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*Innovation: a case study*

Americans worried about their industri­alists’ willingness to take on risky inno­vations should take heart – and learn lessons – from Corning Glass Works.

Corning’s romance with technology began 100 years ago when it made the glass for Edison’s first light-bulbs. The Houghton family, which ran the com­pany then and still runs it now, was deeply affected by the golden age of invention from Edison to Ford. Coming built America’s fourth industrial labora­tory, in 1908. In the 1930s, while every employee took a pay cut, the company’s R&D outlays continued to climb.

The fruits have been at least one major innovation each decade (and a number of minor ones), ranging from the original Pyrex dishes to optical fi­bres, one of the great technological opportunities of the 1980s. Such innova­tions have fuelled Corning’s growth to annual sales of $1billion.

But it has not all been plain sailing. For most of the postwar period Wall Street was somewhat disillusioned with Coming’s profits. Only a management shake‑up in the early 1970s and a subse­quent rationalisation of the product range got Corning back on course: in the past five years sales have risen 5% annually and profits 30% a year.

Coming’s record is a good illustration of the mixture of judgment, grit and luck that underpins the risky business of innovation. Take the new material its scientists first developed to withstand high temperatures for use in the nose cones of missiles. By chance a marketing executive visited the laboratory where the development was under way. He amused the boffins by pointing out that the glass would be a great new material for cooking ware. Corning still makes a few missile cones. But the market win­ner was the cooking ware.

Take another break. One of Coming’s senior researchers visited a rival glass manufacturer and was told what a coup it would be if someone could come up with a photochromic glass – a tinted glass that would deepen or lighten its colour in response to the brightness of light hitting it (for use, for example, in sunglasses). On the train home, the Corning scientist suddenly realised be knew how the trick could be done.

But Coming has also made mistakes. Its flirtation with making windscreens that would shatter safely was an expen­sive disaster. The development began in the late 1950s and ended in the early 1970s, when $42m had to be written off. The windscreen worked a treat but cost too much. Detroit would not buy it.

Meanwhile Coming had been chasing yet another rainbow: heat exchangers for gas turbine cars, the belief being that Detroit was going to switch from the petrol engine to gas turbines. That project was also scrapped in the early 1970s, after some $15m had been spent.

But on this occasion the work was not all wasted. The heat exchangers re­quired development of a porous ceramic with good thermal durability, just what was needed for a catalyst to remove emissions from a car’s exhaust. Corning committed $50m to developing the cata­lyst before the United States had even passed its Clean Air Act – and while Detroit was still lobbying against it. That gamble paid off. Corning has not only re­couped its catalyst investment but also wiped out the losses on its dalliance with the heat exchanger.

With the benefit of hindsight, it is clear that the gambles on the windscreen and the heat exchanger itself should never have been taken. Gas turbine cars were not a serious starter. And it is a cardinal rule never to develop something you cannot make at a price your custom­er can afford to pay.

This last lesson seems to have been learnt by Corning and is being applied aggressively in its development of opti­cal fibres. The company has built a factory in advance of demand in order to bring prices down and hasten the pace at which optical fibres are established in the marketplace.

**Optical fibres**

Optical fibres are attractive as telephone lines, because they occupy a tiny space in the crowded cable ducts of the tele­phone companies, because they offer the prospect of being cheaper than copper, and because they have intrinsically supe­rior qualities, such as freedom from interference by neighbouring electrical cables.

The original idea came from a visit Corning men made to the British Post Office in the mid‑1960s. The Post Office explained how pure a glassy fibre would have to be to be suitable for communica­tions. The magic number was that the attenuation (fading) of the signal could be no more than 20 decibels per kilometre.

By 1970, Corning was able to limit the attenuation to that magic figure and started spending development money in earnest. Approaching $50m has been spent so far, with hardly any sales yet in return. As the chart shows, outlays on developing a new product can cumulate alarmingly before the returns begin to flow in. Furthermore, the patent posi­tion is still in dispute with ITT, whose British subsidiary was also working on optical fibres in the 1960s.

But there is little doubt that in the 1980s Corning will see a big return on its investment. Today the state of the art has reduced the attenuation of signals to just a fraction of 20 decibels; so that optical fibres require far fewer repeater stations than copper cables. By 1985, the annual market for the fibres is expected to be well over $1 billion a year and Corning will have a big share of that.

**Biotechnology**

Corning is also one of the leaders in, of all things, biotechnology. This involve­ment also stems from the 1960s and about $20m has been spent on it so far.

Corning’s discovery that glass and bio­chemistry, are related was another of those lucky flukes. The company hap­pened to make a lot of Pyrex glass for biological laboratories. It noticed that proteins had the inconvenient habitof sticking to glass, so it spent some time trying to rub them off. Then it realised that what it had seen as a problem was really a selective solution: different glasses could be developed to make different proteins stick to them. One application of this property is in test kits for diagnosis of diseases, the trick being the use of glass beads special­ly to them.

A second application of glass in bio­technology is the use of porous beads to which particular enzymes stick. These ‘immobilised’ enzymes can be used as catalysts to speed up chemical reactions. The advantages of making the enzymes stick to glass beads are two. One is that the final product is not contaminated with the enzymes. The other is that the enzymes themselves can be used again and again.

The first reaction that Corning has chosen to tackle commercially is one dealing with cheese whey. For every pound of cheese, you have to make eight pounds of (unwanted) whey. Coming has developed a process to convert the whey into useful by‑products that can be used by the food industry. Trials were successfully completed in Britain and France this year, and now the company is moving to 100,000‑gallons‑a‑day com­mercial plants. Neat. And this is expect­ed to be just the first of many applica­tions of immobilised enzymes.