FELLOWSHIP SUMMARY REPORT

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Project title: Smart farming technologies and transformation in the work of farmers and advisers: Implications for technology adoption and policy

CRP Theme 3: TRANSFORMATIONAL TECHNOLOGIES AND INNOVATION

Host Institution: Countryside and Community Research Institute, University of Gloucestershire, UK

Host: Professor Julie Ingram,

Date of fellowship: April 14-May 31, 2023

I consent to my report being posted on the Co-operative Research Program website.

1. What were the objectives of the research project? Why is the research project important?

Objectives:

a) Identify key features of the change in work (i.e., tasks, work duration, workers, skills and working conditions) of farmers and advisers implementing Smart Farming Technologies (SFT's) in the UK and Australia.
b) Examine how farmers and advisers adapt and learn new work patterns arising from implementation of SFT's.
c) Develop recommendations for factoring in the changes to work in policies and other interventions to support SFT implementation.

Importance of the research:

Focusing on the real-world experiences of farmers and advisers and the change to their work from implementing SFTs, the research is an important addition and departure from studies examining 'non-adopters'. This focus has assisted in anticipating the knowledge, skills and technology governance arrangements required to underpin the capacity of farmers and the service sector to realize the benefits from SFTs. Further, it has identified work impacts that can be factored into interventions and policies in supporting value and benefit from SFTs. Having examined the patterns of change to work from implementation of SFTs in the UK and Australia, the results from this project will contribute to the international knowledge-base on transformative technologies in agriculture.

2. Were the objectives of the fellowship achieved?

Objectives a) and b) have been achieved, in that a literature review and all interviews with farmers and advisers in both the UK and Australia have been conducted. A preliminary analysis of data collected has identified key themes related to effects on work.

Objective c) is still to be achieved as further analysis of the data is being undertaken and a workshop with participants and stakeholders, to present and discuss the findings, is to be conducted on-line on September 6th, 2023. Further, a report of the research for participants and a journal paper is under development. These outputs are important for achievement of objective 3 which will be completed by the end of 2023.

3. What were the major achievements of the fellowship? (up to three)

<u>Benefit 1: Empirical research findings</u>

In total, 21 farmer interviews (11 in UK; 10 in Australia) were undertaken.
- In horticulture
- In livestock and mixed farming
- In arable farming

The key work effects from implementation of smart farming technologies across these farms were organised according to the different dimensions of work identified by Martin et al (2022) being:

1. **Work duration**
   - Work time: save time/don't save time; time to learn; overestimating time saved; fiddling with hardware; computer time

2. **Work flexibility**

3. **Work organisation and work tasks**
   - **Planning work**: Day to day work changes

- **Dis-adoption work:** stop using/can't use/need to find something else, the time and burden of abandoning technology.
- **The work of 'keeping up':** Finding out what's available
- **Programming work:** setting/re-setting machinery and software parameters
- **More /different work and tasks:** robotic maintenance; computer programming; daily routines in robotics, respond to alerts; liaise with service technicians; maintain computer records; integrating data systems

4. **Workload (physical and mental)**
   - **Safety/well-being:** Know where people are (accidents); decreases cognitive load; decrease stress of risk variability; makes things a little easier – something you can now do through to retirement; less tired and stressed; increase safety of equipment; improved quality of life; frees up time; save cows (less vet bills, less losses); better communication (e.g. visual images)

5. **Skills**
   - De-skilling; higher skills (e.g. to understand dendrometer readings); lower skills (technology is 'forgiving'/easier to train); it 'makes skilled labour'; dexterity; people trained to know 'what to look for';
   - Range of skills: technical people, technical pathways; Self taught

6. **Human-Animal relations**
   - Keep connection with farm and observations

And in addition, new types of work, jobs and people involved

- **Data work:** managing your data, visualising data, Interpreting data analysis, using software, data analysis, costings , lots of data (how get the payback from that – where are the analytics?)
- **Project work:** Being involved in projects and demos; work with research and companies on emerging tech; work with proven/existing tech/demonstrate.
- **Training work:** self and employees to use
- **New Jobs:** changes jobs; builds careers of existing people;
- **New people:** computer people
- **Knowledge practices:** not all in the 'kit' : still observing (not 'disconnected' from their farm) ; new insights – inquisitive about the farm ; information without an agronomist
- **Adding Labour** : automation doesn't replace or augment labour that is not there (no people for jobs); more per person – replace labour
- **Labour tracking**/surveillance

In total 15 advisers (9 in UK and 6 in Australia) were undertaken.

Adviser perspectives on their role and farmer needs:

Advisers described roles as 'gatekeepers' and as brokers between software and/or technology companies and farmers. They also noted that a new IT 'specialist adviser' is emerging who is developing tools, using their own knowledge and feedback from colleagues to act as an intermediary between advisers, farmer peer groups and SFTs/software developers. Advisers were generally inquisitive about technologies but emphasized that they must 'believe in it', before discussing with farmers. Many expressed the lack of scalability in technology and that most technology applications are 'bespoke'. Advisers believed that most start-ups and investors don't realise this.

Trends noted by advisers:

-the number of 'new entrants' on the advisory scene associated with technologies, who don't have an agriculture background
- farmer requirements are specific to a region and their sector, and software and technologies need to account for this.

Concerns noted by advisers:

- that much technology and software is not holistic enough – focusing only on 1-2 factors or variables in the system.
-the steep learning curve on the use of satellite data –noting that farmers and sales teams must gain trust in it.
- there is increased interest from farmers on real-time technologies particularly that associated with a need for frequency like in diagnosing disease pressures.

The research identified a range of work effects for advisers:

- **More 'back-room' roles/providing advice remotely:**
    - use of technologies like satellite/remote sensing to support agronomists or field teams prior to adviser visits to inspect crops, etc. This improves services to farmers and is more efficient in that advisers can target field issues/areas and less time walking across fields.
    - More computer work, acting on computers, analysing sensor outputs/reliability checking
    - Expertise needed and niche roles for data analysis.
    - Digital/virtual farm walks
    - Replace crop scouting/walks

- **Advisers are spending time on:**
    - looking at peer reviewed papers and reading tutorials on products
    - how they could add-value to equipment
    - 'following' the progress in technology:
        - Following the best people in Bayer, Syngenta,
        - Following 'start ups'

    - **Developing new services**:
        - Service design. E.g. Digital health check
        - Facilitator services
        - The ubiquitous nature of some technologies (like Variable rate technology in the arable farming sector) has meant some advisers had been able to establish a 'precision agriculture service' but making a viable service is difficult/not straight forward.
        - Some advisers noted their work had changed to involve 'proof of concept' support – applied research: Feedback to plant breeders; Give info to sales teams or agronomists

- **'Project work'**:
    - Advisers spoke about receiving many requests to be involved in projects related to demonstrating new technologies. They also described many instances where this 'ended in nothing', meaning they were becoming more selective and judicious in deciding what to get involved with.

Advisers recognised the need for more training and development:
    - IT
    - Service business models: e.g., digital agronomy services

The farmer and adviser results will be analysed further, along with a workshop with participants to validate and propose recommendations from these findings

In addition, conversation with researchers, intermediaries and companies were conducted which indicated that more support is needed in the level 7-10 in commercialisation. Currently the focus for investment and projects is to the levels 6-7 and 10-11.

Benefit 2: Connecting researchers, farmers, advisers in UK and Australia to share experiences in smart farming

In conducting the interviews, farmers and advisers reported being very interested to hear about the other country experiences and to be connected with others to share experiences. This will be further achieved through the online workshop to be conducted in September to report the findings of the research and allow for cross-country interaction and dialogue.

Benefit 3: identification of further collaborative opportunities related to transformational technologies

Because of the visit, new connections were made with researchers at the host institution working in the area of digital agriculture. Further collaboration is planned to target research funding schemes related to UK-Australia research.

4. **Will there be any follow-up work?**

Yes:

- A journal paper is under development for submission for publication in December 2023
- Future collaboration between Australia and UK on smart farming and advisory systems is planned with the potential to add collaborators from France who are working on similar issues related to work and smart farming/digital agriculture.

It is not expected that the research will result in protected intellectual property, novel products or processes, however the recommendations will be communicated and be useful for policies related to smart farming by government and industry bodies.

5. **How might the results of your research project be important for helping develop regional, national, or international agro-food, fisheries, or forestry policies and, or practices, or be beneficial for society?**

The research has confirmed and expanded the studies to date on the implications for work from smart farming technologies. These findings are important to support the development of practices and policies related to smart farming technologies which factor in the work dimensions of technology selection and use on farm and highlight the important role of advisers in technology implementation. This can assist in more appropriate technology selection and assessment to support both farming and environmental goals at a regional and national level. The research will be of interest internationally through identifying common issues across Australia and the UK that can be applied by multinational companies to avoid a technology push approach to technology use on-farm whereby the human and social dimensions are included in the evaluation of technologies leading to more appropriate and better serviced options.

6. **How was this research relevant to?**

   a. The objectives of the CRP?

The collaboration, through this project, between Australia and the UK researchers has strengthened comparative analysis of policies and practices in smart farming and is of international interest. The research has achieved new insights into the work dimensions of implementing smart farming technologies for farmers and advisers in Australia and the UK. This is an active debate in the digital agriculture field (Martin, et al., 2022) and in sustainable agriculture more broadly. Drawing on experiences of farmers and advisers in the two countries offered insights to the effect of institutional arrangements in the innovation system related to Smart Farming technologies. Both countries have innovation hubs and funding related to new technologies and start-ups but limited follow-on support to commercialisation and work with farmers. The collaboration via the cooperative research program allowed for a contribution to the debates concerning the next wave of SFT's and what farmers expect and need from such developments, a contribution that would not have occurred without the CRP.

b. The CRP research theme?

The research contributes to the objectives of the CRP research theme on ***Transformational technologies and innovation***. Specifically **Theme 3: Transformational technologies and innovation.** The project relates to the implementation of Smart Farming Technologies, with a specific focus on the implications for farm work and advisory practices, with the aim of supporting digital agriculture and generating ways to create value of technology implementation in the agri-food system. The research involves an innovative methodology in farm work assessment to examine the impact of implementation of SFTs in farm systems and in advisory services, which relates to the call for Innovations in Social Science. In combination with the expertise and high international standing of the CCRI (host organization) researchers in digital agriculture studies, the research will make a significant contribution to smart farming policy development, as well as providing vital information to support farmers and advisers in this area of technology implementation in the UK and Australia. To date there has been limited emphasis on SFTs and agricultural work, and hence the project aligns with the CRP goal to make a significant and relevant contribution to sustainable agriculture.

7. Satisfaction

- **Did your fellowship conform to your expectations?**
  Yes. It was a great opportunity to develop new thinking about work impacts from smart farming technologies with new insights from Australia and UK; and to meet and work with UK colleagues. The fellowship was well managed and supported.

- **Will the OECD Co-operative Research Programme fellowship increase directly or indirectly your career opportunities? Please specify.**
  Yes, to be recognised by the OECD in receiving the fellowship and then to be reporting to the University and Australian colleagues on the findings, raises the profile and standing of my research in the organisation.

- **Did you encounter any practical problems?**
  No

- **Please suggest any improvements in the Fellowship Programme.**
  With the increase in the cost of living and travel post-COVID, I found that the financial support provided for the fellowship covered only part of the air-travel, accommodation and living expenses (approximately 60%). I was able to complete the fellowship through drawing on additional funds through my Australian research program. For Fellows that do not have access to other funds, completing their fellowship solely on the support provided by the program would be very difficult.

8. Advertising the Co-operative Research Programme

How did you learn about the Co-operative Research Programme?

- My host in the UK had completed a fellowship and alerted me to the call.

What would you suggest to make it more "visible"?

- Provide promotional material to people that have completed the program to advertise in their organisation and in international conferences.

Are there any issues you would like to record?

- My host organisation and key host were very supportive, and everything went smoothly. The main issue was the costs of travel and living exceeded the fellowship funding.