Environmental Regulation and Innovation in Firms

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Abstract

The Porter hypothesis has advanced the idea that stricter environmental regulation will generate benefits to firms through increased innovation, improved product design and will generally enhance the competitive standing of the firm or industry in adding value to its products. While environmental economists have been critical in receiving the Porter’s proposal as being based on too optimistic expectations of the size of the benefits the business community has welcome them. By using selected case studies for Japan, some indications of the validity of the Porter hypothesis will be presented.

Pollution is considered a negative externality. Governments have to enforce some form of strict regulations or standards to contain the environmental dangers and protect the society at large. There is no doubt for example that increasing carbon dioxide emissions lead to global warming impacts unless efforts to alleviate them are implemented. The compliance to these regulations is claimed to entail some costs to the firms, thus raises the prices of the product, cuts the consumer demand and impacts on the firms’ corporate earnings. In situations like this are environmental responsibility and business concerns seem unreconcilable.
Micheal Porter, a noted Harvard professor, however argues that the firms do not necessarily lose their competitiveness with the imposition of regulations. These standards would rather render the firms more innovative and they will be more challenged to come up with environmental conservation technology in terms of improved product design, and more efficient production processes. In the long run, he contends that the innovation offsets the compliance costs. Hence these standards can boost the competitive advantage of firms and give rise to new business opportunities for firms in the industry. Interestingly some economists are contentious about this win-win situation that Porter proposes. And yet some industry representatives say that smart companies are the “green companies”. Against this background, it is the intention of this paper to see the applicability of the Porters hypothesis using Japanese industry cases.

In accordance with the agreement at the 1997 Kyoto Conference on Climate Change, the Japanese government has vowed to cut by 6% of its 1990 level the emissions of greenhouse gases that include carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, and perfluorocarbons by the year 2012. Hence the Japanese government has to take control measures as well as standards to reach this target in line with the principles of the Basic Environmental Law.

Almost three decades back, Japanese industries tried to be more efficient and leaner due to two oil shocks that greatly affected their oil-run operations. In the 21st century, corporate philosophy and commitments have shifted to increased efficiency to subdue global warming and to protect the environment. Some industry leaders are pessimistic that strict government regula-
tions on carbon dioxide have harmful effects on the industries and the economy as a whole. But some companies take it on stride and show signs that Japanese companies are cognizant of the pollution problems and are thus moving toward finding solutions to the global warming issue and aim to be global competitors in environmental technology.

The companies themselves through the Keidanren (Federation of Economic Organizations) have taken their own initiatives to environmental conservation with the "Declaration of Voluntary Action Plan" in fear of possible stern government regulations. Participating in this action program of environmental concern are the manufacturing, energy, transportation, construction, distribution, fire and casualty insurance industries. Firms in each of these industries have set numerical targets for reducing energy consumption, and carbon dioxide emissions by the year 2010 and have set numerical targets for increasing the use of recycled materials as well. In addition firms have continuously adopted the ISO 14001 environmental management system in their operations. The electronics machinery sector for instance would like to reduce the carbon dioxide (CO₂) emissions per unit of production by 25% of the 1990 levels and to have a 60% recycling rate of waste products by year 2010. The automakers on the otherhand would seek to improve the fuel efficiency of gasoline powered engines by year 2000 and the target for waste recycling for new models after 2002 placed at more than 90%.

Firms can comply to environmental regulations in various ways. Environmental innovations can take the form of end of the pipe technology which tries to minimize the impact of the environmental hazard after it has occurred. Take the case of the chemical industry. One by-product of chemical
companies is waste water from their plants. Sumitomo Chemical for instance indulges in the treatment and recovery of discharges from its plants. The waste water is treated with a closed system or proactivated sludge and refines its process to have a pollution free manufacturing as well. It has developed a recycling system using technology to recoup ingredients from waste water such as sodium carbonate and sulfuric acid. On the other hand, the firm's innovativeness could also be portrayed in the product or process improvements anywhere along the production chain. Along this line, Sumitomo has come up with a proprietary process such as direct oxidation process of MMA monomer (raw material for methacrylic resin) and a hydroperoxide process to manufacture resorcinol (adhesive for rubber) that do not generate dangerous substances and thus weeds out the cause of the pollution before it occurs.

Competition too is building for the development of the next generation cleaner incinerators for waste disposal to be marketed commercially. The anticipated new law to control the level of dioxin releases from incinerators nationwide to be passed by the Ministry of Health and Welfare puts an estimated Yen 1 trillion market for incinerators to handle industrial wastes and a Yen 600M to 800M market for household garbage disposal at stake. Leading in this line of waste disposal business, Nippon Steel Corp. and Ebara Corporation are aggressively competing to develop good technology and have their own market niche amid the current environmental problems. Nippon Steel Corp. two decades ago had developed blast furnace type disposal system used at the local facilities but was considered expensive by local government officials. In 1990 the firm came out with a better and more efficient new gasification and molten incinerator that treats wastes to more
than 1000 C cutting the dioxin release and converts the recovered slugs and metals to construction materials. Less coke is required to run this new system, thus reducing the operating costs and consequently making the construction cost which otherwise would have been considered costly, at par with any other incinerator in the market. This has been contributory to Nippon Steel having won contracts amounting to yen 20–30 Million in 1997 and yet hopes to bid for Yen 200 Million worth of contracts in the future. To meet today's environmental requirements, another company, Ebara Corp. likewise has come up with a fluidized bed gasification combustion system. It dispenses with the fuel oil or coke and instead uses sand to sieve and gasify the metal wastes in fluidized furnace without oxidation. Unlike Nippon Steel, Ebara Corp. is targeting the ordinary household garbage incinerator market. China for one is now reforming its inefficient state enterprises which according to reports contribute much to the pollution problem in the country and building new ones as well. Ebara Corporation knows the big opportunity overseas for advanced environmental technology their expertise can tap. It has developed and exported an electron bean flue gas system that converts SO\textsubscript{x} and NO\textsubscript{x} and other wastes emitted by factories and electric power plants into fertilizers for agriculture. China recently has been constructing a thermal power plant in Sichuan province but waste disposal is nonexistent hence the company wasted no time to penetrate the Chinese market and installed this flue gas treatment system.

Matsushita Co. is putting more value to its products in various stages of the product to make it environmentally friendly and yet provides the users with an improved and reliable product. They have downsized the air-condition outdoor unit thus using less raw materials; and have reduced the use of
wrapping materials, packing instead the air-condition in 100% recyclable cardboard boxes without using Styrofoam. The company stands to benefit from the materials savings in production and packaging. Nowadays home air-conditions use HCFC R-22, a cholofluocardon refrigerant that will be banned by 2020 under the 1987 Montreal Protocol. In lieu of this the company has developed and will market soon air-condition units incorporating a new X6 series of heat pumps that will use instead the HFC R-410A, a better refrigerant since it is a gas that gives better performance and safety reliability and more important, not harmful to the ozone layer. However to accommodate this new refrigerant for the heat pumps, the company has likewise to make technical improvements on the other parts and components such as a new compressor, larger fan with higher efficiency DC motor and a new heat exchanger which is 33% more energy-efficient. Hence due to the environmental standards the company has come up with a much improved product for the consumer and yet there being a more efficient resource use.

Fuji Film has been thorough with its product improvement as part of its environmental corporate policy. One of the result is the development of the Mini Lab System which has increased developing efficiency. There is a great reduction in waste solution of as much as 60% for color negative processing and 80% in the color paper processing. The development of a new processing liquid for their graphic arts film (Integra) and the CEPROS M2 System for the medical x-ray film has reduced the waste solution to less than two-thirds and 50% respectively. Its microfilm processing machine (AP5) uses a new processing chemical that reduces the developing waste solution by 50%; and it has come up with a new digital direct printing plates that do not use intermediate materials as film. With all these efforts, the volume of waste
materials discharged declined by 20% in 1995 in all its 6 factories in Japan. This is further matched with the 72.5% total recycling rate in the company’s manufacturing. For instance, in the Odawa Factory, it has been recycling waste tape and waste plastic as well as reusing waste solvents as paint thinner.

Studies show that energy (electricity) consumption and carbon dioxide emissions vary per product. For instance, wide screen TVs and fax machines are widely used in Japan these days. What we are not aware of is that the former can emit four times as much carbon dioxide than the conventional type TVs and the latter emit CO₂ up to 300%. It was also revealed that VCRs consume 80% of the total electricity when it is on and on stand-by mode. Hence the Ministry of Industrial Trade and Industry (MITI) will soon pass a bill in Parliament to raise the energy efficiency of the following items: home appliances and office machines (from 8% to 30%), and vehicles (20%). Specifically, MITI will have stricter energy conservation rules for air conditioners, televisions, videocassette recorders, lightening equipment, computers, magnetic disks, photocopiers, gasoline-run cars and trucks. The manufacturers are aware that there are much room for improvement in the development of greener products if they wish. Sony Corporation has firm commitment to reduce the power requirements of its soon to be released minicomponent to less than 3 watts vis a vis the current 10–30 watts. The new minicomponent models will carry new integrated circuits and fewer lights.

Similarly, Sanyo Corporation has come up with the 1997 series of video tape players that run with only 4 watts as compared to the 10.5 watts for the
1993 model of the same item. Sanyo, a household name in electric appliances and a world leader in energy efficient cooling systems or heating large buildings, is also doing an active role in the manufacturer of green products. The cooling system they developed uses water as coolants so the machines, called absorption chillers can be run with the use of waste heat or natural gas. Natural gas is less expensive than electricity thus making it attractive. Sanyo also pioneered the use of solar cells which has given the company an advantage as far as providing power to offices and homes using large solar panels. Construction costs are tremendous but it is subsidized by the MITI and the future big savings on power utilization warrant the installation.

A pending recycling bill spurs innovation by many electric appliance makers in Japan. The MITI-backed bills stipulate that electric appliance makers of television, refrigerators, washing machines, etc. which consist of 75% of the discarded appliances to take responsibility in the recycling of their used products and the consumers pay for the process. Dismantling of the product, separating the parts and recycling them are very costly and the recycling materials only sell cheap. A less expensive method then is to crush them and use them as land fills. According to Porter, these scraps or wastes that cause problematic dump sites are signs that resources are not utilized efficiently.

Many of these electric appliance manufacturers are now trying to innovate ahead of the legislation. Sanyo Electric is currently increasing the percentage of recyclable materials in the new product to more than 70% by the year 2000 and to reduce the time needed to dismantle a new product by more than 55%. In order to reduce industrial waste, Fuji Xerox has established a recycling line with a disassembling capacity of 40,000 units worth
Yen 20 million. The new copiers are manufactured from recycled materials. Around 11% of parts of the firm's products are recycled and this is expected to increase to 25% in year 2000.

In terms of technical innovativeness for more environmentally friendly cars the Japanese as always been pioneering. The Japanese car manufacturers are ready to stand by the agreement reached in Kyoto in December 1997. The car manufacturers try to be technically diverse as possible. The Japanese car makers are well ahead of their competitors in developing the direct injection fuel engines. Honda unveiled a revolutionary zero level emission vehicles using three catalyzers to cut pollution to one tenth of the pollution limit proposed in California. Toyota and Honda have commercialized electric cars, the RAV4 and EV, respectively. Honda's EV is considered the most advanced electric car far better than GM's EV1. Toyota has started to export its electric vehicles to California and Massachusetts which have set rigid environmental standards.

Mitsubishi and Toyota have also led the development of technology and production of fuel efficient cars that cut fuel consumption and carbon dioxide and other emissions to 30% to 35% less than the standard engines. Mitsubishi Motors developed and popularized the gasoline direct injection (GDI) engine which has been acclaimed both in Japan and overseas. A main feature of the engine is that gasoline is injected directly into the cylinders while drastically reducing the air-to-fuel ratio. Hence there is less fuel consumption and yet with high power output and less CO₂ emissions. The company first introduced the GDI engine in it New Galant and Legnum series in 1996 garnering a sales of over 60,000 vehicles by the first quarter of
Hino has already produced hybrid electric buses (diesel engine and electric motor) in service in some cities in Japan since 1991. Toyota has started to market the first gasoline-electric hybrid car (HEV), the Prius, in 1997 and became the first in the world to mass-market a hybrid passenger car. Other car manufacturers in Japan like Nissan Motors, Honda Motors and Mitsubishi Motors still have to commercially introduce their versions of the hybrid car in two to three years. This gas-electric vehicle is twice fuel-efficient as a similar-size gasoline powered cars and carbon dioxide emissions are halved. For this kind of vehicle an electric motor turns the wheels at low speeds (such as in traffic jams). Normally a gas engine would consume a lot of fuel and emit considerable pollutants. The engine works only when the car picks up speed with the supplementary propulsion coming from the motor and stops automatically when the vehicle stops. The hybrid car requires no charging from outside sources; the battery is charged by the engine while the car is running.

Waste disposal has always been a problem specially when the car has reached its service life. Car owners have to pay car dealers to scrap their cars which the dealers pass on to the shredders for a fee. Mitsubishi has planned for the recyclability in their production of cars and now about 75% of a scrapped car’s total weight are being recycled. To make recycling more efficient and to facilitate the identification of parts and the type of plastics they contain the company has been putting two identification codes (ISO and the German VDA codes) on all plastic parts weighing more than 100 grams. For example, bumpers made of highly recyclable polypropylene and ther-
moplastic olefine elastomer are reused as bumpers or as interior substrates; seat pads made of polyurethane are being reused as floor pads for backbone pads; cover materials of polyvinyl chloride are recycled into dashboard silencer.

At the innovative stage of the product's life cycle, new products are priced quite high due to the cost of research and development. The same is true for other car manufacturers who are investing so much on R&D and this gives them an edge in today's global market where in the coming years people will be yearning for cars that would assure them of a more safe, comfortable and greener vehicle. Just to be able to be first in the market and to capture a market share, Toyota's Prius has been priced less than its true cost. The Japanese government has subsidized the price of the Pruis and the first few cars being sold to government offices and agencies to aid the company gain volume and market.

Concluding Note

These cases provide us with insights on how firms in Japan have a head start in the improvements and development of greener products. These have render them benefits by being more technically innovative in coming up with environmentally friendly products thus strengthening their competitive advantage not only in Japan but in the global market as Porter proposes. The government regulatory provisions and standards have challenged the firms to be so and they stand to benefit for being on the lead and gain from the trade potentials of environmental technology as well. On the part of the policy makers, the synergy that prevails traditionally and strongly bet-
ween the private sector-public sector can be a good venue to induce and not retard innovation among companies for greener products. The government for one has promoted the use of energy efficient machines and the purchase of low-emission cars in its offices. Tax incentives are being planned by the Ministry of Transport to promote the purchase and ownership of these cars; and to help the manufacturer market its product and allow it to continue to be a leader in car technology. Market pressure in Japan is still negligible but companies to counteract any would-be strict regulations have acted on their own to protect the environment. The government can then set the guideline/targets for emission and waste reduction and then set a monitoring system to see how the firms abide by these guidelines. Government action program should include increasing public awareness through information dissemination and popular education to have a broad-based market that would support and reward the innovation for greener products.

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