IfM MANAGEMENT TECHNOLOGY POLICY

UNIVERSITY OF CAMBRIDGE

briefing

Can environmental legislation spur innovative response?

Most people acknowledge that swift action needs to be taken to curb climate change, and many would suggest that legislation is a primary route to ensure harmful emissions are reduced. However, a study by the IfM's Centre for Technology Management (CTM) shows that law-making alone is not enough. A number of other convergent factors are vital if effective change is to be achieved by legislation.

The CTM study indicates that the success of legislation designed to tackle environmental issues may be predicated upon other unplanned factors, such as:

- the management structures of individual companies
- the level of autonomy given to research centres
- the level of engagement of key personnel

The speed targets will be met also depends on the levels of existing research and expertise and whether a favourable business network and environment of collaborative research effort is in place.

A catalyst for change…

Laws and regulations designed to generate new commercial products to assist in the solution of a major problem can be termed 'technology forcing legislation'. This is a policy where law-making bodies make regulations designed to force manufacturers to come up with innovative responses to the problem. The 'market incentive' comes from the threat of punitive action if the required targets are not met.

The example examined by CTM was the development of catalytic converters for the US car market during the 1970s.

In 1970, the US Congress, created the American Environmental Protection Agency (EPA). In the same year new standards for emission control by car manufacturers were introduced by the Clean Air Act and the EPA was tasked with the responsibility of ensuring measures within the bill were met. Under the bill, the emission standards outlined were far ahead of accepted practice, and were designed to force the big three car firms – GM, Chrysler and Ford – to adopt cleaner technologies.

The motor industry was expected to reduce emissions by 90%

The bill would mean the auto industry would be forced to reduce emissions from car exhausts by 90%.The legislation also applied to cars produced outside the US, meaning non-domestic manufacturers would have to comply.

The reaction from the big car manufacturers was not positive

Crucially it also highlighted the need for new technologies to achieve the ambitious targets. Unsurprisingly perhaps, the reaction from Motor City was not positive.

The 'Big Three' had experimented with autocatalysts as early as the 1950s, but they only had lead fuels to experiment with, so the results were not as effective as they'd hoped. This failed experiment convinced the triumvirate, as well as some major foreign manufacturers, that add-on catalysts would not work; the standards could not be met and the expense of new technology was prohibitive. Other factors would be necessary to bring about the change envisaged.

Business incentive and opportunity

The introduction of the new legislation was no guarantee of success. It also needed businesses to realise that the new law would afford them a commercial opportunity. In 1970, the British-based chemicals company Johnson Mathey (JM), which specialised in catalysts and precious metals, was in just that position. In 2008 it employed around 7,800 people in more than 30 countries and generated £4.5bn in turnover. The company saw the legislation as a way to exploit its long-term research into the use of industrial catalysts.

JM had been researching the use of catalysts in industry since the early 1960s, and had been looking for commercial opportunities for its activities. Initially this work was believed to have a relatively niche application, though they had expanded into reducing Nitrogen Oxide (NOx). The research activity meant it had a clear idea about the best materials and processes available.

In parallel JM were working with German car giant Volkswagen to find the best combination of fuel injector system and catalytic converter to control emissions from the VW Beetle. JM also carried out similar research on US automobiles with British engineering firm Ricardo. The work meant that by the time the EPA launched its emission control bill, JM had built a significant level of expertise.

Autonomous research teams and product champions

Internal structures and work flows also have a significant impact on product delivery and innovation. Encouraging individuals and groups within companies to look at commercial avenues for

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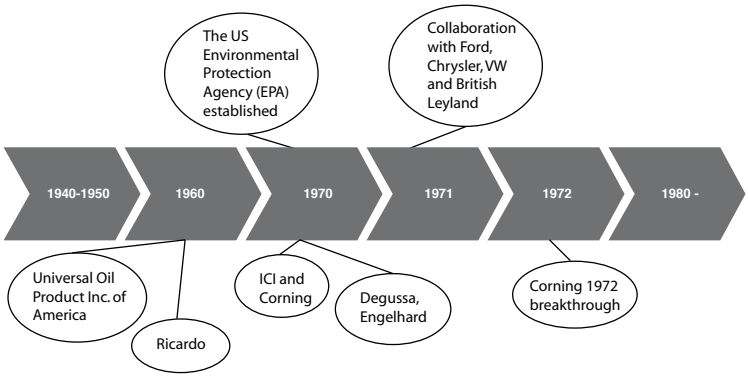

Participants in the developments of ACC
Car companies: Ford, Chrysler, GM, VW. **Competitors:** ICI, Degussa, Engelhard Corporation, Umicor, and Delphi.
Supplier: Corning (ICI). **Partners:** Ricardo

existing research can result in profitable innovation. For example Technology company 3M developed the Post-It® by encouraging individuals to seek new uses for existing technologies. In the case of the Post-It® they found a commercial use for a non-stick adhesive.

Encouraging staff to look at commercial avenues for existing research can result in profitable new ideas

Allowing greater autonomy for research teams and allowing individuals to seek out potential markets was also a policy pursued by JM. From the early 1960s it had begun researching applications for precious metal catalysts. The company had decided ten years before a substantive market existed that the area was worth investment and exploration.

Its success was built around the recruitment of key individuals and affording them greater autonomy to pursue research interests. It appointed Research Director Dr Leslie Hunt who kick-started the research programme and chemical engineer Gary Acres who joined the catalyst research group in 1963. Both championed the technology and kept tabs on potential developing markets.

It was very important that senior management supported the long-term goals of the research, and understood the potential future gains. Their backing was needed to overcome short-term demands from shareholders and the potential difficulties of bringing a new innovation to an established and competitive market.

Partnerships

JM also realised the importance of developing partnerships. These would be vital in order for an outsider to penetrate well established supply chains and markets in the auto industry.

JM also realised the importance of establishing partnerships to help develop commercially viable catalysts

From the very start of the research activity, JM worked with selected partners on projects which could assist the development of commercially viable catalysts.

In the early 1960s it partnered with Universal Oil Product Inc (UOI), supplying platinum for UOI's study into reforming fuel to improve the efficiency and performance of engines. UOI's research was the stimulus for JM to begin work in this arena.

Later it worked with Corning Glass on the most suitable materials for a catalyst. JM was later to use this research, combined with studies by its ceramic department, in the creation of a more durable autocatalyst.

JM had also carried out a programme of research with German car giant Volkswagen. They used VW's Beetle to find the best combination of fuel injector system and catalytic converter to control emissions. Similar studies on US automobiles with British engineering firm Ricardo also helped in the development of effective autocatalysts.

The firms working with JM also benefitted from the research and therefore were happy to collaborate

Developing networks and the transference of expertise and technology helped JM towards it's the final autocatalyst product. Crucially the firms that JM partnered with also benefitted from the shared research so were incentivised to take part in collaborative effort.

Business climate

The EPA legislation was greeted as an opportunity by JM. The 1971 amendment to the Clean Air Act, eliminating lead as a fuel additive, prompted them to enter the market for automotive catalysts. JM was able to see the commercial opportunity for catalytic converters thanks to the seven years of research and ground work it had put in already. It had also indirectly benefitted from the failed experiments with catalysts carried out by the big three US firms in the 1950s. This had discouraged them from seeing the benefits of 'add on devices' leaving the way open for an external developer.

The firm still needed to sell the benefits of the technology to the EPA against a background of hostility by the motor manufacturers. JM encountered this hostility when their offer of collaboration to the big three was rebuffed – a case of 'not-invented-here' syndrome.

Meanwhile, the EPA was also being proactive. It refused to accept the word of the US car makers and actively sought out innovators. This proactive approach allowed JM to speak directly to a legislator and prove its technology could meet new restrictions. The EPA was also particularly interested in the research JM carried out with engineering firm Ricardo on American automobiles.

JM was also able to show that it could manufacture the new products on the scale necessary to achieve the emission targets demanded.

Further information

The IfM working paper concerning this research can be read in full here: http://tinyurl.com/n6xauw