Innovation by Disaster

Course: MOT1410
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Abstract for the paper "Innovation by Disaster: The ozone catastrophe as experiment of forced innovation" by Karel Mulder.

The paper "Innovation by Disaster" reflects upon effective means of stimulating environmental innovation by analyzing the innovations that resulted from the ban on CFCs. The Ozone Hole catastrophe led to protocols that forced industries to innovate. The paper shows that the removal of Ozone Depleting Substances should be primarily considered as a successful attempt of technology steering (influencing the conditions of actors that are involved in the creation of technology to promote specific outcomes) and not technology forcing (setting mandatory targets for future technological performance through regulations).

Solar radiation, as the source of energy for our planet, contains various harmful forms of radiation, especially Ultra Violet-B. A large part of UV-B is destructed by the ozone layer. A thinner ozone layer will cause lots of adverse effects for humans, as well as animals and plants. In 1970, James Lovelock discovered traces of CFCs in the air. The findings triggered Molina and Rowland of the University of California to draw an alarming conclusion in 1974: "The reaction of CFCs and UV-B in the atmosphere catalyzes the destruction of ozone molecules. As a result, more UV-B radiation will reach the surface of the Earth."

CFCs were developed in 1930 to replace various toxic/flammable compounds that were used as refrigerants at that time. In later decades, CFCs were recognized as ideal propellants for spray cans, ideal for making plastics foam, and finally, they were used in the electronics industry for insulation and cleaning of printed circuit boards. All in all, in 1974 the estimated turnover of all CFC containing products was $6.7B.

Although there was yet no empirical evidence supporting the depletion of the ozone layer, public concern was very high. US spray can sales slumped and from 1975 several major companies abandoned CFCs. In 1976, US Congress empowered the Environmental Protection Agency to take drastic measures if necessary. Various alternatives were developed as propellant in spray cans. Hydrocarbons, which are highly flammable, turned out to be the main alternative. Although CFCs disappeared from spray cans, other CFC applications remained unaffected by the ozone turmoil, especially in the electronics industry. The situation completely changed in 1985 by an article of Joe Farman, in which he reported on the strong thinning of the ozone layer that he had measured above the Antarctic. NASA's satellites confirmed these findings.

This created the chance for the UNEP to make a leap on the ozone issue. In 1987 a protocol was signed in Montreal by 27 nations, encompassing the freeze on production and consumption of CFCs and Halons and a reduction of production of these substances by 50% in 1996. The Ozone Hole turned out to be bigger and it became evident that this protocol was insufficient. In 1990, the London Amendments were passed. These encompassed a total ban of CFCs by the end of the century, and most importantly, funding for developing nations to help them acquire and introduce replacement technologies. By 1998, 165 nations had signed the Montreal Protocol. The Technical and Economic Assessment Panel was also created to independently find alternatives for CFCs.

These regulations triggered American companies to innovate and finally suggest HFC 134a as an alternative in refrigeration, while European companies, taking into account the global warming, suggested HC. In the air-conditioning systems, the suggestion was also HFC 134a, but the transition was much slower. This is illustrated by the fact that in the year 2000, 73% of global CFC/HCFC consumption was in this sector. On the other hand, the regulations came as a shock to Micro-electronics companies that used exclusively CFC 113 as cleaning agent. In the end, with the intervention of EPA, the aqueous cleaning and the "non-cleaning" approaches were developed. These new approaches were gradually accepted as they were more cost efficient. Finally, the production of foam was also affected because it was using CFC-11 for insulation, packaging and cushioning. The US implemented alternative was HFC 134a while the European one was either HC or CO2.

In conclusion, it can be observed in various attempts that technology forcing is not effective. In the case of the replacement of ozone depleting substances, regulations coincide with marketing, consumers' demand, and clear-cost advantages, so they should be considered as technology steering. In general, this disaster-based policy cannot be considered as a proper innovation policy.