



EPSRC UKI-FNI in Future Networks Initiative
Delivering Social Good in an Uncertain World
Hothouse for PhD and ECRs
Date- 24th and 25th October 2024
Workshop Report

Executive Summary

Wireless digital connectivity has the potential to deliver massive social benefits, from improved education, healthcare, food sustainability and security, environmental disaster response and recovery, and economic growth through enabling access to international markets. Real challenges exist however, including the escalating cost and environmental impact of infrastructure, cost of devices and service provision to ensure access by all communities, and the need for effective governance and regulation to ensure fairness and safety of citizens. This workshop brought over 30 early careers researchers, PhD students and seasoned educators together with experienced individuals from the telecoms and space industry, regulators and government departments to discuss approaches for maximising the impact of research within the UK-India Future Networks Initiative and the UKRI Future Telecoms Hubs.

This workshop was structured around three independent sessions each of which included briefings, panel sessions, facilitated interactive discussions, and summarisation as follows:

- 1) Societal Drivers, Potential Markets, and Business Factors and Models
- 2) Technology and Innovation in AI and Telecoms and the impact on communities
- 3) Regulation, Innovation, and Collaborative Research Mechanisms

The following findings were developed by the researchers themselves during the workshop:

- i) The sharing of real-world challenges within such workshops generates significant motivation for directing the research towards achieving impact
- ii) Empirical evidence from both industrial market analysis and wider economic studies is a valuable source of information for directing research activities
- iii) Satellite and Terrestrial Telecommunications Networks have the potential for delivering social and macro-economic impact change on a global scale
- iv) Education, digital and creative industries were considered by the researchers to have the biggest impact on socio-economic growth
- v) The rapid integration and acceptance of AI and autonomy in transport systems is likely to have a consequential acceptance in other areas such as digital healthcare
- vi) Consideration of commercial factors and the reality of business models is essential to ensure outputs of research activities are exploited
- vii) Environmental factors such as carbon footprint of economic activity, the embodied carbon and energy cost of operating networks are critical areas for future research
- viii) Creating networks between researchers the wider industrial base, the regional support communities and the regulators opens avenues for exploitation

Each of the researchers identified and committed to either a change of emphasis to their own research to align with social good or environmental impact, or a specific action that they would pursue to increase the likelihood of their research being exploited.

Structure of Workshop

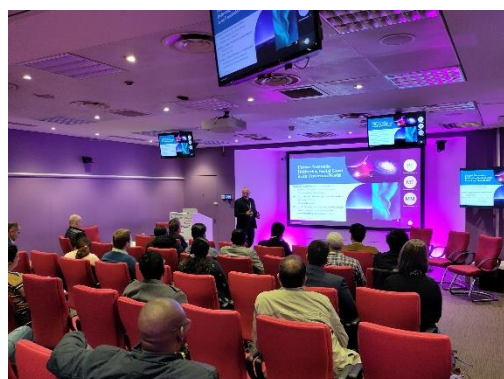
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Workshop 1: Social, Economic & Commercial Factors

Introduction and Context	Mike Short, Catapult	The context for telecoms – global markets and trends
Business Challenges Future Networks - A Telco View	Paul Tomlinson, BT	Awareness of challenges facing telecoms businesses
Societal Factors – UK Government policy drivers	Muhammed Miah, DSIT	Awareness of economic drivers and policy
Briefing: Impact of Data and AI on corporate strategy	Mike Williams, BT	Impact of Data, Information, and Governance regarding AI
Panel Q&A session	Stimulate technology and business thinking	

Working Group 1A: Economic factors



Markets & Societal Drivers

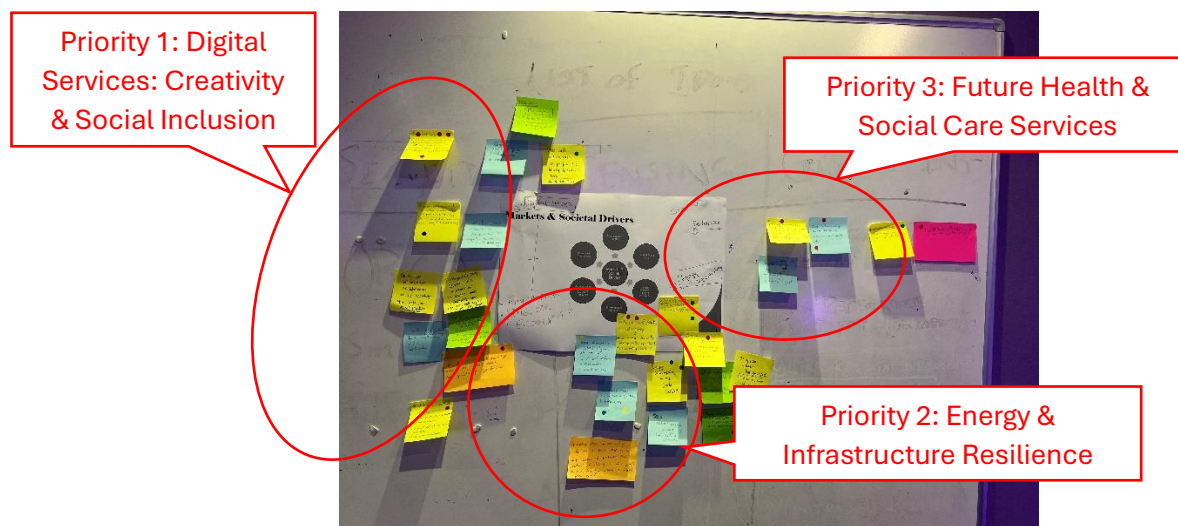


The working group discussed the social, economic, regulatory, environmental and political factors, & opportunities for use of technology to deliver social good, for various sectors:

- a. Food security and water infrastructure
- b. Health and social care, education and housing
- c. Energy, transportation and digital infrastructure
- d. Environmental protection & climate resilience
- e. Manufacturing, minerals & extractive industries
- f. Security of communities



The output of the intense discussions regarding the value proposition and societal trends resulted in a specific prioritisation and classification that the researchers felt were key to future impact:

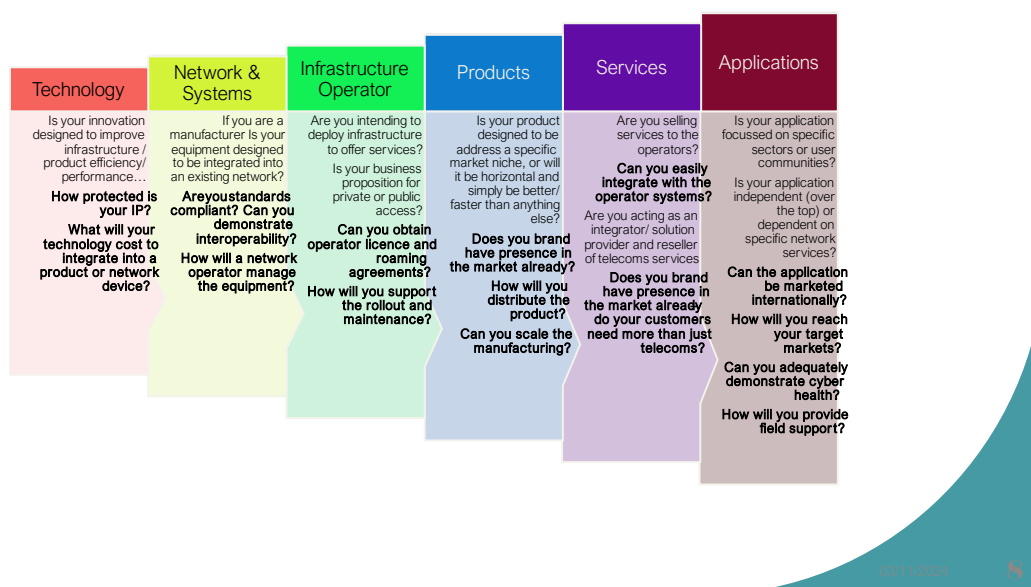


In particular three main domains were highlighted:

- 1) **Digital Services:** These were viewed as the most significant factor regarding social inclusion, enabled by wireless digital connectivity. The advent of digital payment systems combined with evolving social networks allow local marketing and monetisation of micro-services as well as access to a global market for creative products.
- 2) **Critical Infrastructure Services:** The importance of equitable access to energy and water was highlighted as imperative for emerging economies. Digital wireless infrastructure was highlighted as key to both management of renewable energy systems and governance of sustainable use of scarce resources such as fresh water.
- 3) **Future Healthcare:** Social factors such as aging population, and also the social acceptance of AI and advanced sensors and diagnostics as key factors driving uptake of innovations in healthcare dependent upon wireless digital connectivity.

Working Group 1B: Business Model Considerations

Supply & Value Chain- Innovation



The key takeaways from the first business and technical workshop included:

- 1) The necessity for a strategy and vision to drive impactful innovation
- 2) The need for evidence of market existence – the use of reference material from industrial sources such as output of trade-bodies (e.g. TechUK, GSMA) should be considered
- 3) Digital and Telecoms domains should be considered together when innovating
- 4) Network Billing data, customer care data should be used with data from the channel to market should be evaluated, with the interdependency between ‘AI for Telecoms’ and ‘Telecoms for AI’ being important to acknowledge and distinguish
- 5) Data protection legislation and competitive pressures are increasingly significant factors from an industrial perspective – Security from the perspective of protection of individuals and protection of organisations requires collaboration across multiple domains
- 6) Open architectures, APIs and standards facilitate innovation and growth, and can enhance security and help minimise fraud when combined with appropriate identity management standards
- 7) The challenges associated with periods of ‘feast and famine’ must not be underestimated
- 8) Innovation policy should embrace technology neutrality



Workshop 2: Societal Impact of the Technology Trends in Connectivity and AI

Introduction and Context	Gerard Parr, UEA	The context for telecoms – global markets and trends
Wireless connectivity	Ian Thurlow, BT	Industrial context: IoT services and business models
AI & Computing resources	Prof Detlef Nauck, BT	Industrial context: AI Technology Trends, Impacts, implications
Open technology innovation	Subrat Kar, India	Open technology innovation
Digital Inclusion use-cases	Chandra Murthy	Indian societal context and trends
Panel Q&A session	Stimulate futures thinking for technology and innovation	

Workshop 2A: AI Accessibility, Responsibility, Sustainability, and Ethics

Artificial intelligence offers the opportunity for individuals to access the knowledge of humanity and circumvent language barriers and facilitating social and commercial interactions at scale. The challenge is that such cloud AI systems consume valuable earth resources such as materials, energy and water at an astronomical rate.

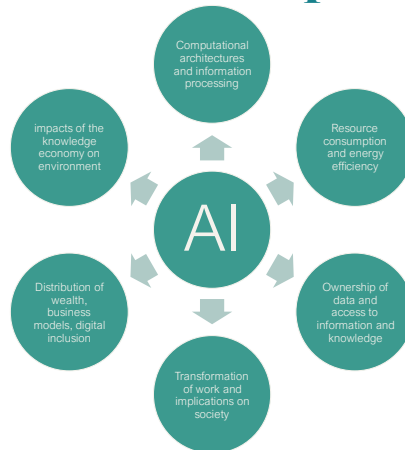
The participants were encouraged to consider the following question:

How can research in Future Telecoms take into account responsible innovation to ensure sustainable and equitable access to such enablers as digital public services that are supported by AI, while also preserving the dignity and rights of individuals?

In particular the participants were invited to consider the trajectory of innovation in data and information services, artificial intelligence and access to knowledge from the perspectives of:

- Computational architectures and information processing models
- Resource consumption and energy efficiency
- Ownership of data and access to information and knowledge
- Transformation of work processes and implications on society
- Distribution of wealth, business models, and implications for digital inclusion
- Positive impacts of the knowledge economy on environment

AI –Equitable Access & Responsible



Approach

The participants were encouraged to imagine a future dystopic scenario – what is the worst case scenario/ fastest way to fail... and how could this be avoided?



The participants identified many dystopian outcomes including:

- excessive consumption of planetary resources (energy and water) contributing to climate change, and even AI self-determinism and control of such resources
- control over access to technology used to enrich a few individuals rather than improve livelihoods
- use of AI to manipulate community sentiment and even individual consciousness
- dissemination and promotion of disinformation
- AI for identity theft and impersonation to circumvent privacy controls
- Emphasis on training mechanisms for AI based upon lowest-common denominator, stifling cultural diversity and personal creativity

The group considered that the research being undertaken could be oriented towards addressing a number of these concerns, but that it would require significant interventions both from a regulatory perspective and from national and international policy perspectives to ensure success. Particularly relevant research areas included:

- a) Research into high efficiency wireless technology standards, software radio platforms, intelligent network resource management, and the integration of NTN systems to incentivise commercial investment in low-carbon solutions for connectivity;
- b) Open-source approaches to dissemination of research, combined with open innovation approaches to intellectual property and creation of international collaboration frameworks that incentivise diversity and collaboration;
- c) Research into trust-worthiness of AI platforms and explainable AI technologies;
- d) Structured educational frameworks to help building of skills in disadvantaged communities and countries with emerging and fragile economies.

Workshop 2B: 6G Connectivity for Resilience and Sustainability

The demand for wireless digital services is tempered by the cost to achieve ubiquitous resilient networks, and consequential environmental cost and price to end-users. Combining Terrestrial and Non-terrestrial networks may provide means by which these costs may be lowered, but what needs to be done to make this a reality?

How can innovation ensure that such advanced digital communications capabilities are within the reach of disadvantaged communities on a global basis?

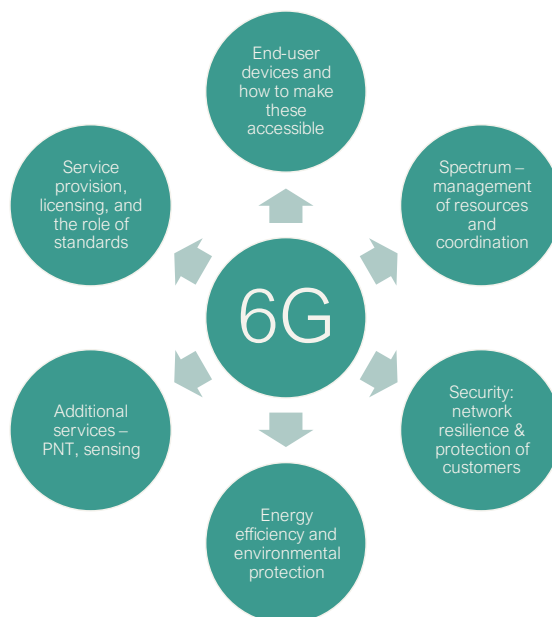
In this group, the participants considered what might need to be done to realise the potential benefits of integration of satellite and terrestrial systems, including perhaps:

- a) Implications on end-user devices and how to make these accessible
- b) Implications on spectrum – management of resources and coordination
- c) Implications on security, both from a network resilience and protection of customers
- d) Consideration of energy efficiency and environmental protection
- e) Potential for new services such as augmentation of PNT, integration of sensing
- f) Challenges of service provision, licensing, and the role of standardisation

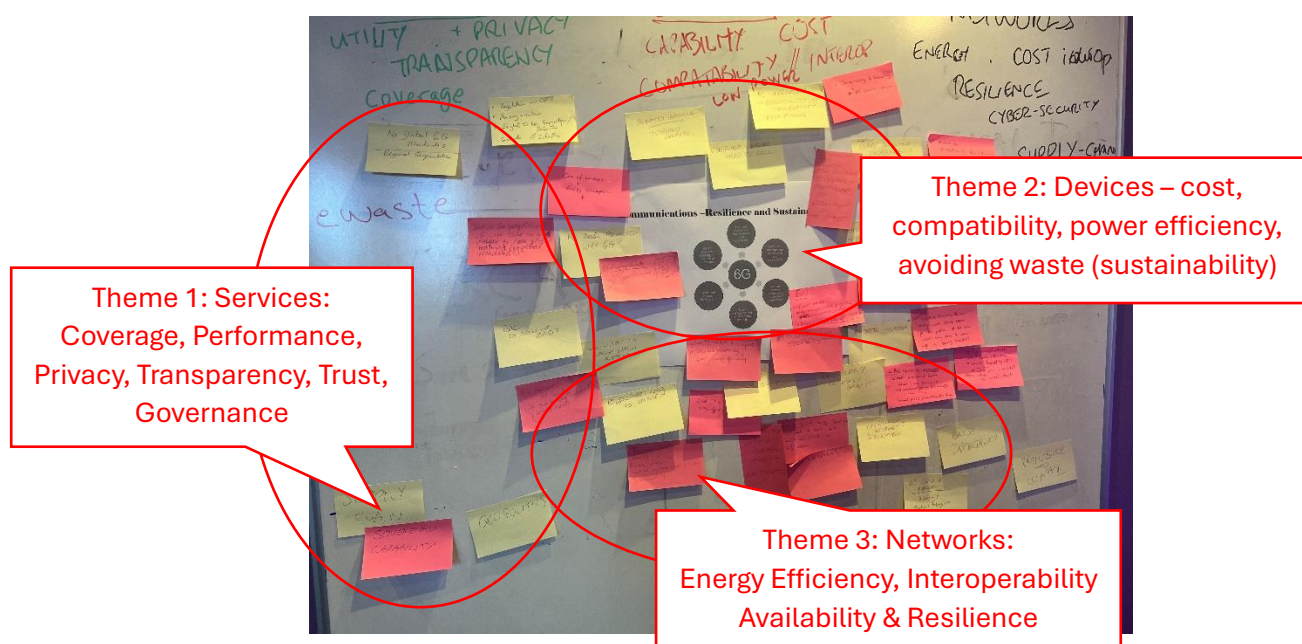


Ways in which the research might make services more accessible to communities on a global basis were considered.

Communications – Resilience and Sustainability



03/11/2024



The continuous demand for more connectivity were noted as having potential implications, including excessive consumption of energy and water, pollution to the environment, radiation effects on human health, pandering to consumer desire for ultra-high power devices, and new forms of societal dysfunction such as online harms. However, it was generally agreed that governed properly connectivity offers a net benefit. Discussions then centred around the need for sustainability, accessibility and availability (including resilience), and these clustered around three main themes, being Services, Devices and Networks.

The following insights and recommendations were derived:

- 1) Regulation for services should be sufficiently open to incentivise competition, while applying stringent controls relating to governance of customer data and privacy
- 2) Applications and services that efficiently utilise data and spectrum are key
- 3) Adherence to standards is imperative to achieve manufacturing scale and low cost
- 4) Standards should evolve facilitate backwards compatibility and interoperability with legacy devices to maximise useful lifetime of products and minimise waste
- 5) Network technology development should embrace power saving mechanisms to reduce impact on the environment
- 6) Satellite and Terrestrial systems integration should prioritise resilience and reach
- 7) Open standards and interfaces should continue to be a priority for the research community to drive for interoperability

Workshop 3: Research and Innovation in a Local, National and Global Context

Pathways for Impact and Potential for Personal Contributions	P Febvre Prof-Space Ltd	Regulation, Innovation & Commercialisation
International & Regulatory Affairs: Spectrum / Market Access	Simon Burley, Ofcom	Understanding regulatory & international dimensions
UK and International Dimensions regarding innovation	Richard Foggie, Innovate-KTN	Understanding Mechanisms for supporting innovation
The role of regional clusters as means to engage with SMEs	Stuart Catchpole, Space-East	Understanding how to engage with clusters
Panel Q&A session	Regulating Innovation	

Within groups the participants were asked to consider the following question:

How should economic factors be taken into account when developing regulation, policies and strategies for innovation in the UK, in India and internationally to incentivise behaviours towards achieving long-term social benefits from Future Networks?

In particular, the groups were asked to consider and discuss relevant pathways for commercialisation of their own research through, considering the information they had received. These discussion points included consideration of the benefits and approaches for engaging with other communities including:

- i) Researchers working in relevant adjacent areas
- ii) Researchers working in similar areas in other nation states, including India
- iii) Industrial organisations looking to invest in skills as well as driving standards
- iv) Small and medium size enterprises working in products, services, and applications
- v) Regulators and international organisations aiming to ensure benefits for citizens

The participants were asked to commit to one specific change that they would make to either the orientation of their research or in the approaches that they would follow for generating impact.

Every single researcher in the workshop expressed that they had learned something that they wished to share, and volunteered a specific personal commitment to re-orienting their research towards achieving greater impact and social good!



The following is a short summary of the various commitments made by each researcher:

- i) Five of the researchers pledged to re-orient their research towards achieving greater energy efficiency, traceability, or integrating sustainability goals
- ii) Six of the researchers pledged to investigate means of integrating improving assurance and trust mechanisms and/or better governance and privacy of personal data into their research approach
- iii) Four of the researchers pledged to introduce societal factors into their research, including consideration of cultural factors in such aspects as human-machine interfaces
- iv) Six researchers committed to building greater relevance to commercialisation through studying of industrial white papers, participating in regional networks and engaging with industry forums.
- v) Five researchers intended to reach out through the FNI network and build upon links with researchers in India to develop new collaborations

Commitments were also made by the panellists and organisers of the workshop as follows:

All panellists agreed to share their contact details for future consultation, and in particular:

- i) Stuart Catchpole will offer a conduit towards other regional groups
- ii) Richard Foggie will help researchers access InnovateUK relevant specialists
- iii) Simon Burley will act as a conduit for discussions on regulatory and spectrum
- iv) Paul Febvre will act as a conduit to the Catapult networks
- v) Mike Williams will act as a conduit to researchers and leaders within BT for discussion on exploitation of telecoms and AI related technologies
- vi) Gerard Parr will commit to establishing means by which the researchers can engage in further discussions on the key topics raised by the participants in this workshop

Conclusions

The UK-FNI steering committee committed to the following:

- i) Set up an enduring mechanism for this forum to maintain communication
- ii) Establish the opportunities for collaboration with social science communities

Key recommendations from the workshop included the need to establish a

- i) Special Interest Group(s) for researchers to engage in further dialogue on the main subjects raised during the workshop
- ii) Researchers would like to participate in a future Horizon Scanning for Future Integrated Telecoms to include TN/NTN integration



Workshop Organisers

UKI-FNI Team:

Prof Gerard Parr- UEA
 Prof Steve Hailes- UCL
 Prof Lajos Hanzo- Southampton University
 Prof Rahim Tafazolli- Surrey University

Local Facilitators:

Mike Williams- BT
 Sarah Mackenzie- BT
 Prof Paul Febvre – Cranfield University, Satellite Applications Catapult



Universities Represented:-

- Leeds
- Loughborough
- Surrey
- York
- UEA
- Glasgow
- Cambridge
- Liverpool
- UCL
- Durham
- QUB
- Imperial
- Swansea
- Cranfield
- Bradford
- Suffolk
- Southampton
- Lancaster
- Indian Institute of Technology Delhi
- Indian Institute of Science Bangalore