

# Collaboration: Accessing the Full Potential of Collaboration in R&D Programmes

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5G RuralDorset



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## Executive Summary

It is essential that collaboration within R&D programmes is demonstrably valued and supported so that activities are successful, and enable the UK to achieve its goal of being a global leader in technology. Collaboration has significant potential to ‘increase the future sustainability of the UK’s 5G ecosystem<sup>1</sup>, and create long-term benefits at a variety of levels from project partners through to the UK as a whole. Collaboration activities bring direct benefit to the UK economy by developing relationships with international technology organisations and innovators, whilst also opening up international markets.

This report is empirically driven and draws on the experiences of five projects within the DCMS 5G Testbed and Trials (5GTT) Programme: 5G RuralDorset, 5G Connected Forest, MANY (Mobile Access North Yorkshire), MONEH (Multi Operator Neutral Host), Liverpool 5G. It is also informed by the insights from 5GTT Collaboration Team representatives from DCMS, UK5G, and KTN. Smart Sound Plymouth, a European Regional Development Fund R&D project, was also studied to provide an alternative perspective. The experiences of these projects and collaboration support teams are used to illustrate the importance of each recommendation. Although this report is driven by data about 5G R&D programmes, the recommendations can be translated into other contexts to guide future programmes.

Ten recommendations are outlined to showcase the success of collaboration across two 5G R&D Programmes, and to demonstrate how the full potential of collaboration can be realised in future programmes. They are:

1. Focus more on external and creative collaboration rather than just inter-project, thus reflecting the improved DCMS guidelines and the wider scope of collaboration
2. Embed the collaboration guidance within the Grant Funding Agreement (GFA)
3. Increase the collaboration budget to 5–8% in the GFA to reflect the importance of collaboration, and encourage larger collaboration activities
4. Mandate in the GFA that an agreed percentage of the collaboration budget is dedicated to mandatory skills development
5. In the GFA outline the need for a strong Collaboration Lead within each R&D project, and provide guidance about this important role
6. Implement agile and flexible collaboration mechanisms to reflect the changing opportunities and needs of a project
7. Recognise and support informal collaboration
8. Ensure any organisation acting to support and promote collaboration effectively exercises this role
9. Invest in the DCMS/R&D funder Collaboration Team and the wider team supporting each of the R&D projects.
10. Ensure Grant Funding Agreement (GFA) payment terms meet the requirements of all partners, and that funds are paid on time to avoid delays to collaboration work, thus encouraging SME programme participation

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<sup>1</sup> DCMS (2021), *5GTT Collaboration Guidance for Projects*, v2.4, [ppt slides]: slide 5.

## Introduction

The 5G Testbed and Trials (5GTT) Programme is an R&D activity focused on exploring and developing 5G technologies. The programme is funded by the Department for Digital, Culture, Media, and Sport (DCMS) and has three key objectives:

1. Accelerate the deployment of 5G networks and ensure the UK can take early advantage of the applications those networks enable
2. Maximise the productivity and efficiency benefits to the UK from 5G
3. Create new opportunities for UK businesses at home and abroad, and encourage inward investment.<sup>2</sup>

Thus far, 8 projects have been completed, and 30 projects are currently running with around 200 project partners. Figure 1 provides an overview of these projects.

This report focuses upon the collaboration activities which occur within 5G R&D programmes by examining the lessons learned and identifying key recommendations for future programmes. In the case of the 5GTT Programme, collaboration is a requirement, and each project must assign 2–4% of their budget to collaborative activities.

The report is informed by data collected via interviews undertaken in May and June 2021 with 5GTT projects, 5GTT Collaboration Team representatives, and an external 5G R&D project. Some of the interview participants were also involved in one of the eight projects within Phase 1 of the 5GTT Programme, and were therefore able to provide valuable added insight into how the collaboration activities have changed over time within the R&D programme.

Although the recommendations within this report are driven by the insights provided by people working on 5G R&D projects, many of the points raised and the recommendations outlined below are transferable into different R&D contexts. This report does not aim to provide a comprehensive representation of all 5G R&D project collaboration activities. However, it captures a wealth of knowledge and experiences so that examples of good practice can be replicated, and learnings can be shared, to the benefit of future R&D programmes.

The objective of this report is to provide recommendations for DCMS and other R&D funding bodies to help support future collaboration activities so that the potential of collaboration is fully realised.

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<sup>2</sup> UK Government, (2021) *5G Testbeds and Trials Programme*, [online website], accessed: 25/06/2021, available at <<https://www.gov.uk/guidance/5g-testbeds-and-trials-programme>>

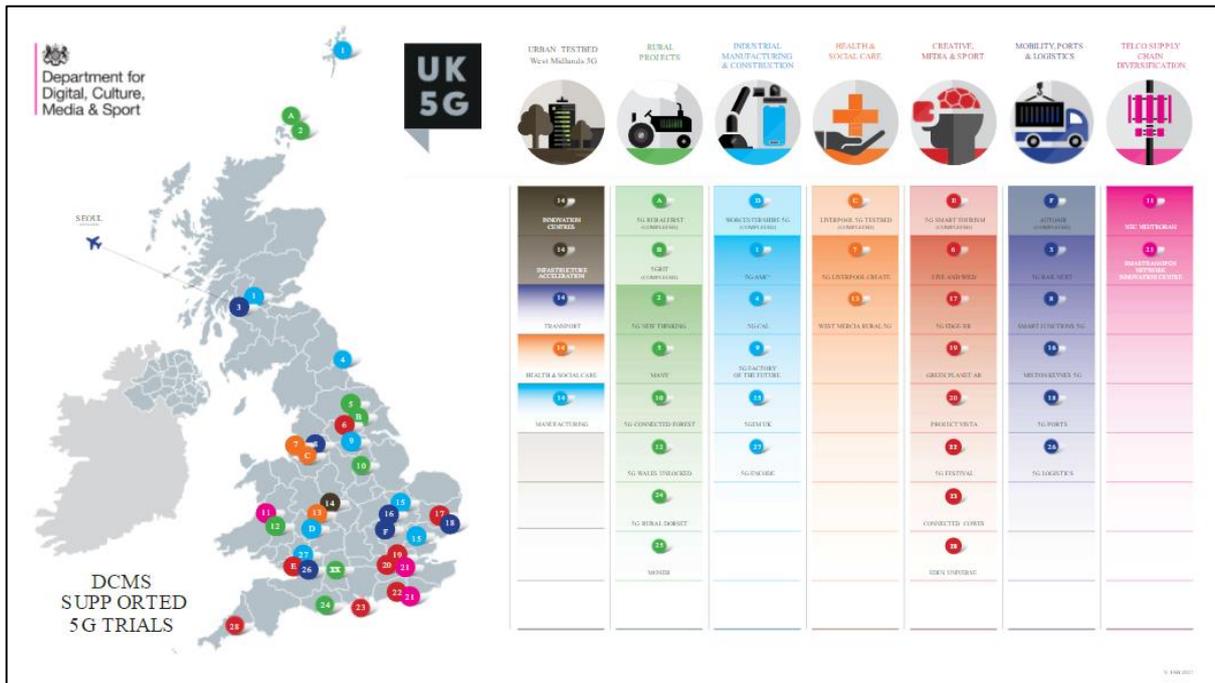


Figure 1: Overview of the DCMS funded 5G Projects as of 2021, UK Government, (2021) *5G Testbeds and Trials Programme*, [online website], accessed: 25/06/2021, available at <<https://www.gov.uk/guidance/5g-testbeds-and-trials-programme>>

## Background

Collaboration within the 5GTT Programme is defined as ‘the inter-working with other 5GTT projects, participation through UK5G channels and the wider 5G ecosystem, on topics of shared interest.’<sup>3</sup> Each 5GTT project must allocate 2–4% of their project budget on collaboration to deliver tangible outputs. These collaboration activities have the aim of ‘solving shared problems’ and ‘improving the 5G evidence base for success, to increase the future sustainability of the UK’s 5G ecosystem’<sup>4</sup>. To achieve this, projects must provide a clear collaboration plan, quarterly collaboration status reporting, and information on collaboration lessons learnt.

5GTT collaboration guidance was improved with the provision of a Collaboration Framework in 2020 to ‘get the most out of any collaboration activities, whilst simultaneously allowing the work to be manageable, practical and beneficial for the projects’<sup>5</sup>. The framework was developed following feedback from the Phase 1 5GTT projects (2018-2020), and sought to encourage collaboration at different levels in order to better reflect project needs, and enable better outcomes.

During Phase 1 of the 5GTT Programme, collaboration was a contractual obligation with 2–4% of project costs designated for collaboration. However, the specifics of collaboration requirements were not clearly outlined, and there was no indication of whether there

<sup>3</sup> DCMS (2021), *5GTT Collaboration Guidance for Projects*, v2.4, [ppt slides]: slide 3

<sup>4</sup> DCMS (2021), *5GTT Collaboration Guidance for Projects*, v2.4, [ppt slides]: slide 5

<sup>5</sup> DCMS (2020), *5G Testbed and Trials Programme: Collaboration Framework 2020*, v1.1: p2

would be a penalty if the obligation was not met. This resulted in some uncertainty amongst projects about how to approach collaboration, and what was expected. Therefore, for many projects the new Collaboration Framework introduced during Phase 2 of the 5GTT Programme has been a welcome improvement.

The 5GTT Collaboration Framework outlines three main categories of collaboration: Principal Topic, Sub-group Topic, and External Topic [Figure 2]. The framework is designed to be flexible, and is intended to be used in association with SMART (Specific, Measurable, Achievable, Realistic, and Time-based) deliverables.

Principal Topics	Sub-group Topics	External Topics
<p>Aim: Address common core 5G topics that are seen as key to solving the initial, broader question.</p> <p>Output: Unified general guidance of best practice, examples of working methods that have demonstrated benefits and failures, recommendations of how to move into practise, proposals for continued exploration/change of policy and further review.</p>	<p>Aim: Smaller-scale collaboration on areas of specific interest.</p> <p>Output: Detailed analysis and exploration of specific topics: to introduce new knowledge or to build and enhance existing knowledge.</p>	<p>Aim: Collaboration with 5GTT or external parties on 5G topics, based upon your project's 5GTT scope.</p> <p>Output: Tangible, 5G-related R&amp;D output.</p>
<ul style="list-style-type: none"> <li>• High-level collaboration and sharing of expertise.</li> <li>• Lead by a project or DCMS/UK5G/Digital Catapult.</li> <li>• Short papers which remain "current".</li> <li>• Suggested duration and output every 6 months: SMART.</li> <li>• All projects are expected to participate if the topic is directly relevant to their project scope or to contribute if they have the relevant expertise within the consortium.</li> </ul>	<ul style="list-style-type: none"> <li>• Diving deeper into the problem.</li> <li>• Lower-level industrial research or experimental development.</li> <li>• Use-case focus.</li> <li>• Bi-lateral or tri-lateral project group.</li> <li>• Short papers on key focus areas.</li> <li>• Suggested duration and output every 3 months: SMART.</li> <li>• Lead by a project. DCMS/UK5G/Digital Catapult can support as needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Individual project activity, with input from other 5GTT parties where appropriate.</li> <li>• No fixed time basis for collaboration output dissemination.</li> <li>• Regular updates and dissemination to the wider 5G ecosystem.</li> <li>• Independently managed.</li> </ul>
<p>Topics:</p> <ul style="list-style-type: none"> <li>- Neutral Hosting.</li> <li>- 5G Rural Business and Deployment Models.</li> </ul>	<p>Topics:</p> <p>Open and to be defined by collaborating parties.</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>- 5G Security (various and extended</li> </ul>	<p>Topics:</p> <p>Open and to be defined by collaborating parties.</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>- OFCOM policy.</li> </ul>

	<ul style="list-style-type: none"> <li>from Phase 1).</li> <li>- 5G and Rural Health/Adult Social Care.</li> <li>- 5G Skills (extended from Phase 1).</li> <li>- 5G Spectrum (extended from Phase 1).</li> <li>- 5G RAN. (various)</li> <li>- 5G Core. (various)</li> </ul>	<ul style="list-style-type: none"> <li>- Local Enterprise Partnerships.</li> <li>- Responding to relevant Government consultations that impact 5G policy direction.</li> <li>- 5G community awareness.</li> <li>- Procurement and Supply Chain.</li> </ul>
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Figure 2: Collaboration Framework table outlining the three key types of collaboration. DCMS (2020), *5G Testbed and Trials Programme: Collaboration Framework 2020*, v1.1: 3-4

Alongside the framework, each collaboration activity has a suggested process to follow: Exploration, Initiation, Planning, Execution, and Closure. This process is outlined in Figure 3 with 'G' representing a Gate which must be passed before the next stage in the process can be reached. In practice, this acts as a way for the Collaboration Team and DCMS more broadly to explore collaboration, whereas the reality on the ground is far more flexible and dynamic.

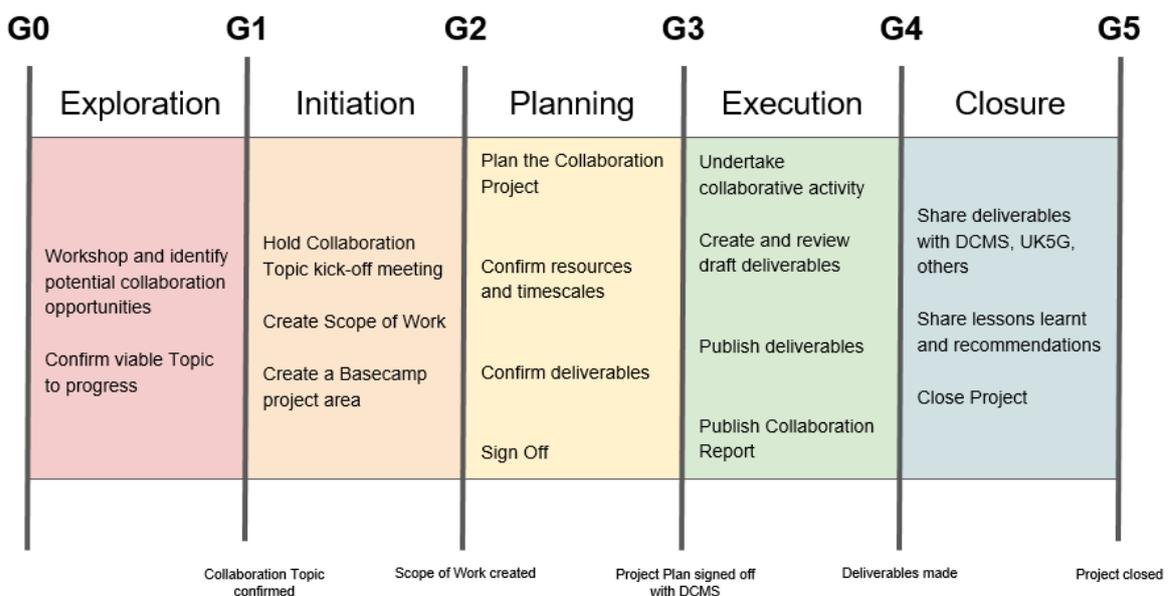


Figure 3: Collaboration Process Overview  
 DMCS, (2021), *5GTT Collaboration Activity Lifecycle*, v1.2, [ppt slides]: slide 2

## Methodology

The research which underpins this report followed a qualitative methodology with the aim of understanding the experiences of members of the 5GTT Programme to inform future R&D Programmes, as set out above.

In the first stage of the research, a series of semi-structured interviews were undertaken with key partners within the 5G RuralDorset project. To gain a more nuanced understanding of experiences across the programme, further interviews were then undertaken with 5G Connected Forest, MANY, MONEH, Liverpool 5G, as well as representatives from DCMS, UK5G, and KTN. Alongside interviews with members of the 5GTT Programme, an additional interview was undertaken with a representative from Smart Sound Plymouth funded by the European Regional Development Fund. Details of these individuals can be found in the table below, and further information about the projects is outlined in *Appendix A*. Certain contextual features of these interviews are important to note: at the time of the interviews the 5GTT projects were in the last year of their funded period; the Covid-19 restrictions were still in place; and a DCMS/UK5G event entitled *Be Better Connected* focused on collaboration had recently occurred. These three topics were discussed within the interviews, and feature within the recommendations.

<i>Name</i>	<i>Affiliation</i>
<b>5G RuralDorset</b>	
Dr Kieran Arnold	Satellite Applications Catapult
Dr Bob Banks	Vodafone Group
Bethan Evans	Excelerate Technology
Hector Gibson-Fleming	Wessex Internet
Rob Leenderts	NGIS
Dr Ross McPherson	Neutral Networks
Dr Greig Paul	University of Strathclyde
Digby Sowerby	Wessex Internet
Colin Wood	Dorset Council
<b>5G Connected Forest</b>	
Ceren Clulow	Nottinghamshire County Council
<b>MANY (Mobile Access North Yorkshire)</b>	
Stephen Leese	Map of Agriculture
Rebecca Proctor	North Yorkshire County Council
Kevin Wood	Cybermoor
<b>MONEH (Multi Operator Neutral Host)</b>	
Jonathan Andrew	Ch4lke Mobile
<b>Liverpool 5G</b>	
Rosemary Kay	eHealth Cluster Ltd
<b>DCMS</b>	
David Pedley	DCMS
<b>UK5G</b>	
Bob Driver	UK5G
Peter Whale	UK5G
<b>KTN</b>	
Richard Foggie	KTN
<b>Plymouth Smart Sound Project</b>	
Rob Watson	MBTC/Plymouth City Council

The insights generated from these interviews act as a vignette of the collaboration process across the 5GTT Programme. The points raised during the interviews have been analysed to identify common themes, which have then been used to inform the ten recommendations.

## Types of Collaboration

### 1) Focus more on external and creative collaboration rather than just inter-project thus reflecting the improved DCMS guidelines and the wider scope of collaboration

- External collaboration provides an opportunity to make a tangible difference to the broader technology ecosystem
- External collaboration which engages with the end-user, and focuses on 'go to market' potential is important for the sustainability of project outputs beyond an R&D programme.
- The ethos of R&D experimentation should be at the heart of collaboration.
- Creative forms of collaboration are more likely to have a lasting impact as a tangible output or by extending knowledge from the lessons learned.

External collaboration activities are an important way for R&D Programmes to have a tangible impact on the broader technology ecosystem. The updated DCMS Collaboration Framework includes a specific category about external collaboration, and has been welcomed by participants who were involved in Phase 1 of the 5GTT Programme. However, further promotion of external collaboration activities is recommended. One of the aims of collaboration is to 'increase the future sustainability of the UK's 5G ecosystem', which external collaboration can help to achieve. External collaboration represents a key opportunity to ensure learnings and outputs are shared beyond an R&D programme. The data indicates that there is clear desire across the projects for greater value to be placed on external collaboration alongside the further promotion of such activities

*“ I'd like to see a lot more [international collaboration], the outreach and interaction with whatever countries that DCMS feel might be critical. And then on a broader scale, how might they collaborate and link into Horizon 2020 that's about to kick off, or any other national country innovation programme? ”*  
- Dr Kieran Arnold, 5G RuralDorset.

External collaboration activities also represent a prime opportunity to move beyond the UK and engage with other countries and their innovative R&D work. This would establish international working relationships, which in turn, would drive investment in the UK's technology ecosystem, open up international markets for UK companies, and further strengthen the UK's position as a key actor on the global technology stage.

Successful external collaboration activities need to be holistic in their approach by thinking beyond the lifetime of the R&D programme. Holistic approaches consider what is needed both within the tech sector and within society. Indeed, interview participants identified that collaboration activities and outputs are more likely to be sustainable when they are focused upon the end-user or market potential. This connects with a core issue across the 5G ecosystem that the work undertaken must be a solution to a problem and not a solution looking for a problem.

*“So if you were looking for sustainable collaboration activities it would be, as we get towards the end of the programme, about external collaboration with what I would term ‘go to market partners’. So you’ve generated these learnings within these projects, and you’ve got shared learnings across the wider cohort...Whatever problems it is you’re going to solve with 5G, you should now be collaborating with the wider problem owner community...You could easily argue that that kind of activity is going to accelerate the uptake of 5G technologies within the UK, therefore, it would meet all the criteria of being a worthy collaboration from DCMS’ perspective”*  
- Richard Foggie, KTN

Further promoting the role of external collaboration and its role in engaging with the end-user would provide long-term benefits. These activities may involve working with community interest groups to identify future uses of the technology, or sharing R&D project learnings to enhance understandings within the tech sector. These collaborative activities could also provide a step towards the market and develop tools which can be used beyond the programme. An example of the latter is the Adoption Readiness Level Toolkit as outlined in *Collaboration in Focus #1*, which draws on knowledge from within the 5GTT Programme to further develop a toolkit to support technological developments beyond the lifetime of the programme.

### Collaboration in Focus #1 – Adoption Readiness Level (ARL) Toolkit

The Adoption Readiness Level Toolkit (ARL) is a free self-assessment toolkit designed to help organisations understand the barriers that might be encountered in the uptake of a product. The ARL toolkit was launched in 2019 by eHealth Cluster Ltd, which is a partner of Liverpool 5G.

This collaboration focuses upon further developing the ARL toolkit and is an activity involving Liverpool 5G, West Mercia, 5G RuralDorset, and West Midlands 5G.

The activity involves 5GTT projects trialling the tool in some of the 5G use cases. Feedback from the trials will then be gathered in order to further develop the toolkit. The aim is that the learnings from the 5GTT projects will update the ARL toolkit and provide long-term benefit for future ARL toolkit users.

Alongside further promoting external collaboration, it is also recommended that more attention is given to creative collaboration activities. R&D programmes are focused upon experimenting and testing to identify what is required for an integrated technology ecosystem. This ethos of experimentation should, therefore, sit at the heart of collaboration across all R&D programmes. In practice, this translates into supporting and encouraging projects to take bigger risks, work with those outside of the R&D programme, and approach collaboration creatively without fearing failure.

*“ We need to be looking more broadly than just reports and similar easy to measure, convenient to measure, things. I think some of the value could come about from some of the crazy, whacky, and wonderful things, and ultimately as a country we need to do more of those crazy things... [we need to be] encouraging people to innovate, take risks, and fail. Failure is not bad, failure is positive because we learn from failure. ”*

*– Dr Greig Paul, 5G RuralDorset*

Collaborative reports are a useful output as they draw together different perspectives and point towards potential solutions or lines of development. However, collaborative reports have become a standard which can have limited impact. Indeed, one interview participant acknowledged that these reports often “end up on a shelf” and are not referenced once an R&D programme has ended. This is not to critique the significant contributions made by previous collaborative reports, instead it is a recommendation to think more creatively and holistically. Thinking in such a way draws attention to what is desired for the future of digital connectivity. R&D programmes can then be used to trial approaches to achieve these desires and make tangible differences.

An example of a more creative form of collaboration is the United Kingdom Telecoms Data Taskforce (UKTDTF), as outlined in *Collaboration in Focus #2*. The UKTDTF was established by 5G RuralDorset and includes two other 5GTT projects, MONEH and West Midlands 5G, as well as organisations across the 5G ecosystem. The UKTDTF is a creative form of collaboration initiated as part of an experimentation with no certainty of if it would succeed. It has since surpassed expectations. The UKTDTF is also an example of successful external collaboration as it draws together representatives from beyond the 5GTT Programme to generate benefits for the broader technology ecosystem. 5GTT projects who are involved in the UKTDTF reflect that the “breadth of expertise” and expansive thinking showcases the strength of this external and creative collaboration activity.

## Collaboration in Focus #2 – The United Kingdom Telecoms Data Taskforce (UKTDTF)

The UKTDTF is an inter-sector collaboration output initiated by 5G RuralDorset with engagement from two 5GTT projects: MONEH and West Midlands 5G. UKTDTF membership also includes INCA, Ordnance Survey, Virgin Media, Talk Talk, BT, The Connected Places Catapult, University of Strathclyde, Invest in Cardiff, and the British Standards Institute. The body is mentored by the Department for Business, Energy and Industrial Strategy, and has representation from the Department for Digital, Culture, Media and Sport Barrier Busting Task-Force. Information is also shared with the Governments of Scotland and Wales, as well as other UK Government Departments including the Cabinet Office.

Since its inception in 2020, the UKTDTF has provided a response to the UK's National Data Strategy, and the UK Supply Chain Security Consultation, as well as proactively providing recommendations following the publication of the UK's National Infrastructure Strategy. The body has also become a resource drawn upon by the UK Government, and a point of contact for a range of organisations who are seeking feedback on work they are developing. Thus far, presentations have been given by DCMS, the Cabinet Office, BT, Network Rail, INCA, the National Infrastructure Commission, and the Centre for Digital Built Britain.

Creative approaches require thinking about collaboration more experimentally rather than as a fixed outcome that must be easily captured within a collaboration monitoring spreadsheet. It is, of course, important to monitor collaborative activities. However, a successful outcome can be working on a topic which brings people together who would not normally interact, or trialling an initiative which may not generate tangible success but can showcase future opportunities. Encouraging alternative approaches and establishing monitoring that views experimental collaboration processes as positive outputs is thus recommended.

It is evident that external and creative collaboration activities have significant potential to generate positive impacts both during and beyond the lifetime of any form of R&D programme. It is therefore recommended that, as per the updated DCMS Collaboration Framework, more focus and support is placed on external and creative collaboration activities.

### Collaboration Guidelines

- 2) Embed the collaboration guidance within the Grant Funding Agreement (GFA).
  - o Embedding guidance upstream enables projects to effectively plan their collaboration activities

- Further clarity about the difference between collaboration, coordination, communication, and consultation will make the planning and delivery process clearer for project.
- Guidance about how to share knowledge whilst navigating commercial sensitivities will help projects confidently undertake collaboration activities
- Greater transparency about why collaboration is required, and what happens with the data collected about the activities will improve project understanding and engagement.

Guidelines are vital in ensuring effective collaboration is undertaken. The current framework within the 5GTT Programme identifies three main types of collaboration: Principal Topics, Sub-group Topics, and External Topics. The aim of this new framework has been to encourage collaboration at different levels and to support projects of different sizes. It was developed during Phase 2 of the 5GTT Programme, and it is evident that it has improved understanding of the collaboration requirements. Project members who had also participated in Phase 1 of the 5GTT Programme welcomed the updated guidance as it has provided greater clarity and understanding of the process and has enabled projects to work more effectively on collaboration.

It is important to note, however, that the Collaboration Framework was developed after the Phase 2 trials had already commenced. Several projects explained that had the framework been available earlier, then it would have fed more explicitly within their original collaboration project plans and helped to generate better outcomes. Indeed, the Collaboration Team have encountered tensions with projects perceiving the framework to be an additional requirement rather than a means to provide clarity on expectations. Making collaboration guidance such as this framework available upstream within the project lifetime is important to improve understanding of expectations and ensure commitments are appropriately made. There is some guidance within the GFA outlining expectation that collaboration activities occur, however, the key learning from both the projects and Collaboration Team representatives is that frameworks should be fully developed in the GFA with clear expectations before the R&D projects begin.

*“ I think the messaging is important, and by that I think DCMS needs to be clear what it wants from it [collaboration], it needs to be clear in communicating to its own team, the wider UK5G, the PMOs, the projects, the partners of the projects, what it's all about. ”*  
– Richard Foggie, KTN

Communicating the expectations of collaboration through frameworks such as the one provided in the 5GTT Programme is important for ensuring the projects understand

requirements “from inception”. The data illustrates that the existing structure would benefit from improvement in three key areas:

1. The definition of collaboration
2. How to balance collaborative activities and commercial sensitivities
3. Transparency about why the collaboration data is collected.

The definition provided within the DCMS guidance is that ‘collaboration is the inter-working with other 5GTT projects, participation through UK5G channels and the wider 5G ecosystem, on topics of shared interest<sup>6</sup>’. This definition is useful. However, when positioned in relation to other activities such as coordination, communication, and consultation some confusion has arisen. Further guidance could involve providing information via a point of clarification or toolkit for identifying what level of interaction between the two or more parties is required for activities to be classed as collaboration.

Successful collaboration also requires confidence in sharing knowledge between parties. There has been some uncertainty for projects about how to balance collaboration with commercial sensitivities. Providing guidance about how to navigate the sharing of knowledge that may be commercially sensitive for partners would help make collaboration a smoother process. The data also illustrates that greater transparency about why collaboration is being undertaken, and what happens with the data, is needed. Projects explained that once they have a greater understanding of what types of collaboration are required, and why, then they would be able to pursue the most effective collaboration activities and accurately report the outcomes.

*“ I would be interested...from a DCMS perspective what the advantages of collaboration are for them. Why are they pushing it so hard? What do they benefit from it? What do they get out of the projects collaborating either with each other or externally? What are the metrics? There must be something there, and I think it's poorly understood, and if we understood that better...then we might better understand why we're having to do all of this reporting. ”*  
- Stephen Leese, MANY

## Budget Allocation

### 3) Increase the collaboration budget to 5–8% in the GFA to reflect its importance, and encourage larger collaboration activities

- o The current 2–4% budget allocation does not enable projects to fully realise the potential of collaboration when balancing the demands of other project activities.

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<sup>6</sup> DCMS (2021), 5GTT Collaboration Guidance for Projects, v2.4, [ppt slides]: slide 3

- Financial incentive for collaboration is important to drive activities.
- Pooling of budget allocation into a separate entity means that collaboration is not fully embedded within a project, thus removing the incentive and milestone tracking.
- Projects who provide evidence of successful collaboration activities should be able to win further funds.

The budget allocation fundamentally shapes collaboration and the importance placed on it. Within the 5GTT Programme, each project must allocate 2–4% of their budget to collaboration. A common theme present within the interview data is that this does not go far enough in enabling effective and sustainable collaboration, nor does it underline the importance of the activity to projects. This centres upon the fact that 2–4% is a small percentage of the overall project, and the remaining 96–98% is prioritised in place of collaboration. This is not because projects do not value collaboration, but rather when having to balance all of the demands that arise throughout the lifetime of an R&D project, the 2–4% cannot be prioritised. This is important to consider when developing requirements as any collaboration activities occur in relation to the wider project milestones and budget.

An increase to the budget allocation for collaboration is therefore recommended. It was noted within interviews with UK5G representatives that discussions are ongoing about developing a new funding model by removing the current 2–4% allocation. Such an approach could involve the pooling of collaboration funds into a separate entity, which would then be comprised of collaboration managers and engineers who would work closely with projects to develop required collaborative activities. This approach is reminiscent of the one taken by the 5G Innovation Centre (5GIC) during the Phase 1 of the 5GTT Programme. This model is seen by UK5G as a potential for ensuring that collaboration is embedded throughout a project rather than solely within a 2–4% allocated budget.

However, this report advises caution in relation to this plan because it does not reflect the experience and recommendations of the projects themselves who referenced that such a “middleman” approach was the “failing of 5GIC”. Projects also highlighted the importance of a specific budget allocation to ensure that collaboration is both enabled and valued. It was viewed that if the percentage allocation was pooled and did not go direct to the projects, it would undoubtedly reduce the projects’ focus on collaboration activities. This, it is felt, would occur irrespective of whether a separate pooled budget is accessible. It is also important to note that the budget allocation helps to facilitate the monitoring of collaboration activities as it embeds them within the project milestones.

*“ I think if it [the budget allocation] wasn't there, people would ignore the collaboration, they would do what they needed to do, but it acts as a driver...if it wasn't there, collaboration just wouldn't really happen. ”*

*- Kevin Wood, MANY*

Retaining budget allocation for collaboration is therefore important. However, the current format of 2–4% does not reflect the importance, the amount of work required, nor does it enable the full potential of collaboration to be realised. This report recommends that the budget allocation for collaboration is extended to 5–8% with an additional pot of money made accessible to all projects within an R&D programme to further supplement and support their collaboration activities where success is evident.

The financial incentive for collaboration activities within an R&D project cannot be underestimated as a budget that more effectively reflects the demand and requirement for collaboration can further enable its success. Extending the collaboration budget to 5–8% would attend to the need for collaboration to be financially embedded within a project and also enable projects to spend more time developing and enacting collaborative activities. It is acknowledged that this change in budget allocation has its challenges, however, this is balanced with the substantial benefits collaboration can bring to projects, and the UK more broadly. This is especially true with an increased budget allocation of 5–8%, alongside an additional pot of money, acting to incentivise further engagement and the development of more creative and holistic collaboration activities. This report, therefore, recommends that a specific budget allocation is continued rather than moved to a separate pooled budget.

## Collaboration and the Skills Gap

### 4) Mandate in the GFA that an agreed percentage of the collaboration budget is dedicated to mandatory skills development

- The digital skills shortage is a major issue impacting the tech sector and the UK as a whole.
- External collaboration activities represent a prime opportunity to work with students to address the digital skills shortage, and strengthen the UK's position as a technology leader.
- Mandating a percentage of collaboration is dedicated to skills development ensures every project within an R&D programmes focuses on skills, and enables students to access these opportunities irrespective of their socio-economic backgrounds.

- Students from a variety of disciplinary backgrounds should be engaged from engineering through to the social sciences to reflect the diverse needs of the sector.

The digital skills gap within the tech sector is an extensive issue which has been *repeatedly* cited as impacting both current and future technology development<sup>78</sup>. The skills shortage has materialised into challenges which are being experienced by all of the 5GTT projects, for example, the current global semiconductor shortage and access to vendors which are not high risk. The lack of UK based options is an outcome of the skills shortage, and if actions are not taken, this is expected to cause further issues in the future.

The external collaboration activities within R&D programmes represent a prime opportunity to address this skills issue. Across the UK, and further afield, there are numerous students whose studies engage with technology, or who have a particular interest in the sector. This group includes students in schools, colleges, apprenticeship schemes, and universities. The potential of this collaboration has been demonstrated via the recorded interest from students approaching both the 5GTT projects and DCMS about undertaking placements. These students have different subject backgrounds including machine learning, cybersecurity, IoT, and social sciences, thus demonstrating the variety of students interested in working with R&D programmes. This variety reflects the need of the tech sector, as a more diverse sector is a stronger and more resilient sector.

Skills development activities have been undertaken via the Skills Working Group which has focused upon identifying inter-project approaches to address the skills shortage. The Working Group has been doing vital work through identifying the level of upskilling needed; how this upskilling can be applied across different sectors; and how projects can help train people in-house. By working with the SME and Regions Working Group, potential activity has been identified for skills development to occur at a regional level, whereby projects will partner with local FE colleges to understand how to upgrade 5G courses and drive interest. However, this work has had to negotiate time and resource constraints, and not all 5GTT projects can balance the collaboration commitments with their broader project activities and requirements. There is clear interest in skills development across the projects, however, the projects need to be supported in addressing the skills gap. Therefore, mandating that a percentage of collaboration is dedicated to skills development will mean that each project invests time and resources into this important work.

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<sup>7</sup> Marshall, H., (2020: Page 48), *Gearing up our people to drive the power of 5G*, Worcestershire 5G Testbed, available at: <[https://uk5g.org/media/uploads/resource\\_files/Worcestershire-5G-Skills-Report.pdf](https://uk5g.org/media/uploads/resource_files/Worcestershire-5G-Skills-Report.pdf)>, accessed: 22/06/2021

<sup>8</sup> Learning and Work Institute, (2021), *Disconnected? Exploring the digital skills gap*, accessed: 12/07/2021, available at: <<https://learningandwork.org.uk/resources/research-and-reports/disconnected-exploring-the-digital-skills-gap/>>.

*“Digital skills is amazingly important, and we value that so much. So we are thinking we need to expand that [skills development] capability...however we can.”*  
–Ceren Clulow, 5G Connected Forest

Beyond the 5G Skills Working Group, projects have been undertaking their own work on skills development. 5G Connected Forest has focused on engaging with schools via challenge based projects to explore how 5G will impact a range of sectors, and are also working with the 5G Innovation Hub in Nottinghamshire to provide skills development opportunities, the latter of which is summarised in *Collaboration in Focus #3*. Within the 5G RuralDorset project, skills development and collaboration has been tightly coupled via a six-month student placement, as outlined in *Collaboration in Focus #4*. This collaboration was generated from networking during a DCMS Briefing. However, such opportunities are not accessible to all students. There is an engagement barrier for students who cannot access such R&D project events, or who do not work in departments with pre-established ties with R&D projects. Indeed, there is no explicit process for engagement. This means that there needs to be clear communication and signposting of skills development opportunities to a range of students at schools, colleges, apprenticeship schemes, and universities, and that within universities contact is made with students from engineering through to the social sciences.

### Collaboration in Focus #3 – 5G Connected Forest and the 5G Innovation Hub, Nottinghamshire

5G Connected Forest has been working with the 5G Innovation Hub in Nottinghamshire to help develop digital skills within the local community. The 5G Innovation Hub is the first 5G enabled business centre in Nottinghamshire.

This skills development has two main focal areas: commercial training, and upskilling students. The commercial training is planned to run within the Innovation Hub, and draws upon the lessons learned from 5G Connected Forest’s quarterly findings. Local colleges and universities are also invited to run R&D events in the 5G enabled building to help students develop their skills and understanding of 5G capabilities.

The focus is now on exploring how to expand this work to further support skills development

It is important to note, that skills development collaboration activities, like placements, can also provide benefit to the host R&D project as the student shares their own knowledge and helps to support project work, as highlighted in *Collaboration in Focus #4*. A clear opportunity, therefore, presents itself when designing collaboration. At its basis collaboration is about working to address challenges and meet the requirements of both the R&D project and a third party. Skills development can therefore bring benefits to both

the student and the project, whilst also addressing the skills gap. Embedding skills development into R&D programmes means that the work being undertaken by R&D projects is sustainable and has a positive impact for the UK beyond the lifetime of the programme. Mandating that a percentage of collaboration is focused upon skills development such as placements, apprenticeships, and active engagement with schools and colleges ensures that skills development is embedded within the projects via their budget. This will therefore require projects to develop a variety of skills initiatives. The UK skills gap needs a concerted effort to address the issue from all parts of the tech sector, including R&D programmes.

#### Collaboration in Focus #4 – Six month student placement

A six month placement collaboration activity has been undertaken as part of the 5G RuralDorset project. The collaboration occurred between 5G RuralDorset, Telint Ltd, the University of Exeter, and the South West Doctoral Training Partnership (SWDTP) which is part of the Economic and Social Research Council (ESRC). For this collaboration a PhD student from the University of Exeter was hosted on a placement by Telint Ltd between January and July 2021. This placement was funded by the SWDTP. As the host, Telint Ltd acted as a point of contact for the student and provided support.

Prior to the placement, a collaboration plan was drafted and insurance taken out by Telint Ltd to cover the planned activities. Weekly meetings were held to set and review work in-line with the collaboration plan. A final collaboration output was agreed upon with the support of DCMS: researching and writing this report on collaboration within 5G R&D programmes, with a particular focus on the 5GTT Programme

Examples of work undertaken:

- Researching and writing a report on collaboration
- Research and writing reports about technologies within the 5G ecosystem including the use of NB-IoT within coastal monitoring
- Supporting the work of the United Kingdom Telecoms Data Taskforce (UKTDTF)
- Representing 5G RuralDorset at events including Digital Leaders Week and UK5G/DCMS *Be Better Connected* conference
- Attending 5G RuralDorset Executive Board meetings, Project Management meetings, and Work Package meetings
- Writing blogposts for Women in 5G and Mobile UK.

This external collaboration has significantly developed the PhD student's skills, and provided them with knowledge about the 5G ecosystem and how R&D projects function. It has also broadened the student's network through connecting them with a variety of people working within the tech sector.

The student has supported the 5G RuralDorset's work through the provision of different insights as well as helping them with their activities and generating content.

## Collaboration Lead

1. 5) In the GFA outline the need for a strong Collaboration Lead within each R&D project, and provide guidance about this important role
  - Collaboration activities which have a clear leader have been shown to be more successful
  - A Collaboration Lead should have experience collaborating with, and working with, public and private sectors
  - For projects to reap the benefits of external collaboration opportunities the guidance should recommend that the Collaboration Lead has a well-developed network of contacts.

A designated person who already has a strong contact base taking a lead on collaboration within projects is key to delivering productive outcomes. Across the interviews, it was identified that the in-project facilitation of collaboration is important so that all collaboration partners are supported, and the activity is managed. As per the Collaboration Framework, each activity requires a lead, however at times, there has been no-one who has actively taken on this role. Allocating the role of Collaboration Lead within each project means that there is clearly someone who will initiate and manage collaborative activities.

*“Where there has been somebody who has clearly stepped forward to say “I am very happy to take on this burden to manage this collaboration activity”, then collaboration works nicely. And they’re able to set clear objectives, clear timeframe, and clear deliverables, and clear strategy on how to work together, then we’ve seen that work really well...So that would be my number one thing really, how do we get people to lead collaboration opportunities?”*

*– David Pedley, DCMS*

From the interviews it was evident that having someone drive collaboration from within a project itself is vital. More than one person can be focused on collaboration, indeed, a number of projects acknowledged that both the Project Lead and a project partner work together on collaboration. However, for ease of communication within and beyond the R&D Programme, it is recommended that a specific individual drives and takes ownership of collaboration. Assigning this role to someone who has experience working and leading collaboration is important as they will automatically collaborate with other Collaboration Leads and external organisations, thereby reducing the strain on DCMS and enabling resources to be directed elsewhere.

*“ Bring in a [collaboration] expert to be available...and I would also have a consortium membership mandate so there's at least one organisation with an expertise in industrial collaboration, who's succeeded in business through collaboration... That's how you stop it from being a bolt on. Someone who [for them] it's their bread and butter [who] right at the beginning is doing that [collaboration]. If you haven't got that, it's always going to be a bolt on...it's that upstream point... Start as you mean to finish. ”*

*– Jonathan Andrew, MONEH*

It is therefore suggested that designating a dedicated Collaboration Lead within each project is mandated so that someone has ownership of, and accountability for, the collaborative work. A Collaboration Lead within an R&D project will also ensure that the collaboration is a key focus within the project and not simply “outsourced”. The role of Collaboration Lead will act to embed collaboration activities within the project and drive the collaboration in a way which most benefits the project, thus encouraging the project to fully engage with this component of an R&D programme.

The decision about who acts as the Collaboration Lead has an impact upon the functioning of the collaboration activities both internally and externally. It would therefore be prudent to provide guidance about the Collaboration Lead role alongside the collaboration guidelines to support the decision. It is advised that two points are conveyed: the Collaboration Lead must have a developed network of contacts to support the development of activities, and must have an appreciation of the different demands placed upon public sector and private sector organisations. A developed network of contacts can increase the likelihood of identifying collaborative opportunities, especially external activities. The UK5G Suppliers Directory has provided some benefit through connecting projects with other organisations. However, projects reflected that this directory requires time and resources to navigate. Instead, the directory is a useful supplementary database rather than a substitute for pre-established working relationships and networks.

*“ If we were a Local Authority and didn't have someone like [our Collaboration Lead]...with his years of experience with other projects like 5G RuralFirst, and his contacts within the industry, I think we might have struggled to know where to go to find the people with the skills and knowledge that we need to get the job done... The UK5G website has the Supplier Database where you can say “OK I want to do something, who's out there that I can collaborate with?” [or] say “is this possible, and who's able to help me achieve it?” It's difficult because if I ever came up against “oh how do I do this thing?”, my first call was to...the Collaboration Lead and he would just come up with a solution. ”*

*– Colin Wood, 5G RuralDorset*

It is also recommended that the guidance advises that the Collaboration Lead has experience working with organisations across both public and private sectors. Within a consortium, a range of organisations are brought together, each of which have very different requirements and working processes. These differences are a strength, however at times, tensions between collaboration and competition may arise. This is highlighted in the data and also within a recent report by MANY, which outlines how multi-stakeholder collaboration leads to ‘inevitable tensions and contradictions’<sup>9</sup>. In the MANY report the suggestion is that a ‘knowledge activist’ is allocated within a project to work across institutional boundaries and mitigate tensions. This is clearly an important role, and this report proposes that the Collaboration Lead is well situated to act in such a way to help mitigate tensions, and act as a broker to ensure each party is supported and their aims are met.

*“ There’s a lot of competition and...the key thing for us is to act as that honest broker... we’re agnostic, we’re here to help as many people as we can. So the way we tend to broker that collaboration is through open dialogue, taking the side of the client. ”*  
– Rob Watson, MBTC/Smart Sound

Over the lifetime of an R&D project different needs and opportunities will also develop, and a Collaboration Lead needs to be attentive to the skills and aims of each project partner so that every opportunity is fully realised. Mandating that each project has an experienced Collaboration Lead from the commencement of any call for proposals will help R&D projects develop effective collaboration activities which benefit the project and also address the aims of the wider R&D programme.

## Agile and Flexible Mechanisms

### 6) Implement agile and flexible collaboration mechanisms to reflect the changing opportunities and needs of a project

- There is a need to balance embedding collaboration plans in the GFA and the fact that collaboration opportunities arise throughout the lifetime of a project
- The experimental nature of R&D projects requires flexibility and agility to be at the heart of collaboration management

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<sup>9</sup> Mason, K., Wagg, S., (2021), *The Importance of Social Engagement in Putting 5G Connectivity Infrastructures in Place*, MANY, [Report]: 12

- In practical terms, agile and flexible mechanisms include smooth and quick administration processes

Opportunities arise and circumstances change for projects as their work develops, and it is necessary that there are agile and flexible mechanisms in place to ensure projects can access these opportunities. It is important that collaboration is embedded upstream within the GFA, which means that projects need to design their collaboration plans as early as possible. However it must be acknowledged, that the exact details of all forms of collaboration will not be fully known at this early stage of a project. At their basis R&D projects are experimental and must be able to attend to changing situations as their trials highlight specific avenues to pursue. The experimental nature of R&D projects thus requires flexibility and agility to be embedded within all activities, including the collaboration process. In the interviews projects explained that opportunities have arisen that were not on their radar when they first began to formulate their collaboration plans. Projects also identified that certain challenges have arisen, which require alternative approaches to be found; and for some projects this has resulted in establishing new collaborative activities with external partners or working with other projects to draw on specific expertise and skillsets.

The 5GTT Programme Collaboration Framework focuses upon inter-project collaboration via Principal Topics and Sub-group Topics, which either 'address common core 5G topics' or 'smaller-scale collaboration on areas of specific interest'<sup>10</sup>. This inter-project collaboration involves projects working together to identify shared topics of interest, designing a collaboration activity timeline, and providing a tangible output which can be shared with DCMS and the broader 5G ecosystem. The identification stage of the process takes time, and is dependent on projects networking and discussing shared interests in order to identify collaboration activities. The point at which projects will be structuring inter-project collaboration timelines will therefore be months after the collaboration plans have been designed and embedded within the GFA. Projects will still be able to gauge general activities within their collaboration plans, however, the specifics which are stipulated in the DCMS collaboration guidance will become evident later during the project lifetime.

Similarly, the External Topics category within the 5GTT Programme Collaboration Framework outlines that activities can be undertaken with external parties based upon the project's scope. The connections with external parties, especially start-ups, may not be present at the very beginning of a project. Indeed, opportunities may arise following external parties approaching a project member, such as the Collaboration Lead, once a project has commenced. For external collaboration it is also vital that a positive working relationship is at the basis of the activity and this takes time to develop.

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<sup>10</sup> DCMS (2020), 5G Testbed and Trials Programme: Collaboration Framework 2020, v1.1: p3

*“Being nimble to bring in new partners and new opportunities... is really important because these projects are sometimes one or two years long. So at the beginning you have an idea and actually you get half way through, and you think I really wish I could have brought these guys into the fold and it would develop a richer [project].”*  
– Dr Kieran Arnold, 5G RuralDorset

The experiences of the projects working on inter-project and external collaboration showcases that opportunities arise over the lifetime of the project. Mechanisms which make the collaboration process flexible and agile are therefore important as they enable projects to work on collaborative activities which are not in the original plan but will provide significant benefit to the project and the wider 5G ecosystem. Practically, this requires ensuring the administration side of the collaboration process is smooth and can be changed and updated as needed. This materialises in ensuring the DCMS (or equivalent funder) Collaboration Team, who oversee the collaboration activities, can efficiently sign off activity proposals so that the activity can begin as soon as possible and enable projects to progress through the collaboration process as exemplified in Figure 3. It is also important that there are mechanisms in place for the on-boarding process of an external party into the project timeline and that this fits in with milestones. This has successfully occurred within the 5G RuralDorset project where two different collaboration extensions have resulted in the Small Robot Company and the British Geological Survey joining the project. The administration underpinning the on-boarding process for these two companies was smooth, thus enabling the activities to commence efficiently. Within the interviews projects reflected that other R&D Programmes should replicate this efficient on-boarding process to ensure the success of future R&D collaboration activities.

## Informal Collaboration

### 7) Recognise and support informal collaboration

- Informal collaboration enables positive working relationships to develop and helps mitigate any issues like language usage
- Informal collaboration can lead to more formalised collaboration activities within the specific R&D programme, or beyond the programme
- Supporting informal collaboration involves ensuring events have substantial non-structured time for networking and generating ideas
- Virtual spaces such as Microsoft Teams, Zoom, WhatsApp, Basecamp, and email chains should be valued, and continue to be utilised after the Covid-19 restrictions have been lifted

In this instance informal collaboration relates to the activities, discussions, and encounters which do not, or cannot, fit neatly within a collaboration framework. This can be the conversations within, and between, projects and external organisations where knowledge is shared, and ideas are generated. Often these interactions happen and are not recorded as they do not directly lead to a formal collaboration, or they may result in collaboration at a later date. The importance of this informal collaboration was repeatedly identified within the interviews as participants highlighted that such collaboration enabled effective working relationships to develop and sparked innovative ideas. Recognising this form of collaboration is vital in helping to support the broader aims of collaboration.

“ *In reality I think a lot of collaborations happen over time...[we had] an initial visit that sparked some interest, and which led to some further discussions, that has eventually led to a funding application. So you can't always neatly fit those [encounters] into a plan. So I think it's fine the way DCMS has specified the collaboration project...but I think the danger is you miss a lot of the sort of smaller things that, although they might not seem too significant now, might lead to something in a year, two years, time. So it is significant in that respect. So it is more about those sort of informal, emerging collaborations that need to be captured.* ”

– Rosemary Kay, Liverpool5G

Informal collaboration also has significant benefit for identifying common ground between groups of people. This is particularly important for smoothing out issues or confusion which may arise, for example how language is used. This is an issue which was raised within multiple interviews and has been a topic of discussion at 5G events including the *5G Realised* conferences. Within and across projects, partners must work together whilst navigating different expertise. The diverse backgrounds of these partners has meant that the people working together have used terms which do not mean the same thing for everyone involved. One example of this is the use of the terms sensors and devices, which can relate to the specific instrument used to monitor a modality, or the broader network within which the instrument is situated. It is vital that these differences in language use and expertise are understood. Informal collaboration and interactions between groups of people can help to mitigate this potential confusion and ensure work can progress smoothly.

Alongside recognising the value of informal collaboration, it is also important that there are processes in place to support it. In the early stages of an R&D programme more work may need to be done to connect different projects together. The UK5G/DCMS *Be Better Connect* event was useful in bringing the projects together, and there was clear demand for similar events. However, it was noted that such events work best if they happen semi-frequently due to the scale and formality of them, that event scheduling must reflect the projects' timelines, and that projects could potentially organise the events. The closer to the

end of an R&D programme, the less focused a project will be on devoting time and resources to informal collaboration opportunities. In order to capture some of the informal collaboration opportunities, one suggestion was for regular face-to-face or virtual drop-in coffee mornings to be held at the early stages of an R&D programme. Such events would not be a requirement but, if effectively managed, could provide spaces for informal interaction thus helping to develop a “sense of community”. This sense of community not only strengthens collaboration during an R&D programme, but also incentivises projects to continue working together after the programme ends.

*“ Feeling you’re part of a cohort I think is really important. The relationships form between individuals and between organisations as a result of doing collaboration together... it all comes down to people at the end of the day... it’s not only the collaboration work you do together, but by collaborating together you’re doing something meaningful together, and that forms and deepens networks between people and organisations, so to me that’s a key factor in what happens post-March [end of the funding period]. ”*  
– Peter Whale, UK5G

Informal collaboration within the 5GTT Programme has been restricted due to Covid-19 and the various national, regional, and organisational restrictions. This has meant that in-person events where networking enables ideas to develop organically have not been an option. However, interview participants pointed towards online platforms such as WhatsApp, Microsoft Teams, Zoom, Basecamp, and email chains as providing spaces for productive discussions. These virtual spaces have been generative for sharing knowledge and developing positive working relationships. The lockdown has meant that all project partners and external organisations have had to learn to use these platforms and find approaches which are productive.

Some of these spaces were informally established through WhatsApp groups, whereas others, like UK5G Basecamp, were integrated into the 5GTT Programme. The use of online platforms to enable informal collaboration has been vital during the pandemic. A point of focus within a number of the interviews was that the UK5G Basecamp has provided opportunities for people to connect and learn from one another. However, it was also seen to be limited as the remit of the platform was not apparent to everyone and engagement has been varied. One interview participant reflected that previously a technical question had been raised, and as they could not answer the question they had to check with other members of their project and ask them to respond. This process involved work and time which is hard to record. There are clear challenges in using platforms such as Basecamp, especially for providing sustained and considered engagement from all 5GTT Programme projects. However it is important to note, that this is a general challenge of online spaces where numerous participants may act to limit sustained and considered engagement.

Despite the challenges experienced with online platforms, many interview participants reflected that the move to virtual spaces has provided new opportunities. It is evident that the projects and collaboration support representatives are looking forward to returning to in-person events. However, it was emphasised that the skills and opportunities generated through virtual interactions should still be valued in future R&D projects. There should not be a line drawn where the use of online spaces are positioned as lesser. Instead, it is recommended that the learnings gained through the use of virtual meeting spaces and online platforms should be transferred into future R&D programmes with Microsoft Teams, Zoom, Basecamp, and WhatsApp still valued as productive spaces.

*“ If I take all the meetings I’ve had to have, and if we hadn’t embraced this virtual zooming and teaming as we have, I actually think... I would have struggled personally with just making the time for the driving down and back and forth for all the meetings. Whereas, because everybody has been forced to embrace this virtual type of world... it’s probably made it more efficient. I think it’s been a successful part of the project. ”*  
–Bethan Evans, 5G RuralDorset

Informal collaboration is important for developing a positive rapport between people and organisations working across the 5G ecosystem. This informal collaboration helps to develop positive working relationships which are more likely to translate into formal collaboration within the R&D programme, and ensure that the learnings and connections are utilised beyond the programme. It is, therefore, recommended that the value of informal collaboration is recognised.

### Collaboration Support

The Collaboration Team within the 5GTT Programme is comprised of DCMS and three external organisations: UK5G, KTN, and the Digital Catapult. The Collaboration Team ‘exists to provide guidance, support and liaison between parties’<sup>11</sup>. So as to best reflect the data, the following section has been divided into external collaboration support comprised of UK5G, KTN, and Digital Catapult, and funder collaboration support as provided by DCMS.

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<sup>11</sup> DCMS (2021), 5GTT Collaboration Guidance for Projects, v2.4, [ppt slides]: slide 6

## External Collaboration Support

### 8) Ensure any organisation acting to support and promote collaboration effectively exercises this role

- The remit of each party within a collaboration support team must be clearly communicated within the team and to the projects
- Support needs to be streamlined and data should be shared between the parties supporting collaboration
- There must be consistency in the promotion and support of all types of collaboration, including external collaboration
- Mechanisms to help translate collaboration ideas into collaboration activities would provide benefit to the projects and R&D programme.

The role of a Collaboration Team and the organisations within it needs to be clear, and that any organisation acting to support and promote collaboration effectively exercises its role. Within the 5GTT Programme, the Collaboration Team is comprised of DCMS, UK5G, KTN, and Digital Catapult. In this section the focus is upon UK5G, KTN, and Digital Catapult, as the role of the funder, DCMS, is discussed in Recommendation 9.

The “outsourcing” of aspects of the collaboration support work from DCMS to UK5G, KTN, and Digital Catapult means that it is vital that roles are clearly designated, and expectations are communicated to the projects and the Collaboration Team itself. This is important as it ensures that projects understand which organisation to approach for support.

The interview data shows that this has not always been effectively managed due to the overlapping of responsibilities and confusion about what these different organisations do to promote collaboration, and is a situation which may not be apparent to the 5GTT Collaboration Team or DCMS more broadly. This has resulted in occasions where projects have had to duplicate communication by relaying collaboration plans and lessons learned to DCMS and UK5G on separate occasions. This duplication requires dedicating extra time to the administrative side of collaboration when projects could be enacting collaborative activities. The remit of each organisation within a collaboration support team needs to be made clearer, in the case of the 5GTT Programme how the roles of UK5G, KTN, and the Digital Catapult are distinct from DCMS. It would also provide significant benefit if knowledge sharing between the different organisations within the 5GTT Collaboration Team is present.

The UK5G as the national innovation network is ‘dedicated to the promotion of... collaboration’ and has a key role supporting 5GTT collaboration. This role is specified within the Grant Funding Agreement as outlined in 2.3.6 subsection c) that the recipient of the funding must ‘collaborate specifically with UK5G through involvement in UK5G Working Groups, attendance at UK5G collaboration and trade events and sharing of media and publicity products for use in UK5G media channels’<sup>12</sup>.

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<sup>12</sup> DCMS, (2020), *5G Testbeds and Trials Grant Agreement for RCC*, (5G RuralDorset), [administration form]

The incorporation of UK5G's role within the GFA is positive as it situates project engagement upstream within the project lifetime. However, the details of how projects engage with the UK5G, especially via the Working Groups, has not always been clear, and in the early phase of the projects the engagement from UK5G was described by some as "lumpy". The Working Groups have been a useful platform for developing inter-project collaborative activities. However, concerns have been raised that this work is not formally recognised as collaboration, and some projects have felt excluded when events have arisen from Working Groups that they were not involved in as the remit was not clear and items "suddenly appearing" from UK5G. The remit of Working Groups, or similar entity, therefore needs to be more clearly outlined and the work undertaken within them needs to be recognised as projects do not have the capacity to engage with all of these groups, especially within the current 2–4% collaboration allocation. The projects who have engaged with the Working Groups have benefitted from collaborating with other projects who have shared interests.

*“ I'm on two of the UK5G Working Groups...so I get to meet other people and hear what's going on... and that should be recognised under the collaboration, it's not part of a formal collaboration project, but we're giving our time...which I think is good and enhances all of the learnings. ”*  
- Rosemary Kay, Liverpool 5G

More generally, spaces provided by UK5G which enable opportunities for projects to come together have been appreciated, especially the *Be Better Connected* event, and prior to the pandemic, in-person showcases. However, interview participants reflected that more non-structured time would have been beneficial for giving projects more autonomy in deciding how to engage with each other. Interview participants explained that the productive discussions which arose were limited as it was a closed event focused on inter-project collaboration. It was noted that this is a common feature in the promotion of collaboration from UK5G and KTN, whereby inter-project collaboration tends to be almost exclusively prioritised. There was clear desire expressed in the interviews that more focus is given to external collaboration at such events. At its basis, UK5G has a clear opportunity to drive innovative external collaboration as it focuses on 'international engagement into the UK's 5G ecosystem'<sup>13</sup>.

The main challenge arising from collaboration events like *Be Better Connected* is translating an idea into a collaboration activity. This has meant that some discussions and plans have not been pursued and the role of the external support has become simply a "facilitator". Some interview participants reflected that the event was organised with short notice and

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<sup>13</sup> UK5G, (2021), What is UK5G?, Accessed: 24/06/2020, Available at: <<https://uk5g.org/about/>>.

the expectation to attend the event was unfairly placed on projects when other project activities needed to be prioritised. This wider context impacted the outcomes of the event as the attendance was used to claim against the 2–4% of collaboration rather than as a platform to initiate meaningful collaboration. This links back to the need for 2–4% to be increased to 5–8% as it enables projects to assign the necessary resources to follow up discussions. It also points towards the need for mechanisms to ensure collaboration ideas are followed through and plans are enacted.

It would therefore be beneficial for any networks and groups which promote collaboration to also support the process of translating an idea into an activity. In the case of the 5GTT Programme, it is recommended that new mechanisms are developed by the 5GTT Collaboration Team to ensure that projects are supported in taking collaboration plans further. It is important that events are not perceived as an end in and of themselves. The 5GTT Collaboration Team has had to navigate complex challenges, especially with Covid-19, and everyone has clearly been working hard. However, it is critical that the potential of collaboration is fully realised, and that the necessarily light touch approach does not mean that opportunities are missed. The varied experiences across the projects highlights that more needs to be done. It is vital that if external support is brought in to promote collaboration, as with the 5GTT Programme, then every role is clearly communicated and each organisation effectively exercises this role.

## Funder Collaboration Support

### 9) Invest in the DCMS/R&D funder Collaboration Team and the wider team supporting each of the R&D projects.

- The support provided by the R&D funder is vital and must be evident throughout an R&D programme
- The in-house Collaboration Team and Project Managers play a pivotal role in supporting collaboration and their work must be recognised and supported.
- An R&D funder should help to connect different projects together by sharing data and lessons learned as appropriate

The role of DCMS has been *pivotal* in supporting and enabling collaboration within the 5GTT Programme. This section focuses upon the role of an R&D funder, in this context, DCMS. Within the 5GTT Programme, support is also provided by external organisations, as discussed in Recommendation 8. The data highlights the importance of DCMS, and the tangible support which has been given through guidance in collaboration plans, application of activities, and recording of the activities. The continuation of support from the Collaboration Team, and DCMS more broadly, throughout the pandemic is testament to DCMS' hard work. One interview participant reflected that a different project they had been involved in could not continue due to the impact of the pandemic. It is evident the 5GTT

Collaboration Team values the activities being undertaken by the projects, and this is clearly greatly appreciated.

However, the data highlights that more needs to be done in connecting lessons learned from collaboration activities. The number of projects within the 5GTT Programme means it is not easy for a project to know exactly what work every project is undertaking. Sharing the lessons learned is of great importance, and DCMS as acting as the “hub” to promote this sharing of knowledge would benefit everyone.

*“ One of the things the collaboration process has taught me, is that we need to feedback to the projects the thing that they are a part of...if people feel a part of something, then they're more willing to collaborate. ”*  
– Bob Driver, Head of UK5G

The current reporting structure means that a significant volume of data is produced, yet projects do not know what happens with all of this data, or, often, why it is needed. A tension was identified in the reporting process with some projects feeling that DCMS’ focus overall was more on “report” rather than “support”, and that projects cannot access any shared data. Efficient sharing of data would increase the awareness between projects of what is happening across an R&D programme which would aid in identifying common interests for collaboration activities. The project funder has a key role in this process, and it was suggested that because collaboration reporting uses a set template the sharing should be a straightforward process. Indeed, it was suggested that someone should have a role in removing sensitive data and sharing the learnings across the programme.

*“ I think it [the support] is not enough... [DCMS] have an overview of collaboration and they are recording it quarterly, why can't they just put them in a template or report and share that with all projects because we are all using the same templates?... [In the spreadsheet it says] “is it OK if we share this?” And we say “yes”, but we never get any information from anybody else...so that massive list should be quarterly shared. ”*  
– Ceren Clulow, 5G Connected Forest

It is also evident that DCMS Project Managers have provided tangible benefits to projects. They have been instrumental in identifying similar challenges faced by projects and enabling the sharing of knowledge to find solutions and opportunities. However, it was identified that many projects have experienced a quicker than desirable turnover of Project Managers. It is acknowledged that in some cases this is inevitable due to the structure of DCMS and public sector bodies in general. Nevertheless, such a turnover has had an impact on the experience of projects, for example, 5G RuralDorset and MANY are currently

working with their third DCMS Project Manager in just over a year. This turnover rate has had an impact as each new Project Manager must spend time acquainting themselves with their respective projects. This takes work from both the DCMS Project Manager and the project who must then ensure that everyone is on the same page. This is not a critique of the DCMS Project Managers as these are important roles and the individuals working in these roles have provided significant support, but rather it points towards some broader structural issue at play. The interest in this report is solely on the impact this has on deliverables.

There have also been differences in the approaches adopted by different DCMS Project Managers, as might be expected. These differences have been particularly evident for projects who have worked with more than one DCMS Project Manager. One project explained that when the project encountered a problem their DCMS Project Manager actively engaged with other projects to help find a solution. The project reflected that their DCMS Project Manager provided pivotal support. However, this same level of support was not mirrored by another DCMS Project Manager they were later assigned. This is not a direct critique of the work of this DCMS Project Manager, but rather highlights the differences in approaches and expectations placed upon the DCMS Project Managers, and how this is interpreted both by them and the projects with whom they work. It is also important that the different groups working *within* DCMS communicate with one another regularly so that there is a clear understanding of what activities projects are working on and where overlap might exist. There were reflections within the interviews that knowledge is not always efficiently shared by DCMS staffers outside the 5GTT Programme with those working within it, and vice versa.

It is evident that the role of DCMS Project Manager is important in supporting projects and that it can significantly shape inter-project collaboration. Although, it is noted, this may change as expectations are altered, commitments are more clearly defined, and the GFA updated. It is recommended that DCMS further invests in the internal Project Manager roles as the main point of contact for projects. This would, in a perfect world, involve putting planning in place to aim to have each Project Manager remain within their role for the lifetime of the project they are supporting.

This may involve restructuring and investing financially in the roles, which it is acknowledged, involves work and time. However, it is important that there is a clear demonstration that collaboration is valued. A key way of achieving this is through ensuring that there is support provided by the funder. Similarly, it is vital that there is investment in a more clearly and efficiently structured external Collaboration Team, as outlined above, and that such a team is not solely inter-project driven in a way which overlaps with what the projects will be committing to in the GFA.

## Payment Administration

10) Ensure Grant funding Agreements (GFAs) payment terms meet the requirements of all partners, and that funds are paid on time to avoid delays to collaboration work, thus encouraging SME programme participation

- Grant claims need to be paid on time as a late payment can severely delay or even stop collaboration altogether
- Delayed payments can disrupt the functioning of SMEs and disincentivise SME engagement in R&D programmes.
- The payment process should be reviewed with changes embedded in the GFA focused upon claim submissions, the DCMS point of contact, and the payment.

The Grant Funding Agreement underpins the administrative side of the collaboration process and is key to ensuring that collaboration is effectively planned and managed. The contractual status of the GFA means that information contained within it must be delivered. It is, therefore, paramount that the GFA meets the requirements of all partners and there are checks to ensure this happens.

A recurring complaint within the interviews relates to the cash flow via the payment of grants following milestone claims. This is a complex process of checks to ensure the correct claims are being made in relation to the grant and spend. However, it was explained within the interviews that the payments from DCMS have been late, in some cases taking 3–4 months rather than the 20 Working Day Payment Target. The interview participant reflected that this is in contrast to other projects where DCMS has provided payment within a week of the claim being submitted. Within the projects partners collaborate closely, which means that if one partner has been impacted financially due to a late payment, they may not be able to meet their future collaboration commitments, which in turn has a knock-on effect on other project members and the wider project work.

Ensuring the claim payments are met in a timely fashion is especially important for SMEs, particularly in the current economic climate. A payment which is substantially late has significant impact upon a company's operational cash flow, and can even directly threaten their survival. These experiences of payment delays are often discussed beyond R&D programmes, which has a long-term impact of disincentivising smaller business from engaging in R&D projects. This is problematic as often SMEs drive innovation and provide significant project developments. The delays in grant claim payments can therefore impact the R&D project in question, and also future R&D programmes.

It is, therefore, recommended that the process is reviewed, and changes are embedded in the GFA, so that:

1. All claims are *only* ever submitted by the Project Lead on all occasions, thus simplifying the interface with DCMS

2. DCMS dedicates the *same individuals* in the DCMS financial team to a project for its duration, just as they do today with dedicated project officers, thus building understanding and trust
3. If there is a problem with payment to an SME, and *if the sum involved is agreed with the Project Lead to be under a certain threshold, then the claim is paid with the potential for downstream clawback by DCMS* if it transpires there is a “manifest and grave” error. In this way the principle of proportionate action can be reflected, and SMEs are not deterred from joining R&D programmes in the first place. The aim must be to avoid delay to projects, balanced with ensuring that public funds are being wisely used.

“ *It depends how small they [the funders] want the organisations to be on the trials. My inclination would be that they will get bigger benefit for the industry by encouraging more smaller businesses to get involved in these trials and really create something innovative...and if you do that, the cash flow is more important.* ”

– Hector Gibson-Fleming, 5G RuralDorset

## Summary

Within R&D programmes, collaboration has significant potential to create long-term positive impact for organisations directly involved in the programme and for the UK technology ecosystem more broadly. Collaboration draws on innovative “bleeding edge” work happening within, and across, projects working in an R&D programme as well as UK and international organisations. The data exemplifies that collaboration must be demonstrably valued so that the positive impacts of collaboration are fully realised.

It is recommended that the collaboration budget is extended to 5–8% of the overall project budget, and that the cash-flow is a smooth process. It is vital that different types of collaboration are supported and recognised, and that skills development is mandated as a collaboration activity. The pivotal work of the Collaboration Lead, a (re)focused Collaboration Team, and the guidelines must be recognised, and, where possible, embedded in the GFA to ensure activities are efficiently undertaken to the benefit of the R&D programme and the broader technology ecosystem. These actions will also make it easier for DCMS/R&D funder internal staff to evaluate collaboration activities.

This report is empirically driven by experiences within 5G R&D programmes. However, the ten recommendations outlined have a broader relevance for all forms of R&D programmes. It is, therefore, hoped that the recommendations will generate discussion about how best to promote sustained and productive collaboration in all future R&D programmes, not just testbeds.

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Further details of each of these R&D projects are provided in *Appendix A*

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## Appendix A – Project Overviews

### 5G RuralDorset

5G RuralDorset is an £8 million research and development project aimed at understanding how next generation connectivity can help people lead safer and more prosperous lives in rural communities, even in environments as sensitive as a UNESCO-designated world heritage coastline. The project focuses on how 5G can make Dorset a better place to live, work, and visit.

There are five main research areas within the project:

- Connected Coast
- Rural Community Accelerator
- Future of Food
- Innovation Acceleration
- Coastal Cliff Monitoring.

More information about the project can be accessed here: [www.5gruraldorset.org](http://www.5gruraldorset.org)

### 5G Connected Forest

The project is centred around the ancient Sherwood Forest and has been created to explore the potential for deploying 5G in woodland areas (especially within the constraints of working in some of the most highly designated heritage and conservation sites) around the twin aims of using 5G to protect and promote areas of natural and cultural heritage. The 5G Connected Forest project is exploring:

- The potential for 5G applications in the preservation of forests and their environment
- How 5G can enhance the experience of visitors to the forest and surrounding area.

This work includes robotic environmental management and non-intrusive live monitoring of the health of a forest, live AR and VR experiences for visitors of all ages, and inspiring public transport users. The project is also investigating business models that can enable operators to boost rural connectivity and create innovative applications with the potential for commercial development.

More information about the project can be accessed here:

<https://uk5g.org/discover/testbeds-and-trials/5g-connected-forest/>

### MANY (Mobile Access North Yorkshire)

The Mobile Access North Yorkshire (MANY) project supports the development of future rural connectivity in the county by developing new technologies, apps and services tailored for rural areas.

It aims to understand how the public, private and community sectors can work together to reduce the cost of delivering mobile access in rural areas, The project is building small mobile phone networks in areas that have no mobile coverage.

There are four use cases within the project which will highlight how 5G can:

- Boost tourism and other rural businesses to develop a growth economy
- Enhance environmental monitoring supporting relief agencies and council led teams
- Support mission critical services delivery
- Improve residents' wellbeing and mental health.

More information about the project can be accessed here:

<https://mobileaccessnorthyorkshire.co.uk/>

### MONeH (Multi Operator Neutral Host)

The MONeH consortium aims to demonstrate how multi-operator, neutral host cellular networks based upon small cell technology can be used to provide multiple user slices, serving different customer groups within rural areas with little or no coverage.

Deployments are utilising unused mobile spectrum, and using the new Ofcom-issued Local Access licencing procedures to offer a service that is both technically and financially robust in areas where conventional coverage solutions are not commercially viable for mobile network operators or cannot scale to cover small areas.

More information about the project can be accessed here:

<https://uk5g.org/discover/testbeds-and-trials/multi-operator-neutral-host-moneh/>

### Liverpool 5G

Liverpool 5G is building a 5G network designed to benefit local NHS, social care services and other public bodies in a post-Covid-19 world.

Liverpool 5G is creating a private, independent network designed to:

- Develop affordable connectivity for remote health and social care
- Improve future resilience
- Reduce inequalities that arise from lack of affordable access.

This builds on the existing 5GTT Phase 1 funded project in Liverpool, and develops the commercial business case for testing new applications in the health and social care sector. The project will stimulate the development of low-cost 5G technology as well as improving future pandemic resilience and reducing inequalities. The project will reduce digital poverty for those in need, providing safe, free and accessible connectivity to health, social care and education services.

More information about the project can be accessed here: <https://liverpool5g.org.uk/>

### Plymouth Smart Sound

Smart Sounds Plymouth facilitates trials, validation and providing of marine innovative technologies. Part of the Marine Business Technology Centre's (MBTC) testing and proving ground is Smart Sound Plymouth, the testbed benefits from a 5G mobile private network built by Vodafone using Nokia equipment. The network, known as Smart Sound Connect, enables ultrafast download speeds and low-latency 5G connectivity to support the development of new marine technology.

The MBTC is a £4.5 million European Regional Development Fund (ERDF) supported partnership between Plymouth City Council, Plymouth Marine Laboratory, the University of Plymouth, the University of Exeter, and the Marine Biological Association that works to facilitate innovation in the marine and maritime sector. The partnership received £1.8 million in funding from the Heart of the South West Local Enterprise Partnership (HotSW LEP) to develop Smart Sound Connect.

More information about the project can be accessed here:

<https://smartsoundplymouth.co.uk/Home>

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This report is driven by empirical research. The recommendations outlined within the report are informed by data collected via interviews with R&D projects and collaboration support team representatives. The views expressed within the quotes have been directly attributed, as agreed during participant recruitment.

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