A close-up, slightly blurred image of a green printed circuit board (PCB) with intricate white and silver traces and circular components. The image is oriented vertically, with the top portion showing the board's surface and the bottom portion showing the text area.

EFUTURES

Impact Report

*Feb 2021-
Feb 2022*



Engineering and
Physical Sciences
Research Council

EFUTURES

Table of Contents

04

Executive
Summary

05

Our Story So Far

06

ECR Programme

08

ECR Small Grants

16

Brain-Inspired
Computing
Report

18

2021-22
Workshops

23

Electronics for
Sustainable
Societies

28

Social Media

29

Upcoming events

31

Acknowledgements

Executive Summary

The challenges that the COVID-19 pandemic posed to the international research landscape are already well established. As a national (UK) Network for electronic systems, eFutures sought to pivot our activities in an agile and creative way, so that the community we aim to support and grow could continue to access to our resources.

We did this in three ways: (1) by switching to an online programme of meetings and events, (2) by increasing the frequency of these, to give people who were isolated and working from home the chance to make new connections during lockdown, and (3) by establishing new priority area themes and challenges that reflect the new reality of modern society (rapid diagnostics; equitable access to quality healthcare; new frontiers in compute; and the climate emergency).

Since the grant began in May 2019, we have had over 2000 people attend our events (95% of which were online). Between February 2021 and February 2022 we held 14 online events, including facilitated training for Early Career Researchers, a networking session for women working in electronics, an international panel on Spintronics, the launch of a landscaping report on brain-inspired computing in the UK, a seed fund for medical electronic interventions for deployment by nurses and doctors in low income countries, and a series of workshops exploring how electronic systems can help achieve the UN Sustainability Goals.

This report aims to highlight a portion of this activity, but also point towards future priorities might be, and indicate how we might pivot our activities in new ways for 2022-23.

Our story so far...

Starting in May 2019, the eFutures 2.0 grant aimed to "Address Future Challenges"; both in terms of technological innovation (like embedded solutions) and on an application level (like diverse applications of innovative sensor technology).

Complex challenges require multifaceted and innovative solutions and so our Network takes a multidisciplinary approach.

We are invested in horizon scanning to identify future challenges and also in facilitating the growth and connection of our community, so that collectively we can be ready to embrace opportunities and to formulate innovative solutions to future challenges.

>2000
participants
at our events

"Electronics is the enabler of all things digital. It is the hardware and embedded software that allows products and processes to communicate, have power, have intelligence and awareness, be controlled, be automated and operate safely. It's built into many sectors, including health, aerospace, manufacturing and retail."

- KTN <https://ktn-uk.org/electronics/>

"Electech is everywhere. We often talk about the "multiplier effect" of electech. It adds value and is fundamental to virtually all sectors....."

Electricity infrastructure, electric vehicles, sensors, lighting, television, broadband and so much more are based on electech. We rely on electech and are surrounded by it in almost every aspect of our smart, connected lives."

<https://www.ukri.org/publications/electech-sector-a-roadmap-for-the-uk/>

Our ECR programme

Every year new academics join the electronic systems research sector, and we need to be ready to welcome them into the community and offer support to them at the beginning stages of their career. eFutures aims to do this by (1) signposting opportunities, (2) delivering training and (3) awarding seed funding for proof of concept projects.

Despite the restrictions on the in-person events that are so crucial to networking, we managed to deliver a programme this year that reached over one hundred Early Career Researchers, and awarded them a total of £59,000 in funding. Some highlights of this programme are in the table below.

EVENT	LEAD	OFFER
Working with Industry (15th July 2021)	Facilitated by Dr Nik Watson, University of Nottingham.	Presentation of practical insights into working with Industry, including developing research proposals with industry partners and the lessons learnt.
Understanding your Creative Mindset (23rd June 2021)	Hosted by Beth McEvoy (QUB) with professional facilitation from ReJig Consultancy	Introduction to Design Thinking for 25 ECRs, including FourSight Profiling and practical group exercises.
Writing Workshop (4th August 2021)	Facilitated by Dr Oliver Fisher, University of Nottingham.	Practical session to help Early Career Researchers develop their proposal writing for the Small Grant Programme.

Feedback from ECRs



88%

of participants scored the events 5/5

"I LOVED LEARNING ABOUT THE DIFFERENT PROFILES; AND THINKING HOW THIS WILL IMPACT ON HOW WE APPROACH FUTURE WORK AND HOW WE WORK WITH STAKEHOLDERS"

"I liked how challenging the session was - very insightful. I am very glad I joined"

"I WISH THIS COULD BE AVAILABLE TO EVERYONE IN MY DEPARTMENT"



100%

PEOPLE

said the training more than met their expectations



100%

PARTICIPANTS

said they now wanted to undertake more design thinking training

ECR Small Grants: 2021





1

Feasibility of objective, real-time digital capture of rapid diagnostic test results in community clinics in Senegal, using cloud-connected readers

PI: Dr Elizabeth Fitchett, London School of Hygiene and Tropical Medicine.

Dr Elizabeth Fitchett is a Clinical Research Fellow at London School of Hygiene & Tropical Medicine. She is a clinical doctor and held a Kennedy Scholarship to Harvard's TH Chan School of Public Health

The Institut Pasteur de Dakar Foundation (IPD) is a Senegalese foundation and national public health institute, serving as the WHO Centre for Arboviruses and Viral Haemorrhagic Fever, the WHO regional reference laboratory and vaccine manufacturing facility for yellow fever, and one of two laboratories designated by the Africa Centres for Disease Control as reference centres for SARS- CoV2.

DIATROPIX is a social venture, headquartered at Institut Pasteur Dakar, working to accelerate access to diagnostics in Africa. The primary focus of DIATROPIX is the manufacturing of high quality and affordable Rapid Diagnostic Tests based on lateral flow technology (RDTs) to serve the African market. It is strictly demand-driven and provides its services via the subscription to an annual membership by African states and supranational organisations, Non-Governmental Organizations, and international donors.

Currently, DIATROPIX works in close collaboration with three private technology transfer partners, namely Mologic (UK), the bioMérieux/Institut Mérieux (France) and BIONOTE (South Korea).

" Our aim is to assess the feasibility, usability and acceptability of digital RDT readers; both for providing objective test results at the point-of-care to guide treatment decisions, and for capturing data for surveillance, research and monitoring of public health interventions."



Project Team Members

Marieme Samb, Technology Transfer Specialist and Molecular Biologist, DIATROPIX, IPD
Awa Faye, Laboratory Technician, DIATROPIX, IPD

Oumar Ndiaye, Production Manager, DIATROPIX, IPD

Dr Cheikh Tidiane Diagne, Director, DIATROPIX, IPD

Dr Elizabeth Fitchett, Clinical Research Fellow, LSHTM

Dr Aliou Barry, Infectious Disease Epidemiology Unit, IPD

Dr Joseph Fitchett, Senior Advisor for Biotechnology, IPD

Professor Shunmay Yeung, Head of the Clinical Research Department, LSHTM

Progress Report

The project has three key stages:

- 1) In-lab calibration and testing of rapid test readers: accuracy, reliability and usability
- 2) Pilot implementation in community clinics: feasibility, usability and acceptability
- 3) Evaluation of feasibility of integration within a cloud- connected surveillance network (dependent on stages 1 and 2)

Stage 1: Progress

Through our collaboration with ExperimentX; we have conducted in-lab testing of Igloo™ RDT readers and an associated phone and tablet based app (DxCare™), to assess their accuracy, reliability and usability. Specifically, we are assessing:

1. Ease and reliability of calibration for using Igloo™ with the DIATROPIX SARS-CoV2 antigen test (SAYTU), at a range of sample concentrations (using SARS-CoV2 antigen spiked calibration samples)
 2. The digital readings of lateral-flow rapid test device results including:
 3. Successful capture of the test device image
 4. The reliability of returning results to the DxCare app using Bluetooth connectivity
- c. Appropriate 'interpretation' of the result
1. The functionality of reading results at a pre-specified time interval
 2. The data output from the DxCare app (and whether usable for monitoring, research and
 3. surveillance purposes)
 4. The duration of functionality without access to power

These analyses will complete at the end of April 2022, during which we are also planning next steps for Stage 2: the implementation pilot study.

2

SMILE – System for Monitoring Infants in Low-Resource Environments

PI: Dr Steven Sam, Brunel University



Dr Steven Sam (PI)

Dr Steven Sam's research activities centre around ICTs and society, HCI (including HCI4D) and computing for social good. His work has involved the effective use of technologies to amplify social impact solutions that deliver real change in society. He has employed a range of approaches such as ethnography, user-centred design, participatory design and data-driven approaches to develop and evaluate the use and impact of context-based technology solutions for complex societal problems in areas such as health, education, agriculture and social welfare. Steven is a Lecturer in Computer Science and the founder and co-leader of an interdisciplinary computing for social good research group at Brunel University London.



Dr Cigdem Sengul (CoI) received MS and PhD degrees in Computer Science from the University of Illinois at Urbana-Champaign (UIUC) in October 2003 and 2007, respectively. Since 2008, she has worked and led small and large-scale projects on networked systems and the Internet of Things in various R&D environments in the USA and Europe; she published and presented more than 50 journal and conference publications and demonstrations.

Dr Sengul contributes to standardisation activities in IETF for IoT security. She also has interdisciplinary work experience; she is the PI of the EPSRC-funded THRIDI project (Trust in Home: Rethinking Interface Design in the Internet of Things) and designed and facilitated an online design workshop with two co-PIs, with the participation of 24 researchers.

SMILE – System for Monitoring Infants in Low-Resource Environments



Dr Sylvia Fasuluku (Col) is Medical Doctor with experience in research and practice in both Europe and Africa. She has served as a Medical Doctor at the Princess Christian Maternity Hospital for approximately Five (5) Years. She has worked as a Sexual Reproductive Health (SRH) Programme Specialist at the UNFPA. Sylvia is currently a District Medical Officer in the Western Area Rural, Sierra Leone, where she has developed a project to address the high maternal and infant mortalities in the Western Area Rural District, and a space challenge project for the District Health Management Team Office and Drug Store that was approved by the World Bank.



Mr Sylvester Darlington Macauley (Col) is a dedicated professional with a strong background in social development project management, information technology, research and general office administration in Sierra Leone. He has a combined 24 years' experience working both in the private and social organisation sectors. Sylvester is a Country Director of Mamie Foundation Sierra Leone, the main partner organisation that is leading and supervising the project SMILE locally.

About SMILE

SMILE (System for Monitoring Infants in Low-Resource Environments:) aims to assist efforts to reduce infant and under-five deaths in Sierra Leone through developing culturally appropriate, people-led design of wearable IoT solutions to:

i) facilitate remote monitoring of infant health (vital signs such as temperature, pulse rates, respiration blood pressure, etc.) and detection of critical illness in non-clinical settings and

ii) improve healthcare access and ethical and FAIR data sharing between parents and health workers.

Sierra Leone is among the countries in the world with the highest infant mortality rates, estimated at 39 per 1000 live births – this is three times higher than the Sustainable Development Goal target of 12 infant deaths per 1000 live births by 2030.

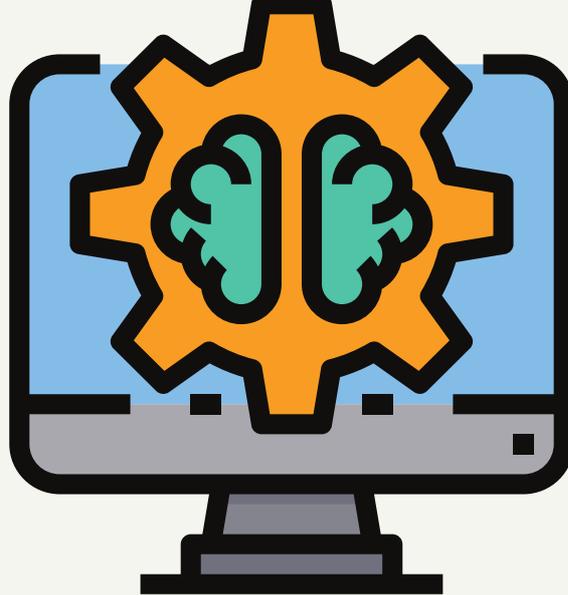
SMILE will be the first infant wearable technology system in Sierra Leone, to offer remote health monitoring solution with a range of support features for effective communication and clinical information and data sharing that are contributing factors for infant deaths.

If you are an Early Career Researcher and would like to join the eFutures Network + , including access to pump priming funding calls, events, advice, and training opportunities, please email the Project Administrator, Tiffany Forde:

t.forde@qub.ac.uk

The logo for EFUTURES is located in the bottom right corner of the page. It consists of the word "EFUTURES" in a white, sans-serif, all-caps font. The letter "E" is highlighted in a light green color. The text is positioned on a dark blue circular background that is partially visible at the bottom right of the page.

eFutures Report: Brain-Inspired Computing



In August 2021, we published an independent report on the UK's current capabilities and future potential in energy efficient neuromorphic computing.

The report emerged from detailed discussions between UKRI-EPSC and the UK electronics systems community about the enormous potential of a radical new technology: brain-inspired, neuromorphic, computing, to transform the Artificial Intelligence (AI) landscape and spawn new industries, all while accelerating the adoption of AI – a government priority (and a central theme of the UK's new AI Strategy).

The community and EPSC recognised early on that the UK has a leading position in this field, hosting some of the world's pre-eminent researchers, and a growing number of start-up companies laying the groundwork for a new industrial sector. We are delighted that the independent international experts who wrote this report concur. They describe compellingly the promise of this exciting new technology to increase massively the energy efficiency of computing. **They highlight where the UK holds a lead, and where it can leverage that to disrupt and innovate.**

They concluded that now is the time for the UK to capitalise on its strengths and create a Centre of Excellence as a focus and stimulus – bringing together the somewhat disparate groups working in the field; enabling the best science; training the next generation of researchers and innovators and, importantly, accelerating innovation and translation to industry.

What is proposed is distinct from, but highly complementary to, existing initiatives such as the Turing Institute. The new entity would focus on wholly new ways of computing – ways that take inspiration from the brain rather than being further developments of existing digital technologies – and would initially focus on hardware: new types of computer that are hugely more power efficient than existing digital systems.

The new technology would disrupt AI, sensors, satellites, automotive, and industrial process control – all important UK industrial sectors.

“Why is it that a human brain working at 20 watts can outperform a supercomputer that is using many kilowatts? It is this puzzle that brain-inspired computing is trying to solve”
– Hermann Hauser

90
people at
the
launch
21 UK
universities
involved

EFUTURES

**The UK Landscape in
Artificial Intelligence
and Brain-Inspired
Computing Hardware:
the potential for
establishing a new
Centre of Excellence**

August 2021

GIACOMO INDIVERI,
UNIVERSITY OF ZURICH AND ETH ZURICH

WALID NAJJAR,
UNIVERSITY OF CALIFORNIA, RIVERSIDE

EFUTURES

eFutures Workshops: 2021-2022



EFUTURES

1 Spintronics

EFUTURES

Spintronics

11th March 2021

In partnership with the Universities of Edinburgh and Glasgow, we ran an online forum to present cutting edge European research exploring the potential of next-generation nano-electronic technologies.

The event was jointly hosted by **Dr Hadi Heidari (University of Glasgow)** and **Dr Srinjoy Mitra (University of Edinburgh)**, with a Keynote from **Professor Robert Bowman (Queen's University, Belfast)** on "HAMR time.... challenges for data storage". Professor Bowman's talk addressed the global need and demand for ever increasing data storage to support private (e.g. IoT, social media), government (e.g. surveillance) industrial (e.g. AI, FoF), economic (e.g. digital services, WFH). He surveyed the evolving landscape of hard drives, and looked at new recoding paradigms that will be used, focusing on heat assisted magnetic recording, and some consequential challenges it poses for parts of the recording head subsystem like spintronic reader.

This Keynote was followed by the following talks:

"**Magnetoresistive sensors: not-so-new physics enabling new applications**" – **Prof. Dr Susana Cardoso de Freitas, INES (University of Lisbon)**

"**Radio-frequency Spintronic neural networks**" – **Dr Julie Grollier, CNRS (French National Centre for Scientific Research)**

"**Skyrmions in chiral magnetic multilayers**" – **Prof Christopher Marrows, University of Leeds**

"**Spin electronics for bio-magnetic recordings**" – **Prof. Dr Myriam Pannetier-Lecoeur, CEA (Atomic Energy and Alternative Energies Commission)**

56 PEOPLE

100%

gave the event a 5 star rating

2

Can

Electronics

Evolve Digital

Manufacturing?

EFUTURES

6th May 2021

In partnership with the EPSRC-funded Connected Everything Network +, we hosted a two-part event chaired by **Dr Nik Watson (University of Nottingham)** that posed the question of how electronics will enable future advances in digital manufacturing, and posited what those advances might be.

Keynote: **Professor Mark Gillan**, COO of Artemis Technologies

Talks and a panel session by:

Dr Alessandra Caggiano, University of Naples

Dr Alessandro Simeone, Shantou University

Dr Nick Polydorides, University of Edinburgh

Dr Carmen Torres Sanchez, University of Loughborough

Dr Sarah Connolly, Innovate UK.

46 PEOPLE

94%

Rated the event excellent

Things attendees loved

"GREAT PANELLISTS - REALLY INTERESTING TALKS"

"DIVERSITY OF TOPICS AND SPEAKERS"



70% ATTENDEES FROM INDUSTRY

3

Healthcare Technologies for Low & Middle Income Countries



14th May 2021

We ran the second iteration of our interactive online workshops asking "How can new technologies address the healthcare needs of low and middle income countries?". This year's event, chaired by **Prof Pantelis Georgiou (Imperial College London)**, looked at a number of new case studies as well as holding a panel Q&A.

Talks from:

Dr Paul Arkell, Imperial College Healthcare NHS Trust

Dr Conor O'Mahony, Tyndall National Institute, Cork

Professor Heike Rabe, Professor of Perinatal Medicine at Brighton and Sussex Medical School & Honorary Consultant Neonatologist Brighton & Sussex University Hospitals Trust

Esther Shaylor, Innovation Specialist at UNICEF, Copenhagen

Dr Louise Thwaites, Oxford University Clinical Research Unit, Ho Chi Minh City

99
PEOPLE

"Talks were all at an informative, high level - not too technically detailed. Topics were all very closely related which was great."

EFUTURES

4 Many Futures of Cybersecurity



Many Futures of Cybersecurity 22nd June 2021

Held in partnership with the Centre for Secure Information Technologies (CSIT) at Queen's University, Belfast and the UK Research Institute in Secure Hardware and Embedded Systems (RISE) at the University of Bristol, this workshop explored the question: **"Is Engineering Significant Difference the key to enhanced cybersecurity?"**

Hosted by **Regius Prof. Máire O'Neill**, ECIT, Queen's University, Belfast, and **Prof. Kerstin Eder**, Trustworthy Systems Laboratory, University of Bristol, the session heard a keynote given by Peter Davies, Thales, titled **"Significant Difference in Cyber Security"** was , followed by presentations from:

Dr Chongyan Gu, Queen's University, Belfast, on **"Hardware Security for Engineering Significant Difference"**

Prof. Weiqiang Liu, Nanjing University on **"Approximate Computing and Security"**

Dr Daniel Page, University of Bristol, on **"Diversified Instruction Execution"**

The panel discussion focused on challenges and opportunities for the deliberate introduction of differences into otherwise digitally identical systems to improve their cyber security.

**87
PEOPLE**

"Some fascinating talks that approached the question from a wide range of perspectives . Excellent event."

EFUTURES

Electronics for Sustainable Societies Series



EFUTURES

Four online
events

332
participants

26 speakers
from 11
countries

42% of
speakers were
women

UK speakers from

Bournemouth University
University of Cambridge
University of Glasgow
Lancaster University
University of Liverpool
University of Newcastle
Queen's University, Belfast
University of Southampton
Ulster University

EFUTURES

"Excellent speakers provided interesting and varied views on the central topic"

"Talks were great!"

"Diverse presentations and diverse panel - really useful event"

"All elements were very interesting"

"The mix of input was great - really helpful to get different perspectives from each of the contributors"

EFUTURES

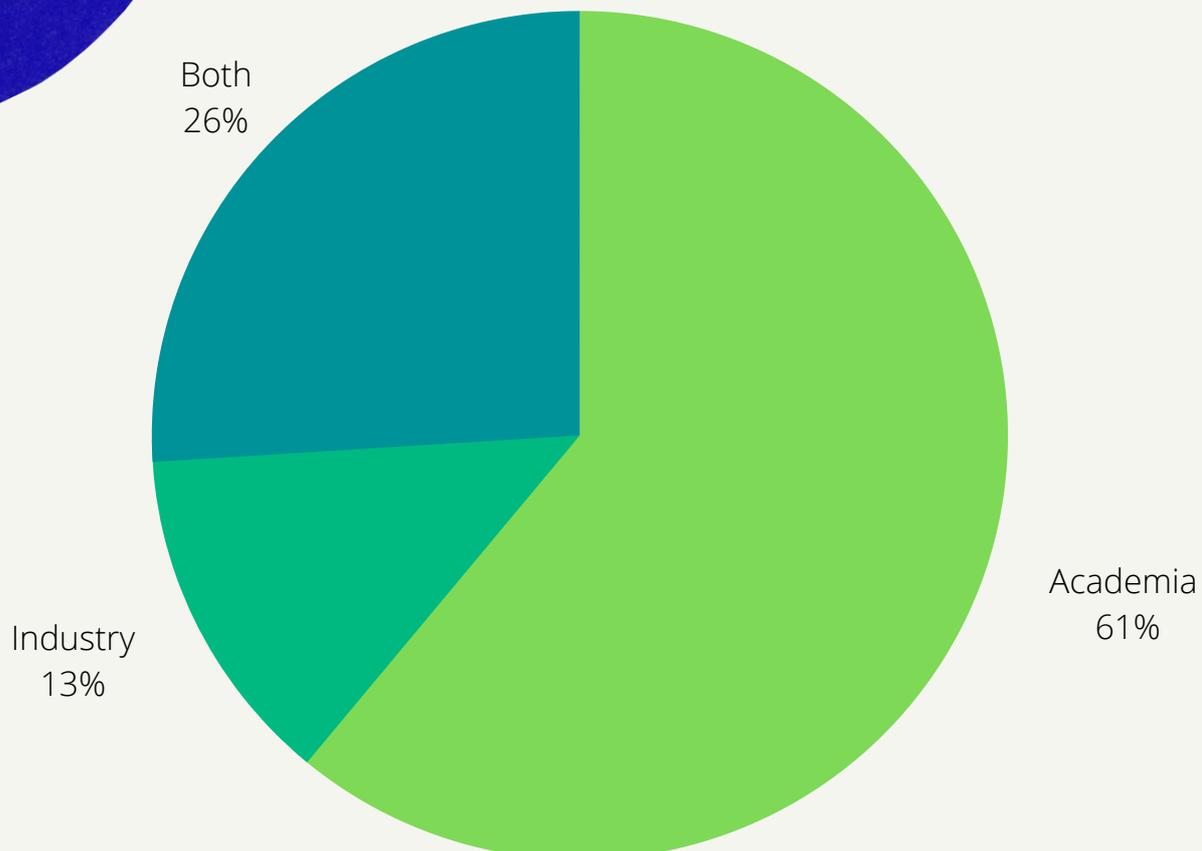
Average score
for events:
4.5 out of 5

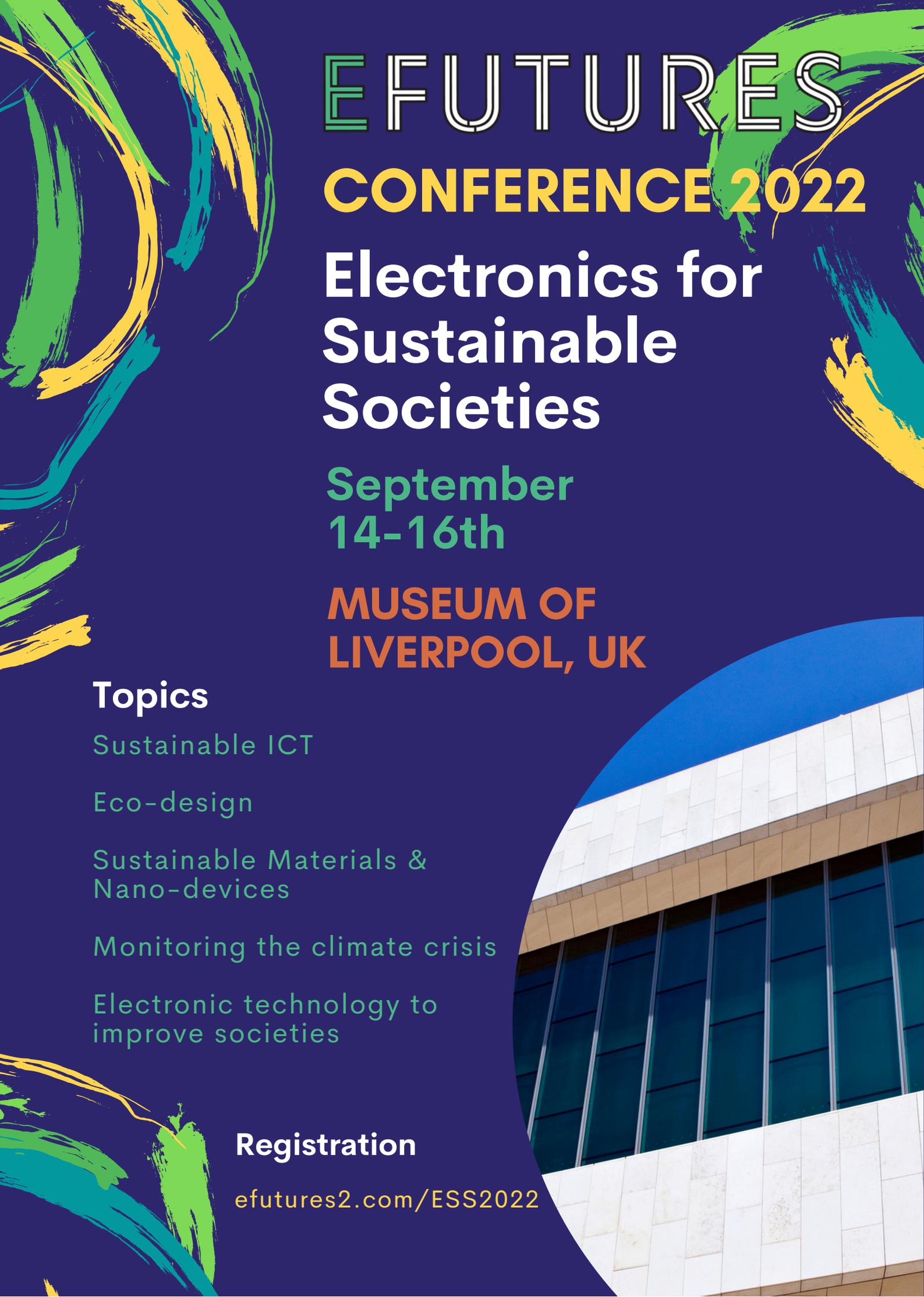
19% of
participants
fed back

94% of
respondents
said the events
met their
expectations

100% of
respondents said
they would
participate in
another eFutures
event

Our respondents were from:





EFUTURES

CONFERENCE 2022

Electronics for Sustainable Societies

September
14-16th

MUSEUM OF
LIVERPOOL, UK

Topics

Sustainable ICT

Eco-design

Sustainable Materials &
Nano-devices

Monitoring the climate crisis

Electronic technology to
improve societies

Registration

efutures2.com/ESS2022



eFutures Social Media Feb '21-'22

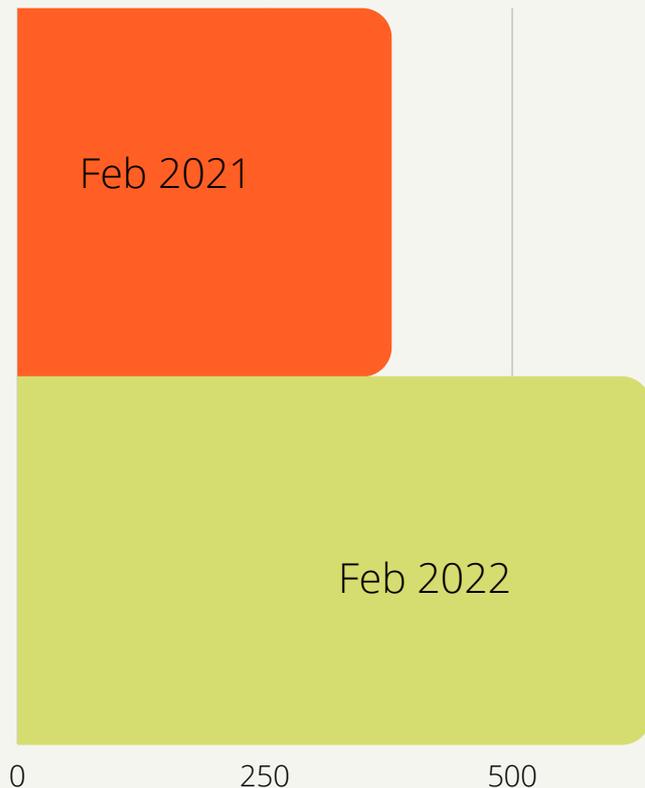


285,663
tweet
impressions

34,309 visits
to our twitter
profile



Twitter Followers



968 relevant
followers
on LinkedIn

EFUTURES

2022 Events



To register for any of these events by signing up for the eFutures newsletter, please email t.forde@qub.ac.uk

EFUTURES

150
places

Conference 2022
14–16 September
Museum of Liverpool

Electech for Healthcare
16–17 November
Royal Geographical Society,
London

80
places

30
places

Middle Career Researcher event
1–2 December
Queen's University, Belfast

EFUTURES

EFUTURES

Acknowledgements

eFutures Principal Investigator, Professor Roger Woods, Queen's University Belfast

eFutures Co-Investigator, Professor Anthony O'Neill, University of Newcastle

The eFutures' Steering Group members: Dr Alex Oliver (EPSRC), Dr Andrea Kells (Arm), Beth McEvoy (Queen's University, Belfast), Dr Bipin Rajendran (King's College London), Dr Catherine Ramsdale (PragmatIC Semi), Cathal McCabe (Xilinx), Prof. Eiman Kanjo (Nottingham Trent University), Dr Elizabeth Rendon Morales (University of Sussex), Prof. Esther Rodriguez Villegas (Imperial College London), Prof Geoff Merrett (University of Southampton), Dr Hadi Heidari (University of Glasgow), Dr Hamza Shakeel (Queen's University, Belfast), Dr Ivona Mitrovic (University of Liverpool), Prof Jim Harkin (Ulster University), Prof. Kerstin Eder (University of Bristol), Dr Martin Trefzer (University of York), Dr Matt Ball (Thales), Prof. Merlyne de Souza (University of Sheffield), Dr Michael Hill-King (Huawei), Prof Pantelis Georgiou (Imperial College London), Dr Paul Huggett (KTN), Prof Piotr Dudek (University of Manchester), Dr Rishad Shafik (University of Newcastle) Prof Rob Mullins (University of Cambridge), Dr Srinjoy Mitra (University of Edinburgh), and Tiffany Forde (Queen's University, Belfast).

Also at EPSRC: Dr James Coombs OBrien, Dr Maryam Crabbe Mann, Dr James Dracott, and Dr Glenn Goodall

Our speakers and workshop chairs; and all our Network Members

We thank you
for your
continued
support
of our
programme

© eFutures Network +, May 2022

EFUTURES