

Scientific review



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A number of theoretical studies have established that the motivation that leads to the uptake of new technology is enhanced under market based instruments as opposed to markets under regulation (Duke & Kammen, 2009). On the other hand, a comparison of the theoretical aspects among market based instruments produce differential outcomes. Sue (2006) analyzed organizational incentive levels that enhance the diffusion of technology through an analysis of auction emission permits, command and control, abatement subsidies, freely allocated emission permits, and emission taxes. It was established that auctioned permits had the highest rate of adoption among all the instruments followed by emissions taxes and subsidies and lastly freely allocated permits and direct controls. Stewart (2011) also came to the same conclusion asserting that auctioned permits were the greatest motivators, second came taxes and subsidies and lastly free permits and performance standards. Further studies conducted by Fischer et al established that auctioned permits and freely allocated permits offered less incentive for diffusion as compared to emission taxes. They were however more effective than command and control measures. With permits that are tradable the diffusion of technology leads to a decrease in permit price equilibrium leading to lesser incentive for adoption of the technology. The permit system is therefore a tool offering lesser incentives for adoption relative to taxation when the two instruments are used equally prior to diffusion.

A common outcome of empirical investigation on the doption of environmental technology asserts that environmental regulation is a necessity if firms are to adopt pollution control techniques. According to

Rosenberg (2012) in the instance of regulation of decisions taken by gasoline refiners at the period of the phasing out of leaded fuel, increase in regulatory stringency played a great part in enhancing the adoption of the new technology. It was also found that in the instance of tradable permit systems was a source of incentive for the adoption of more efficient technologies. Parry (2008) also established that an increase in flexibility of market based instruments is a source for incentives that drive the adoption of technology. The study established that the organizational decision to adopt new technologies was more focused upon differences of costs as opposed to the rate of emissions. A 2008 study by Parry established that the existence of environmental technologies in themselves do not present enough incentive for their adoption. The adoption of technology is in most instances adopted when firms are required to adhere to stringent emission limits.

Generally firms may decide to opt for either one or two strategies in complying with regulation regimes. End of the pipe abatement leads to a reduction in emissions through the use of add on technologies for cleaning the waste coming from a plant. On the other hand better models reduce emissions through reducing pollution during the production process. Northaus (2004), analyzed the adoption of one strategy as opposed to another. It was established that many production plants in the developed world adopted clean process technologies. On the other hand the introduction of environmental regulations tends to lead to firms resorting to end of the pipe means. When market forces such as economics of costs and environmental audits are allowed to influence markets, firms tend to adopt cleaner process techniques.

Another study analyzed the effect of diffusion of technology when control and command means are employed together with environmental regulations. In many instances, in which command and control have been employed, the set level of emission reduction has been set at a level deemed stricter on new sources as compared to current ones. Empirical evidence has shown that differences in environmental regulation have led to an increase in the time taken for plants to be taken out of commission.

There is empirical evidence that such differential environmental regulations have lengthened the time before plants were retired (Duke & Kammen, 2009). Additionally the adoption of differential systems may result into greater emission since it allows for plants which are dirtier to continue in operation.

It has also been found that while economic incentives, information provision and direct regulation play a great role in influencing emissions, community pressure is also a major factor in the adoption of new technologies. The issues of price also play a great role in the adoption of efficient technologies. It has been established that the instance of energy prices is directly related to the instance of the adoption of energy saving technologies.