A Farrer Legacy

Innovation through collaboration

William Farrer had a clear vision of the legacy that he wished to leave. In words recorded by his friend and colleague Dr George Sutton he expressed a very clear objective.

"Do you know why I commenced this work? It was because I wanted to think that when I died my life had not been wasted".

It is self evident that Farrer achieved his goal. He left as a legacy a body of work that ensured that the Australian wheat industry grew and prospered. By the time of his death in 1906 the emerging industry was expanding its footprint from cool, higher rainfall, coastal regions into the drier warmer inland plains of eastern Australia. In an all too brief two decades Farrer and his collaborators had set in train changes that were to transform the fledgling industry and put it on the road to the dominant agricultural industry that it is today.

To some he was a genius, to others he was a saviour. His ground breaking cross bred wheats were legion and Farrer himself was a legend. Little wonder that he came to be recognised as the Father of the Australian wheat industry, little wonder that he was seen by his contemporaries as "Australia's greatest benefactor"[1]

In this oration I will briefly reflect on Farrer's life and the contribution that he made to Australia and Australian agriculture. I will postulate that his legacy is even broader than the direct contribution that he made through his innovative approach to wheat breeding, and the array of wheat cultivars that laid the foundation for an industry of national and international significance. In particular I will consider the example he set by innovation through collaboration.

I will then examine collaboration in more recent times, looking at some of the contemporary collaborative models of which I have had some experience. In doing this I will examine challenges facing our agricultural science sector and consider how collaborative research can countervail some of these challenges.

Finally I will address some of the impediments to collaboration and propose some remedies. That the establishment of collaborations and partnerships should so often be such hard work is an unflattering reflection on systems that can be antipathetic to co-operation and unsympathetic to would-be collaborators. As Australian's we often take pride in a history of rugged individualism but, in today's environment, we can no longer afford the luxury of always going our own way. If we are going to fully capitalise on our Farrer inheritance collaboration is more important than ever.

1. H.Wenholz, Director of Plant Breeding, Department of Agriculture, NSW. Australian Quarterly, Vol. 2. No.6 (June1930)

Farrer – a brief history

William Farrer arrived in Australia in 1870, a young man of twenty five years who had to give up his medical studies because of a personal health problem, tuberculosis. He came seeking a more suitable climate and the opportunity to establish a pastoral property. Unfortunately, like many before and since, he invested in mining ventures that failed.

As a consequence Farrer had to reconsider his immediate future. He studied and became a licensed surveyor in 1875. For the next decade he worked as a surveyor with the NSW Department of Lands, principally in the region of Dubbo. During this time he met and married Nina de Salis, daughter of the owner of Cuppacumbalong Station.

Farrer resigned from his position as a surveyor in 1882 and purchased a small parcel of Government land which he had selected from the Cuppacumbolang run. This property, named "Lambrigg" after his mother's girlhood home in far off England, was to be the unlikely centre of breeding research destined to transform Australia's wheat industry.

Although Farrer had no real farming experience he had spent time as a child with his tenant farmer father in northern England. His subsequent education, including mathematic studies completed at Cambridge, were a useful foundation for the demanding task that was to be his destiny. And, during his years as a surveyor, he had keenly observed the triumphs and tribulations experienced by NSW farmers.

So it was that, in 1886, he commenced the work for which he was to become renowned. In an all too brief career, firstly as a private wheat breeder, and later when employed by the NSW Department of Agriculture in 1898 as the first government Wheat Experimentalist, he laid down a legacy that continues to this day.

The Farrer influence

The impact that Farrer had cannot be understated. In 1897, on the eve of his move to his new departmental role and with the early Farrer cultivars gaining popularity, the area of NSW sown to wheat was just over 1,000,000 acres (400,000 hectares). In less than a decade the wheat area had doubled, and by 1914 the NSW wheat crop had doubled again to 4,000,000 acres (1,600,000 hectares). Because much of this exponential expansion was due to a shift of the wheat belt into drier regions it could have been expected that yields would fall. However, thanks largely to Farrer bred wheats, average yields had actually improved.

The remarkable influence of Farrer bred wheats such as Federation, Firbank Florence, Cleveland, Clarendon, Bunyip, Major, Rymer and Yandilla King was felt both within and beyond the borders of NSW. In 1914 twenty two of the twenty nine wheats recommended for growing across the differing regions of NSW were Farrer wheats and by the mid 20's 60% of wheat grown in NSW was bred by Farrer. Even in my home state of South Australian, where the Mediterranean climate could be expected to be less suitable to these wheat cultivars, 20% of the crop was Farrer bred.

I was most surprised and delighted to find, upon checking some old farm records for my family property in the mid-north of South Australia, that two of our preferred wheats in the 1920's were Farrer bred - Florence and Major. According to those records, with wheat bringing seven shillings a bushel in 1920 and twenty two inches of annual rainfall (550 mm), my forebears enjoyed a bumper season.

The yield benefits that Australian farmers realised by growing Farrer's wheats would have been value enough but he sought greater goals. Following the disastrous rust epidemic of 1889, which led to a series of inter-colonial rust-in-wheat conferences, he busied himself with breeding more resistant wheat varieties. While the wheats he bred were not stem rust resistant, and whether they were rust tolerant or simply avoided the worst of rust outbreaks due to their earlier maturity, the fact is that they proved their worth with farmers voting with their fields and planting Farrer wheats. And as Farrer was wont to say "You can't argue about a fact".

But Farrer did much more than improve the yield and rust resistance of NSW and Australian wheats. Amongst a kitbag full of legacies he –

- applied a scientific approach to wheat breeding
- developed wheat cross-breeding in Australia
- bred bunt and flag smut resistant wheats
- released drought tolerant wheats more suited to Australian conditions
- improved the milling and baking quality of Australian wheats
- was alert to the interests of all participants along the value chain –farmer, miller, baker, exporter and consumer
- pioneered green manuring in broad-acre cropping
- experimented with alternatives to the fallow/wheat cropping system
- recognised the value of humus and nitrogen fixed by legumes
- and finally he was a great collaborator

Farrer the collaborator

As an Australian wheat breeder it is self evident that Farrer needed to collaborate with other breeders, both nationally and internationally. He drew on the work of early Australian wheat breeders who had selected wheats from Europe and South Africa. Many of these wheats were South Australian bred as, in the 1980's, that state was the nation's bread basket producing more than half of Australia's wheat crop. One SA wheat, "Purple Straw", bred on a property only 30 kilometres from Adelaide by John Frame, was destined to contribute to Farrer's most famous cultivar, "Federation".

Farrer was in regular contact with wheat breeders around the world, including breeders in the United States, Canada, India, England, France and Sweden. Of particular note was his relationship with Professor Blount from Colorado, USA, with whom he was a prolific correspondent. Archer Russell, author of the definitive biography of Farrer's life described them as "the perfect collaborators – a golden example of unselfish co-operation in the name of science".[2]

Another great collaboration arose as a result of Farrer's interest in improving the milling and baking qualities of the wheats that he released. When he wrote to the NSW Department of Agriculture in 1891 seeking assistance Farrer struck up a critical relationship with the Department's chemist, Fredrick Guthrie, which enabled him to address the quality deficiencies of his wheat varieties. As Dr Walter Waterhouse observed in his 1938 Farrer Oration "Farrer.... worked in close co-operation with that great chemist, the late F.B.Guthrie, and it was this teamwork that made possible the striking quality improvements that were affected".[3]

And so it was, through his collaboration with wheat breeders around the world, and in co-operation with his friend and colleague, Fredrick Guthrie, and many others, that William Farrer was able to achieve his dream.

Contemporary Collaborative Models

There are many good examples of collaborative research in the Australian agricultural research sector and I will refer to two models in particular - Research and Development Corporations (RDCs) and Cooperative Research Centres (CRCs). As an example of each I will instance the Grains Research and Development Corporation (GRDC), the Future Farm Industries CRC, and the Plant Biosecurity CRC.

The GRDC was established in October 1990 under the Primary Industries & Energy Research & Development Act 1989, and replaced fourteen commodity research councils and state research committees. Despite the fact that the Grain Council of Australia (GCA) Executive had supported the move industry representatives initially rejected the proposal at the 1989 Annual Grains Conference. Fortunately industry leaders prevailed and one of most significant grain industry research funding bodies was established.

2. P.46 " William James Farrer – a Biography"
3. Dr W.L.Waterhouse, Farrer Memorial Oration, 1938

Two decisions taken early in the life of the GRDC were to have an enduring impact on grains research and research funding. The first was the ground breaking decision of the GRDC Board to move away from the traditional state based structure to a structure based on more logical geo-climes. The separation of Australia's grain growing area into three regions, while resisted by some, set the scene for a national and regional focus on collaborative research and development.

The other fundamental change was a decision taken by the GCA at its 1991 Annual Conference to move to a common levy basis for funding grains research and a shift from a rate per tonne basis to an ad valorem rate. The industry ultimately settled on a rate of 1.0% of farm gate value which essentially continues today (currently 0.99% of farm gate value). The substantially uplift avoided a serious shortfall in research funding and put grains research funding on a sound and enduring footing. In conjunction with Australian government dollar for dollar matched funding up to 0.5% of gross value of product the industry has had the resources to become a leading funder of Australian grains research.

Another GRDC initiative, the establishment of one national and three regional panels, has strengthened the collaborative nature of the model, with joint researcher and stakeholder expertise incorporated on the panels. These advisory panels contribute to the direction and relevance of research investment and involve growers, agribusiness and researchers.

Today the GRDC is a fine example of innovation through collaboration. In the Corporations 2012 -2017 Strategic Research and Development Plan the objective is a highly efficient national grains research sector that works with partners to:

- "build on existing national collaborations
- develop effective relationship models for private-public collaboration
- develop and implement the national RD&E framework for the grains industry"[4]

Further, as part of the national RD&E framework, the National Grains RD&E Strategy provides a structure that encourages industry and government priority setting partnerships, more continuity in investment, and greater efficiency in delivery. Through these collaborative arrangements the GRDC invests about one third of the $400 million dollar annual expenditure on grains-related RD&E. I am sure that Farrer would approve.

Another collaborative research model that typifies the co-operation necessary to maximise innovative outcomes is the Co-operative Research Centre program. This collaborative model was the brain child of former Chief Scientist, Professor Ralph Slatyer, who proposed the idea as means to encourage collaboration between the private sector and public sector research bodies, to establish world class research teams, and to increase the opportunities for PhD graduates.

One of the great strengths of the CRC program, which has now been in place for two decades, is that it links researchers and end-users. It also brings together a range of disciplines and research bodies from universities and government research agencies.

The benefits of this collaborative approach to innovation have been frequently measured and extensively examined. The program has been reviewed eight times with the most recent being the 2012 Allen Review. The Allen Consulting Group was tasked with determining the economic, environmental and social impact of the CRC program from commencement in 1991 through to 2017. The Review concluded that the program had delivered an estimated direct economic benefit of $8.6 billion up to 2012 with a further $5.9 billion estimated to be realised through to 2017, resulting in a total $14.5 billion impact.[5] On the basis of these figures every dollar invested by the Australian Government has realised a return of three dollars.

According to the Allen Review the program has had its greatest impact on agriculture with a total estimated benefit of $6.15 billion over the review period. This represents an average annual economic benefit of $237 million to the agricultural sector. Furthermore the Allan Review estimated that, in the period from 1991 to 2010, 2200 research post graduate degrees were supported through CRCs in the agricultural sector.[6]

Regrettably the investment in the CRC program has fallen from a peak of $216 million in 2007 to $145 million in 2013/14. Fortunately this decline in investments has stabilised in the past few years but there has been a concerning decline in the number of CRCs being established in the agricultural sector with only two being funded in the fourteenth Selection Round, none in the latest Round and only 8 agriculture sector CRCs still being extant. Several of these CRCs are in their final year, including the CRC with which I am associated - the Future Farm Industries CRC (FFI CRC).

The FFI CRC is a good example of collaboration, both through cross commodity and cross discipline research involving sixteen participants in a seven year co-operative research initiative. Over the life of the CRC we expect to direct, in cash and kind, $179 million to develop new farming systems and products to deliver total net benefits of $2.5 billion in commercial and industrial growth by 2030. Research outcomes include crop production systems better adapted to soil and climatic constraints, grazing systems based on novel and/or native plants better adapted to climatic variability, and new woody cropping options.

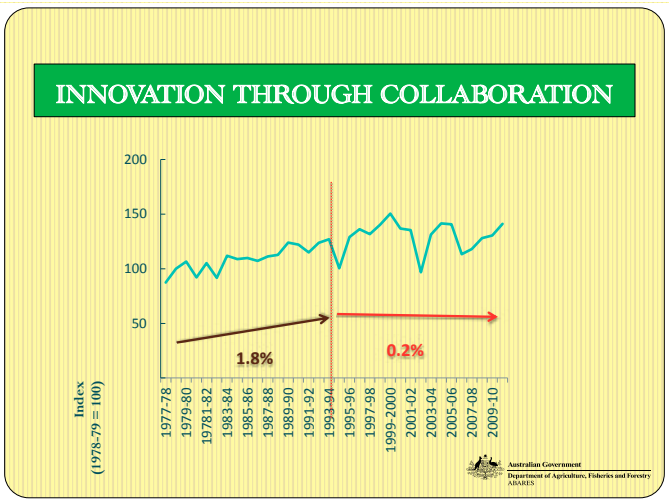
4. GRDC Strategic Research & Development Plan 2012 -17. Page 38
5. Executive Summary, The Allen Consulting Group Review 2012
6. The Allen Consulting Group Review 2012 Page 27

Another good example of the value of collaboration between the public and private sectors and researchers and end users under the CRC model is the Post Harvest Grains Biosecurity Program managed by the Plant Biosecurity CRC. This initiative has attracted $5.56 million of cash contributions from the three largest grain companies operating in Australia, along with a $12 million investment from the GRDC to support a six year stored grain research program. With additional support from the CSIRO, state research agencies and universities this collaboration will help maximise the value, integrity and competitive advantage of Australia's post-harvest value chain.

Productivity and investment

As encouraging as the contributions of these research collaborations are there remains a challenge to sustain productivity improvements and to maintain and preferably increase investment in agricultural research. In both respects Australian agriculture is experiencing negative trends. ABARES analysis indicates that broad-acre productivity improvement is falling, and reduced resourcing of public research agencies is impacting on capacity. According to an ABARES report -

"Recent ABARES research suggests that a slowdown in productivity growth since the mid-1990s has been associated with diminished public R&D intensity since the 1970s".[7]



Productivity growth in the broad-acre cropping sector is influenced by a number of factors including seasonal conditions, soil fertility and farm scale. However, as ABARES notes, "changes in the level of productivity growth over the long term are more likely to reflect technological progress."[8]

While Australia has generally maintained productivity and competitiveness relative to some of our main competitors in the world marketplace the current downward trend will need to be arrested if we are to retain our market position. This means that we must reinvest in technology and lift our commitment to research. Equally we must ensure that we maximise the efficiency of our research assets. More collaboration is one answer.

Improving collaborative arrangements

A recent Australian Farm Institute Conference took up this challenge and addressed the subject of the Australian Agricultural Innovation Systems at the Crossroads.[9] Speakers from industry, government research agencies and universities presented a common message – the rate of productivity growth is declining, public investment in agricultural research is falling, and more effective use of finite resources is critical. More collaborative research was one of the solutions widely recommended.

However, for all the merits of collaborative research establishing new arrangements is no simple matter. In order to set up a new collaborative venture aspirants must take into account some or all of the following –

- institutional self interest
- governance and compliance issues
- access, ownership and protection of IP
- investment time and decision frames
- divergent interests
- availability of discretionary funds

The commitment of researchers is something that I have always admired and respected. Collaboration amongst scientists is intrinsic. Similarly the interest of agency and institutional leaders in the greater good of our national research effort has continued to be a strength of the Australian agricultural research sector.

It is therefore puzzling and perplexing to have to face the frustrations of dealing with structural impediments and institutional self interest. While competing interests can add value in many walks of life these interests should not override and compromise the greater ambition of meeting national and international research challenges. A collaborative culture must be nurtured and promoted, and this requires vision and leadership.

Good governance and sound compliance arrangements are essential elements of any modern business or body, be it public or private. Accountability, transparency and prudence are non-negotiable requirements. However best practice in these respects can be adopted without unreasonably constraining business operations. Too often barriers to collaboration are raised where bridges should be built. The focus should be on how cooperative activities can be undertaken, rather than why they cannot.

7. Dahl, A. Leith, R. Gray, E. 2013 Productivity in the broadacre and dairy industries ABARES Agricultural Commodities March Quarter Page 202
8. Australian Agricultural Innovation Systems at the Crossroads Conference, Canberra, 29 -30 May, 2013
9. "The role of universities and government research organisations in the agricultural innovation system". Professor James Rowe, Australian Agricultural Innovations at the Crossroads Conference, 30 May, 2013

One of the more difficult, time consuming and resource hungry activities is the management of intellectual property. While there are good grounds for protecting intellectual property these need to be weighed up against costs and benefits to overall research objectives. That there are excessive constraints and unreasonable costs is self evident. While it is only with the benefit of hindsight that the real value of intellectual property protection can be known with certainty there are arguments for adjusting the balance.

The timeframes for decisions on establishment of collaborative arrangements are excessively long and concomitantly costly. For example a CRC bid requires at least twelve months preparation and, even if a bid is successfully shortlisted and ultimately approved, the process is likely to take two years from the first step to final establishment. And of course if a second bid is necessary, as can be the case, another year is added. This process consumes large sums of finite cash and kind, not to mention equally valuable time.

Conversely the investment periods are often too short. At the recent Australian Farm Industry Innovation Conference Professor James Rowe, CEO of the Sheep CRC, branded three year funded projects as "useless".[10] While every research proposal should be judged on its merit there has long been recognition that funding timeframes are often out of alignment with research time frames. Even the original seven year life of a CRC has proven to be inadequate to address some of the big research questions and ongoing challenges facing Australian agriculture.

The divergent interests of some research providers bring both benefits and handicaps. Given the complexity of many research challenges the potential to have access to a range of disciplines can be very beneficial, provided that these assets are actually available. And bringing education and training interests into a collaborative venture such as a CRC can be particularly useful. However, if the research area is not part of an institution's core interests, or these interests change over the life of a particular collaboration, the venture can be disadvantaged. Changed funding circumstances may contribute to interests diverging.

The lack of discretionary funds can also create difficulties in a collaborative arrangement. One of the great strengths of the CRC program has been the availability of Commonwealth funding, the additional dollars that are often referred to as the glue that binds CRC parties together. Without some discretionary funding to direct and support research initiatives collaborative bodies can be at risk of duplicating management rather than adding value. Unless there is trust and commitment from participating partners some of the joint value of collaboration may be compromised.

Solutions to these challenges are at once simple and challenging.

- Institutional interests need to be addressed by ensuring that there is a collaborative culture at all levels.
- Governance and compliance arrangements need to be soundly applied without unnecessarily impinging on collaboration.
- Intellectual property management should be structured to enhance rather than hinder innovation.
- Research funding should be aligned with research challenges.
- Decision making timeframes needs to be tightened to reduce costs and hasten establishment of structures and programs.
- The interests of partners in research must be strong and consistent with objectives and capabilities.
- Finally collaborative bodies need to have sufficient funding discretion to add value to research activities

Steps are being taken, albeit slowly. The National Primary Industry Research, Development and Extension Framework is being developed to encourage a more co-ordinated and collaborative approach to rural research, development and extension. Governments, CSIRO, the fifteen RDCs and the Australian Council of Deans of Agriculture have recognised that fragmentation and duplication must be overcome if the $1.6 billion invested annually in agricultural research is to be effectively directed to improve the productivity and sustainability of Australian agriculture. As the Department of Agriculture, Fisheries and Forestry (DAFF) records the objective of the Framework initiative -"Research capability will be more collaborative, specialised, have larger critical mass, and will be less fragmented across the nation."[11]

The argument for a greater commitment to collaborative research initiatives is compelling. In a recent interview broadcast on the ABC's Country Hour Australia's Chief Scientist, Professor Ian Chubb AC, supported an increased emphasis on collaboration on the grounds that finite research resources needed to be better aligned, more focused, and to have appropriate scale. As Professor Chubb succinctly said -"It's all about aligning, it's all about focussing, it's all about scale"[12]

While I agree with Professor Chubb I think that it is also about culture. Unless individuals and institutions have an embedded culture that seeks out opportunities for collaboration we will not realise the true potential of our research capabilities and will not optimise our capacity to meet the research challenges that lay ahead. If we are to follow the example set by William Farrer, if we are to build on one of Farrer legacies, the seeds of collaboration need to be sown on fertile grounds.

"Where grows? Where grows it not?
If vain our toil
We ought to blame, the culture,
Not the soil."[13]

10. National Primary Industry Research Development and Extension Framework
11. DAFF Website August 2013
12. Chief Scientist, Professor Ian Chubb AC, ABC Country Hour, Tasmania, July 18, 2013
13. Alexander Pope, An Essay on Man

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