are not automatically translated into market costs because the environmental effects of particular economic transactions are diffused among a wider population and to some extent projected onto future populations. Under such circumstances, it is irrational for any individual producer or consumer to accept voluntarily the higher costs involved in curtailing pollution of the environment. Thus a company that purifies the water used in production before disposing of it into a river adds to its own costs, fails to benefit from the purified water flowing downstream, and weakens its competitive market position with respect to those companies unwilling to institute purification procedures. Since it is reasonable to assume that other companies in a market system will not voluntarily weaken their position in this way, it is irrational for any single company to choose to do so.

The same logic also applies to the purely self-interested consumer. One example of this is the case of a consumer's decision to buy an emission-control device to place on an automobile exhaust system. As shown in Figure 1, if the individual desired a pollution control device, a good situation would exist if everyone purchased the control device. But it would be even better if everyone else purchased the device and the individual did not, since the individual would get the benefit of cleaner air without paying for it. Similarly, it might be a bad situation if no one at all purchased the device, but it would be worse if the individual purchased it and

no one else did. For then the individual would have paid for the device but would not have received the desired benefit. Thus, regardless of what others might do, the individual would always be in a better position in not purchasing the emission-control device, even though pollution control would be worth much more than the price of the device.

Figure 1 Individual versus Collective Rationality in the Purchase of a Pollution-Control Device

Individual	Everyone Else: Purchases	Everyone Else: Does not purchase
Purchases	Good	Worst
Does not Purchase	Best	Bad

Thus practices that are desirable from the viewpoint of the public are irrational from the viewpoint of any particular consumer and producer. And policies that are rational for individual consumers and producers go against the collective interest in preserving nonrenewable resources and maintaining the environment.

To cope with this problem most planners think that the government should establish by law a system of **taxes and subsidies.** In this market model of environmental management the adverse side effects of market transactions are then taxed high enough to make it economical for producers and consumers to conserve nonrenewable energy sources and to establish waste-disposal systems that preserve the purity of air, water and soil. At the same time, the system of subsidies can be used to stimulate private business to produce improved disposal and recycling facilities since there is now profit in such enterprises.

Tax on Pollutant Discharge

In the market model of environmental management, it is possible for the government to control many types of pollution by placing taxes on polluting activities. Where the amounts of pollutant discharge can be measured, a tax can be placed directly on each unit of discharge. This will induce the polluter to reduce the amount of pollution that is discharged. In some cases, where such measurement is not possible, polluters may be taxed indirectly. For example, automobiles not equipped with pollution control devices can be subjected to a tax on a mileage basis. This would induce their owners either to install pollution control devices or to drive less. Tax can also be collected indirectly through various permits. That is the government can force the polluters to buy permits for their polluting activities. For example, the government can establish a permit for sulfur dioxide emission, so that large sulfur dioxide emitters must pay for the permit.

Figure 2 illustrates the use of tax to control pollution. Suppose Figure 2 shows us a case of one industry producing one product. And in producing that product, the industry also creates pollution within society.

Suppose JF is the demand curve for the product which is represented by a straight line,* and CG is the production cost per unit of the industry. The more you produce, the higher the costs of production.

Suppose in the production of this product, the industry also creates pollution (air or water pollution) within society. The amount of pollution is represented by CD. The more you produce, the greater the pollution you create.

In the case where there is no government intervention, the industry will produce more goods than it should do. That is, the industry will push the costs of pollution onto society. These social costs do not enter into the cost calculation of the private industry, so that the cost of production of the industry is still equal to only CG.

In this case, the amount of product produced by the industry is equal to OB. And, at this point, the industry will create a very high level of pollution, which is equal to CEK.

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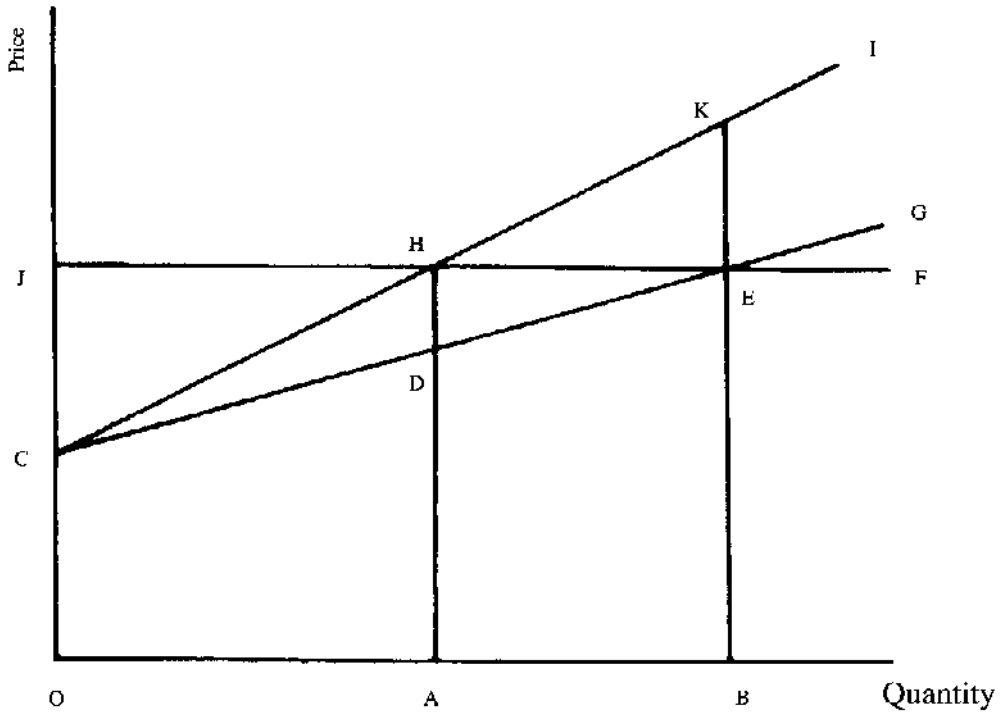
* In the case of only one industry, changes in supply do not affect demand. The demand curve is represented by a straight line.

Figure 2 Tax on Pollutant Discharge



JF = Demand curve
CG = Production cost per unit
CI = Amount of pollutant discharged.

However, in the case of government intervention, the government can impose tax according to the amount of pollutant discharged. In this case the amount of tax is equal to CEK. As the industry has to pay pollution tax, the cost of production of the industry is increased from CG to CI.

As the cost of production is higher, the industry will reduce its production to OA. And the amount of pollutant discharged is also reduced to CHD, which causes less damage to socicty than without government intervention.

Moreover, the government also receives revenue from pollution tax which is also equal to CHD. This revenue can be used to relieve the effects of pollution on society.

Government Subsidies : The Case of Transport

In the market model of environmental management, the government has also used subsidies - the opposite of taxes - as a pollution control measure. These consist of grants made to local government for the construction of sewage treatment facilities. A system of subsidies can also be given to local business or industries to stimulate the use of more effective pollution control devices.

The case of transport can also be used as an example to illustrate the rationale of subsidies as a pollution control measure. If we compare the United States transport system with those of other Western industrial countries, we can see that the U.S. transport system is built around automobiles, trucks, and airplanes which use fuel and metal resources extravagantly and impose enormous load on the self-purification capacities of the ecosystem, and eventually drive up the cost of alternative modes of transport.

The rising cost is linked to the increasing demand of Americans for cars, which use about half of all oil consumed in the country, as compared to about a sixth of the oil consumed in Europe and Japan. On average each of the over 100 million U.S. cars consumes 2 tons of fuel annually. To reduce that consumption to the 1-ton-per-car level of Western Europe would save more than the total oil consumption of Canada or South America (Foley, 1979 : 62). Yet as Table 3 shows, an average-occupancy car gets approximately a fifteenth the passenger miles per gallon achieved by a fully loaded bus and rail vehicle. A fully loaded car averaging 30 miles a gallon can reduce the proportion to about a fifth of a fully loaded mass transit vehicle.

Cars use a range of other limited resources, such as iron, steel, aluminum, lead, zinc and copper, the prices of which will also rise as the rate of depletion rises. While public transport uses these same materials, it does not use them so inordinately (Nash, 1976 : 29).

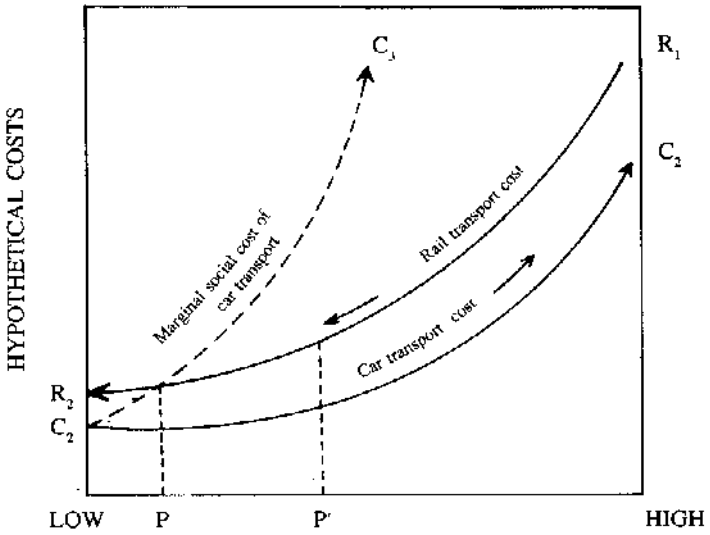
The advantages of public urban and interurban transport are not restricted to resource saving. A study conducted in France estimates that mass transit there has the potential capacity to move 50,000 passengers during rush hour as compared to 3,000 by car, for no matter how many freeways are constructed, the small Paris streets will only absorb cars at 5-10 miles per hour (Bosquet, 1987 : 33).

Table 3 Fuel Consumption by Transport Mode

	Miles per Gallon	Average Occupancy	Passenger Miles per Gallon	Maximum Occupancy	Passenger Miles per Gallon
- Car	30	1.3	39	4	120
- Rear-engined double-decker bus	7	16	112	75	525
- Two-car diesel railcar	4	35	140	150	600
- London transport seven-car tube train	0.75	105	79	840	630
- Light-transit two-car set	2	50	100	240	480

Source *: R.G. Harmon. "Fuel in Transport",* ***Traffic Engineering and Control,*** *15 (1989).*

FIGURE 4 INTERDEPENDENCE OF ROAD TO RAIL TRANSPORT COSTS



SOURCE : C.A. Nash. **Public versus Private Transport,** 1976.

Transport choices provide an idea of how the split between individual and collective rationality operates. As individuals shift from the rail to road, they simultaneously drive up the cost of road and rail transport. Figure 4 illustrates the relationship between increasing number of motorists and rising costs of transport. An accurate positioning of the curve would require inclusion of the costs of congestion, resource scarcity, pollution, the thousands killed and millions injured annually by car accidents, insurance and legal fees, policing, and the public space lost to roads and car parks. Whereas C_1 C_2 indicates the cost to any individual purchasing a car, C_1 C_3 indicates these costs plus the external costs,* that is uncompensated costs imposed on all other car owners by the new car buyer. Rail transport, on the other hand, generates collective benefits. A new train rider reduces the costs to all other train riders. This is illustrated in Figure 4 by the downward movement of curve R_1 R_2 from right to left.

Given these characteristics, the market will lead to higher prices for both road and rail transport as long as the rail system serves only a small proportion of the populace. At any single transport mix - for example, point P or P' in Figure 4 - the self-interested individual will choose the road over the rail, and the collective effect of these choices will increase the congestion and pollution costs to all road users, whether traveling by bicycle, rail, or foot.

In an area such as transport, the reduction of individual and social costs (toward point P from P') requires public coordination of individual product choices. The market will not lead consumers, acting alone, toward the socially rational mix at point P; instead private consumers responding to market signals individually will push the actual mix toward increased reliance on the road and ever higher transport costs (to the right in Figure 4).

A decreasing-cost industry such as a mass transit system provides a basis for public subsidy. While public transport is often opposed as a wellfare program as subsidy to the poor, it is in fact rational from the point of view of social cost

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* Curve C_1 C_2 is the conventional average cost, and curve C_1 C_3 the conventional cost curve with the inclusion of external costs.

and the efficient use of scarce resources. A comparison of London Transport (LT) and the Paris public transport service (RATP) is instructive. Responding twenty years ago to the vicious cycle of deteriorating service, higher prices, and fewer passengers, RATP lowered fares and increased subsidies. Consequently, the fare per kilometer today is less than one-third that of London Transport (see Table 5). Since 1970, RATP's business has expanded by 20 percent and LT's has dropped by 16 percent, so that the former now carries 1 million more passengers daily. While LT's service is deteriorating, RATP has been reaping the benefits of better, cheaper service through the replacement of old trains with modern, comfortable, quiet vehicles; the refitting of old stations to make them safer and more attractive; and the elimination of queues by the widespread use of unlimited travel passes.

Clearly the potential for developing a rational railroad transport system exists, but public coordination is required to close the gap between the result of the market and collective rationality.

Table 5 Fares and Subsidies in London and Paris

	Fare (pence)		Operating Subsidy	
	Per Kilometer	Per Journey	Amount ($ million)	Percentage of Operating Costs
London				
Rail	5.9	44		
			135	26
Bus	5.6	19		
Paris				
Rail	1.8	16		
			417	59
Bus	1.5	N.A.		

Source : Anatole Kaletsky, "Why Fares are so High in London Transport", **Financial Times** (June, 1980).

Costs and Benefits of Environmental Management

Human beings often react to problems with their emotions rather than with their capacity for logic. Recommendations for environmental management reflect this human characteristic. Typical recommendations call for **direct control of pollution** by the government. That is, an appealing and probably simple way to control pollution is to have the government ban polluting activities or agents. If phosphate contaminates water, then ban the use of phosphates in detergents. If DDT pollutes water and land, ban the use of DDT. If the burning of fuel oil and coal increases the sulfur dioxide content of the atmosphere, prohibit their use. Require industrial plants to clean the pollutants from whatever it is they discharge into the atmosphere or water. The method is straightforward and, on the face of it, seems fair.

Government agencies, such as the Environmental Protection Agency (EPA), commonly use direct controls to reduce many kinds of polluting activities. They set and attempt to enforce emission standards for such polluters as automobiles, power plants, and steel mills.

However, the use of direct controls has some major limitations as well. The first limitation on this direct measure is that it is unjust. This is because the costs of pollution control and administration must be paid for by general taxpayers, not by the polluters themselves.

The second problem raised by the use of direct controls to limit the amount of pollution is that it presupposes that the government (or the regulating body) has a working knowledge of what the permissible levels of pollution are, and what are the permissible amounts of pollution for different polluters. For example, it may be more costly for a steel mill to eliminate a unit of sulfur dioxide from its emission than it is for a power plant. In the interests of economic efficiency, it is best to eliminate pollution where it is least costly to do so. Thus, the power plant should be required to reduce its sulfur dioxide emission before the steel mill is required to do so. This is a difficult kind of decision for a government to make since it is unrealistic to suppose that the government has a knowledge of the nature of costs for every polluter.

For example, in the U.S. during the 1970s, the Environmental Protection Agency's overly zealous efforts to end industrial pollution caused many firms to take

actions that limited their productive ability. Capital investment required to meet EPA emission controls reduced the amount of capital available for new investment and for research and development. Some production operations were closed altogether when business enterprises determined that cleanup costs exceeded profit possibilities (Carson, 1983 : 147-148).

The third problem is that of enforcing the standards of emission, once it has been determined what those standards should be. Direct controls fail to provide polluters with an economic incentive not to pollute. In fact, it will pay them to seek ways and means to evade the pollution standards set for them.

However, direct control of pollution by the government is only one of the possible avenues for reducing environmental problems. Others include the use of a **market model of environmental management,** through a system of taxes and subsidies which give incentives encouraging potential polluters not to pollute or to limit their pollution.

There are some advantages to the market model of environmental management over direct control. A major one is that it provides an incentive to the polluter to seek improved ways and means of cleaning up its discharge. Another advantage is that it prevents the polluter from shifting some of its production costs (pollution costs) to others; it reduces the incentive to overproduce. Moreover, the government also receives revenue from the pollution tax. This revenue can be used to relieve the effects of pollution on society.

There are also some limitations to the use of this market model to control pollution. First, the use of a pollution tax can be effective only in a more competitive market situation. If we have a monopolistic market situation, the polluter will be able to shift the tax burden to the consumer by simply increasing prices.

Second, the use of the market model through the system of taxes and subsidies also requires a huge bureaucracy to identify the environmental costs of so many production processes and waste-disposal systems and to administer tax and subsidy programs. Moreover, taxes and subsidies are levied by political bodies, and politics may well get in the way of the enactment of appropriate tax and subsidy levels.

Summary

The environment provides environmental services that are used by both household units and producing units of the economy. In the processes of consumption and production, wastes are generated. If the ecological system cannot recycle those wastes as fast as they are generated, waste accumulates. This constitutes pollution.

The market model of environmental management provides a perspective on the causes of environmental problems, along with the costs and benefits of controlling them. Incentives to pollute stem from the collectively consumed nature of whatever is being polluted. Polluters, by polluting, transfer a part of their costs to others. There are two main avenues that government pollution control policies can take. First, certain polluting activities may by controlled directly through prohibition or limitations on polluting activities. Second, they may be controlled through the use of a market model, by providing polluters with incentives not to pollute - say, through taxes and subsidies. The use of a market model of environmental management has some advantages over the use of direct control.

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