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10 June 2001

Online at <https://mpra.ub.uni-muenchen.de/413/>

MPRA Paper No. 413, posted 11 Oct 2006 UTC

Environmental Sustainability and Regulation: To-Down Versus Bottom-Up Regulation

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ABSTRACT

Environmental regulation can be broadly divided into those that follow the top-down and bottom-up approaches. The two approaches have similar objective with respect to environmental protection and sustainability. However, the success with which each approach achieves goals of environmental protection and sustainability may vary. Moreover, the costs and benefits of each approach differ. The present study will explore the implication of environmental regulation to sustainability, costs associated with regulations, and alternatives with respect to using mixes of market-based instruments. The study will review top-down and bottom-up environmental regulations with the objective of identifying weakness and strength of each approach. Furthermore, the study will make recommendations on possible strategies (e.g., mixes of regulatory instruments) that will contribute toward the attainment of sustainable environment, and by implication to sustainable development.

Key Words: Regulation, Top-down, Bottom-up, Market-based, Performance-based, Environmental

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1. INTRODUCTION

"Regulation" is an all-encompassing public policy term that has come to include many different political and economic issues and ideas. To make things simple, government regulations can most easily be divided in two distinct categories -- "economic" regulations and "social" regulations.¹

Economic regulations generally cover sectors of the economy such as electricity, natural gas, communications, transportation, aviation, agriculture and banking. These regulations usually take the form of overt barriers to entry or exit, licensing and tariffing laws, and price and wage controls.

Over the last two decades, numerous economic regulations have been reformed or repealed after academics, policy makers and the general public became convinced that these rules and statutes made markets less competitive, discouraged economic efficiency and lessened overall consumer welfare. Specifically, comprehensive deregulatory efforts were undertaken in the fields of trucking, aviation, agriculture and telecommunications. Banking and electricity reforms have also occurred and more comprehensive initiatives are likely to be pursued within the next few years as well.

Social regulations, on the other hand, include those statutes or rules that are intended to protect citizens or workers health and safety, accomplish environmental and other aesthetic goals, or promote civil rights objectives. Often times, however, several intricate and overlapping linkages exist between social and economic regulations, resulting in duplication of efforts hence cause of substantial public sector expenditures.

Few efforts have been made, however, to repeal or even reform the vast majority of social regulations. This is largely due to the fact that powerful interest groups exist that support these rules, especially those on the environmental front. Critics of current social regulations argue that rules are inflexible, expensive and administered in a "command and control" fashion. Proponents of the current system reply that strict rules are needed to deter unfavorable behavior and outcomes.

The thrust of this paper is USA's social regulation, especially that related to environment. US Environmental policy has evolved since the National Environmental Policy Act (NEPA) was passed almost thirty years ago. At that time, the prevailing approach to environmental protection was command-and-control regulation. These policies generally mandated that all firms use a particular type of pollution control technology, or that they keep their emissions below a certain level, and ignore the manner in which these federal environmental regulations are attained.

Over the past 25 years, the magnitude, complexity and modalities of environmental regulations have changed significantly. Much of the apparent complexity of environmental problems arises from their interdisciplinary nature. No one person has the professional background required to understand fully the nuances of any one problem. That is, successful design and implementation of environmental regulations require the use of multi-disciplinary approaches. The objectives of this study is to review, compare and suggest whether or not top-down (e.g., command-and-control type) or bottom-up (especially those that are participatory or incentive-based approaches) approach is the preferred modality of regulation that will contribute toward the attainment environmental sustainability.

1.1. The Need for Regulation

The task of the economic system is to allocate finite resources to best meet human wants. Striving for cost efficiency in environmental protection increases welfare subject to these finite resources. The idea that cost efficiency is necessary to conserve valuable resources clearly is not a new economic principle. Nor is its implication for political decision-making a new discovery. The task of the economic system in the allocation of resources is assisted by markets, regulations, voluntary initiatives or combinations.²

In unregulated markets, firms and individuals may impose societal costs that are not reflected or captured by the prices of the products. Human activities pollute streams, cause health hazards, endanger the safety of workers or customers, or subject consumers or the broader economy to undue risks. Regulation can be used to reduce these harmful effects by prohibiting certain activities or imposing the societal costs of the activity in question on those causing the harm. One goal of regulation is to induce private parties to act as they would if they had to bear the full costs that they impose on others.

Similarly, in an unregulated market, firms and individuals may not have incentives to provide individuals with accurate or sufficient information needed to make intelligent choices. Firms may mislead consumers or take advantage of consumer ignorance to market unsafe or risky products. Regulation may be needed to require disclosure of information, such as those on the possible side effects of drugs, the contents of a food or packaged good, the energy efficiency of an appliance, or the full cost of a home mortgage. Even when consumers have full information, the Government may wish to protect individuals, especially children, from their own actions. Regulation may thus be used to restrict certain unacceptable or harmful practices such as substance abuse.

It is conventional wisdom that competition in the marketplace is the most effective regulator of economic activity. However, markets are not always perfect and when they are not, society's resources may be imperfectly or inefficiently used or allocated resulting in welfare loss. The advantage of regulation is that it can improve resource allocation or help obtain other societal benefits. Regulation can be used to protect consumers by regulating prices charged by natural monopolies or preventing firms from restricting competition through mergers, collusion or

creating entry barriers to entry.

Regulation can be used as corollary of government policies to reduce risk of significant costs to taxpayers and the economy. Regulation can also be beneficial in achieving goals that reflect national values, such as equal opportunity and universal education, or a respect for individual privacy.

It has been argued that the purpose of regulation was to protect consumers from monopoly prices. However, this view has been challenged. From 1879 to 1907 electric utilities were not subjected to any price regulation.³ They were required to obtain operating franchises from municipalities. The literature of the day described an era of free competition in which municipalities granted franchises to many who applied. It was the industry itself, whose profits suffered from open entry that vigorously lobbied for entry restrictions and for state regulation of prices and profits. Regulations were implemented to protect the industry from the competitive pricing that dominated its early history.³

Regulatory analysis studies have shown that the first states to adopt regulation were those in which electric rates and profits were lowest and output highest. Furthermore, the effect of regulation during the early period was to increase prices and profits, and to reduce output. These data support the hypothesis that regulation was a response to the utilities' desire to protect profits, not a consumerist response to monopoly pricing. Indeed, monopoly pricing had not been a significant problem.

In the 21st century, the need for economic regulation has subsided. However, the skyrocketing costs of regulations and their impacts on competitiveness of American businesses has resulted in a dramatic shift toward deregulation of economic sectors. Nonetheless, regulation continues to protect consumers from unnecessary increases in prices of goods and services, protect the public from exposure to sources of environmental and health risks, and ensure business to continue operate in a competitive environment. Continuity of using regulation either to protect the public, assist government or other reasons has created enormous controversy mainly because of it is inconsistent approaches and impacts.

2. THE PROBLEM

Government regulations affect all Americans: from the food we eat and the medications we take, to how we use our private property and run our businesses. Although the direct costs of regulation are typically imposed on businesses and governments, ultimately they are passed on to consumers in the form of higher prices or the reduced quality and availability of products and services. In addition, regulation can increase the cost of employing workers and thus act as a tax on job creation and employment.¹

Regulation is one of the most politically convenient ways to carry out public policy because it

typically does not require substantial direct taxation or government spending. This is particularly appealing in an era of fiscal budget restraint. However, regulation acts as a hidden tax because its direct and indirect costs are passed on to consumers, employees, and employers -- making those costs harder to measure and track.

The US federal regulatory agencies develop and implement more than 2000 new rules per year.¹ It is estimated that in order to administer regulatory programs, the federal government spends almost \$16 billion per year. It has been estimated that the direct annual cost of compliance with federal regulations was \$700 billion in 1998. This estimate is conservative because it does not take into consideration the indirect effects of regulation on labor and productivity.¹

The costs of "social" regulations alone, particularly environmental regulation, has almost tripled over the last twenty years from about \$80 billion in 1977 to more than \$267 billion in 2000.¹ A recent study by the Center for the Study of American Business shows that in addition to the costs of complying with regulations, the long-term costs of reduced productivity are high. Research on the impact of regulation has estimated that Federal regulations cause \$1.5 trillion in economic activity to be lost each year, the equivalent of an economy the size of Germany.¹ A study by the Employment Policy Foundation in 1995 found that 19 percent of the productivity slowdown during the 1970s is directly attributable to regulations published by the Office of Safety and Health Administration (OSHA) and that nearly half of the slowdown in long-term productivity can be explained by rising government regulatory activity.¹

Researchers argue that many regulations today are either unnecessary or poorly designed and needlessly inefficient and expensive. Federal regulatory agencies have not developed a system for making rational, well-informed decisions on how to allocate limited resources efficiently to maximize health, safety, and environmental protection. It is necessary to reform existing regulatory practices so that resources would be shifted to more efficient regulations. Firms can use the unnecessary regulatory expenditures owing to inefficient regulation to invest in innovative and productive activities.

One of the principal causes for inefficiency of regulation is the approach in which it is designed and implemented. Most federal and state regulations are prescriptive, reactive, and directive. These kinds of regulations may not be effective in addressing many real life problems. Researches have documented that regulations that are proactive, local or grass-root based or bottom-up may be efficient, least cost and produce sustainable results. The purpose of this paper is to review costs and effectiveness of top-down and bottom-up regulations, and suggest compromise or alternative approaches that takes into account the best of the two or other approaches, with the goal of maximizing societal welfare.

3. REGULATIONS AND ENVIRONMENTAL SUSTAINABILITY

3.1. Regulations: Top-Down and Bottom-Up

Top-down regulations are those rules that are developed at a higher level of decision-making ladder and passed down along the hierarchy for implementation. These kinds of regulations have, if any, little input from the public or decision-makers at the lower or local level. Top-down regulations use aggregate models of the entire macro economy that draw on analysis of historical trends and relationships between the sectors of the economy.⁴

There are several real-world examples of top-down regulations. For instance, the framework for regulating exposure (e.g., exposures of the public to radiation) is what is called "top-down" approach.⁵ This approach has two components. First, a limit on radiation exposure corresponding to an upper bound for acceptable risk is established. Then, exposures are reduced below the limit by requiring all exposures to be "as low as reasonably achievable" (ALARA). The ALARA principle takes into account costs and benefits, technical feasibility, and societal concerns about cancer risks. However, it is a regulatory design at a high level of the decision-making tree that did not take into account the inputs from public on trade-offs between environment and health impacts versus economic losses, speed with which it is implemented, alternative forms of regulations, etc.

Another example of top-down regulations is one that identifies land-use changes that have occurred in watersheds and compares them to the natural disturbance regime.⁶ Changes in land-surface characteristics are documented, and the likely effects of these changes on hydrological, biological, social, and geomorphological processes are inferred. Each of these changes, in turn, is then examined to identify those influencing the local problem (e.g. declining fish stocks or water quality downstream). Because each chain of causality involves influences that cross-disciplinary boundaries (e.g. a change in vegetation influences runoff volume, and thus the utilization of water resources), this approach is also inherently interdisciplinary. Nonetheless, the need to conserve watershed is conceived, designed and implemented by federal regulators with little consultations with the public living in those watersheds.

Regulatory practices of the USEPA with respect to determining emissions limits or caps, prescribing the use of specific emission control technologies, and achieving specific levels of air or ambient concentration related to specific pollutants are all top-down regulations. Relative to bottom-up approaches, inputs from the regulated or from those affected by pollution are not critical to top-down approaches. Similar to bottom-up approaches, top-down regulations assess alternative ways of attaining similar goals (e.g., lower reductions) such as the use of mixes of resources or inputs that influence the production process, hence production of wastes. However, the continuity of use of alternative may not guaranteed compared to alternatives chosen by bottom-up approaches.

Top-down or command-and-control regulations have been criticized on several grounds. Critics argue that command and control regulation is not cost-effective, because it normally requires all polluters to comply with the same pollution limits. Others argue that command and control regulation (i) imposes unreasonable and exorbitant information-gathering burdens and costs on government; (ii) often imposes disproportionate burdens on new pollution sources; and (iii) does not provide any incentives to polluters to develop new strategies to reduce their pollution beyond the levels required by law.

Bottom-up models, for example in the environmental and energy arena, incorporate detailed studies of the engineering costs of a wide range of available technologies, describe energy consumption in great detail, provide a menu of mixes of resources to use, and determine implementation of strategies that maximize societal welfare. However, compared with top-down models, they typically incorporate relatively little detail on non-energy consumer behavior and interactions with other sectors of the economy.

Bottom-up regulations are initiated by local, state and grass-root organizations, and refined to reflect regional, national and international circumstances as it passes higher in the ladder of the administrative framework. These kinds of regulations are inherently expected to be less costly and enjoy greater success compared to top-down approaches.

The bottom-up approach in the environmental sector proceeds from the point of view of a damaged resource or issue of concern. First, the types of existing or potential damage to the resource are identified. Next, the mechanisms that could produce those impacts are described. Finally, the historical changes in affected resource characteristics (i.e. soils, vegetation, etc.) that might have influenced these mechanisms are identified. Each step requires information from an increasing number of disciplines and segments of the society. This approach has often been used in "forensic" environmental studies: an impact has occurred, and an investigation is carried out to identify its cause.⁶

The bottom-up approach has been used by USEPA to set standard for drinking water under the authority of the Safe Drinking Water Act. These standards specify zero risk from carcinogens in drinking water as a non-enforceable health goal. However, because this goal also cannot be achieved at any cost, the standards then establish legally enforceable limits that must be set as close to zero risk as possible, taking into account cost and technical feasibility. The goal must also be based on trade-off between what the public would be willing to accept vis-à-vis losses in economic benefits. The FDA uses similar approaches in designing an upper bound of acceptable risk from all carcinogens and sources of exposure.⁵

In countries where the population and sectors are characterized by diverse economic, social and culture configuration, bottom-up or grass-root approaches may prove useful. The bottom-up approach has been used in customer-oriented investment strategies by less developed countries. Under this "bottom up" approach to investment strategies, pricing and market incentives become cardinal factors.⁴ Overall, customer-oriented strategies incorporate flexible, market-based rules accommodating both competitive forces and the demands of individual customers.

One objection toward bottom-up approach, such as those in environmental protection, is that state and local governments, in their eagerness to promote economic development through attracting new business investment and creating jobs, will set excessively lax environmental standards to keep down costs of pollution control. What results is a "race to the bottom" with States and localities competing with one another to reduce environmental standards.

3.2. Comparative analysis of Costs of Top-Down and Bottom-Up Regulations

There are many potential disadvantages of regulation, to the Government, to those regulated, and to society at large, that can give rise to significant costs. The direct costs of administering, enforcing, and complying with regulations may be substantial. The direct economic costs of regulations include the expenditures by businesses and consumers to comply with the act, the benefits from investments foregone because of stringent new-source standards or other procedural requirements for investing in new products or processes, and the state and federal governments costs of administering the act.¹ Some of these costs may be borne by the Government, while others are paid for by firms and individuals, in a form of higher prices, lower wages, and foregone investment, research, and output. There are also disadvantages of regulation that are difficult to measure, such as adverse effects on flexibility and innovation, which may impair productivity and competitiveness in the global marketplace, and counterproductive private incentives, which may distort investment or reduce needed supporting activities.

A study by Bureau of Economic Analysis (BEA) found that GNP had been reduced by about 1 percent by 1990 due to the direct and indirect effects of the act.⁷ An earlier study by Michael Hazilla and Raymond Kopp also indicated that the GNP had been reduced about 5.8 percent by 1990 due to environmental policies.⁸

The rate of increase in the output of the American manufacturing sector has slowed down after 1973. It has been argued that it is possible that pollution-control expenditures diverted scarce funds from productivity-enhancing investment. In 1991, manufacturing output of \$1.033 trillion constituted about 18 percent of the \$5.725 trillion gross domestic product of the United States. According to the Council on Environmental Quality, the manufacturing sector spent \$20.912 billion in 1991 on pollution abatement. Spending to comply with environmental regulations also fell heavily on electric utilities, natural gas, mining, state and local governments, and private persons (e.g. motorists).^{7,9}

According to estimates by the Office of Technology Assessment in 1991, pollution-control spending averaged 0.8 percent of total sales for the manufacturing sector.^{7,9} However, average expenditures were 1.92 percent of sales for the four industries most heavily affected by EPA regulation: paper, chemicals, petroleum refining and primary metals. These industries, on average, experienced a productivity growth slowdown of 1.53 percent. The remaining manufacturing industries spent, on average, only 0.45 percent of their sales revenue on pollution

control and their average productivity growth slowdown was only 0.37 percentage points per year.^{7,9}

Studies have also found that in the absence of pollution control expenditures, manufacturing output would have been 21 percent (\$223 billion) larger in 1992. That is, manufacturing output was 17 percent less in 1992 than it would have been in the absence of pollution control spending. It was also found that productivity was 11.4 percent lower than it could have been by 1986 as a result of the growth in environmental regulation since 1974.^{7,9}

The direct effects of environmental regulation spread indirectly throughout the entire economy, transmitted by changes in wages, prices of intermediate products, and levels of saving and investment. It was found that all sectors of the economy experienced substantial impacts from environmental regulations even though direct compliance costs are concentrated in just a few sectors.^{7,9} It was estimated that by 1990, when manufacturing output was, reduced by 6.33 percent, output of the financial, insurance, and real estate sector was depressed by 4.97 percent, even though virtually no direct compliance spending took place within that sector. Higher prices for inputs purchased by banks added costs in the financial sector. Indeed, environmental regulations caused real GNP to be 5.87 percent lower by 1990, almost as much as the direct effects on the manufacturing sector alone.^{7,8,9}

There have been attempts to assess the competitive impacts of environmental regulation on U. S. manufacturing since the early 1970s. The majority of studies dealing with this question have concluded that environmental regulation does increase the costs for U. S. producers, but that these increases are relatively small. Some studies have failed to find a relationship between environmental regulation and trade and investment.^{7,8,9} Therefore, regulations have no impact on essential parameters of economic growth (e.g., trade and investment).

The impact of regulation on non-farm business sector of the American economy has also been examined. The results showed that multifactor productivity growth averaged just 0.08 percent annually from 1973 to 1994, dropping to virtually zero after 1988. From 1960 to 1973, by contrast, it grew at 2.1 percent per year on average, a rate that doubles the standard of living every thirty-four years.^{7,8,9}

Cost and efficiency of regulations is not a local, or national concern but also that of the international community. This is because of its anticipated impact on macroeconomic parameters such as productivity and competitiveness. For instance, the global climatic change and the need to reduce emission of CO₂ have been hot policy issues on the agenda of many countries. Stabilizing emissions at 1990 levels is estimated to result in annual costs that range from 0.5% to 2% of GDP (or equivalent to a gain of about \$60 to \$240 billion for OECD countries at today's GDP levels). However, other studies have showed that appropriate timing of abatement measures and the availability of low-cost alternatives may substantially reduce the size of the overall cost of regulating emissions.¹⁰

The discussions above with respect to top-down or command-and control regulations seem to suggest that these approaches to regulation result in significant monetary expenditures, losses in productivity, reduced innovations, etc., hence contribute toward reducing economic growth. the costs of regulation. As a result of these and other studies regarding the impact of top-down regulations, several countries are changing their emphasis either to bottom-up, performance- and market-based, or other forms of regulations.

There are few, if any, studies dealing with the costs of bottom-up environmental regulations due to the fact that it has they have not been used by many countries or agencies. Consequently, little research is carried out on costs and benefits associated with bottom-up regulations. Most of the studies dealing with bottom-up approaches are related to i) changes in fuel type, and ii) use of market-based approaches. The need to address environmental problems quickly and absence of markets for most environmental goods and services are two of the major reasons for continue use of command-and-control, and less reliance on market-based, bottom-up or other approaches.

Unlike Europeans who make use of fiscal instruments such as taxes to implement environmental regulation, the USA has entirely devoted to the use of trading as a means of implementing regulation, especially those related to abatement of emissions of SO₂ and NO_x. System of tradable permits, at a price of \$80 per ton, resulted in significant cost saving over the scrubbing strategy that could cost as much as \$500 per ton to abate SO_x. In fact, the literature indicates that depending on the type of technology, unit cost of abatement of emission of SO₂ have been estimated at \$1000-\$4000 per ton.¹¹ Market-based incentive programs, such as buying back old higher-polluting autos, a gasoline-tax increase, or emissions-based vehicle registration fees were found to lower VOC emissions at an estimated cost of \$1,650-\$6,000 a ton (Reason Foundation, California Study). On the other hand, command-and-control policy such as mandatory sales of low emissions vehicles and alternative fuel vehicles could possibly achieve the same reduction in VOC emissions at a cost ranging from \$2,200-\$108,000 a ton. Thus, mandatory use of a specific technology (e.g., electric and alternative fuel vehicles), unnecessarily raises the cost of reducing ground-level ozone (smog).¹²

The most prevalent bottom-up or alternative to command-and-control regulation in the USA is permit or allowance trading. Some studies seem to argue that the environmental impacts of the emission trading have been negligible. This is because of the fact that cost effective compliance with existing standards was the primary motivation for this kind of regulatory approach. As of 1986, the US permit or allowance-trading program has resulted in a cost savings of about \$10 billion, which is claimed to be lower than expected. Furthermore, this cost saving may be due to delayed use of permits (or credits) that may be used at a future date.¹²

In the context of international environmental agreements and negotiations dealing with CO₂ emissions, bottom-up regulations have been found to result in more optimistic results because of the potential for low or negative cost of emission reductions, and the capacity to implement that potential. Such studies show that the costs of reducing emissions by 20% in developed countries within two to three decades are negligible to negative. Other bottom-up studies suggest that there exists a potential for absolute reductions in excess of 50% in the longer term, without increasing,

and perhaps even reducing, total energy system costs.⁴

From a brief review of top-down and bottom-up approaches, it is clear that both approaches have their own advantages and disadvantages. The question, then, becomes which components of each approach, when and for what kind of regulation we should choose? The following section will address this issue.

4. A COMPROMISE APPROACH TO REGULATIONS

Humans are regarded as the cause and recipient of impacts of environmental pollution or degradation. If progress is to be made with respect to improved environmental quality, the first course of action ought to be to influence human activity and the driving forces of these activities. In order to influence behavior, appropriate intervention strategies should be designed. These intervention strategies can broadly be divided into two: i) market-based, and ii) non-market-based.^{12,13}

The non-market approach could involve command-and-control regulations, voluntary mechanisms, education, etc. An important driver that may bring a lasting difference with respect to behavior of individuals or firms is education so that not only regulation can be implemented as planned but also their impact is long lasting, provided they respond to the needs of the public. Thus it is essential that governments be prepared to provide the public with access to information. The source of education and the ability of humans to contribute toward the attainment of goals of regulation depend on timely availability of information needed for decision-making. Often, it is argued that this information is either hoarded or too expensive to obtain.^{12,13}

Command-and-control environmental policy can be effective where large point sources are the major polluters. However, the net benefits of this approach are questionable, especially at the margin. Uniform command-and-control systems do not allow local communities the flexibility to achieve the most environmental benefits for the expenditures of their limited tax dollars.

Environmental improvement in the USA has been realized because of the shift from a manufacturing-based economy to a service-based one, technological evolution, increased resource efficiencies, advances in environmental remediation, and, to some degree, by command-and-control regulatory policy. This approach to policy specifies the type of pollution control technology and limits the pollutants discharged.

In the 1970s and early 1980s, the financial impact of command-and-control policy on state and local governments and their taxpayers was minimal because state and local governments received financial assistance for compliance in the form of financial incentives or federal grants. No similar federal assistance was provided to private sector employers for their requirements.

^{12,13}

Similar to all economies around the world, the American economy could enjoy substantial and long-lasting benefits from regulatory reform. An ever-growing body of evidence suggests that such reform would increase productivity, lower prices, eliminate shortages, and stimulate innovation and consumer choice, ultimately enhancing economic growth. The question is how should regulation change? The selected regulatory framework should be such that it must be cost-effective, do not deter innovations or productivity, and contributes to sustainable environment and/or development.

As a result of criticisms of past regulatory practices (e.g., top-down or command-and-control), the federal government and state governments are increasingly shifting their approach towards implementing market-based approaches and/or use economic incentives to encourage pollution reduction in the most cost-effective manner. Market-based approaches are also called incentive or performance-based regulations or economic instruments. The design of these kinds of regulations often includes mixes of top-down and bottom-up approaches. Theoretically, market-based approaches achieve the same, or greater, level of pollution reduction as command and control regulation, and eliminate the information-gathering burden on the government. However, studies have shown that market- or incentive-based strategies would be fair if all participants have access to information related to regulated activity. The public, however, is not better situated to obtain timely needed information to make decisions that increases the success of regulations. Thus, this paper argues that the government is in better situation to provide this kind of information to the public.^{12,13}

Markets can be used to influence behavior through internalizing costs of damages to resources and the environment. These internalized costs would be revealed through prices of good and services. However, markets may not always be effective to influence behavior of individuals. This may be due to market imperfections, institutional, social, etc., barriers. The impact of these barriers can be minimized by conscious and targeted government intervention and use of performance or market-based regulatory instruments.

Among market-based instruments, significant numbers of countries are pursuing the implementation of economic instruments as the preferred option in pollution abatement strategies. These instruments are gaining more attention because, at least in theory, they promise a robust mechanism for promoting cost-efficiency. Several studies have confirmed that the use of economic instruments results in significant cost savings in comparison to command-and-control or top-down regulatory approaches. However, in reality the actual cost-effectiveness may differ from theoretical model results. The reasons are imperfect information, political acceptance, high transaction costs, compliance verification and sequential rather than simultaneous trading.

Economic instruments were also found to complement or supplement regulatory instruments. Economic instruments aim to bridge the gap between the private and social costs by internalising external costs to their sources, that is, to producers and consumers of resource depleting and polluting commodities.

Economic instruments could be classified into the following categories: i) property rights, ii) market creation, iii) fiscal instruments, iv) charge systems, v) financial instruments, vi) liability instruments, vii) performance bonds and deposit refund systems, and viii) regulatory waiver or variance. Inadequately defined and insecure property rights cause environmental depletion and pollution (e.g., tradable property rights). These instruments may not be feasible when there are many users of a commodity such as air, water, etc. Markets could also be created for environmental goods and services including wastes, or emissions. This instrument internalises environmental damages on the production side because the government creates markets by permitting the use of the environment as a waste sink, or it issues pollution permits (emission trading).^{12,13}

Fiscal instruments, such as taxes or subsidies for environmentally sound production, can be used for full cost pricing of production and consumption. There are three types of environmental or pollution taxes: taxes on final products associated with pollution (such as motor vehicles), taxes on goods which are generally used as inputs into a polluting activity (such as coal), and taxes on polluting substances contained in inputs (such as the sulfur contained in coal). In addition to market prices, taxes or subsidies equivalent to marginal environmental damage caused by an activity could be added to the cost of production.

Financial instruments give incentive to support environmentally friendly activities or projects with positive externalities (e.g., reforestation, techniques of erosion control). Revolving funds, green funds, subsidised interest rates, or soft loans are justified as instruments to mobilise financial resources for conservation, environmental protection and sustainable development.

Liability systems are instruments aimed at inducing socially responsible behaviour by introducing legal liability for the use of environmentally unfriendly technology. Performance bonds or deposit-refund systems, on the other hand, shift responsibility for controlling, monitoring and enforcement to individual producers and consumers who are charged in advance of the potential damage.

Regulatory waiver or variance programs are programs in which the government allows polluters to avoid some command and control requirements if the polluter uses other means to achieve the same level of pollution reduction in a more cost-effective manner. This approach could be viewed as incentive- or performance-based approach.

Markets are expected to operate "efficiently" if consumers have perfect information. In practice, consumers almost never have perfect information. In the environmental arena, as a result, a community may be unaware that a particular action could adversely affect the health or environment of the community, and the community may, therefore, not bargain with the actors to prevent the occurrence of an adverse impact of individual's action. If the community had more information, they might have bargained with the actor to prevent the harm. In such a situation, the market allocates resources inefficiently because consumers have imperfect information. Governments can facilitate the operation of the market by providing information or reducing the

cost of information on issues related to environmental and human health impacts of pollution.

Despite efforts to implement economic instruments as a preferred strategy to attaining environmental goals, structural obstacles remain the most influential barrier. For example for instruments to be effective, strategies that subsidise environmental bad (e.g., the production of electricity) should be removed. Elimination of policies that distort energy prices, regulations to set minimum efficiency standards for energy using equipment and building, financial incentives for energy efficient programs, and support for research and development are some of the elements of sound environmental management system that may enable the attainment of reduced emissions of common air pollutants.

Recommendations that would remove institutional, economic, and regulatory barriers affecting progress toward achieving sustainable development in the energy sector need to be developed. One such alternative is performance or incentive-based regulation. The increased regulatory flexibility under an alternative performance-based management system would encourage energy efficiency as a method of pollution prevention. For many industries, introduction of innovative technologies that prevent pollution and lower compliance costs typically decreases energy consumption. The industries that produce the most pollution and incur the highest abatement costs also consume the most energy. Successful research and development aimed at pollution prevention and waste minimization would reduce pollution remediation costs as well as consumption of energy and raw materials.^{12,13}

The environmental literature argue that successful intervention strategies are those that aim at pollution prevention than those that are reacting to consequences or impacts. Pollution prevention can best be achieved by bottom-up approaches or regulations that utilize instruments that are performance- and market-based. Given that almost all environmental ills are related to energy consumption, intervention strategies aiming at influencing the pattern and magnitude of energy consumption can produce a lasting impact on environmental sustainability.

Of the measures that are based on bottom-up approach, programs intended to increase energy efficiency seem to be relatively more plausible. Energy efficiency is a primary tool for sustainability because it can help achieve the interdependent objectives of improving the economy, increasing equity, and reducing environmental costs. Despite the substantial efficiency gains of the past 20 years, consumers and industry can still save energy cost-effectively by using newer technologies and improved practices. Many of the least affluent in society have not yet reaped the economic gains from energy efficiency because of lack of financial resources and access to technology. And because current patterns of energy production exact a toll on the environment, energy efficiency can directly reduce environmental effects.^{12,13}

The reviews above are focused on top-down or bottom-up regulations (market or non-market-based). Other studies in the field of regulatory reform suggest increasing the efficiency of existing regulatory structures or minimizing the current level of government intervention or regulation (or deregulation). While increased efficiency can be preferred for immediate action, deregulation has to be exercised with at most degree of sensitivity.

Critics argue that new regulations threaten emerging industries and new technology. The rise of new markets and advanced technologies has been met with new forms of regulation. According to a study by the Economic Strategy Institute, the failure to modernize export controls could cost U.S. companies up to \$97 billion over the next five years. A recent Heartland Institute study finds that regulatory merger delays in restructuring industries resulted in costs of more than \$12 billion in 1996.¹

Others claim that current government initiatives towards removing regulatory barriers are proving to be useful. A recent study found that deregulation has resulted in price declines ranged from 30 percent to 75 percent across a range of industries, including airlines, trucking, railroads, banking, and natural gas. Analysis of deregulation of five major "network" industries--natural gas, telecommunications, airlines, trucking, and railroads -- showed that regulatory reform and customer choice generated very beneficial results. Specifically, within the first two years of deregulation, prices had fallen by 4-15 percent, and sometimes more for certain groups of customers. Within 10 years, prices were at least 25 percent lower, and sometimes close to 50 percent lower. The report argued that deregulation is a long term process, from which society will continue to reap benefits as firms continue to adjust to free market competition and as more and more industries are more fully deregulated.^{1, 12, 13}

The reviews presented in this paper seem to indicate to the following conclusions: i) top-down or command-and-control regulations are costly, inflexible, may inhibit innovations, include adequate descriptions of macro-economic characteristics of the system being regulated, incorporate very little input from segments of the society that may feel the impact of anticipated regulations, thus produce results may not be sustainable; ii) bottom-up regulations are relatively cost-effective, do not have adequate provision to incorporate macro-economic factors along the decision-making process, flexible, promote innovations and incorporate inputs from local communities or bottom of the decision-making hierarchy, thus produce results that may be sustainable. Both approaches are necessary but not sufficient to enable the implementation of strategies that are cost-effective, efficient, contain mixes of micro- and macro-economic policy issues, flexible and most of all having the ability to contribute to sustainable environment and development.

Among the strategies that were explored, and also thought by many as effective in implementing regulation are market or incentive-instruments. However, the public is not fully equipped with respect to information on the causes and impacts of environmental pollutions. Therefore, they are not in a position to effectively bargain with polluters or the government. Moreover, allowing the market as a sole mechanism to implement environmental regulations would result in unfair consequences or results and much more significant damages to the environment because most environmental goods and services are not marketed.

The conclusions from the above discussion are that all regulatory framework or intervention strategies may be correct in their own right, at a given time and place. None of the approaches can be classified as satisfying the necessary and sufficient condition for a successful regulation.

Regulation is said to be successful if and only if the following conditions are satisfied: i) cost-effective, ii) flexible, iii) efficient, iv) promote innovation, v) reflect the needs of local community and yet able to incorporate the macroeconomic reality, vi) action-oriented, vii) able to balance economic growth and environmental conservation, thus produces results that are self-sustaining, viii) is replicable, and iv) its continuity requires combination of command-and-control and incentive or performance-based, with the latter becoming more dominant. Regulations that are characterized by these features can be expected to produce results that are sustainable. That is, they satisfy the necessary and sufficient conditions for successful regulation.

5. CONCLUSIONS AND RECOMMENDATION

Regulations (like other instruments of government policy) have enormous potential for both good and harm. Well-chosen and carefully crafted regulations can protect consumers from dangerous products and ensure they have information to make informed choices. Such regulations can limit pollution, increase worker safety, discourage unfair business practices, and contribute in many other ways to a safer, healthier, more productive, and more equitable society. Excessive or poorly designed regulations, by contrast, can cause confusion and delay, give rise to unreasonable compliance costs in the form of capital investments, labor and on-going paperwork, retard innovation, reduce productivity, and distort private incentives.

The late 1960's and early 1970's marked a period in U.S. history of major expansion of health, safety and environmental regulation. Numerous new government agencies were set up to protect the American workplace, the environment, highway travelers, and consumers. Most regulations started with the preparation of the strategic, long-term environmental policy papers (top-down or strategic-oriented) and followed with action-oriented plans (bottom-up). Both top-down and bottom-up approaches provide a means for understanding what is important in an area, and this is the primary objective for the new generation of environmental analyses. Instead of being able to focus on a particular activity or impact, analysts must now evaluate the full variety of impacts that have occurred or might occur from many different activities.

Decisions on energy production, distribution, and use can have important effects on the U.S. and global environment, the prices of most basic goods and services, international competitiveness, and national and economic security. Changes in technology and economic behavior offer an effective way to reduce the environmental and social burden associated with energy production and use. Cost-effective investments in energy efficiency, could lead to economic, environmental, and equity benefits by reducing energy costs and environmental effects. In the energy sector, individual citizens can strive to improve the economic and environmental performance of energy use to enhance national competitiveness and social well-being.

The reviews in this study suggest that successful regulations should be able to contribute to sustainable use of energy and the environment. Regulations must reflect local, national and global perspective, and yet respond to the needs of those that are regulated or those that feel the impact of regulations. Reviews of regulatory studies suggest that combination of incentive or

performance-based regulations and top-down or command-and-control regulations could result in successful intervention strategies. This is especially true in the field of environment where regulation cannot be left to free market because most environmental goods and services are not marketed. Thus, combination of command and control regulation, and incentive or performance-based (bottom-up) approach are required to ensure the implementation of successful regulations.

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