The use of space technologies in international development: opportunities and challenges

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Host Institute: The Open University, UK	
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Project Highlights:

- Investigates the application and acceptance of robotic technologies in humanitarian emergencies
- Uses the knowledge of human-robotics interaction in space exploration to transfer best practice to the use of robotic technologies in humanitarian emergencies
- Supervised by an interdisciplinary team of scholars with expertise in international development, robotic space exploration and space technologies

Overview:

Recovery from emergency situations such as earthquakes, tsunamis or floods should be considered in relation to long-term development and the reduction of vulnerability, frequently called the 'Relief-Development Continuum' and 'Developmental Relief' in the 1990s, and 'Recovery Plus' and 'Build Back Better' in recent times (Twigg, 2015). The Sendai Framework for Disaster Risk Reduction 2015–2030 includes 'Build Back Better in recovery' as one of the four priority areas. Building effective resilience systems as well as building back after natural disasters such as earthquakes have not been well applied in practice. The nature of the destruction as well as the first response to the 2015 earthquakes in Nepal and the Philippines are well documented (Hayes et al., 2015; Dutta et al., 2016) and are excellent case studies for reflection. The governance of relief efforts involving a diverse range of stakeholders, as well as the cultural contexts of building resilience, also need further academic and practical discussion. The 2015 Sustainable Development Goals state that losses just from earthquakes, tsunamis, and tropical cyclones have been devastating to development and that we "can reduce the loss of life and property by helping more vulnerable regions... become more resilient" (UN SDG 2015). How can technological innovations help such vulnerable communities? How can the humanitarian sector work with academics to

Fig. 1. Human interaction with technology: Priests take turns to view a phone within a virtual reality box in Ethiopia **(Source:** https://www.scidev.net/global/innovation/news/african-countries-fare-poorly-in-innovation-ranking.html**)**

pool resources and expertise in order to encourage the building of resilience amongst affected communities, as well as humanitarian first responders?

While there are challenges in alleviating such levels of vulnerability, it is possible to help first responders better deal with emergencies through the application of space technologies in humanitarian emergencies. There are many well trained first responders and there have been great strides by multilateral organisations such as the UN, bilateral organisations such as USAID and DFID, and international NGOs, yet the levels of training have been inconsistent and the range of technologies potentially available for first responders have been overlooked.

Human interaction with technology: China counts on AI to find a cure for its ailing health care system **(Source:** https://www.thestar.com.my/tech/tech-news/2018/07/02/china-counts-on-ai-to-find-a-cure-for-its-ailing-health-care-system/**)**

Methodology:

The project will follow a 'mixed methods' approach consisting of qualitative and quantitative methods. Each of the three stages of the project will require a different set of methods:

1. Reviewing and identifying candidate space technologies with potential application in international development

   Methods: broad-based literature review consisting of peer-reviewed and grey literature; use of bibliographic searches (Google Scholar, Scopus, Web of Knowledge)

2. Deploying candidate technologies to address one or more international development challenges (e.g. humanitarian emergencies, infectious diseases, natural disasters)

   Methods: understanding of and ability to develop and operate space robotic technologies

3. Identifying opportunities for 'frugal innovation' to adapt current technologies to suit the needs of low-income countries

   Methods: social survey methods including questionnaire surveys, focus groups, and participatory appraisal; analytical methods including descriptive statistics of quantitative data with SPSS, thematic analysis of focus group transcripts with NVivo, and geographical information system analysis with ArcGIS or QGIS.

Training and skills:
Training and skills will include:

- Bibliographic search in Google Scholar, Scopus, Web of Knowledge
- Hardware and software development in space robotics
- Social surveys methods including questionnaire surveys, focus groups, and participatory appraisal
- Analytical methods for qualitative and quantitative survey data in SPSS, NVivo
- Geographical information system analysis in ArcGIS, QGIS

Partners and collaboration :
Partners and collaborators will include:

- Humanitarian agencies (e.g. Humanitarian Leadership Academy)
- International Development NGOs (e.g. Oxfam, Save the Children)
- Small and medium enterprises developing commercial applications in space technologies

Possible timeline:
Start: February 2020

Literature review, pilot fieldwork, and identification of specific research objectives: Feb-Dec 2020

Probation review: Dec 2020 – Jan 2021

Field research (phase 1): Feb 2021 – Apr 2021 (deploying existing space technologies in a low-income country)

Lab work (adapting space technologies to field conditions): May 2021 – Jul 2021

Field research (phase 2): Aug 2021 – Jan 2022 (adapting and modifying space technologies in a low-income countries and exploring opportunities for frugal innovation)

Data analysis: Feb 2022 – Jul 2022 (qualitative and quantitative analysis of data)

Thesis writing: Aug 2022 – Jan 2023

Contingencies: Feb 2023 – Jul 2023

Further reading:
Betts, A. & Bloom, L. (2014). Humanitarian Innovation: The State of the Art. OCHA Policy and Studies Series No. 009. United Nations Office for the Coordination of Humanitarian Affairs. https://www.unocha.org/sites/unocha/files/Humanitarian%20Innovation%20The%20State%20of%20the%20Art_0.pdf

Daar, Abdallah S., Trillium Chang, Angela Salomon and Peter A. Singer (2018) Grand challenges in humanitarian aid. Nature 559, 169-173. doi: 10.1038/d41586-018-05642-8 https://www.nature.com/articles/d41586-018-05642-8

Dutta, S. C., Nayak, S., Acharjee, G., Panda, S. K., Das, P. K. (2016) Gorkha (Nepal) earthquake of April 25, 2015: Actual damage, retrofitting measures and prediction by RVS for a few typical structures. Soil Dynamics and Earthquake Engineering, 89: 171-184, http://dx.doi.org/10.1016/j.soildyn.2016.08.010.

Hayes, G. P., Briggs, R. W., Barnhart, W. D., Yeck, W. L., McNamara, D. E., Wald, D. J., Nealy, J. L., Benz, H. M., Gold, R. D., Jaiswal, K. S., Marano, K., Earle, P. S., Hearne, M. G:,

Smoczyk, G. M., Wald, L. A., and Samsonov, S. V. (2015) Rapid Characterization of the 2015 Mw 7.8 Gorkha, Nepal, Earthquake Sequence and Its Seismotectonic Context, Seismological Research Letters, DOI: 10.1785/0220150145.

Searle, M. Humanitarian Technology: New Innovations, Familiar Challenges, Difficult Balances. (RSIS, Singapore, 2017 Report) https://www.think-asia.org/bitstream/handle/11540/9579/PR190128_Emerging-Technologies.pdf?sequence=1

Twigg, J. (2015). Disaster Risk Reduction. Good Practice Review, 9.

Further details:

Students should have a background in some combination of geography, international development, science and technology studies, and training at masters level in social research methods, with a keen interest in the application of science and technology to global challenges.

This studentship is interdisciplinary and the student will be welcomed into the Astrobiology Research Group within the STEM faculty and the International Development and Inclusive Innovation Strategic Research Area (SRA) in the Faculty of B Arts and Social Sciences at the Open University.

Please contact shonil.bhagwat@open.ac.uk for further information.

Applications must include:

- a cover letter outlining why the project is of interest and how your skills are well suited to the project
- an academic CV
- an application form and an Open University application form, downloadable http://www.open.ac.uk/students/research/system/files/documents/Application%20form%20-%20ukeu_0.docx
- contact details of three academic references

Applications should be sent to STEM-EEES-PhD@open.ac.uk by 5pm on 30th September 2019

About us:

AstrobiologyOU has recently been awarded a £6.7m 'Expanding Excellence in England' award by Research England to grow capacity and capabilities. This will allow us to expand and bring together expertise in technology, international development and governance to address the scientific and governance challenges associated with the advancement of astrobiology and related space exploration missions. As part of this expansion we will be recruiting new PhD students who will span these discipline areas. Each studentship will play an important role in the growth of AstrobiologyOU.

The PhD candidate joining us for this project will be working in a vibrant interdisciplinary environment, alongside PhD students from STEM, Law and Governance, and Social Sciences. They will also be part of the wider OU student community, which is a friendly and supportive cohort, with regular social events organised through groups such as RocSoc, HookeSoc and the OU Club.