

conducted through the research association, MTIRA, but this is concerned largely with basic technology and safety requirements. Its contribution is not substantial. In 1978, the latest year for which figures are available, 19% of research spending was undertaken within research associations. The remainder was undertaken within private firms. At the same time, there is little evidence to support a belief in strong and close co-operation between the machine tool builders and the Universities.

As already has been noted, British firms were slow to develop general purpose CNC machine tools, instead continuing to produce conventional machine tools. One point to emerge from a comparative study of the UK and Swiss industries was that UK companies have generally been slow in product innovation, whilst displaying equal speed in the area of process innovation. One reason may be the relative independent financial position of the Swiss companies, whilst UK firms, at least those which are subsidiaries of larger groups, have been limited by group financial requirements (Ackermann and Harrop, 1985). However this merely highlights the differences in relative performance between two countries rather than an overall approach to product development. Indeed a criticism made of UK producers in the past has been the undue emphasis placed on customisation and product innovation for its own sake rather than for the requirements of the market place.

Most of the product development which has taken place in recent years has been incremental in nature rather than revolutionary, typically involving raising machine efficiency as well as the integration of electronics into machine tools. The strategy has been broadly the same however with its stress on product innovation rather than manufacturing engineering.

Government's role in the promotion of the industry has tended to vary over time and with the coming of a avowed non interventionist Government in 1979, the industry has seen that role diminish. State assistance for the industry has taken a variety of forms over the period under consideration. The simplest, Government funding of research has occasionally supplemented the total although this is not on a regular basis, instead being devoted to special initiatives. In 1978, 82% of R&D spending was privately financed. In 1989, this had fallen to 57%, but this was of out of a figure of only £8.8 million.

The Government has attempted in other ways to promote innovation by machine tool firms. Under the Science and Technology Act of 1965, a Pre-Production Order Scheme (PPOS) allowed the Government to buy pre-production models of advanced machine tools and grant free use to companies on a trial basis. A year later, a second scheme required users to pay to become involved, but this was withdrawn in 1970. Although the scheme encouraged the development of 49 new models, only 5 had been sold to users by 1968 (Sciberras & Payne 1985).

In 1975, the Machine Tool Industry Support Scheme granted loans for the design, development and marketing of new machine tools. The scheme was closed in 1977 and by 1980 some £17.4m had been paid out. In 1977 a scheme was introduced allowing grants for product and process development and this scheme, along with an extended PPRO, was incorporated into the Support for Innovation scheme in 1983. This itself finished in 1987 since when there have been no further grant schemes.

In addition to these schemes for the promotion of innovation within the industry, there have been a number of initiatives with the objective of stimulating demand for