Centre for Agricultural Strategy

Agricultural and food research – who benefits?

Edited by T E Wise

CAS Paper 23 May 1991

Wise T E (Ed) (1991) *Agricultural and food research – who benefits?*. CAS Paper 23. Reading: Centre for Agricultural Strategy.

Poster presentation: The economics of agricultural research and technology

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This poster session offered a brief overview of several economic aspects of agricultural research, which can be summarised as follows.

1 THE EFFECTS OF SCIENCE AND TECHNOLOGY ON AGRICULTURE

By the early 1980s, the value of agricultural output, at constant prices, was two and a half times that of the 1930s, four times that of the 1870s and nearly nine times that of the early nineteenth century. Wheat yields – output per unit of land – were twice those obtained in 1950, three times those of the 1930s, five times those of the 1830s and ten times the yields obtained before 1650. Labour productivity had grown even faster – as a result, the labour input required to produce crops like potatoes, sugar beet, wheat and barley was, by 1983, only about one tenth that required in 1930 (Grigg, 1989).

Increasing productivity is now dependent on the development of the scientific and technical capacity to invent new biological, chemical and mechanical technologies that can be embodied in more productive inputs. But precisely because of the rapid increase in the use of chemical and mechanical inputs, often requiring considerable investment, simple 'partial productivity' measures, such as yields and labour productivity, are an inadequate measure of the increases in efficiency, which are partly attributable to technological change. However, 'total factor productivity' (TFP) measures (the increase in output per unit of all inputs) take full account of all these changes and TFP appears to have nearly doubled from 1950 to 1987 (Bottomley, Ozanne and Thirtle, 1990). How can this increase in efficiency be accounted for?

2 THE RATE OF RETURN TO INVESTMENT IN AGRICULTURAL R&D

The TFP index defines the relationship between inputs and outputs at any point in time. Over time, output per unit of inputs tends to increase, as improved technology changes the production relationship. But technology must be produced (like any other intermediate input), in public and private research institutions. Existing knowledge, skilled labour and other inputs are combined in basic research, to produce new knowledge, that applied R&D embodies in new technology. After screening, testing and adaption, the new technology is embodied in improved inputs, that must be adopted by farmers in order to enter the agricultural production process and increase its efficiency. Thus, if growth in TFP is to be explained, information is required on all public and private, basic and applied research and development expenditures and on ADAS Advice and Promotion costs. These are collected and explained in Thirtle (1989). For example, in 1987/88, public sector agricultural research expenditures were close to £200m; the private sector spent about £240m and the relevant ADAS costs were £37.3m for 1983/84.

Allowance must also be made for the considerable lags between R&D expenditures and their effects on productivity; for the fact that better farmers adopt new technology more readily; for the contribution of increases in farm size, and for the effects of the weather on agricultural production. Taking these factors into account, models can be constructed that estimate the relationship between agricultural R&D expenditures and the value of productivity growth. Thus, Thirtle and Bottomley (1990) estimate the rate of return to agricultural R&D in the UK, finding it to be about 40%. So, agricultural research appears to have been a very good investment, from the point of view of society, and the past expenditure of public funds in this area appears to be justified. However, this historical analysis is entirely production-orientated, whereas concern is now turning increasingly towards broader issues, including the environmental effects of agricultural intensification.

3 THE 1980s: BUDGETARY CUTS, INSTITUTIONAL CHANGE AND RE-ORIENTATION

From 1947 to 1982/83, the real resources devoted to agricultural research by the public sector in the UK increased by a factor of about eight and the number of scientific officers and above employed by the Agricultural and Food Research Council increased by more than six-fold. However, the 1980s have seen a dramatic reappraisal of the appropriate size and role of the public sector. As a result, by 1988, the real research expenditures of the public sector had been reduced by about 18% from the 1981/83 peak and the AFRC had lost 25% of its scientific staff. By the mid 1970s, the ARC had 29 institutes and 12 units, but by 1990 these had been reduced to 7 institutes. In 1987 the Plant Breeding Institute and the National Seed Development Organisation were privatised and in the last two years one of

MAFF's experimental husbandry farms has been privatised and three of its six experimental horticulture stations have been closed.

The Priorities Board (1990, p 10) states that 'all Government funding of near market R&D will have been withdrawn by 1991/92, totalling some £30 million'. The current view is that the Government (ie MAFF) 'will no longer act as a proxy-customer for applied R&D on behalf of industry' (p 2). Furthermore, since a large part of the activities within MAFF's remit are of a kind that should be taken up by the private sector, the DES will play a proportionately larger role in supporting public agricultural and food research. The DES grant to the AFRC has been increased and there is a reorientation of the system towards basic research, strategic research and 'public good' R&D, and away from near market work. The universities are expected to play a larger role.

The report also stresses the re-direction of research efforts away from increasing productivity and towards demand-orientated objectives such as improving human health and nutrition, food safety and quality, plant health and animal health and welfare, pollution control and environmental protection. So, the complexity of the research resource allocation problem has grown as the advent of biotechnology has led to increasing interdependencies in the performance of research. The Priorities Board has confronted the system with a multiplicity of inter-related socio-economic goals, but how the research system is to deliver the enhanced quality of scientific activity, increased economic and social returns, better management and greater selectivity in scientific and technological activities, that the government requires, remains to be seen.

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