NOT-EQUAL

EPSRC Network+: Social Justice through the Digital Economy

Pilot Projects: Application Form

We are seeking funding proposals from shortlisted candidates for Not Equal's first call for pilot projects. For full guidance please see details of the call on the Not Equal website.

Pilot research projects can be between 6-8 months in length. We expect to fund up to 12 pilot research projects of up to £40k (80%FEC) for this first funding call.

Please submit this form before the deadline of **5pm, 30th April 2019** to notequal@ncl.ac.uk.

Applicants will be advised on the outcome of their proposal by the 30th May 2019.

GENERAL INFORMATION	
Lead Applicant (PI): Leanne Townsend **Email address:** leanne.townsend@hutton.ac.uk **Job Title:** Senior Social Scientist **Department:** Social, Economic and Geographical Sciences (SEGS) **Organisation:** James Hutton Institute	**Co-Investigators (names and organisations):** Rowan Ellis, James Hutton Institute Simon Robinson (Swansea University) Jen Pearson (Swansea University) **Supporting Partner(s):** Scottish Crofting Federation Smallholding Scotland **Project Title:** Smart Small Farms **Project Tagline:** Co-designing small-scale technologies to address the agricultural digital divide **EoI Reference Number:** NE66

1. SUMMARY

Please provide a summary of your proposed research project (<300 words).

"Smart Small Farms" is an interdisciplinary research project which will work with small farms in Scotland to create pathways to accessing the benefits of the digital economy through the development of small-scale farming technologies. Smart farming technologies (SFTs) are most likely to be adopted by large farms: the larger the farm, the more likely it is to benefit from technological advancements in agriculture. Technologies such as variable rate precision farming entail costly investments, so it is typically the largest farms that are able to invest and see a return on investments quickly. Whilst large farms enjoy the benefits of the digital economy, smaller farms are left behind and suffer competitive disadvantages. This represents an *agricultural digital divide* illustrating both winners and losers in an agricultural landscape where the use of digital technologies is increasingly prominent.

In this project, we will: conduct a participatory workshop with small-scale farmers to garner insights on the barriers and potential of SFTs for small-scale farming, and to co-produce ideas for prototype SFTs for use on their farms. This will include demonstrations of SFTs to encourage farmers to think about potential applications. We will then undertake rapid prototyping of the SFTs based upon insights from this first workshop. We will then conduct a second workshop to trial these SFTs with farmers. Following the final workshop, we will communicate with farmers to obtain feedback on the trialling of prototypes on the farm. The key outputs from this work are a short film documenting the project; a toolkit of SFTs, which will be disseminated to relevant actors through our networks of key stakeholders; and a report outlining the key findings from the participatory workshop on barriers to, and potential benefits and applications of technologies on small farms.

2. HOW DOES YOUR PROPOSAL ALIGN WITH THE THEMES AND OBJECTIVES OF NOT EQUAL?

Please describe how your proposal helps understand, explore or develop practical responses to social justice issues within the digital economy; and how does your proposal enhance a cross-disciplinary way of working. Please also indicate which of the Not Equal challenge areas your proposal focuses on e.g. Algorithmic Social Justice, Digital Security for All and Fairer Futures for Business and Workforce (<500 words).

The Not Equal challenge area of relevance to this proposal is: *Fairer Futures for Business and Workforce*

This challenge area seeks projects aiming to: *"realise more ethical business models and equal opportunities for economic development".* The digital economy creates opportunities but also inequalities for businesses and those in the workplace. In this project we are concerned with inequalities arising as a result of unequal levels of access to digital technologies which are revolutionising agriculture. Smart Farming Technologies (SFTs) are often more accessible to large-scale farms, because the high investment costs are typically more affordable for larger farms and returns on investments can be seen more quickly, in comparison with smaller farms. Small farms are already potentially vulnerable due to limited land and capital assets, geographical and economic marginalisation; this can also impact on the wider rural communities that they support, which are often already at a disadvantage as a result of uneven access to technologies – the urban-rural digital divide. Advancing digitisation of agriculture therefore potentially threatens further marginalisation both for small farms, and their wider rural communities. The Not Equal Network seeks to fund projects which empower and more equitably distribute the opportunities of the digital economy. Our project seeks to do just that, through ***creating new pathways to a more inclusive approach for development of SFTs by working with small farms to design prototype technologies, and trial them on farms to evaluate their effectiveness in these contexts.*** The project will therefore empower small-scale farmers who wish to embrace the opportunities offered by SFTs.

This proposal enhances cross-disciplinary working by bringing together social scientists (Leanne Townsend and Rowan Ellis, James Hutton Institute) with computing scientists (Simon Robinson and Jen Pearson, Computational Foundry, Swansea University) to develop new understandings of social injustices arising from the agricultural digital divide, and pathways to more inclusive innovation in this field. There are no existing cross-disciplinary collaborations on this particular topic specifically in relation to small farms. Researchers from the different disciplines will be working together throughout all stages of the project, including in designing all project activities and in analysing the data and outcomes from each of the workshops. Working together on these activities should create mutual learning and understandings across the different disciplinary areas as well as new routes to interdisciplinary research in future projects (including the planned development of a larger interdisciplinary project resulting from this pilot research). In addition, the research team will be working closely with non-academic partners including Smallholding Scotland and the Scottish Crofting Federation, which will lead to new transdisciplinary networks and research.

3. CASE FOR SUPPORT

Please describe your proposed projects, including its aims and objectives. This will include the design and method of your project, context, background literature and data to be collected. Please also indicate why is this research important and for whom (<1000 words).

Small farms in the UK are facing challenges resulting from geographical remoteness and scales of production, leading to declining shares of profit and barriers to market access (Berti and Mulligan 2016). The marginalisation and potential loss of small farms has wide implications for the vitality and resilience of rural places. These vary across different rural contexts, but are particularly pronounced around food system resilience, employment and rural depopulation, as well as the role of small farms in resisting rural land pressures like residential development and agricultural consolidation (Correia, T. P., et al, 2018; Shucksmith and Ronningen 2011). Small farms can be important for rural food security, particularly in the event of supply chain disruptions, extreme weather events, or other food-related shocks (Bosc, Pierre-Marie, et al. 2013). In rural places where economic opportunities are limited, small farms are also vital sources of employment.

Smart farming technologies (SFTs) such as variable rate precision farming and smart sensors (e.g. "Internet of Underground Things" - Vuran et al. 2018) and drone technologies are revolutionising agriculture, leading to better productivity, yields and cost savings as well as supporting more environmentally sustainable farming practices (Rose and Chilvers 2018). Arguably then, small farms and the rural places they support have much to gain by embracing the digital age and engaging with tools for more efficient and profitable food production. However, as found in research led by Leanne Townsend (in EU H2020 Agrilink project: https://www6.inra.fr/agrilink/) farm size is critical to whether a farm is able to 1) adopt, and 2) benefit from these developments. SFTs are most likely to be adopted by larger farms because these are better placed to benefit from technological advancements in agriculture (Kernecker et al. 2019). Many SFTs entail costly investments, as well as regular subscription fees to multiple software platforms. Not all small farms will have the financial resources to invest in SFTs, and the small scale of their operations means that returns on investments would take much longer.

SFTs also contribute to an increasingly mechanised sector with farms operating on much larger scales. Small farms face increasing marginalisation as many SFTs are not well adapted to small scale farming practices (Wegren 2018). Hence whilst large farms enjoy the benefits of the digital economy, smaller farms are left behind and suffer competitive disadvantages and increased marginalisation (Wegren 2018). These are the elements of the *agricultural digital divide* characterised by both winners and losers in an increasingly high-tech agricultural sector (see also Hennessy et al. 2016).

"Small Smart Farms" *aims to understand and demonstrate the value of SFTs for small-scale farms, enabling them to benefit from future technological developments.* By "small farms" we refer to those farms under 25 hectares. We will focus on upland farms, given that they face particular challenges in terms of geographical remoteness, limited outputs and relatively low incomes, which might reflect particular technological needs and benefits. We will work with the Scottish Crofting Federation and Smallholding Scotland, in order to gain access to a diverse sample of small-scale farmers in upland areas of rural Scotland. While the focus here is upland systems, we will also consider the potential of SFTs in diverse small farm settings.

The project is interdisciplinary (bringing together scholars across different institutes from different academic disciplines within the social and computing sciences) and transdisciplinary (bringing academics together with third-sector organisations to develop new pathways to responsible agricultural innovation). We have designed the

project activities to be participatory, so that farmers and other relevant actors play a central role in the research, bringing to the fore their perspectives and needs, and working with the project team to develop SFT prototypes to trial on farm.

In this project, we will 1) conduct participatory workshops with small-scale farmers to garner insights on the barriers and potential of SFTs for small-scale farming, and to co-produce ideas for prototype SFTs for use on their farms. This will include demonstrations of small-scale SFTs to encourage farmers to think about potential applications; 2) undertake rapid prototyping of SFTs based upon insights from the first workshop; 3) conduct a second workshop to trial SFTs with farmers. Following the workshop, we will communicate with farmers to obtain feedback on the trialling of prototypes on the farm.

We will use a range of apparatus in the workshops and prototyping phase such as: mobile devices; embedded sensors (e.g., motion, moisture, temperature); actuators (e.g., for external device control); power-lean information infrastructures (e.g., NFC or local "clouds"); development platforms such as Arduino. The Computational Foundry has a range of existing Maker Lab facilities that will be used to complement this work, including 3D printers, laser cutter and CNC machine for modelling and rapid-prototyping; and, a large library of electronics maker kits, including Raspberry Pi, Arduino and sensors, that will be drawn on when prototyping hardware designs.

The project has a number of outputs and deliverables as outlined in the Workplan. There are three notable deliverables: 1) a final report outlining the key findings from the participatory workshop on barriers to, and potential benefits and applications of technologies on small farms; 2) a toolkit of SFT prototypes, trialling of those prototypes by farmers, and interdisciplinary evaluation and reflection on findings from the workshops; 3) a short film presenting the project overall, footage of the prototypes in action and reflections from participants on the experience of SFTs and their potential for the future. These key deliverables will be used as a basis for communication with relevant audiences through: one open access journal publication, one conference attended (such as IFSA – International Farming Systems Association), and engagement with key stakeholders through various channels including through the networks of our non-academic partners. Outcomes of the project will form a foundation for a larger project, allowing us to build on the Not Equal funding and continue to develop our work in this area. Outcomes will also lead to positive impacts on the small farming community relating to benefits of digital technologies for their farming practices (e.g. increased outputs, more efficient farming practices etc.).

References:

Berti, G., & Mulligan, C. (2016). Competitiveness of small farms and innovative food supply chains: The role of food hubs in creating sustainable regional and local food systems. *Sustainability*, *8*(7), 616.

Bosc, P. M., Berdegué, J., Goïta, M., van der Ploeg, J. D., Sekine, K., & Zhang, L. (2013). *Investing in smallholder agriculture for food security* (No. 6). HLPE.

Correia, T. P., Guarín, A., Knickel, K., Godinho, S., Méndez, M. R., Grando, S., & Brunori, G. (2018). Assessing small farms' role in the food systems at a regional level: insights from a territorial approach. In *European IFSA Symposium, Theme 5–Sustainable agrifood systems, value chains and power structures* (pp. 1-5).

Hennessy, T., Läpple, D., & Moran, B. (2016). The digital divide in farming: a problem of access or engagement?. *Applied Economic Perspectives and Policy*, *38*(3), 474-491.

Kernecker, M., Knierim, A., Wurbs, A., Kraus, T., & Borges, F. (2019). Experience versus expectation: farmers' perceptions of smart farming technologies for cropping systems across Europe. *Precision Agriculture*, 1-17.

Rose, D., & Chilvers, J. (2018). Agriculture 4.0: responsible innovation in an era of smart farming. *Frontiers in Sustainable Food Systems*, *2*, 87.

Shucksmith, M., & Rønningen, K. (2011). The Uplands after neoliberalism?–The role of the small farm in rural sustainability. *Journal of Rural Studies*, *27*(3), 275-287.

Vuran, M. C., Salam, A., Wong, R., & Irmak, S. (2018). Internet of Underground Things in Precision Agriculture: Architecture and Technology Aspects. *Ad Hoc Networks*, *81*, 160-173.

Wegren, S. K. (2018). The "Left Behind": Smallholders in Contemporary Russian Agriculture. *Journal of Agrarian Change*, *18*(4), 913-925.

4. NOVELTY OF PROPOSAL

Please explain the novelty of the proposed research project (<150 words).

"Smart Small Farms" is novel in four ways. 1. Although there is much research on the importance of small farms, likewise on the adoption (and barriers to adoption) of SFTs, there is not yet any participatory research seeking to overcome barriers to SFT adoption amongst small-scale farmers. 2. The project represents a novel collaboration between social scientists and computing scientists pursuing more responsible innovation in small farm contexts. 3. The research applies the co-produced rapid prototyping approach to a new context – small farms. 4. The research will result in novel prototypes or apply existing technologies in new contexts as determined by the unique needs and characteristics of our participants.

5. NON-ACADEMIC PARTNERS

Please explain how your non-academic partners will engage with the project e.g. in-kind time, use of facilities, etc. (<150 words)

Our partners have access to large numbers of farmers based on smallholdings and crofts throughout Scotland. The Scottish crofting federation has over 2,000 farmers as members. Both organisations conduct their own surveys of members and hold extensive knowledge about issues facing small farms in Scotland. This knowledge will be invaluable for informing the design of research activities, and both organisations will provide advisory services in this respect. Further, the two organisations have access to suitable venues in locations which are convenient for the project participants. Our partners at both Smallholding Scotland and the Scottish Crofting Federation have indicated the importance of advancing digitisation in agriculture for small farms throughout Scotland. The SFT toolkit and other outputs will be useful for our partners in their own engagement activities, as a means of raising awareness of SFTs with their members. They will disseminate these widely throughout their networks of relevant stakeholders.

6. DELIVERABLES AND SOCIAL IMPACT

Explain the outcomes and deliverables of your project as well as the expected social impact. Please ensure this answer is suitable for a lay audience (<300 words).

Key outcomes:

1. **Better understanding of barriers** to small farms adopting SFTs. Deliverables **1.1:** Summary note on participatory workshop format, preliminary insight; **2.1**: Mid Term Report on potential benefits/applications of SFTs for small farm; **5.1:** Final Report on barriers/opportunities for small farms to participate in SFT developments.

2. **Novel, low cost technologies to support small farms**. Deliverable **3.1**: Toolkit of SFT prototypes

3. **Innovative approach to co-producing knowledge and digital solutions** for small farms, which we call Co-produced Rapid Prototyping. Deliverables **3.2**: Short film documenting workshops and prototypes in action on an upland croft, reflections from participants on the experience of the workshop and technology; **4.1**: Practice Brief for non-academic partners profiling key lessons/applications of SFTs.

4. **Raise awareness of an emerging agricultural digital divide** and the potential for small farms and rural communities to benefit from emerging low-cost technologies**.** Deliverables **6.1:** Regular tweets throughout project, profiling key findings and publications; **6.2:** 2X blog posts reflecting on 1.) Experience of Co-Produced Rapid Prototyping approach; 2.) Potential of SFTs for upland systems; **6.3:** Peer Reviewed Academic Paper sharing key findings

Expected Social Impact

The ability of small farms to benefit from digitisation has potential for addressing the growing 'agricultural digital divide' currently disadvantaging small producers, many of whom have limited land and capital assets. Small farms benefit when these technologies support increased outputs/yields, decreased inputs, and/or access to new markets. Small farms can also benefit from increased awareness of the challenges and threats they face. This exposure has the potential to catalyse policies supporting farm extension services and technologies that meet small farm needs. Small farms are part of rural communities, and their ability to survive has broader implications for the future of these rural places, through maintaining employment opportunities, supporting localised food systems, and resisting rural land pressures.

7. WORK PLAN

Please outline the work-plan for your proposed research/activity (<200 words).

	Task	Activities	Outputs/Deliverables	S	O	N	D	J	F	M	A
1	Workshop 1	• Plan and prepare workshop materials • Co-produce knowledge: participatory activities to understand challenges and potential; demonstration of existing SFTs; prototype ideas	• 1.1 Summary Note								
2	Problem characterisation and rapid prototyping	• Thematic analysis of workshop data • Lit Review • Rapid prototyping of SFTs based on outcomes of first workshop	• 2.1 Mid Term Report on potential benefits and applications of Small Farm Tech								
3	Workshop 2	• Trialling of prototype SFTs with original group of farmers on upland croft	• 3.1 Toolkit of prototype SFTs relevant for small farms • 3.2 Short Film Documenting workshop and prototypes in action								
4	Follow-Up with Farmers	• Survey of participants • Distillation of lessons from Workshop and prototypes	• 4.1 Practice Brief for non-academic partners								
5	2nd Stage Analysis: Findings and Reflection	• Analysis of survey data • Synthesis of all data sources • Reflective Exercise	• 5.1 Final Report								
6	Communications	• Regular Communication of Findings and Activities	• 6.1 Tweets • 6.2 2X Blog posts • 6.3 Open Access journal publication								

8. HOW WILL YOU COMMUNICATE THE FINDINGS OF YOUR RESEARCH TO THE PUBLIC?

Please outline your dissemination plans e.g. events, networking with local support groups, creating vlogs, writing blogs, etc. (<200 words).

Social media and online: We will engage regularly with diverse academic and non academic online audiences. Twitter posts will be at least on a weekly basis using the #smartsmallfarms project hashtag and linking to the @notequaltech Twitter handle. We will communicate our project activities and outcomes through at least two blog posts, one hosted on the James Hutton Institute website and a second hosted by the Cherish DE website - both will be available to host on the News section of the Not Equal website if appropriate. A key deliverable is a short film which will be hosted on Youtube, with viewers guided to it via Twitter posts and other online activities.

Stakeholder engagement: Two of the main organisations supporting small farms in Scotland are partners on the project; we will be sharing our findings with them regularly and receiving their input on evaluation of project

outcomes. We will produce a practice brief. This will be disseminated through our partners' networks (along with link to the short film and social media content), including to their members, (e.g. 2000+ farmer members of Scottish Crofting Federation) and other relevant actors including those working in policy and organisations supporting small farms.

9. EXISTING FUNDING

Will any existing funding be used on this project (e.g. PhD funding)? If so, please provide information on these and how they will be used on the project.

N/A

10. TRACK RECORD OF APPLICANTS

Please indicate any previous relevant experience, qualifications and publications of the lead applicant and team (<200 words).

Leanne Townsend has expertise in the social implications of digitisation for rural economies and communities including agriculture. She has 8 years experience working on digital economy-related projects. Between 2010 and 2015 Leanne led much of the social science research carried out at the EPSRC-funded dot.rural Digital Economy hub. She currently leads H2020 research on digital futures for rural economies and communities.

Rowan Ellis has over 10 years experience researching issues of sustainable land use and management, agri-environmental decision making, as well as participatory and co-creative research methods. She currently leads a work package within the H2020 SALSA project exploring the governance of small farms for food security. The Scottish Crofting Federation are part of the communities of practice participating in this project.

Simon Robinson's research focuses on interaction design with and for emergent users – people in rural or developing regions where connectivity and technology availability are often low. His work has been part of several funded projects in this area, most recently EPSRC Reshaping the Expected Future.

Jennifer Pearson has expertise in emergent user research, information interaction, deformable interfaces, speech interfaces and co-creation. She wrote the book Designing for Digital Reading, has been involved in the creation of several open source toolkits (e.g., bettertogethertoolkit.org and digitalinclusiontoolkit.org).

11. BUDGET BREAKDOWN

Please provide a detailed budget breakdown and justification for your budget - for example: salary grade, point, duration and %FTE: specified journeys or conferences; identified items and quantities of consumables (<300 words)

Staff:
Leanne Townsend (PI) 30 days, 21% FTE; Rowan Ellis 18 days, 12% FTE = £12,417
Simon Robinson and Jen Pearson: 20 days each (14% FTE) = £10,666

Consumables:
Catering at the two workshops for up to 20 participants = £400
Workshop consumables (across two workshops) = £150
Open access publishing for one journal paper = £1,000

Facilities and equipment:
Prototyping tech equipment (including a range of apparatus such as: mobile devices; embedded sensors e.g., motion, moisture, temperature; actuators e.g., for external device control; power-lean information infrastructures e.g., NFC or local "clouds"; development platforms such as Arduino = £5,000
Sub-contracting the production of a short film = £1,500
Consultancy rates for non-academic partners: 3 x day rates (2 for workshops, 1 for workshop preparation) at £552 = £1,656
Venue hire for two workshops = £276

Travel:
Travel, accommodation and subsistence for both workshops for all academic partners, non-academic partners and participants. Note, this mostly involves travelling to remote rural areas from Aberdeen, Swansea and other parts of Scotland = £4,400
Attendance at relevant workshop or conference in UK or Europe for one person = £1,000

11. TOTAL PROJECT COST

Please list in GBP under the headings - Overall cost, Staff, Travel and Other

	Directly incurred costs (80%)	**Directly incurred costs (100%)**
Staff	18,466	23,083
Non-Staff Costs: Consumables	1,240	1,550
Non-Staff Costs: Facilities/Equipment	6,745	8,432
Non-Staff Costs: Travel		5,400
Non-Staff Costs: Estates (RA's only)	n/a	n/a
Non-Staff Costs: Indirect (RA's only)	n/a	n/a
Overall Cost*	Total Not Equal Funding Requested: **£30,772**	Total for information only: **£38,465**

Directly Incurred Posts

Role	Post	Start Date	Period on Project (months)	% of Full Time	Scale	Increment Date	Basic Starting Salary	Super-Annuation and NI (£)	Total cost on grant-80% FEC (£)	Total cost on grant-100% FEC (£)

*Please note you are able to claim for RA time and RA relevant FTE related costs, PI/Co-I time and other non-staff costs. You are not able to claim for FTE related costs attributed to PI/Co-I time.

Further Information

If you have any further questions regarding this call for proposals, please contact notequal@ncl.ac.uk or Kate Kelly (Not Equal Project Manager) on 0191 2088268.