

Institution: University of Aberdeen		
Unit of Assessment: UoA4: Psychology, Psychiatry and Neuroscience		
Title of case study: The Human Factor in Agriculture: Introducing non-technical skills to the UKs most dangerous industry		
Period when the underpinning research was undertaken: 2015 - 2019		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Amy Irwin	Lecturer (Psychology)	Oct 2009-present
Period when the claimed impact occurred: 2018-2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact (indicative maximum 100 words)		
<p>Farming is the UK's most dangerous occupation with an average fatality rate 18 times higher than any other industry. A team at Aberdeen, led by Dr Irwin addressed this challenge by applying the principles identified in her research to define the non-technical skills (NTS) necessary for safe farm practice. The findings were used to develop a range of practical resources, educational tools encompassing online training, a checklist tool and safety and mental health guides, which have been adopted by key agricultural stakeholders. The research has influenced organisations, businesses and practitioners in the farming industry, through the adoption of new learning provision, and new guidance and tools, resulting in the introduction of non-technical skills for safety in the farming industry.</p>		
2. Underpinning research (indicative maximum 500 words)		
<p>Non-technical skills (NTS) at work fall into two categories – cognitive (such as decision-making and situation awareness), and social (including leadership, teamwork and communication) – both of which are key to ensuring safe and effective job performance. Originally identified as crucial for safety in aviation (where NTS training is now mandated), training on NTS awareness and NTS improvement is applied across a range of high-risk industries with the aim of reducing work-place injuries and fatalities. Farming is the UK's most dangerous occupation with an average fatality rate 18 times higher than any other industry and 14,000 non-fatal injuries in 2018/19. The aim of the Aberdeen research was to apply NTS principles to farming for the first time, to bring understanding of these skills to farmers and change risky behaviours.</p> <p>Dr Irwin's research focused on understanding NTS in aviation and healthcare [R1; R2] prior to turning her focus to farming – an industry with little previous understanding of the importance of NTS and no training provision on NTS. Drawing on expertise in behavioural research assessing NTS from both a social and cognitive perspective, Aberdeen researchers (the NTSaG research group) conducted mixed-methods research (both qualitative and quantitative elements) investigating NTS in agriculture.</p> <p>The first step was the evaluation of skills used during safety-critical incidents in farming. Interviews were conducted with 32 Scottish and Irish farmers to examine skill use and lapses during incidents. Analysis revealed NTS were important for safety, and that failure to share information and lack of awareness of surroundings were particularly linked to farm accidents [R3]. These findings formed the basis for an agriculture non-technical skills framework which informed further research and the development of practical tools.</p>		

The next stage of research involved considering the relationship between psycho-social context and attitudes towards NTS, specifically the impact of stress, safety climate and safety motivation. A questionnaire study [R4] surveying 170 farmers from the UK and Ireland indicated a link between a work climate prioritising safety and a positive attitude towards NTS. It was apparent that NTS culture and practice was highly variable across different farms and highlighted the importance of specific individual and environmental characteristics to feed into developing NTS training for agriculture. This study revealed a knowledge-gap in agriculture about the link between stress and safety which directly influenced the development of a new mental health practitioner guide.

A subsequent study evaluated tractor driver decision-making by 148 farmers [R5] across various risk scenarios such as illness or equipment failures. Results indicated that safety messaging around tractors would be better accepted if framed in the context of positive financial outcomes or effectiveness of work practice. This has been incorporated in the interventions developed by the team including the pocket guide - see Section 4. A final qualitative study [R6] surveyed 57 UK and Irish farmers specifically on situation awareness requirements for tractor driving. Key situation awareness skills needed while driving a tractor include a mental map of their surroundings, the locations of other workers, the status of the machine and environmental conditions. Factors that can lead to situation awareness lapses included fatigue, distraction, and stress. This research was used to create a tractor checklist tool to support farmer situation awareness.

Results from these studies have led to the widespread development and dissemination of resources and training for NTS to improve farm safety, which have been adopted by key agricultural stakeholders around the UK and internationally.

3. References to the research (indicative maximum of six references)

The quality of the research is deemed to be of 2* quality as corroborated by the following peer-reviewed, international publications (Aberdeen research staff in **bold and underlined**; Aberdeen research students in **bold**):

[R1] **Irwin**, A., Taylor, S., Laugerud, E., & Roberts, D. (2016). Investigating Non-Technical Skills in Scottish and English Aircraft Maintenance Teams Using a Mixed Methodology of Interviews and a Questionnaire. *The International Journal of Aviation Psychology*, 26, 105-119. <https://doi.org/10.1080/10508414.2017.1319734> (Google Scholar citations: **7**)

[R2] **Irwin**, A. & Weidmann, A. (2015). A mixed methods investigation into the use of non-technical skills by community and hospital pharmacists. *Research in Social and Administrative Pharmacy*, 11, 675-685. <https://doi.org/10.1016/j.sapharm.2014.11.006> (Google Scholar citations: **13**)

[R3] **Irwin**, A. & Poots, J. (2015). The human factor in agriculture: an interview study to identify farmers' non-technical skills. *Safety Science*, 74, 114-121. <https://doi.org/10.1016/j.ssci.2014.12.008> (Google Scholar citations: **37**)

[R4] **Irwin**, A. & Poots, J. (2018). Predictors of attitudes towards non-technical skills in farming. *Journal of Agromedicine*, 23, 60-69. <https://doi.org/10.1080/1059924x.2017.1384775> (Google Scholar citations: **2**)

[R5] **Irwin**, A. & Poots, J. (2018). Investigation of UK farmer go / no-go decisions in response to tractor-based risk scenarios. *Journal of Agromedicine*, 23, 154-165. <https://doi.org/10.1080/1059924X.2017.1423000> (Google Scholar citations: **8**)

[R6] **Irwin**, A. Caruso, L. & Tone, I. (2019). Thinking ahead of the tractor: Driver safety and situation awareness. *Journal of Agromedicine*, 24, 288-297. <https://doi.org/10.1080/1059924X.2019.1604279> (Google Scholar citations: **6**)

Grant Funding

Irwin, A., Hamlet, O., Tone, I. & Lipan, G. (2019). University of Aberdeen, Impact support award. GBP4,100.

Irwin, A., Hamlet, O. & Tone, I. (2018). ESRC Business Boost Seedcorn fund for impact. GBP900.
Irwin, A. & Tone, I. (2018 – 2022). University of Aberdeen, School of Psychology, PhD Studentship (1+3). GBP80,000
Irwin, A., & Nordmann, E. (2017). University of Aberdeen Impact, Knowledge Exchange and Commercialisation award. GBP5,000.
Irwin, A. (2014). University of Aberdeen, School of Psychology Summer internship award. GBP1,000

4. Details of the impact (indicative maximum 750 words)

Impact has been achieved through the development of freely available online courses; tractor safety checklist; a smartphone safety app; leaflets; videos; and a pocket guide. Adoption of these resources by key agricultural stakeholders has led to benefits to organisations, businesses and practitioners in the farming industry, bringing a recognition of the importance of non-technical skills for safety in the farming industry.

Training for farmers

The research outlined in Section 2 led directly to provision of NTS training for farmers, for the first time. To achieve this, the Aberdeen team initiated a collaboration with Lantra, a leading educational provider for UK and Ireland offering training and certification across farming tasks, including eLearning. They produced two new eLearning modules on NTS [S1i]. The training offers practical advice and guidelines to implement NTS in farming. Since the first module launched in June 2018, 474 farmers have completed the training, making it the 3rd most popular eLearning course at Lantra, with post-study surveys indicating improved understanding and awareness [S1i]. Resources developed from the research have been adopted by the Royal Agricultural University to embed health, safety and mental health awareness in their induction programme and curriculum for circa 400 agricultural students [S1ii].

Safety for tractor drivers

The Aberdeen team developed a tractor checklist – a practical tool for daily practice - focusing on situation awareness; checking and preparation; vigilance and anticipation whilst driving [S2i], based on their research [R5; R6]. The checklist is available for farmers from the research team as a free laminated hard copy, can be downloaded from the team's website, and has been developed into a free smartphone app. Its creation was led by the Aberdeen research group in association with Teagasc (Irish Agriculture and Food Development Authority), Lantra, and Elizabeth Creed Consulting; and supported by the Institute of Safety and Health (IOSH) and Women in Agriculture (Scottish Government) - all of whom were brought together to an NTS event organised by Dr Irwin in 2018, and have since been regular collaborators [S1i; S2ii; S2iii; S3]. Chief executive of NFU Scotland (NFUS), speaking on behalf of Farm Safety Partnership Scotland said: "*Practical measures that help to improve safety on farm is welcome. The tractor checklist helps farmers and crofters be aware of the potential risks they face as they go about their work. This has the potential to reduce accidents and I would encourage all to adopt it as part of their routine*" [S4i]. Lantra provide the checklist alongside existing eLearning courses [S1i]. The laminated checklist was issued to 1000 UK farmers by 2020. The smartphone app [S2iv] was launched in June 2020 for use within the tractor cab, where the majority of farmers have a smart phone or tablet. The app webpage had 231 views in the first 7 months with the response overwhelmingly positive: an NFU policy advisor reported "*have just got off the phone with a farmer who employs a range of tractor drivers- predominantly from the Czech Republic or Poland. He has downloaded the app and is delighted with it – already discussing it with his H&S manager about how to use it in their H&S toolbox*" [S4ii; S4iii].

New wellbeing guidance for farmers

The research on stress impacting farmer's wellbeing and safety [R4] highlighted mental health issues in farming. To tackle this, the Aberdeen team developed a free downloadable guide [S5i] - promoted by the NFU since September 2018 [S5ii] - focusing on stress management for safety in farming. The Lincolnshire Rural Support Network adopted the guide for presentations about their services and for use by their nurses at health screening and outreach clinics [S5iii]. The guide

was promoted in the Farmers Weekly Fit2Farm campaign [S5iv]. Content from the guide was included in *The little Book of Minding Your Head* released in 2019 in collaboration with the Farm Safety Foundation charity, on farmer mental health [S5v-vii]. As a result of this work, Dr Irwin was invited to join the National Rural Mental Health Forum [S6], a group of public, private and third sector organisations, supported by the Scottish Government, brought together to tackle rural mental health issues.

Raising awareness of the importance of NTS for safe farm practice

In order to ensure widespread reach and uptake of NTS training and support in agriculture, the Aberdeen team has engaged extensively in dissemination of their research findings. The research team's website [S7i] and twitter page [S7ii] host project outputs, tools and videos. Information on the research and resources developed by the team have been disseminated widely through TV, radio, print and blogs; including BBC Landward; and Farmers Weekly - a major industry publication [S8]. These activities led to invitations for Dr Irwin to present at 3 industry events since 2019 and to lead NTS events for attendees from the Scottish Government; IOSH; Health & Safety Executive; Scottish Rural Colleges; Young Farmers Association; NFU; Lantra; with stakeholders attending from Australia, USA, Canada and Europe [S7iii].

National and international reach of NTS resources for farmers

As a result of the extensive engagement of the Aberdeen team with key stakeholders within and outside the UK, resources developed from the research have been adopted by agriculture organisations around the UK and internationally. A user-friendly *Farmer Resource Management* pocket guide [S7iv] was developed by the Aberdeen team to make use of the research findings and provide practical tips to farmers for implementing NTS. The pocket guide was provided free to 1300 members and clients of: Farmers Union of Wales; Scottish Young Farmers Association; Scottish Rural Network; safety consultants in New Zealand [S9i] and Canadian Centre for Health and Safety in Agriculture [S9ii]. The UK Farming Forum, representing 40,000 members, hosts the *Farmer Resource Management* pocket guide along with six other leaflets produced by the Aberdeen team on its safety page, which has been viewed 24,000 times [S10i-ii].

The Aberdeen resources are endorsed by other major agricultural partners: IOSH; NFUS; Royal Environmental Health Institute of Scotland; and Teagasc [S10iii-vi]. The Chair of IOSH Rural Industries Group said of Dr Irwin's NTS research and resources: "As a consequence of its relevance, usefulness, novelty and extensive promotion, I am aware that the advice and techniques are already being used by Occupational Safety and Health (OHS) consultants providing advice and training, and others managing health and safety in the industry" [S11]. The NFUS Vice-President said: "Undoubtedly, early engagement with the agricultural community through the "conducted with farmers, for farmers" approach from Dr Irwin's team and has enabled the final tools to be more impactful. Industry engagement with the outputs has been far reaching, and uptake of the various NTSAg tools has been seen across Scotland and the wider UK" [S4iii].

5. Sources to corroborate the impact (indicative maximum of 10 references)

S1. Training material: (i) Lantra Testimonial letter; (ii) Royal Agricultural University email

S2. Tractor Checklist: (i) The checklist; (ii) [Teagasc](#) link to checklist; (iii) Lantra [link](#) to checklist (iv) [App](#) link

S3. Teagasc Testimonial letter

S4. NFUS: (i) Scotsman [article](#) quoting NFSU Chief executive; (ii) email from NFUS Rural Business Policy Advisor; (iii) Testimonial letter NFUS Vice-President

S5. Stress Management Leaflet: (i) the leaflet; (ii) [NFUS hosting of leaflet](#) (iii) Lincoln Rural Support Network emails; (iv) web link [Fit2Farm](#); (v) web link yellow wellies [thanking](#) AI for help in creating

“Little Book of Minding Your Head”; (vi) email Farm Safety Foundation Manager; (vii) [youtube](#) citing Abdn

S6. Email from Convener of National Rural Mental Health Forum & Director of Policy and Public Affairs, Support in Mind Scotland

S7. Aberdeen-hosted resources: (i) NTSAg website; (ii) NTSAg Twitter; (iii) NTS Event Programme, 2018; (iv) Pocket guide link

S8. Media collection: (TV, radio, Press, Blogs): [BBC](#) article on Landward show; [Landward](#) BBC - checklist requests; [Podcast](#) Farmers Weekly; [STV](#) News article; [Farmers](#) Weekly news article; [Farmers](#) Guardian news article; [Scottish](#) Farmer news article; [Aberdeen](#) Chamber of Commerce article; [Courier](#) news article; [Blog](#) NFUS

S9. International stakeholder emails: (i) New Zealand, H&S consultant; (ii) Canadian Centre for Health and Safety in Agriculture, Knowledge Translation Specialist

S10. Organisations hosting the Aberdeen resources: (i) [Farming](#) Forum; (ii) Farming Forum - screenshot of views for Aberdeen materials; (iii) [IOSH](#) ; (iv) [NFUS](#); (v) [Royal](#) Environmental Health Institute of Scotland; (vi) [Teagasc](#)

S11. IOSH Chair of Rural Industries Group – Testimonial letter