

KNOWLEDGE NETWORKS IN UK AGRICULTURE, 1940-85

Introduction

A knowledge network, as the term is used in this paper, was the means by which scientific or technical knowledge was transferred from those who originated it to those who used or applied it. The originators were scientists, engineers and technologists, and the final users were farmers and those who worked for them. If the state requires an agricultural industry that produces more, and produces it more efficiently, and expects those output and efficiency gains to arise largely from scientific and technical changes, it should presumably, in a perfect world, invest in science to produce new technology and then ensure that farmers and their workers acquire familiarity with that new technology.

There are numerous theoretical approaches to the analysis of knowledge networks, in which I include here the analysis of technical innovation, diffusion, and adoption, although it could be argued that a knowledge network is simply one part of that larger process. A crude division would be between economic and sociological models, and it is crude because many of the models analyse both economic and sociological variables, although some privilege an economic methodology while others write from a sociological perspective. Thus Hayami and Ruttan (1985) with their induced innovation concept (essentially, that technical change is a response to factor price changes) would be among the more obviously economic in approach, although they emphasise the importance of land tenure and other rural institutions (see also Koppel, 1995; Geroski, 2000). From a more sociological perspective, Oudshoorn and Pinch (2003) emphasise the role of users in constructing technical change, Clarke (1998) examines the 'social worlds' in which the various actors in the process of technical change interact, and Murdoch et al (2000) attempt to identify the conventions operating in a market and the ways in which they change over time in response to technical change. Another approach based on an agricultural study is the Authority-Discourse-Media model which attempts to identify the ways in which new technologies achieve a dominant intellectual position and in so doing undergo changes in the discourses used to discuss them and the media in which the different discourses appear (Brassley, 2007). This could perhaps be seen as a similar approach, using different language, to the concept of 'travelling facts', analysed in an agricultural context by Howlett and Velkar (2011).

The following paper ignores, for lack of space, the original production of scientific and technical knowledge, but concentrates on the way in which that knowledge, once produced, was transferred to those who used it in practice. It is important to remember, however, that agricultural research in the UK expanded between the 1940s and 1980s, in terms of the money spent on it, the scientists engaged in it, and the results it produced. The function of the knowledge network was

to pass those results on to those who could benefit from them, and also, in the reverse direction, to keep the researchers in touch with their needs.

The user-scientist network

Many agricultural scientists and university academics had close informal links with farmers through discussion groups, meetings, and the occasional necessity to carry out research or survey work on farms, but there were also official bodies designed to foster links between scientific research and practical agriculture. In 1941 two Agricultural Improvement Councils (AICs), one for England and Wales and one for Scotland, were established. Sir Donald Fergusson, chairman of the England and Wales AIC, identified the different roles to be played in a letter to Sir Thomas Middleton, then chairman of the ARC: 'The ARC will concentrate their energies on strengthening the efficiency of the research organisation, but will not be concerned to get the results applied in practice. This will be the job of the AICs' (Henderson, 1981: 33 and 38). Their functions were further defined in the 1942 report on Agricultural Research in Great Britain as keeping in touch with scientific research, advising on testing promising results for incorporation into farming practice, and expediting this process, and also advising on farming problems in need of attention from researchers (ARC, 1943: 9 & 16). The AICs initially operated through a system of committees examining specific problems. In 1944, for example, there were committees on hill sheep farming, artificial insemination, the supply of fruit plant stocks, seed potato production, and the deterioration of cereal varieties. When their work had been completed and action taken to implement their findings, they were automatically dissolved. The Technical Development Committee and the committee for liaison with the ARC were however permanent (Anon, 1944: 466). This proliferation of committees and sub-committees produced a network of contacts between the universities, research institutes, experimental husbandry farms, advisory services and the Ministry which must have made it very difficult for those at the centre to remain in ignorance of any significant scientific work, and for the scientists to remain ignorant of the requirements of the farming industry and the Ministry.

These arrangements lasted until 1963 when the then Minister of Agriculture, Christopher Soames, replaced the AICs with the Agricultural Advisory Council and the Horticultural Advisory Council, on the grounds that he wished his advisers to be independent of his Ministry, and he felt that the existing councils had become too large. (TNA, MAF 132/40,). Although it was a slimmed-down organisation, the basic function of the Council appears to have changed little from the previous AIC priority of getting new technology into practice. The AAC was still operating in 1973, but by 1975 it appears to have been transformed into the Advisory Council for Agriculture and Horticulture, which in 1979 was involved in a Quangos review, which it appears not to have survived. (TNA, MAF 113/656 and 659; MAF 458).

The AIC and its successor bodies facilitated communications between the leading figures in the agricultural science, agricultural policy and farming worlds, but

the extent to which their knowledge percolated through to their less prominent colleagues needs further consideration, particularly through an examination of the way in which farmers acquired information.

Transmitting knowledge from scientists to farmers

Most farmers acquired new technical information from a combination of education, extension workers, media sources and discussions with fellow farmers. For many farmers education was probably the least significant of these, partly because relatively few farmers had much full-time agricultural education, and partly as a result of the time lag between their education and the point at which they took control of the management of their farms. Formal agricultural education in Britain in this period was provided by the university departments, of which there were seven, teaching at degree and postgraduate level, the national agricultural colleges, of which there were also seven, preparing students over two years of full-time study for the National Diploma in Agriculture, and the county farm institutes, which provided more practical training largely aimed at farm workers and small farmers and lasting no more than an academic year. The farm institutes were the expanding sector in the post-war years, expanding in number from 16 in 1939 to 37 in 1957-8, with a corresponding increase in student numbers from 774 to 2000 over the same time period. They also provided teaching for about 5000 day-release students who worked on farms but spent one or two days per week in classes. As these numbers suggest, they were small institutions, most of them having fewer than 100 students, but the university departments and colleges were not much bigger. A national report on agricultural education in 1958 found that there were 40,000 people between the ages of 15 and 17 in the agricultural workforce, but only 2,600 students with a full-time agricultural education in universities, colleges and farm institutes entered the industry each year, a 'lamentably small proportion' (Luxmoore, 1943; De La Warr, 1958). On the other hand, a report on the demand for agricultural graduates in 1964 concluded that there was no shortage of graduates in general agriculture, although there were shortages in some of the specialist disciplines such as agricultural economics. Of the 400 students graduating annually at that time, only about 70 went into practical farming, although more joined the advisory services, and the proportion of those with diplomas from the agricultural colleges entering agriculture was higher (Bosanquet, 1964).

The Bosanquet committee's views on the need for agricultural graduates were clearly informed by what actually happened in agriculture, rather than what might be desirable. Although a formally trained workforce might be thought desirable by those on the De La Warr Committee, it did not in practice exist. A survey of the East Anglian counties in 1974-5 found that only 15.8 per cent of farmers had a degree or diploma in agriculture, and 77.2 per cent had no formal agricultural qualifications of any sort. Of those who farmed a thousand acres or more 45.1 per cent had a degree or diploma, but still fifty per cent had no formal qualification. These results were supported by an earlier survey of England and Wales suggesting that the proportion of farmers with agricultural qualifications increased with farm size. Only 6.1 per cent of

those with farms of less than 50 acres had a qualification, whereas 24 per cent of those farming over 500 acres did (Newby et al, 1978: 64-65; Hill and Ray, 1987: 179). By that time, however, an expansion in student numbers was well underway. The total of agriculture, forestry and veterinary students in the UK increased from 3099 in 1956-7 to 4741 in 1974-5 and 5100 by 1984-5 (*Annual Abstract of Statistics*, various years). Wye College, London University's agricultural college in Kent, had 100 students in 1946, 300 in 1970, and nearly 700 in the early 1990s, about a quarter of whom were postgraduates and 40 per cent women (Richards, 1994: 318). Similarly, at Seale-Hayne College in Devon (from the author's personal recollection) numbers grew from seventy or so before the war to about 250 diploma students in the early 1970s and nearly 1000 at its peak in the 1980s, by which time it was also teaching at degree and postgraduate level. However, for an industry with over 200,000 farmers and twice that number of employed workers for much of this period, the numbers in formal training remained small.

Although this low level of formal education may have attracted criticism in official reports it was not generally perceived as a problem within farming itself, where attitudes to education exhibited a wide range of variation, as interviews with farmers (conducted in 2011 and 2012) reveal.¹ There was a long tradition of farmers learning from their fathers, and many young people entering agriculture felt like farmer 209: 'I wanted to leave school and get to work on the farm, despite my parents' suggestion that I went to Seale-Hayne'. As far as farmer 109 was concerned, 'colleges weren't about then'. There is interview data about the agricultural education of twenty five farmers, and of these 14 had no full time agricultural education at all. Farmer 162 went to Bicton for a fortnight's course while he was still at school, but he had no desire to go there for any longer course: 'I was never interested. I learned most from father, I suppose I must have admired what he did and I wanted to be like him, so to be home here was the natural thing to do.' And neither had his father been to college. Farmer 101, however, provided an interesting insight into this: 'I learned a lot at home from father, about what he did, and when I went to college [he went to Seale-Hayne College in Devon] I learned *why* he did it. And when you learn why you did it, you learn to think about whether it can be done any other way to achieve results'. Farmer 466, who had a BSc in agriculture from Cambridge and an MA from Reading, made the same point: '...it's an attitude of mind. What the university education does is to introduce you to the upcoming technologies but also give you the ability to deal with them.' This farmer was the only one in the sample with a degree in agriculture, although farmer 929 had a geography degree from Exeter, farmer 826 a chemistry degree from Bristol, and farmer 2/9's father was an agricultural student at Reading in the 1920s. Other farmers went to Seale-Hayne, the local agricultural college, or to the local farm institutes, Bicton in Devon, where farmer 193 did a one year National Certificate in Agriculture (NCA) course and Kingston Maurward in Dorset, where

¹ The transcripts of these interviews are currently held at the University of Exeter and will eventually be transferred to the ESRC archive. Those interviewed are referred to in the text by their code numbers, e.g. 'farmer 209' or 'farmer 3/1'

farmer 7/8 also did an NCA. Of those with no formal full time education, it is interesting to note that their children did later go to college. Farmer 535's daughter did an agriculture degree at Oxford, farmer 844's son a Reading BSc, and farmer 209's son an OND at Bicton. Farmer 209 was one of several who, although they had no full-time agricultural education, did one or more part-time day release classes. He remembered that 'The first farming classes at Cornwall Technical College started in 1955, and I went in 1956 for the autumn and spring term, and then I did the advanced class the following year'. Farmer 576 remembered Cornwall Council starting local classes in 1960, '...that was at the back of the bakery over the bus depot in Liskeard, there were men who came up, the senior one was based at Truro, I did that for four years, they went on to City and Guilds stage 2, that was a day a week.' The City and Guilds qualifications, in several stages, were awarded for successful completion of day-release courses. Farmer 782 was anxious to succeed his father on a county council farm, against normal council policy, so he '...went to day release classes at Bicton, did City and Guilds stages 1, 2 and 3, which demonstrated that I was keen'. In general these courses appear to have been enjoyed and valued, but not always. Farmer 7/8, whose father had been at Seale-Hayne in the 1930s, and had done a cheesemaking course at the Somerset farm institute at Cannington, himself went to Kingston Maurward but felt that 'if you were a farmer's son you knew a lot of it before you went down there,' although he also '...learned about the feeding of cows, how much cake they really wanted, and fertiliser use, and that sort of thing. It was useful.' Farmer 3/1 was more decided in his conclusions. Asked if his OND [Ordinary National Diploma] course at Seale-Hayne in the early 1970s had taught him anything he replied 'Certainly in that era agricultural colleges were regarded as a finishing school by most farmers In terms of what I brought back to my own dairy farm, I would have to say probably "No". It was just too general. Ideally I would have been sent abroad I would personally send my son off to a big farm in New Zealand for two or three years', although he did admit that his sandwich year on a big dairy farm in Dorset 'showed me how *not* to farm'. What this interview evidenced illustrates, therefore, is that the evidence of the numbers in agricultural education, and of the various post-war reports on the sector, show in general what was being experienced on individual farms. The range of educational experiences was very wide, and especially the numbers from higher education entering agriculture were very low in the 1950s and '60s, although they increased somewhat by the 1970s and 1980s, reflecting an expansion in post-school education in general and agricultural education too.

Formal education and training shades imperceptibly into advice and on-the-job training, and there was a wide variety of sources of information and training in the four decades after the war. Of these the most important, especially in the 1950s and '60s, was the National Agricultural Advisory Service, more commonly known in the agricultural industry by its initials, NAAS. Before the war agricultural advice was a County Council responsibility, but the 1943 Luxmoore Report argued that the system had been inadequate, largely because it was underfunded, and proposed the creation

of a national service (Luxmoore, 1943). The proposal was accepted, and the NAAS was created in 1946, with the aim of increasing the efficiency of the agricultural industry. By 1950 it was employing about 1500 people, a number that remained roughly constant over the next twenty years. Some of these were specialists in a range of disciplines from animal husbandry to entomology and plant pathology, but the core of the service were the 460 or so District Advisory Officers. These were the general practitioners and the people that farmers contacted first. For farmer 3/1 in Dorset they were ‘our biggest single contributor to farm information, they were the first port of call for new technical information, and within ADAS [see below] it was the District Adviser. We only rarely went beyond him to the specialist advisers, we used the DA as a general practitioner, and they helped the industry a lot’. Similarly, farmer 2/21 was ‘quite an avid supporter of NAAS, I had good friends who were in it, ... and I always valued their advice, which was free at the point of need, like the Health Service’. The NAAS remained in being during the twenty post-war years when agricultural output increased most rapidly. It was changed in 1971 when NAAS was brought together with the Agricultural Land Service, the Land Drainage Department and the Ministry’s Veterinary Service to form the Agricultural Development and Advisory Service (ADAS), but its services remained essentially free to farmers until about the mid-1980s, after which it was gradually commercialised and run down (Foreman, 1989: 117).

The annual reports of the County Agricultural Officers provide a useful survey of the activities of NAAS, and later ADAS, at a local level. Throughout the 1950s, ‘60s and ‘70s the basis of their work remained the individual advisory visits to farms, but in addition individual officers or county teams carried out their own research work – those in Devon worked, for example, on the use of wheat reed for thatching and control of fat hen in kale in 1962-3 – held advisory meetings, attended conferences and shows, co-operated with local authorities, bankers, and accountants, wrote articles for the press and appeared on radio and television programmes. They also played a major part in organising emergency fodder supplies by airlift and road to over 300 farms during the blizzards in the cold winter of 1962-3 (TNA, MAF 114/747). In his report for 1952-3 the County Officer for Devon emphasised the success of the informal discussion meetings that had been held in small village halls for an audience of 30 to 40 people, which ‘have brought in many farmers who would not go to the local market town, and would not rise to ask questions at a formal meeting’ (TNA, MAF 114/241). This question of the success with which advisory services were connecting with farmers remained central to the concerns of both county and national advisory officers. The county reports always quantified the number of advisory visits, and a national report on the first eight years of the service’s operation included a statistical survey of the activities of NAAS officers for the year 1953-4, which included 375,223 advisory visits, equating to an average of roughly one per farmer per year in England and Wales. Of course, some farmers were visited much more often and others not at all. A six-month national study in the spring and summer of 1967 demonstrated that advisers had visited 25 per cent of 50 to 150 acre farms but

over 40 per cent of farms bigger than 500 acres. In Cambridgeshire, between 1954 and 1961, advisers had visited nearly half of all holdings of less than 50 acres, two-thirds of 10 to 150 acre holdings, and four-fifths of all holdings larger than 150 acres (McCann, 1989: 73).

NAAS officers were also responsible for running Experimental Husbandry Farms (EHFs). Addressing the Agricultural Education Association in 1947 Sir John Fryer, the ARC secretary, suggested that 'In pre-war days the criticism was sometimes made that agricultural research too seldom produced practical results. On the other hand, research workers sometimes felt that practical men made too little use of their discoveries'. These criticisms, Fryer felt, were 'not without a certain foundation', and the reason, he suggested, was that there was a gap between the two. The results from the experimental stations were not always ready for direct application, but there was no suitable place or institution in which they could be developed (Fryer, 1947: 15). In consequence, he announced the establishment of what were to be called 'Experimental Husbandry Farms', at various locations in England and Wales (Anon, 1945: 515). By the end of 1952 nine had been acquired, and eventually there were twelve, two on the fens, three mixed farms on heavy land, three mainly arable farms on light land, and three upland grass farms, covering altogether some 6000 acres, together with a 3000 acre Welsh hill farm. They were managed by NAAS officers, and the Director of NAAS, writing in early 1953, outlined some of the work being carried out on them. It included comparisons of various rotations, post-harvest treatment of straw, the effect of different ploughing depths on optimum sowing dates, various fertilizer experiments, variety trials in conjunction with NIAB, the effect of heifer nutrition on subsequent milk yields, and the value of feeding antibiotics to fattening pigs (Macmillan, 1952: 421-4; Macmillan, 1953: 459-62; Anon, 1965: 42-3). By 1963 their function and future was under discussion in the newly-formed Agricultural Advisory Council because, as W.Emrys Jones, then Director of NAAS explained (TNA, MAF 253/105, October minutes p.3), 'there had been pressure to reduce costs, and it was very difficult to obtain finance for new lines of experiment'. The ARC and some individual members of the AAC wrote at some length on the functions of the EHF's and their desirability. While it was generally agreed that it was difficult to draw firm and clear lines between fundamental research and its application, it was clear that the EHF's had a role which was different from that of the research institutes. Sir Harold Sanders, a member of the AAC, considered that they had five functions: following up the work of ARC institutions, for example work on steaming up of dairy cows, building on initial work at the NIRD; carrying out experiments on general questions, such as the management of continuous cereals; local problems identified by their own committees, e.g. the application of chalk on the Yorkshire Wolds; demonstrating up-to-date methods (the work on silage and cereals for cows at Bridgets near Winchester and leys versus permanent pasture at Great House in Lancashire; and, finally, acting as an 'inspiration' to NAAS. 'Snags arise', argued Sanders, 'when new ideas are put into practice, and it is still worthwhile for the NAAS to have experience to draw on when advising those who are considering

following the pioneering farmers' (TNA, MAF 253/105). The EHF's remained in being until after 1985, although they have now been sold off to private farmers or farming companies. While some farmers ignored them, others were enthusiastic. Farmer 570 in North Devon learned a lot about silage making from visits to Liscombe, the nearby EHF: 'Everybody got into the idea by going to Liscombe. They were doing research, but it was such down to earth research. You could look at the bullocks, and those had been fed silage, and those had been fed silage and meal, and then they always had a few outside, and you could see the difference between them, and you learned how to do it, and which improved grasses to put in.'

The national advisory services were not the only sources of advice available to farmers. The Milk Marketing Board, for example, ran a Low Cost Production (LCP) Service from 1962 which involved monthly visits by Consulting Officers to participating farms, of which there were 3,700 by 1973. It also had a scheme for an annual test of milking machines to which a further 7,500 producers subscribed (Baker, 1973: 230-233). Other organisations concerned with particular commodities such as the British Sugar Corporation, the Home Grown Cereals Authority (HGCA) and the Meat and Livestock Commission (MLC) also provided technical information, although it was not the purpose for which they were specifically established. The MLC was established in 1967 and employed fieldsmen to visit farms and give advice, and also to run courses on specific topics, such as on-farm artificial insemination of pigs (Wormell, 1978: 505; Brassley on pig AI). The National Institute of Agricultural Botany (NIAB) had been established before the Second World War to provide advice on varieties of all farm crops, for which it carried out trials all over the country, issuing recommended lists of varieties for each crop with details of yield variations, disease resistance, suitability for different soils, and so on. Any farmer could join NIAB and so receive these lists, as farmer 2/7 in Dorset did: 'I used to look forward every January to the NIAB leaflets coming out to see what was recommended for the spring planting.' In the Blackmore Vale dairy district of Dorset, however, farmer 3/1 felt that recommended lists were of more use to cereal farmers than grassland specialists, and instead 'you'd ask the seeds rep – often the cake rep, the same firm – and he'd say "I'll send you some bags of No.4".'

In 1966 the government established the Agricultural Training Board, one of a number of industrial training boards, to provide training beyond that provided by the agricultural education system and the commodity organisations. What they provided was essentially in-service training for farmers and their workers. As farmer 3/1 recalled of the ATB 'I went on some courses, foot trimming, for example, and they were good, they were held on farms, very specific, so you went to look at one thing, how to stop dermatitis or whatever, and they would be a one-day course, fitted in between milkings.' Young Farmers' Clubs were another source of training used by many, although they were not specifically established for that purpose. Beginning in 1921, the movement reached a peak of 1500 clubs and over 70,000 members in 1955 (Wormell, 1978: 460).

In addition to these official or semi-official organisations there were also commercial firms that farmers looked to for advice along with their products. . One agricultural journalist estimated that in the ‘heady days’ of the 1960s and ‘70s there were ‘at least 50,000 people’ calling on farmers, advising them, and arranging technical events for them (Montague, 2000: 111). Farmer 2/7 in Dorset remembered having ‘a chap called Doug Matthews, he used to sell Boots products, Isocornox etc, and we used to rely on his advice, he was the technical rep’, and then in the 1980s ‘we went on to the independent adviser ... you would pay him about £3 an acre and he would do this farm and several others in the locality’. Farmers had often dealt with the same firm for years, and trusted their judgement. As farmer 787 said, ‘If you’re interested in something you find out anyway, I ask people, I wanted some machinery for the corn, and I went and talked to a dealer’. Similarly farmer 3/1 remembered that ‘Everybody had a firm they dealt with. We had one at Bruton called Sheldon Jones, they were a compounder, but they expanded into dairy seeds. It was all very friendly...’ and farmer 109’s memories supports this: ‘We didn’t avoid reps, we still know some. There were a lot of reps about in those days, but we always had the same one, from Wyatt and Bruce ... And there was Tuckers, we dealt with Tuckers as well, Mr Johnson, for seeds and feeds, and fertilisers’.

Fertiliser producers such as Fisons and ICI, and feed firms such as BOCM, might charter complete trains to take 3,000 farmers at a time to demonstration farms or factories. Most farmers bought their feeds, seeds and fertilisers from agricultural merchants rather than directly from the producers, but many of the bigger producers nevertheless employed their own teams of technical representatives who would visit farms to advise on the use of increasingly technically complex products. These men (and they were then, in contrast to later, almost all men) not only knew about their own products, but would also have called on numerous other farms in the district, so they often had a well-informed picture of technical changes beyond their own immediate commercial interests. Talking over such things was a way to capture a potential customer’s interest, and many of these representatives were trusted by farmers and seen as a free and reliable source of technical information. British Oil and Cake Mills (BOCM), one of the larger feed manufacturers, was one of those that did not sell direct to farmers, but nevertheless there are 83 people in a photograph of its technical sales team taken in the 1960s. Firms such as ICI and Fisons were one of the bigger recruiters of agricultural students from universities and colleges during this period. At its peak ICI had 5000 people in its fertiliser operation (Montague, 2000: 110-111, 260-261).

Another, more traditional, source of information for farmers was the agricultural show. There was an enormous variety of these, from the local show to the county or regional shows such as the Royal Cornwall, the Devon, the Bath and West, the Great Yorkshire etc, and the national show, the Royal, which moved around the country until 1963 when it held the first Show at its permanent showground at

Stoneleigh in Warwickshire. Although in their nineteenth-century origins most or all of these had as their objective the promotion of technical change – ‘improvement’ in the language of the time – by the mid-twentieth century it was clear that the more local shows were essentially social events, where rural people met their friends and engaged in friendly competition showing all kinds of products from breeding animals to jam. The big regional and national shows were different. For traditional livestock breeders wishing to sell their animals at high prices a presence and a good performance at such shows was essential, and for machinery manufacturers, seed firms, fertiliser and pesticide companies they represented an opportunity to present their latest products to farmers who operated on a big enough scale to be able to take one or more days away from the farm and travel some distance. Banks and advisory services also had a permanent presence at such shows. Attendance at the Royal Show rose steadily to the mid-1970s, when there were around 200,000 visitors and exhibitors each year, and these numbers were maintained or even exceeded until the mid-1980s. While a proportion of those attending the Royal may have had little or no connection with agriculture and simply sought a day’s entertainment, visitor surveys found that 36 per cent of all male visitors in 1975, and 43 per cent in 1983, were farmers, farm managers, or farm workers. Sixty per cent of the male visitors in 1972 were connected with agriculture in some way, and in that year over 26,000 farmers and farm managers visited the show. Since they farmed a total of 11 million acres, which represents 423 acres each, it is clear that, as suggested above, they tended to be drawn from the ranks of those farming on a larger than average scale. And this minority of the farming population were there to do business: a 1986 survey found that two-thirds of the farmers, managers and workers attending the show made a purchase related to what they had seen with seven months (Goddard, 1988: 264-267).

Agricultural shows, with the exception of the Smithfield livestock show in December, were held in the summer months, but throughout the year the print and broadcast media aimed their output at farmers. As with the shows, agricultural journals aimed at farmers had existed from the eighteenth century. The market leaders in the 1950s and ‘60s were *Farmer and Stockbreeder*, which had first been published in 1889, and *Farmer’s Weekly*, which began in 1934. The former was effectively taken over by the NFU in 1971 and became *British Farmer and Stockbreeder* before closing in 1984, leaving the latter as the principal weekly farming publication, although by no means the only one (<http://www.reading.ac.uk/merl/collections/merl-collections.aspx>). There was also *Farmers Guardian*, published in the north of England, and a range of specialist magazines, such as *Dairy Farmer* and *Pig Farmer*. The Ministry of Agriculture had its own journal, *Agriculture*, published monthly (originally as *The Journal of the Board of Agriculture*) since 1894, until it was closed in 1972. It was probably read more by advisers and academics than by farmers in general, as was the *NAAS Quarterly Review*, published from 1948 (Foreman, 1989: 90-92). It was claimed in 1978 that there were 126 farming magazines or other publications in existence, and in addition the serious national newspapers and some of the regional newspapers such as the *Western Morning News* all had full-time

agricultural correspondents. At that time *Farmer's Weekly* had a circulation of 130,000, and the combined circulations of the *Farmers Guardian* and the specialist publications such as *Dairy Farmer*, *Power Farming*, *Arable Farmer*, *Big Farm Weekly* and *Big Farm Management* amounted to as many again (Wormell, 1978: 541-550). Even taking account of the fact that some farmers would read several of these publications each week, it would have been unusual, given these numbers, for a farmer *not* to have been exposed to some source of printed farming news each week. Certainly most of the farmers interviewed mentioned reading, often the *Farmers Weekly*, as a major source of information. As farmer 2/7 said, 'The *Farmers Weekly* has been my compulsion every Saturday morning for fifty years'

Commercial publishers also found it worthwhile to produce books on farming technique, many of which sold well beyond the student market. *Farming for Profits*, the first edition of which was published by Penguin, was written by Dr Keith Dexter and Derek (later Sir Derek) Barber, both of whom worked for NAAS at the time. It sold 25,000 copies between 1961 and 1963 (Dexter and Barber, 1967). In 1955 the Ministry of Agriculture published *The Farm as a Business*, giving advice on 'the principles underlying farm business analysis and planning', and from 1963 this was converted into eight booklets in an *Aids to Management* series, comprised of a general introduction to management and individual booklets on beef, sheep, pigs, poultry, labour and machinery, arable crops, and dairying, each available at 2s-6d (which was roughly the cost of a Penguin paperback in 1963) (MAFF, 1967: iv and 1). Standard textbooks must have sold well too, for there were four new editions of Fream's *Elements of Agriculture* between 1948 and 1983, and four of Watson and More's *Agriculture* between 1945 and 1962. As far as the press and the publishers were concerned, agriculture was clearly a market worth catering for.

Radio farming programmes began before the Second World War and continued during the war. A radio soap opera, *The Archers*, designed to provide a combination of instruction, information and entertainment became a fixture on BBC radio from 1951 (Laing, 1992: 144-145). By 1958 BBC radio was broadcasting a Market Report for farmers in the early morning. In July 1962 the early morning market report was incorporated into a ten-minute 'Farm Bulletin' of news items broadcast from 6.40 a.m. each weekday. By 1965 the programme had become 'Farming Today', broadcast from Monday to Saturday between 6.35 and 6.50 a.m., still with market prices at the beginning, and continuing to attract favourable comments from the Ministry of Agriculture (TNA, MAF197/44, Minutes of the BBC Central Agricultural Advisory Committee 21 January 1965). There was also a weekly radio programme, 'Farm Fare', which soon changed its title to 'On Your Farm', was broadcast on Wednesday lunchtimes, but later became a regular fixture on early Saturday mornings until the twenty first century.

BBC Television farming programmes began on 3 October 1957. The programme was simply called 'Farming' and usually consisted of three items, linked

by a chairman, who was always a farmer with the kind of large farming business that (according to one of them) allowed him to be absent from the farm for up to 50 days each year (Cherrington, 1979). By the autumn of 1960 it had settled into a Sunday lunchtime slot and had evolved to use much more film and outside broadcast material. Independent (Commercial) television began in 1955, but farming programmes did not begin everywhere from that time. In the west of England the regional company Westward Television began in 1961 and immediately introduced the half hour 'Farming News'. Like the BBC farming programmes, it was aimed at an agricultural audience with little attempt to relate to the wider population. Unlike the BBC, it included advertising, a significant amount of which was sold for products targeted at the agricultural audience, especially livestock health products (Constable, 2013). Initially a relatively low proportion of farmers listened or watched. In 1961 the BBC commissioned an Audience Research Report on farming programmes, based on a sample of nearly 3000 farmers selected at random from NFU and Scottish NFU members. It revealed that only about a third of farmers were regular listeners (i.e. at least three or four times a week) to the early morning farming programme, and concluded that about a quarter of farmers saw the BBC television farming programme regularly. The audience for the ITV farming programmes was even smaller (TNA, MAF197/40,). These early programmes had a largely technical focus, one reason for which was almost certainly the composition of the committees advising the programme makers, which were dominated by producers. Both the BBC and ITV had advisory committees overseeing their agricultural output. Most of those on the BBC's committee were farmers or landowners, but in 1958 there were also two Ministry of Agriculture civil servants, a publisher and the Professor of Agriculture at Leeds University. The committee was chaired in 1958 by Clyde Higgs, a prominent farmer who had also been involved in making radio programmes, and in 1965 by Tristram Beresford, a farmer and agricultural journalist (TNA, MAF 197/40 and 197/44,). The chair of the Agricultural Advisory Board for Westward TV from the 1960s until the end of its franchise in 1981 was R.G.Pomeroy, a North Devon farmer and a member of the Milk Marketing Board. There were also three farmers, one from each of the counties of Devon, Cornwall and Dorset, representatives of the Ministry of Agriculture and the NFU, an independent agricultural adviser, and the Director of the Agricultural Economics Unit at Exeter University (Constable, 2013).

Living in 'a sea of information'

If, as the above discussion suggests, the supply of information and training available to farmers increased dramatically in the forty post-war years, what happened to the demand for it? To judge from the uptake of agricultural education, it was not always enormous, but the extent to which commercial firms were prepared to keep technical reps in the field in the 1960s and '70s suggests that they were providing something that many farmers were willing to consume. The problem is that the relationship between farmers and technical training and information is not easy to measure because much of it is an informal process, and what evidence there is tends to be anecdotal. The evidence from the sample of farmers interviewed in the south west is

that, as in many other aspects of farming, there were considerable differences from one farmer to another. As with their experiences of education, what worked for one farmer might be anathema to another.

Few farmers among those interviewed used no sources of advice or information whatsoever, and it is perhaps significant that those nearest to being complete non-users were no longer farming when they were interviewed. Farmer 692 belonged to the YFC, where he learned to shear sheep, but apart from that he 'didn't have much to do with ADAS or demonstration farms didn't often *read Farmers Weekly* ... I used to watch the farming programme on TV but I didn't get a lot of information from it ... you gradually learn from each other'. Farmer 162, who had a 132 acre livestock farm on the edge of Exmoor used to read the literature sent to him by the advisory services and the Ministry, but he 'never asked for any help', and although he was a keen member of the YFC it was 'more a social thing' than a source of information or training. On the other hand, he was always heavily involved in a sheep breed society, and farming newspapers and magazines were 'very important when I was leaving school, I used to read everything that was going'. His father used to listen to the early morning radio programme for the fatstock prices, and both his father and mother followed *The Archers*, but more for the story than for any technical information. The 'best guide of the lot', he felt, was the Exeter University Farm Management Survey report, because it 'showed you where you were earning a pound'. Farmer 826 also felt that he received useful advice from the Investigation Officer [Estelle Burnside] who visited him regularly, and farmer 782 found that the FMS figures were 'very useful, they influenced my decisions to a certain extent'. Farmer 209 found that '...sometimes it wasn't good reading, because you weren't doing as well as you thought you were, but it told you what to stop doing'.

Farmer 162 also emphasised the importance of the informal knowledge network: '.... Generally speaking the farmers round here got together and talked among themselves, what their plans were, and one of them would say that he'd tried something, and the others would look over the hedge. [*were they formal meetings?*] No, if they met on the road, or rent day, or harvest festival'. Farmer 243, with a small dairy farm in East Devon, made the same point: 'I got my information by asking people who I thought knew something about it, neighbours and so on I very rarely went to demonstrations. You used to pick up hints from the Young Farmers' Club, talking to people you met there. And for machinery we had Medland Sanders and Twose who had a base at Plymtree, and several of their workmen used to live round here, and you'd say "Bob, come and have a look at this", and they'd say "You want this" or something, and they'd make it up for you. So it was an informal way of doing things'. As farmer 782 said, 'You pick up things talking to other farmers, chatting at market for example'. Farmer 2/7, who had a 680 acre farm in Dorset, emphasised the importance of 'meeting the other members of the family socially, who are all farming, that gave me a lot of my information', rather than any published sources. 'You learned by a process of osmosis, I suppose, when you were chatting to

farmers, you learn on the shooting field, you say “That’s a good crop there, or what have you done about so and so, how did you plant that, why are you growing that?” You don’t know you are learning or taking it in’. As farmer 535 put it: ‘from journals, and YFC, and NFU, you get lectures, and you meet people – you are living in a sea of information and you pick out what you want ... and I would talk with my cousin, and my wife’s brother – it was a network’.

At the opposite extreme from those farmers who emphasised the informal knowledge networks were those who seemed to use all possible sources of information and training. Farmer 209, who began with a 34 acre rented farm in Cornwall in the 1940s and is now farming over 700 acres, was never a full-time agricultural student, although he did day release classes, and read farming textbooks. He went to NFU meetings with his father, which often ended with a technical talk in those days, read farming periodicals, watched farming television programmes and used ‘quite a bit of ADAS advice back then, either at a meeting or somebody coming here. It was free then, it would be from the District adviser, Truro office. Back in the 50s and 60s there were many more reps coming round to farms, feeding you information.’ Farmer 466 had a very different educational background, with degrees in agriculture and agricultural economics, but he and his father also used a wide range of information sources. In addition to the normal farming periodicals he read NIAB leaflets, used ADAS and MLC demonstration farms, went on study tours to the Netherlands and Israel, and emphasised the importance of ‘technical reps. They ran things like grassland clubs, and we all trotted off to the grassland society, and it was very effective technical extension work, very practical extension work at no cost to the farmer except his time’.

Conclusions

An atomistic industry – one comprised of many small firms – has knowledge acquisition and transfer problems not found in more concentrated industries with fewer larger firms. Large firms can afford specialised research and development departments; equally, whereas they can profit from introducing technical changes before their competitors, they stand to lose if their competitors find output-increasing technologies first. Neither of these considerations applies in more competitive markets. Few farmers operated on a large enough scale to carry out their own research, and those that did, such as Brian Cadzow and Richard Waltham, received help from research institutes such as ABRO and the GRI (Seddon, 1989). More importantly, virtually no farmers controlled such a large part of the market that their production decisions had any impact on market prices. Thus the research had to be done outside the farm, and farmers had every incentive to adopt output-increasing innovations, so some kind of network was needed to connect the research institutes, EHF’s and commercial firms that were developing the new techniques, machines, pesticides, seeds, etc with the farmers and farm workers who would finally use them. This paper has sought to identify the various components of the network that existed

in the UK between 1940 and 1985, and to examine their effectiveness in transferring technical knowledge from its producers to its end users.

The first point to make is that very large numbers of people were involved in comparison with the number of farms and farmers. For most of this period there were about 200,000 commercial farms in the UK, and, as we have seen, one estimate suggested that some 50,000 people were involved in visiting them (Montague, 2000: 111). Another estimate at the end of this period suggested that some 40,000 public sector employees worked in education and the civil service in areas related to agriculture, and they had their counterparts in the commercial firms too (Craig et al 1986: 94-9). Earlier, an inspection of the reference book *Farming and Mechanised Agriculture* gives some idea of the complexity of the system. The fourth edition was edited by Sir George Stapledon, at that point one of the most prominent agricultural scientists in the country, and published in 1950. It contained descriptions of the work of 41 government and public bodies and 46 private organisations, together with contact details of a further 247 organisations ‘interested in farming and mechanised agriculture’, from the Autosexing Breeds Association to the Wickham Market Fruit Station, and 70 breed societies (Stapledon, 1950). There were some changes over time, in that the number of students in agricultural education increased, as did the number of agricultural print periodicals and broadcast radio and television programmes, but on the other hand the number of advisory officers employed by the Ministry of Agriculture seems to have changed little, and it is difficult to know whether the number of commercial representatives increased or decreased.

Secondly, governments, scientists, advisers, firms in the agricultural supply industry and farmers did not always have the same objectives and priorities. When the Ministry of Agriculture was attempting to expand agricultural production at the time of the Korean War, in 1952, for example, they identified several reasons why farmers had been reluctant to comply with their policies. Sir Reginald Franklin, the Ministry’s Deputy Secretary, had visited several County Agricultural Committees and found ‘a very mixed response to appeals to grow more food ... Some farmers felt that expansion meant more effort, more risks, and higher taxation than they were willing to incur’. He was supported by Mr Swallow, an agricultural merchant from Grantham, who argued that ‘Labour supply difficulties, in Lincolnshire particularly during the potato harvest, had meant a fall in production. The general feeling was that increased production meant more risks, a lot more work and little better return.’ A further meeting of the Working Party, in February 1953, heard from Lord Carrington, Parliamentary Secretary (Lords) to the Ministry, who had visited the County Committees in about half the counties in the country in recent months. He reported that ‘The three difficulties invariably mentioned as deterrents to the production drive were (i) shortage of capital; (ii) military call-up and general labour shortage; and (iii) use of land.’ (TNA, MAF197/18). Similarly, the objectives of agricultural scientists and farmers were not necessarily the same. Writing at the end of this period, the Economic Development Committee for Agriculture, part of the government’s

National Economic Development Office, was less sanguine than the ARC had been. The value of research, it found, 'was too often judged on the publication of research papers with lack of regard for the practical value of the end product' (Agriculture EDC, 1985: 31). Perhaps this was not surprising, for the Committee also argued that 'In public sector research, the motivation of staff is often directed towards an improvement in general scientific understanding rather than to dealing with the specific identified needs of users.' (Agriculture EDC, 1985: 14).

Perhaps as a consequence of this difference in priorities scientists did not always communicate well with farmers. The report contained several case studies on the adoption of specific technical changes, which 'showed the continuing difficulty of presenting research findings to the industry in a meaningful way. They are often presented as scientific papers, written in the language of the researcher, and do not indicate how the research might be applied in farming systems' (Agriculture EDC, 1985: 18). This is reminiscent of Jonathan Harwood's identification of the 'tension between the worlds of scholarship and practical agriculture', which, he argues, leads to a process of 'academic drift' in which scientists ostensibly serving an economic community seek professional status by increasingly taking their research questions from the basic sciences (Harwood, 2005: 19, 31). As far as the knowledge network is concerned, what matters here is not so much the priorities of the scientists *per se* but the language or, as others might put it, the different discourses used by different groups (compare Brassley, 2007). Scientists communicated with each other in a technical language using scientific periodicals and academic conferences which were not read or attended, or perhaps even understood, by farmers. Although from time to time they might write articles in the farming press (e.g. Polge, 1954) in general it was more likely that farmers would hear about new technologies through intermediaries in the knowledge network in the form of advisers, journalists, technical representatives or even other farmers. As Bourdieu might argue, agricultural science and farming were different fields, and consequently the habitus and doxa of those in them were also different. What the knowledge network did was to form a third field, the members of which shared at least some of the habitus and doxa of the other two (Grenfell, 2008).

Another way of looking at these relationships between those who initially produced new technologies and those who eventually used them is in terms of formal and informal linkages. This paper has been structured to follow the formal linkages: scientists produced new knowledge, which was then transferred via education, extension, and the print and broadcast media, each of which might be seen as formal, and in some cases sequential, links with the farming community. For example, Blaxter and his colleagues in the 1960s developed a new system of livestock rationing, the metabolisable energy system, to replace the starch equivalent system that had been in use since the beginning of the century (Blaxter and Robertson, 1995: 231-2). Those in formal agricultural education at the time learned to use the new method, it was discussed in the latest textbooks (e.g. McDonald et al, 1966), and as

some of them took up their positions in the extension services or as technical representatives or farming journalists they began to explain to farmers how to use it. This was how a new technique was spread through formal linkages. But, as the remarks of farmers recounted earlier show, there were many ways of learning about new technologies that ignored these formal sequential pathways but instead relied upon chance meetings, informal conversations, and snippets of information acquired from a range of sources, which eventually meant that a farmer was in a position to make a judgement on whether a specific new technology was worth adopting or not.

The role of this complex and multi-layered knowledge network is thus revealed as crucial to the transmission of new technologies. It was unlikely that any one pathway would work for all technical changes and all farmers. As we have seen, the level of formal education in the agricultural industry was generally low, with some significant exceptions, and in any case farmers were unlikely to be taking the significant management decisions on their farms very soon after their formal education was completed. Farmers with different levels of education, experience and expertise responded to different stimuli, so there is a distinct impression (albeit difficult to prove statistically) that small farmers with little training were more likely to consult or take notice of those with lower levels of technical training such as neighbours, salesmen and popular farming journals, whereas those with higher levels of education farming on a larger scale were more likely to use more professional advisers, specialist publications, conferences and peer group meetings. The important feature of the 1940-1985 period was that for much of the time governments were prepared to fund large numbers of people to operate in the various pathways of this knowledge network, while at the same time commercial firms also found it profitable to do so, so most of the requirements of most of the farmers were met by one organisation or another.

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