Department for Digital, Culture, Media & Sport

5G Testbeds and Trials Programme

Rural Connected Communities Overview and Application Guidance

Contents

1. Programme and policy context

The Rural Connected Communities project (RCC) will support the overall strategy for improving mobile coverage and driving successful 5G implementation in the UK[1] by:

- Improving the case for investment in rural network deployment by testing new commercial and technical solutions for more efficient deployment of advanced network infrastructure including 5G.
- Supporting the business case for 5G by building and proving demand from new use cases that incentivise investment in rural areas.

This will ensure that even as we move to bring better mobile coverage to rural parts of the country, we are already investing in the next generation of mobile connectivity and building the business case to help industry deliver it.

We expect RCC projects to align with, and benefit from, the work of the government's Barrier Busting Task Force, which will be a key part of reducing costs and friction in deploying the new generation of mobile.

In RCC, we regard 5G as the converged set of mobile connectivity standards that 3GPP[2] will in time encompass: a description of the characteristics of 5G is set out in **Annex A**.

RCC is not designed as a network roll-out programme, but a series of trials and testbeds to de-risk and inform future network roll-out programmes.

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[1] Key strategy documents include "Industrial Strategy: building a Britain fit for the future", "Next Generation Mobile Technologies: An update to the 5G strategy for the UK" and the "Future Telecoms Infrastructure Review" (FTIR)

[2] The 3rd Generation Partnership Project (3GPP) is a standards organization which develops protocols for mobile telephony.

2. Competition outline

The Department for Digital, Culture, Media & Sport (DCMS) announced RCC on 27 August 2019 as part of the Government's 5G Testbeds and Trials (5GTT) Programme. The remainder of this document provides guidance for applicants seeking funding for this project.

Project ambition

5G provides the opportunity to improve the extent, quality and benefits of connectivity in rural areas by enabling new use cases and associated commercial and technical deployment solutions.

A key conclusion of the Future Telecoms Infrastructure Review (FTIR) was that 5G creates an opportunity for market expansion in the type of wireless services available and in the number of providers of networks and services. This includes new approaches to spectrum sharing, and new business models for managing access to spectrum, including spectrum leasing and 'neutral host' networks.

Use cases tested through RCC will help demonstrate demand from a variety of economic sectors and rural communities for 5G technologies. The use cases are expected to show a combination of societal and economic benefits that will together create a stronger case for investing in the deployment of 5G infrastructure for rural areas.

These use cases will also serve to drive increased levels of technology innovation. A key capability of 5G is its ability to integrate different access technologies (e.g. WiFi as well as conventional cellular) and deliver a variety of services with very different service characteristics (including using network slicing). This potentially makes 5G a key enabler of wireless expansion and innovation, across a range of different sectors. This, in turn, can help generate a new and growing rural innovation ecosystem, driving rural economic growth, and the delivery of improved, lower cost public services. That innovation ecosystem will include enterprises of all sizes, together with academic and research bodies working closely with local government, regulators and policy makers.

5G has also been designed to provide higher levels of security than previous mobile technologies, with a number of new security features. RCC will help explore what network architectures most effectively deliver security in practice, how technical standards might be used to promote best practice, and how new and independent assurance processes might be used to provide transparency as to the level of security being delivered.

It is expected that projects will demonstrate the commercial and wider social value of 5G in several ways:

- By testing new commercial (see **Annex B**) and technical (see **Annex C**) solutions to improve and accelerate the business case for deployment in rural areas.
- By demonstrating that sector-specific use cases create investment cases for sector-specific operators and technology providers, and demonstrate increased demand for wireless connectivity (see **Annex D**).

Eligible applicants

This competition is open to applications from consortia from across the UK. Organisations which do not have a UK presence may participate in the delivery of RCC but will not be eligible to receive DCMS funding. There are no prescriptions, beyond those set out in the "Proposing consortium" section, regarding what types of organisations should be consortium members, e.g. consortia should include one or more organisations capable of owning and operating 5G infrastructure and services in the area and projects must involve at least one micro, small or medium-sized enterprise (SME). However, consortia are likely to consist of a mixture of organisations including the public, private and third sectors, and academia.

Funding

Central government funding for RCC will come from the £200m of investment that has been allocated to the 5GTT Programme from the National Productivity Investment Fund (NPIF). Funding for RCC is profiled over three financial years, from 2019/20 to 2021/22.

Funds must be used for experimental development, as described in the "5G Testbeds and Trials - General Guidance for Grant Applicants" document. Grant recipients will be required to confirm that the costs they wish to claim for are capitalised and/or treated as capital expenditure in line with UK GAAP and the requirements of the European System of National and Regional Accounts (ESA 2010).

DCMS will make available grant funding ranging from £2 million to £5 million for around 10 projects, totalling up to £30 million. Across all of its investments, the 5GTT Programme expects those organisations receiving grant funding to match that funding with an equivalent amount (1:1 match funding). However, different projects and types of business can receive different levels of grant funding within that. Where a proposal does not propose 1:1 match funding of DCMS funding, then an explanation of why this is not possible should be provided. Please note the maximum grant funding rates for businesses set out below, as prescribed by state aid rules.

For experimental development involving collaboration, the maximum grant allowed towards your eligible project costs under state aid rules if you are an organisation receiving direct grant funding from DCMS is:

- up to 60% if you are a small business
- up to 50% if you are a medium-sized business
- up to 40% if you are a large business

For the purposes of this competition, the EU definition of an SME is used.

Research organisations undertaking non-economic activity will be funded as follows:
- universities: up to 80% of full economic costs
- all other research organisations: up to 100% of eligible costs

To discover what costs are eligible please see the standard definition of eligible costs in the "5G Testbeds and Trials - Eligible Project Costs Guidance" document.

The applicant(s) selected at the end of this competition will need to follow the process and criteria that will be set out in a DCMS grant funding agreement to access funding (a template for which is available [here](#)) for individual activities under RCC. DCMS may also make additional funding available to the project at a later date.

RCC projects should complete all DCMS funded activities by 31 March 2022, unless an extension is agreed with the 5GTT Programme. Non-DCMS funded activities will be expected to continue beyond this date. DCMS will, as a condition of making funding available, require the successful applicant to set out the principles of how they will create sustainable project outputs in their application (see Question 6 below), and to have an approved plan in place prior to 31 March 2022.

DCMS funded projects are expected to be:

- Part supported by financial and non-financial contributions from consortium participants; and
- Compliant with state aid rules.

Please read the ["5G Testbeds and Trials - General Guidance for Grant Applicants"](#) document for more information on the different categories of funding and the rules around our state aid framework.

The following criteria apply to the distribution of funds amongst a consortium:

- Total subcontracting cost is limited to 30% of the total project costs - a clear case must be made as to why subcontractors are not key project partners and why it is not possible for the work to be conducted by a project partner.
- No single partner can receive more than 70% of the total eligible project costs
- At least 70% of total eligible project costs should be incurred by private sector business organisations
- For all research organisations and public sector organisations the total level of project participation is set at a maximum of 30% of total eligible project costs. If your consortium contains more than one research or public sector organisation, this maximum will be distributed between them

Within a consortium, there must be a lead partner who will be the accountable body and recipient of any DCMS grant awarded. They will also be responsible for managing the consortium and for any distribution of DCMS funds to consortium partners, as set out in the consortium's collaboration agreement. The lead partner will be required to ensure value for money when distributing grant funding. Further details of the expected consortia are described in the "Eligibility criteria" section below.

Organisations engaged in the delivery of RCC must collaborate with other projects funded by the 5GTT Programme, and/or the wider 5G ecosystem. This is to boost 5G ecosystem development, ensure learning is shared between projects and so that common issues affecting projects and the wider 5G ecosystem can be explored or addressed.

Proposals for such collaboration activities should be included in applications and should make up 2-4% of the DCMS grant, with grant claims for this activity subject to match funding requirements specified by state aid rules. Such activities should lead to the production of tangible outputs such as published reports, events and workshops. Bidders should refer any

new proposals for collaboration with other projects to DCMS ahead of submission to enable potential sharing of these ideas with other bidders. Potential areas for collaboration activity include key cross-cutting strategic issues, including:

- Practical implementation of secure networks, including security assurance, and the resilience of services;
- Access to spectrum, e.g. spectrum sharing, neutral host networks, private networks;
- The delivery of differentiated services over networks, e.g. by exploiting network slicing;
- The integration of 5G and AI – new services which combine connectivity, intelligence and data;
- Human interfaces which make complex services easy to use, e.g. voice recognition, AR/VR, conformable screens, neural interfaces;
- Public engagement with 5G;
- Digital skills; and
- Overcoming barriers to deployment e.g. planning.

The evaluation of proposals for collaboration is a key component of the evaluation process. Collaboration deliverables should be identified as specific milestones in project plans. Following selection of applications for grant funding, DCMS will work with the selected bidders to update their plans for collaboration, to align projects where appropriate. Once projects have had grants awarded, we expect projects to work together, with other ecosystem participants and with DCMS, to agree further details on timescales and input requirements. These details will inform an expected early deliverable: a detailed plan for delivery of collaboration outputs.

In addition to formalised plans for collaboration, all projects must sign up to the "5G Testbeds and Trials - Programme Participation Agreement" with DCMS as part of the application process.

Additional documents

The following additional documents are provided to support you in your application:

- "5G Testbeds and Trials - General Guidance for Grant Applicants" - which contains general information relating to this competition and the processes DCMS will use to deliver it, including: funding rules guidance, information on the different categories of funding and the rules around our state aid framework
- "5G Testbeds and Trials - Eligible Project Costs Guidance" - which contains detailed information on which project costs are eligible for funding
- "5G Testbeds and Trials - Guidance for academics applying via the Je-S system" - which explains how academics should make use of the Je-S system
- "5G Testbeds and Trials - Template Grant Funding Agreement" - which demonstrates the process and criteria to access funding for individual activities
- "5G Testbeds and Trials - Potential Monitoring Indicators / Quarterly Benefits Reporting Template" - which will help inform the benefits realisation approach and includes a reporting template
- "5G Testbeds and Trials - Programme Participation Agreement" (one per applicant) - which is provided for information and will need to be completed upon award

The following documents need to be completed as part of your application:

- [Application form](#) (one per project, plus any allowed appendices)
- [Project Finance Form](#) (one per applicant)

Dates and deadlines

Competition opens	27 August 2019
Clarification questions on the Application Guidance	27 August - 27 September 2019
Competition closes	12pm, 25 October 2019
Shortlist applicants notified	14 November 2019
Interviews for shortlisted applicants	25 November - 6th December 2019
Successful applicant(s) notified	December 2019
Grant claim period	From January 2020 to end March 2022

3. Eligibility criteria

Consortia must demonstrate clearly in their application how they meet **all** the eligibility criteria set out in this section.

Application format

You can only use the application form and templates provided. They contain specific guidance on information you must provide.

The application form and templates contain specific fields. It is important that you complete each field and submit a fully completed form. Incomplete forms will be considered ineligible and will not be sent for assessment.

The application form and templates must not be altered, converted or submitted as a different file type.

The submission must conform to the maximum length specifications stated in the "Competition questions" section below. Information in excess of this will be disregarded. Hyperlinks referencing further information may be included to inform more detailed understanding post-selection, but will be disregarded during the assessment of applications.

Additional information submitted at the request of the 5GTT Programme must meet any timing, format and length requirements we may specify at the time.

Project location

We are interested in applications from a variety of types of rural locations, from sparsely populated areas with primarily natural or agricultural land use, to more populous rural areas including some settlements. However, proposals must clearly focus on rural services, communities and economies and the benefits to them, not on any urban areas that may be within the proposed region.

All activities funded under RCC must be carried out in the UK.

The project area is the area where trials will be conducted and must include either:

- A contiguous rural area (which may incorporate multiple local authorities); or
- Multiple, separate rural areas, with a strong rationale for why they are interlinked for the purpose of this project.

The project area, at postcode-level, should meet the relevant rural classification applied by the project's host country - England, Wales, Scotland, or Northern Ireland. The relevant country definitions can be found in the table below.

Country	Classification	Source	Definition
England / Wales	Rural Urban Classification, 2017	https://ons.maps.arcgis.com/apps/webappviewer/index.html?id=20467878cc20410d961a3f71db356b6d	Postcodes assigned to any of the categories D1, D2, E1, E2, F1, F2
Scotland	Scottish Government Urban Rural Classification, 2018	https://www2.gov.scot/Resource/0054/00544930.csv	Postcodes assigned to any of the categories 3-8
Northern Ireland	Technical guidance, 2016	The Central Postcode Directory https://www.nisra.gov.uk/support/geography/central-postcode-directory	Postcodes assigned to any of the categories E, F, G, H

Proposing consortium

In order to attract the broadest range of proposals, we are open to receiving proposals from consortia that can be led by any type of organisation from the public, private, third or academic sectors, providing that the consortium meets the following criteria:

- There must be a lead organisation that demonstrates that it can act as the accountable body, has the capability, and is able to manage the delivery of the project across the consortium with clear project governance and leadership.
- The consortium shows evidence of public and private sector partnership, including strong industry representation, and includes, or can demonstrate strong commitment to collaborate from, all local public sector bodies responsible for any services or assets involved in the project, or areas within which planning permission will be required.
- The consortium has access to the spectrum and network capabilities required to deliver the project, or has a clear plan to acquire or build them in a timely manner. This may be in the form of an agreement with an existing network provider, or through the deployment of new network infrastructure, in addition to any required connections to existing or third-party infrastructure. Spectrum may be commercially licenced, by using an Ofcom Innovation and Trial Licence or by making use of Ofcom's new licensing approach to provide localised access to spectrum bands that can support mobile technology.[3]

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[3] Ofcom are making spectrum in the 3.8-4.2 GHz, 1800 MHz and 2300 MHz spectrum bands available through local licences, as well as a section of the 26 Ghz band for indoor licensing. They are introducing a new way to

- To be considered a consortium, at least two organisations must be requesting grant funding from DCMS.
- The consortium includes one or more organisations capable of owning and operating 5G infrastructure and services in the area.
- Projects must involve at least one micro, small or medium-sized enterprise (SME).
- The consortium can demonstrate an operating and commercial model that can be replicated outside the local area.
- The consortium should demonstrate that it can meet the match funding requirements described in the "Competition outline" section above.
- The consortium contains organisations from both the user-side and the supplier-side for at least one use case dependent on 5G technologies and with the potential to create a viable, sustainable market opportunity.
- The consortium demonstrates committed support from individuals with decision-making and budgetary responsibility from each member organisation.

Organisations or consortia that have previously or are currently receiving funding through the 5GTT Programme are welcome to participate, but only by making proposals that are clearly new in scope and adding value beyond previous project activities that they have undertaken or are funded to undertake.

Applicants involved in existing 5GTT Programme projects or considering participating in applications for other 5GTT projects will not be advantaged or disadvantaged in this or any other competition. Each proposal will be evaluated on its individual merits, although applicants should demonstrate that they are not duplicating the commitment of resources, and that they have the capacity to deliver in the event of multiple successful applications.

Project proposals

Project proposals should:

- Include a clearly defined business plan for the RCC project, including the use cases, applications and services that will be involved, and the benefits 5G technologies will bring to them in a rural context.
- Include a fully costed delivery plan, following the "5G Testbeds and Trials - Eligible Project Costs Guidance" document. The plan should demonstrate how both capital and operating costs are met by a combination of DCMS funds and investment by the proposing consortium. Grant recipients will be required to confirm that costs supported by DCMS funds will be capitalised and/or treated as capital expenditure in line with UK GAAP and the requirements of the European System of National and Regional Accounts (ESA 2010). Project activities to be funded by DCMS should be compliant with state aid requirements and constitute experimental development. Please refer to the "5G Testbeds and Trials - General Guidance for Grant Applicants" document.
- Demonstrate that a strategic approach will be taken to information and cyber security using industry best practices and standards. Show that risks are appropriately managed end to end across the project scope and delivery lifecycle.

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access spectrum that is already licensed to mobile operators but which is not being used or planned for use in a particular area within the next three years.

- Test new commercial and technical solutions for more efficient deployment of advanced network infrastructure, particularly spectrum sharing and differentiated services
- Offer a convincing model and capacity for collaborative delivery by the consortium.
- Demonstrate the added value DCMS funding will make to delivering the project and its outcomes.
- Describe how the project will baseline, measure, document and report over time on the value added by, and the impacts of the project. This should include some suggested quantifiable metrics and qualitative measures, indicating how achievement of project KPIs will be measured through benefits delivered by the project (Please refer to the "5G Testbeds and Trials - Potential Monitoring Indicators / Quarterly Benefits Reporting Template" document.) This should include social, environmental and economic impacts as well as commercial achievements and sustainability.
- Where relevant, demonstrate how it will deliver, or accelerate the delivery of, infrastructure and services that will be sustained beyond the period of DCMS funding and that can scale to or be replicated in other rural areas.

4. Competition process

The competition process will follow these steps:

- Applications should be submitted by email to 5Genquiries@culture.gov.uk. We will confirm by email the receipt of your application within two working days.
- Applications will be assessed against the questions set out in this application guidance, including pass/fail assessment against eligibility requirements. We may request that applicants also answer clarification questions.
- Eligible applications will be ranked for shortlisting based on total score. The top ranked applications will be invited to a second stage assessment, which will include an interview. Details of the interview stage will be confirmed nearer the time but will be in central London unless advised otherwise. Shortlisted applicants will be provided with a list of questions/topics for the interview and requests for further information to clarify aspects of their applications.
- The assessment of shortlisted applications will be updated following the interview, also taking into account any information provided, where requested by DCMS.
- Shortlisted applications will be ranked in descending order, based on total score, and the selection of preferred applicants will be undertaken using a portfolio approach to ensure that there is an appropriate balance of projects which support the 5GTT Programme and policy objectives as set out in the "Programme and policy context" section above.
- The applicant lead(s) will be notified of the selection decision.
- DCMS may elect to identify reserve applicants, in case the preferred applicant(s) is/are unable to complete a funding agreement with DCMS on a timely basis.

Each question response will be assessed and marked on a scale of 0-10:

- 0-1 – Serious concerns: for example, does not meet requirements, and/or raises serious concerns.
- 2-3 – Some concerns: for example, meets some requirements but with gaps and/or some concerns.
- 4-5 – Adequate confidence: for example, meets most/all requirements, but lacks sufficient detail in some areas.
- 6-7 – Good confidence: for example, meets most/all requirements and provides a response that demonstrates a good understanding of the requirements.
- 8-9 – Very good confidence: for example, meets all requirements and provides a detailed response that also exceeds expectations in some areas and/or demonstrates a strong understanding of the requirements.
- 10 – Outstandingly good confidence: for example, meets all requirements and exceptional detail that exceeds expectations in many areas and demonstrates an excellent understanding of the requirements.

Following the selection process, we expect that a period of due diligence will be carried out to validate the project scope, delivery plan and funding arrangements prior to the award of a grant.

Quality threshold

A moderation panel will review the individual scores of assessors, before agreeing final assessment scores. Following this, any application with a final assessment score of one or below against any individual competition question, including where an error has been made by the applicant, will not be considered further for shortlisting (Step One)

All remaining applications with a final assessment score against all competition questions (i.e. the weighted score across all competition questions) of five and above will be considered for shortlisting (Step Two).

DCMS also reserves the right to consider applications for shortlisting that do not meet the thresholds above in the following cases:

a) If an application fails to meet the threshold in Step Two by a narrow margin as a result of the range of scoring by individual assessors being of significant variance from the average score for one or more competition questions for that application ("an outlier"). The application may be considered for shortlisting following a review of the outlier assessor's comments and approach if the outlier score may reasonably be eliminated and the final assessment score that is recalculated falls within the threshold above.

b) If there is a significantly higher volume of applications meeting the thresholds in respect of grant funding available, DCMS may raise the threshold that applies to Step Two for the consideration of shortlisting. This will be on the grounds that DCMS will not want consortia with lower assessment scores to invest time and effort in preparing for the interview stage if there is a very limited prospect of them being successful.

c) If there is a very low volume of applications meeting Step Two in respect of grant funding available, DCMS may lower the threshold that applies to Step Two for the consideration of shortlisting. This will be on the grounds that DCMS will not want grant funding to be unallocated if there is a realistic prospect of consortia being able to improve their assessment score to a satisfactory level.

5. Application structure

The structure for applications should be set out as follows:

- **Applicant information**
- **Public Description** (400 word limit)
- **Section 1 - The business plan (40%):**
  - Question 1: What will your project deliver? (12.5%) (900 word limit)
  - Question 2: Why will your proposal create a meaningful difference to rural connectivity and services enabled by 5G technology? (10%) (720 word limit)
  - Question 3: How will the project contribute to the local rural economy and society? (10%) (720 word limit)
  - Question 4: How will you ensure that the environment created by the project will support the development of a 5G ecosystem in the UK? (7.5%) (550 word limit)
- **Section 2 - Delivery of the project (40%):**
  - Question 5: How is the delivery consortium constituted, and how will it operate to deliver the project? (15%) (1100 word limit)
  - Question 6: What is your approach to ensuring a commercially sustainable environment after the period of DCMS funding? (12.5%) (900 word limit)
  - Question 7: What local strengths and commitment will support delivery of the project? (12.5%) (900 word limit)
- **Section 3: Funding and added value (20%):**
  - Question 8: What is your outline proposal for financial and non-financial contributions to the project? (12.5%) (900 word limit)
  - Question 9: What is your approach to demonstrating the added value and impacts of the project? (7.5%) (550 word limit)
- **Appendices** (see below)

Supporting information is required, as appendices, for Questions 5 and 7. Supporting information may be provided, as appendices, for Questions 1, 2 and 5. These will be assessed, if included. Each organisation within the consortium must also attach a completed Project Finance Form.

Any information beyond the above should be included in an appendix as links, e.g. to any existing documents/brochures, which explain in more detail the local environment, initiatives or other relevant details. These will not be considered as part of the assessment process but should aim to provide more in-depth background information of the wider context in which the project will form part of. Note that the evaluation team will not consider these materials when scoring proposals however they may be read as part of due diligence in the later stages of the assessment

Your proposal should be clearly and concisely written, emphasising how the project will be delivered and the benefits it will create. Avoid repetition and jargon wherever possible.

6. Competition questions

Applicants should answer all questions, using the application form provided.

Applicant information

Please provide the following information:

- Project name
- Name of application lead organisation
- Contact details for application lead organisation
- Name(s) of additional organisation(s) forming part of this application
- Contact details for additional organisations

Public description of the project

To comply with government practice on openness and transparency of public funded activities, DCMS has to publish information relating to funded projects. Please provide a short description of your proposal in a way that will be understandable to the general public. We will publish this information for all bids, including those not awarded funding, so do not include any commercially confidential information, e.g. intellectual property or patent details.

We would also like to publish the partners involved in your proposal and the public description of the project, but this is not mandatory. Please confirm in the application form to indicate if you are happy for these to be published as well.

Section 1: The business plan (40%)

Question 1: What will your project deliver? (12.5%) (900 word limit)

- Describe your project, setting out:
  - Your rationale for the project, the industry challenges and the use cases that grant funded trials and any other planned trials with funding from other sources will address.
  - The key outcomes you plan to achieve in the project.
  - The rationale for your approach.
  - How the project meets the aims of the 5GTT Programme as set out in the "Programme and policy context" section above
  - At a high level, why it will make a significant impact locally, and with national and international relevance (subsequent questions explore this topic in more detail).
  - At a high level, your information and cyber security strategies including the standards and principles that your consortium will adopt.
- Describe which vertical industry sectors, and cross industry sectors, you will seek to develop initially as part of delivery of the project and which sectors will also be good candidates for future development as part of your approach to a sustainable delivery

model. Identify the use cases that the project will develop. The description should be clear why 5G technologies provide a particular benefit to these sectors and use cases in rural areas. Describe why these use cases constitute a significant increase in demand for rural mobile connectivity over the present market for 4G services.

- Identify the advantages and expertise demonstrated by the consortium and the local area, including in vertical industry or cross industry sectors, which will be most relevant to the project.
- At a high level, describe how the project will enhance the lives of people in the area through the creation of a Rural Connected Community (this issue is addressed in more detail in Questions 2 and 3).
- Describe the geographical area the project will cover – you may include a single appendix in .pdf format and up to two pages long to support your response. This should address all of the criteria relating to project location described in the "Eligibility criteria" section above. Include:
  - An outline of the geographic area(s) that the project will cover.
  - Where applicable, the rationale for why physically separate areas are interlinked for the project, clearly demonstrating how they will be interconnected to provide a contiguous experience.
  - Statistics (stating sources and dates published) for (i) the size of the area (square kilometres); (ii) the number of domestic premises and the resident population; (iii) the number of SME businesses and other businesses; and (iv) any other relevant figures.

Question 2: Why will your proposal create a meaningful difference in rural connectivity and services enabled by 5G technology? (10.0%) (720 word limit)

- How will your proposed project improve the existing market for rural mobile connectivity and services? This may include new commercial solutions, particularly those related to spectrum sharing; the use of new technologies (particularly differentiated services) or to specific new use cases and their benefits. If necessary for the use case, it must also include plans for Mobile Network Operator interconnectivity.
- For proposals that contain plans to deliver or accelerate the delivery of local mobile connectivity in the project area, you should demonstrate evidence of low or poor connectivity. To do this, you should use a combination of local authority-level and postcode-level data publicly available from Ofcom, as set out in **Annex E**. You are also invited to include any supporting evidence of poor connectivity as you see fit. You may include a single appendix in .pdf format and up to two pages long to support your response
- How will the project improve the long-term incentive for commercial investment in infrastructure and services that create social, economic and environmental improvements in rural communities?
- Why are 5G technologies crucial to enabling the new products and services and improving market incentives to invest?

Question 3: How will the project contribute to the rural economy and society? (10.0%) (720 word limit)

- Identify the economic and other benefits of the project (for example, business growth, local regeneration and examples of services / programmes where it is expected that

the project will lead to measurable improvements and/or benefits). This should include any specific local needs or challenges which the project will address.

- Cite evidence that supports the case for making the intervention represented by your proposal, for example, is economic growth currently impeded by a lack of digital connectivity? Are social mobility or educational attainment impaired? Why are these specifically rural issues and how will 5G enable them to be addressed through the project?
- What proportion of the population within the area of your project do you anticipate will experience or be impacted by the project? Give examples, including how you will maximise the impact of the project on people living in, working in, visiting and/or travelling to/through the project area.
- Where relevant, describe your approach to delivering or accelerating the delivery of local mobile connectivity, including any Local Connectivity Plans or work with the UK Government's [Barrier Busting Task Force](which is addressing barriers to the deployment of digital infrastructure). Please use the coverage metrics in **Annex F** to demonstrate existing connectivity and planned improvements.
- Describe any wider local strategies, initiatives and plans that are specifically relevant to the successful delivery of the project and its outcomes and how you will engage with them to maximise benefits. These could be innovation programmes, infrastructure projects, regeneration activities, business engagement or skills programmes. Include synergies that can be achieved. This should include any other activities to encourage the roll out of full fibre.
- Describe how the project will contribute to the provision of digital skills across target audiences within local rural communities.

Question 4: How will you ensure that the environment created by the project will support the development of a 5G ecosystem in the UK? (7.5%) (550 word limit)

- Describe your approach to ensuring an appropriate open access basis for organisations to conduct trials and use available infrastructure or services. You should explain how you will enable an open testbed and overcome issues with sharing sensitive commercial information and operations with potential competitors.
- Describe how the project will contribute to developing the UK's capabilities in the emerging 5G environment. This should demonstrate a good understanding of relevant industry sector and cross sector requirements and strengths.
- Describe any potential international visibility of specific aspects of your project, for example in developing trade and supply chain links.
- Describe your approach for the identification and dissemination of lessons learned and project outcomes, including to wider 5GTT Programme participants and [UK5G].
- Describe the key features of your delivery and commercial approaches that will be suitable to be replicated by other projects.
- Describe how the project activities contribute to the development of a safe, secure and resilient UK 5G network.

Section 2: Project delivery (40%)

Question 5: What is the delivery consortium, and how will it operate to deliver the project? (15%) (1100 word limit)

Your answer to this question should address all of the criteria relating to the proposed consortium described in the "Eligibility criteria" section above.

- Describe the roles, responsibilities and relevant skills and experience of all partners that are relevant to the approach you will be taking. Do they have experience working in the proposed locality? Do members of the consortium have a history of working together?
- How will your consortium help the UK to underpin and increase a diverse and secure supply chain for digital infrastructure?
- Describe the organisational structures, policies, and processes that will be put in place to understand, assess and systematically manage security risks.
- What capability does the consortium leader have to lead successful delivery?
- Include a diagram of the organisation and describe the relationships between the organisations involved in your application. This should be an appendix in .pdf format and up to two pages long.
- Set out a fully costed delivery plan including specific activities, resourcing, timeframes, milestones, deliverables and critical success factors. This should be an appendix in .pdf format and up to five pages long. Please indicate which members of the delivery consortium are responsible for each component of the plan. The plan should be consistent with the details of your funding request in response to Question 8. The delivery plan should be fully costed, following the "5G Testbeds and Trials - Eligible Project Costs Guidance" document. Assume any project activities for which grant funding is applied for should begin from January 2020.
- The costings should demonstrate that DCMS-funded activities constitute experimental development and are compliant with state aid requirements. Confirm that the grant amount requested from DCMS includes any irrecoverable VAT, all fees and charges, and appropriate allowance has been made for any price inflation during the project period.
- Describe how the consortium will access the assets and data required to deliver the project, in particular those required for access to spectrum and the delivery of infrastructure. Are the asset owners, or those responsible for permitting access to them, members of the consortium? If not, explain why not and can they demonstrate strong commitment to collaborate, for example in the form of letters of support?
- Describe the main risks and dependencies of your proposed RCC project, together with mitigations. You may include a single appendix in .pdf format and up to two pages long to support your response.

Question 6: What is your approach to ensuring a commercially sustainable environment after the period of DCMS funding? (12.5%) (900 word limit)

This section is seeking information about commitments and sources of funding that will remain in place *after* the period in which DCMS funding supports the project. Commitments and funding that the consortium will make available to deliver the project within the period of the DCMS grant are covered in Question 8.

- **Describe the ongoing operation of project assets, infrastructure and services by the consortium:** what longer term roles do you see for consortium members in sustaining delivery of the project beyond the period of DCMS grant funding?
  - Who will own and operate infrastructure and data assets?
  - What is your approach to maintaining the availability of any infrastructure, facilities, relevant services and data?
  - How you will attract other trials from organisations involved in the project and from additional organisations? This may include 5G and non-5G trials.

- ○ How could the project be further developed, scaled and improved beyond the timeframe or outside of the scope of the project as described so far?
  - ○ What future sources of funding including from cost savings on the delivery of public services, or income from commercial sources such as fees paid for access to the network, data generated by it, or services delivered using it do you plan to access?
- **Describe the sustainability and scalability of products and services developed by the consortium:** for products and services that will be developed by members of the consortium, are the relevant budget-owning representatives of the organisation committed to long-term investment in, and support of, those services, if the project proves they are viable? Have budget-owning representatives from potential customers of those projects expressed a strong interest in purchasing them?
- **Describe the sustainability and scalability of third party products and services:** how will you attract and support members of the consortium and third-party organisations to use the project to develop new products and services with long-term independent commercial viability, and support them scaling beyond the project? This could include services operated by organisations from the public, private, third and academic sectors. Through what process will you validate that proposals to use the project to develop new products and services have realistic and complete commercial cases?
- **Describe the extension to other rural regions:** how will the project lead to the delivery or acceleration of delivery of similar services and infrastructure to other rural areas? Do members of the consortium intend to extend or scale delivery to other rural areas themselves? Or if the model used in the project is replicable once proven to other areas without requiring DCMS funding, how will the consortium disseminate experience and contribute to capability building and barrier busting?

Question 7: What local strengths and commitment will support delivery of the project? (12.5%) (900 word limit)

- Describe how there is strong, clear leadership of the consortium partners and, as appropriate, related regional organisations such as Local Enterprise Partnerships and regional innovation ecosystems that could contribute to the success and impact of the project.
- Describe the relationships between your consortium and other relevant local bodies such as Local Enterprise Partnerships and innovation and business support organisations. Are good working relationships already in place?
- Describe the commitment from senior leaders locally to the project, including both from those organisations forming part of your proposal and from other relevant major local stakeholders. This should specifically include organisations from whom the project will require assets or access to assets. Letters of support should be included as an appendix to this question.
- DCMS will expect the leaders of local authorities, where involved in the project and relevant, to commit during project delivery to becoming champions for the DCMS Barrier Busting Task Force.
- Describe existing or planned engagement with local individuals, local or wider businesses and other stakeholders that are relevant to any of your answers to this application.
- If relevant, please provide details of timings, scale and outputs of existing testbed, trial, pilot or similar projects that are relevant to this project, including details of scope, timings, scale and parties involved in delivery. Set out the successes and

failures of these projects and the lessons learnt, which will be applicable to this project.
- Describe the network and any other infrastructure that will be available for use in the project, and your approach to accessing it. How will you secure investment in mobile infrastructure, or accelerate plans to deploy it? How will the project secure access to spectrum? How would you go about discovering and managing ownership and access arrangements for relevant assets that are likely to be utilised as part of providing connectivity solutions.

Section 3: Funding and added value (20%)

Question 8: What is your proposal for financial and non-financial contributions to the project? (12.5%) (900 word limit)

Your answer to this question should be compliant with the guidance in the "Competition outline" section above on the use of DCMS funding, including its distribution amongst consortium partners, and the provision of match funding by members of the consortium.

You should give reasonable and justifiable indications of the commitments that members of the consortia and other relevant organisations will be able to make in agreement with DCMS if RCC funding is made available to you.

The consortium will need to demonstrate the ability to commit sufficient funds, resources and assets to make the project viable; it should also demonstrate the ability to attract additional funds during the grant funding period (for example, from investors, research and innovation agencies and corporate R&D funding) to support third parties in using the project to test and develop new products and services.

This question is specific to the funding that will support delivery of the project during the period of the DCMS grant. Sources of funding to sustain activities beyond the grant period are covered in Question 6.

- Detail the estimated project cost for each work package. Make clear the level of contribution from each project participant and the level of grant funding requested from DCMS. A summary of this information should be provided in the financial summary table in the application form.
- Provide a narrative description summarising what each project participant will be delivering and the costs associated.
- Provide a cost breakdown of forecast expenditure on the project. Identify costs for the testbed and funded trials separately. Explain how the costs have been calculated.
- Detail the spend profile by month, linking it to milestones and deliverables as needed. This should be fully consistent with the dates you have specified in the project plan.
- Describe any sub-contractor costs and why they are critical to the project and are not grant receiving consortium members.
- Describe how you will secure or accelerate investment in and deployment of 5G infrastructure and services through the project.
- Describe what the organisations involved in your application will commit to the project, in terms of financial and non-financial contributions as well as leveraging other available resources and assets. Confirm which organisations have agreed to

provide financial and/or non-financial contributions and whether they represent capital or revenue.
- Set out how you will ensure value for money through your sourcing approach and supply chain.
- Identify the amount of DCMS grant and other funding you will set aside for working with other participants in the 5GTT Programme. A minimum of 2-4% of grant funding is required.
- Describe any criteria or constraints that are likely to have a significant impact on the availability or timing of financial and non-financial contributions.
- Describe your relationship with funding bodies such as investors, research and innovation agencies and corporate R&D bodies in a position to fund third parties to use the project to develop new products and services, and your track record in attracting funding from them.
- Describe how the funding made available to match DCMS funds meets the state aid requirements.
- Noting that DCMS can only provide grant funding following evidence of expenditure, how will the consortium access working capital?
- Confirm that the grant amount requested includes any irrecoverable VAT, all fees and charges, and appropriate allowance has been made for any price inflation during the project period.
- Confirm that all grant funding claims do not extend beyond 31 March 2022.

Assessors need to be confident the project can be delivered to the stated cost. They will consider:
- The response to this question and the supporting financial information provided.
- The suitability of the proposed costs - costs considered excessive will be a cause for serious concern.
- The total amount of grant funding requested from DCMS.
- Whether there is an appropriate level of contributions from public sector organisations who are key project partners.
- Whether there is a significant contribution from any public sector organisation who is the lead project partner.

Question 9: What is your approach to evidencing the added value and impacts of the project? (7.5%) (550 word limit)

- Tell us what you are intending to, or could, deliver without government funding, and what added value government funding would bring.
- Describe how you will baseline, measure, document and report over time on the value added by, and the impacts of, the project. Include some suggested quantifiable metrics and qualitative measures in your application. (Please refer to the "5G Testbeds and Trials - Potential Monitoring Indicators / Quarterly Benefits Reporting Template" document). You will be expected to work with the 5GTT Programme team on the monitoring and evaluation of benefits, reporting quarterly.
- Added value should include social, economic and environmental value in addition to any financial revenues delivered by the project. This value should be related to national United Kingdom priorities such as productivity, sustainability and social mobility, and to specific local issues, challenges and opportunities set out in Section 1 of the questions.
- Describe any additional areas of added value not set out elsewhere in your application.

- To note that the reporting of benefits will be considered a deliverable of the project and will feed into the programme's evaluation.

Appendices

Required

For Question 5, "Include a diagram of the organisation and describe the relationships between the organisations involved in your application..." This should be an appendix in .pdf format and up to two pages long, attached to your application.

For Question 5, "Set out a fully costed delivery plan including specific activities, resourcing, timeframes, milestones, deliverables and critical success factors..." This should be an appendix in .pdf format and up to five pages long, attached to your application.

For Question 7 (and, where relevant, Question 5), attach to your application letters of support from each of the organisations listed in your application, signed at a senior level. We would expect each letter to state, as a minimum:

- Support for participation in, and delivery of, the RCC project.
- Confirmation of the roles and responsibilities that the organisation will undertake.
- Acknowledgement of willingness to provide financial and/or non-financial contributions, including the potential nature and likely sources of contributions, and any caveats that apply at this initial stage of project development. We do not require that you commit to specific figures at this stage but an indication of potential amounts against any specific activities will be helpful.
- Intention to invest beyond the project in the sustainable development of new products and services trialled through it.
- Intention to buy or procure new products and services trialled through the project as a potential customer.

All proposal submissions also require completion of the [Project Finance Form](#) by each partner. The Project Finance Form provides details on the eligible project costs for each partner in the consortium. A Project Finance Form is required from each industry partner for any submission, irrespective of grant value.

Each organisation in the project must provide a Project Finance Form using the template which is provided.

Each Project Finance Form provides a detailed breakdown on each organisation's total eligible project costs. All total figures listed in the Finance summary table must match those totals within the Project Finance Form.

The ["5G Testbeds and Trials - Eligible Project Costs Guidance"](#) document contains detailed information on which project costs are eligible for funding, how to complete the Project Finance Form as well as submitting any academic costs into the Je-S system (a requirement for all academic partners).

Optional and assessed, if included

For Question 1, "Describe the geographical area the project will cover…" you may include a single appendix, attached to your application, in .pdf format and up to two pages long to support your response.

For Question 2, "For proposals that contain plans to deliver or accelerate the delivery of local mobile connectivity in the project area…" you may include a single appendix, attached to your application, in .pdf format and up to two pages long to support your response.

For Question 5, "Describe the main risks and dependencies of your proposed RCC project, together with mitigations…." you may include a single appendix, attached to your application, in .pdf format and up to two pages long to support your response.

Optional but unassessed

As stated above, any information beyond the above should be included in an appendix as links, e.g. to any existing documents/brochures, which explain in more detail the local environment, initiatives or other relevant details. These will not be considered as part of the assessment process but should aim to provide more in-depth background information of the wider context in which the project will form part of. Note that the evaluation team will not consider these materials when scoring proposals.

7. Further information

If you have any questions on the Application Guidance please submit a question to 5Genquiries@culture.gov.uk, with the subject heading of 'RCC Competition Clarification Question' at any time up to the date specified in the "Competition outline" section above.

The 5GTT Programme team will provide a response to your question, and will make copies of answers publicly available.

If you are asking a clarification question that is specific to your organisation's application and is commercially sensitive please state so in your question and the 5GTT Programme team may provide a response without making the answer publicly available. We will clarify your question with you if we think the response should be made publicly available.

Further information, including details of previous 5G Trials and Testbeds projects, can be found through the UK 5G Innovation Network:
https://uk5g.org/discover/testbeds-and-trials/

8. Notices

This document is issued in text format to organisations wishing to make an application to RCC. Should you require access to this document in another format (e.g. Braille, large font or audio) please contact us at 5Genquiries@culture.gov.uk.

All applicants are solely responsible for all their costs and expenses incurred in connection with this selection process at all stages. Under no circumstances will DCMS be liable for any costs or expenses borne by or on behalf of the applicant or any party associated with this selection process.

We reserve the right to cancel the competition at any point. We will accept no liability for any losses caused by any cancellation of this competition nor any decision not to award grant funding as a result of the competition.

At any time prior to the deadline for receipt of proposals, we reserve the right to amend, add to or withdraw all or any part of the competition material at any time during the competition. Any such amendments, additions, or removals will be notified identified in the documentation on the competition webpage.

Answers must be in English. Bidders should note that where any supplementary documents are not published in English, certified translations into English must be provided with the proposal (if applicable).

Proposals should remain valid for a period of 120 days from the competition closing date. A proposal valid for a shorter period may be rejected.

Bidders must not inform anyone outside of their proposed consortium, even approximately, what their total proposal costs are, or will be. Furthermore, bidders must not try to obtain any information about anyone else's proposal or potential proposal.

We reserve the right to discuss, for the purpose of clarification, any aspect of a proposal with the relevant bidder prior to the award of grant funding.

We reserve the right to undertake a detailed financial and technical appraisal of each bidder and their proposal and for this process to continue up to the award of any grant funding. Any such appraisal will be conducted in line with government policy at the time of assessment. Further appraisal may continue if required through the duration of the grant funding period.

No representation, warranty or undertaking, express or implied, is or will be given by DCMS or any of its agents or advisers with respect to the information contained in the competition material, including with respect to its accuracy, adequacy or completeness.

Information provided in response to this document, including personal information, may be published or disclosed in accordance with access to information regimes, primarily the Freedom of Information Act 2000 (FOIA) and the Data Protection Act 2018 (DPA) and Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and

repeating Directive 95/46/EC (General Data Protection Regulation) OJ L 119/1, 4.5.2016 (GDPR).

If you would want the information that you provide to be treated confidentially, please be aware that, in accordance with the FOIA, public sector organisations are required to comply with a statutory code of practice which deals, amongst other things, with obligations of confidence. In view of this, it would be helpful if you could explain to us why you wish that information to be treated confidentially. If we receive a request for disclosure of that information, we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances.

DCMS will process your personal data in accordance with the DPA and the GDPR and, in the majority of circumstances, this will mean that your personal data will not be disclosed to third parties.

Department for Digital, Culture, Media and Sport
www.gov.uk/dcms

Annex A: Characteristics of 5G

5G is the next evolution of mobile networks as defined in releases 15 and 16 of the 3GPP global standards. The deployment and roll-out of 5G will see significant enhancements on previous mobile generations (2G, 3G, 4G), taking the connectivity beyond the consumer focus on speed and data volume, to be the first network that is designed so that a single physical network can simultaneously support multiple diverse use cases, from the high density low-power sensors, through to connected autonomous vehicles and advanced manufacturing, generating gigabytes of data per hour.

It will incorporate new architectures in the radio access network, new system architectures and new protocols, which will enable new ways of integrating mobile communication and cloud services together. It aims to offer ultra-low latency and 10+ Gbps bandwidth to the end user. 5G is being designed to blend the requirements of previous communication technologies into a new mobile network architecture. The main features of 5G and the value they add to mobile services are set out below:

Feature	Value Added
Ultra-High Bandwidth	Increases overall capacity of the mobile network, facilitating growth in users, devices and traffic demands. 5G will also enable novel use-cases such as streaming video and 3D content such as immersive or augmented reality environments, or simply more reliable video services, including video-conferencing to support connectivity for health and other people services. It will also allow for high data throughput and processing that will come from high density / large volume deployments of internet of things sensors that may also connect "dumb" low power sensors with long battery lives to artificial intelligence / machine learning capabilities in the cloud.
Ultra-Low Latency	This feature will bring about improvements to existing mobile connectivity, such as improved Voice over Internet Protocol (VoIP) quality, the streaming of Ultra High Definition video, and other tasks that are reliant on m/s accuracy such as real-time time-critical alerts for decision makers (e.g. in emergencies or for health and safety) or the visualisation of highly accurate data that can be interpreted and visualised using advanced analytics and machine learning techniques. This may include, for example, remote control of infrastructure, robotics or machinery; devices such as drones; or other safety-critical use cases such as autonomous vehicles.

Massive machine type communications	Massive Machine type communications are crucial to large deployments of Internet of Things and machine-to-machine use cases, particularly for devices distributed in rural environments with a high cost of maintenance. Ability to support massively higher number of endpoints than 4G (1 million / sq. km)
Advanced management and operations support system (OSS)	This feature will reduce operating expenses for operators and carriers. Up to 72% of 5G revenue growth is dependent on OSS/BSS transformation according to TM Forum. Automation and specifically AI-powered closed automation will be essential to monetizing the service differentiation that sets 5G apart from its predecessors. The scalability and capacity of a virtualised 5G network can enable CSPs to extend their business to become an over-the-top (OTT) service provider, offering high quality, reliable networks for the delivery of OTT services.
High-motion mobility	Better able to support users and devices on fast moving transport such as high-speed trains.
Improved security	Better protection of large amounts of data produced, as 5G technology is meant to be secure by design
Spectrum	5G will be deployed in a variety of spectrum bands at low, medium and high frequencies, each of which have different characteristics and can be used to deliver different benefits. Sub-1GHz spectrum will support improved coverage; mid-frequency spectrum (1-6 GHz) will meet demand for increased network capacity; high frequency spectrum (so-called mmWave) is likely to be used to support new 5G applications, in particular those that require very high capacity and very low latency.
Enhanced performance	With 5G, higher orders of MIMO can be deployed, compared to 4G systems. Standard MIMO networks tend to use two or four antennas to transmit data and the same number to receive it. Massive MIMO, on the other hand, is a MIMO system with an especially high number of antennas. This increases the capacity of the network significantly and provides more reliable links. Network Slicing can provide service level differentiation, enabling the provision of business-critical and mission-critical services to different customer types. Mobile Edge Computing will enable content and services to be generated and consumed locally and data to be analysed and processed locally, enabling real time services to be performed and reducing the requirements for backhaul and connections to the cloud.

Universal application support	Ability to provide connectivity for a range of use cases; from low volume, high latency to mission critical systems.

Therefore, for the purposes of this project, we will assume the following characteristics for 5G in RCC:

- It is largely a wireless system.
- It is mainly terrestrial, and may involve some satellite capability.
- It will have capabilities significantly beyond today's commercially available 4G networks, although the capability to integrate existing technologies such as Wi-Fi, 4G/LTE and low power IoT networks into a managed 5G heterogeneous network are considered in scope.
- It will support a wide range of applications for industry sectors, in addition to mobile broadband and consumer applications.
- The usage scenarios for 5G are expected to include:
  - Enhanced mobile broadband (eMBB)
  - Massive machine-type communications (mMTC)
  - Ultra-reliable and low latency communications (URLLC).

5G radio access technologies

We will accept a broad interpretation of 5G that includes the 3GPP release 15 standard for 5G New Radio as well as pre-standard versions (16 onwards) which may utilise innovative communications technologies. Bids could include elements of new radio access technologies and systems that will be important for 5G (such as massive MIMO, self-optimising networks, beam-forming, mmWave and mobile-edge computing). Bidders should explain where the innovation lies and that there should be significant, but not exclusive, use of 5G New Radio capabilities.

Network architectures

Network architectures could include network slicing, software defined networks, network function virtualisation and mobile edge computing.

Convergence

This could include convergence between mobile and fixed networks or satellite networks or broadcasting.

Annex B: Possible commercial and deployment approaches

There are a number of different commercial solutions that could be adopted for 5G infrastructure in rural areas. Examples of some are set out below. These vary greatly in terms of potential market disruption, scalability and potential market / regulatory challenges.

Model	Description
Neutral Host	Comprises a single third party shared network solution provided on an open basis. Provides a shared platform supporting all MNOs' technologies.
Site and Mast Sharing	Passive infrastructure sharing (e.g. Towers/Masts) to host multiple MNOs' equipment.
Network Sharing	Two or more mobile network operators sharing passive and active infrastructure, including RAN sharing. Examples include MORAN (Multi-Operator Radio Access Network) and MOCN (Multi-Operator Core Network).
Spectrum Sharing	Spectrum sharing can take many forms, including leasing, sub-licensing on a localised, geographic basis and pooling (where two licensees combine their spectrum and operate a joint RAN with that spectrum). Ofcom is making available spectrum sharing in the 3.8-4.2 GHz, 1,800MHz and 2,300MHz bands through local licences (under the spectrum sharing framework outlined in their December 2018 consultation).[4] Ofcom has also added the 24.25-26.5 GHz band ("the lower 26 GHz band") to their spectrum sharing framework for indoor use.
Localised Roaming	Third party rural or neutral host network provides roaming to an MNO to improve coverage.
R&D/Test Bed	Small-scale deployment to test technology and potential business models.
Ecosystem Enabler	Relates to a provider which offers a technological platform on the top of connectivity to enable specific providers to deploy their applications (e.g. AgriTech, Mobility and Public Safety).

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[4]

https://www.ofcom.org.uk/__data/assets/pdf_file/0033/157884/enabling-wireless-innovation-through-local-licensing.pdf

Annex C: Potential technology solutions

Mobile internet connectivity in rural and remote areas is significantly challenging due to the economic viability of deploying cellular sites in those areas.

The main factors affecting the commercial case for deploying mobile network infrastructure are:

- physical site acquisition and deployment of equipment;
- backhaul connectivity;
- power required at sites;
- the likely density of demand-creating subscribers; and
- access to spectrum.

There is also uncertainty in terms of what will be the revenue from 5G in rural areas. The connectivity requirements in rural areas are normally quite diverse and span from low data rate applications (e.g. weather monitoring for agritech, remote maintenance of infrastructure) to high bandwidth applications (e.g. video streaming or AR/VR experience for smart tourism).

Although new relevant applications in rural areas have the potential to generate extra revenue to MNOs, they are still in the early stages of their development. This makes it challenging to assess the timeframe to recover the investment in increasing infrastructure in rural areas. Finding innovative ways to tackle these challenges, would significantly assist in providing the required connectivity to the rural communities - and building the business case for investment in other rural areas.

5G technology enablers for rural connectivity

With support for higher capacity, as well as ultra-low latency and machine-type communication services and the integration of multiple technologies with greater flexibility, 5G networks could support a much broader set of uses than 4G networks, dynamically configurable in software.

5G mobile communications systems also offer the potential for convergence of various networks, creating a "network of networks", converging fixed and mobile networks, and in which a single investment can support infrastructure meeting demand from diverse subscribers and usage types. It will also support seamless connectivity to numerous devices by integrating different technologies, intelligence and flexibility. This convergence should enable the acceleration and extension of deployment of 5G infrastructure in rural areas.

Possible technical solutions

We would expect proposals focused on technological solutions to feature some or all of the below:

- Core network technologies
- Management and network orchestration
- Differentiated services

- Multi-access edge computing
- Radio network technologies
- Spectrum
- Satellite
- Roaming/ interworking

Another key cost is backhaul, the most common technology choices for which to date have been fibre and microwave. Both are widely deployed in today's LTE networks. However, given the ambitious expectations from 5G, which include a 20x increase in peak data rates and a 10x reduction in latency, many operators are taking a closer look at alternative connectivity solutions such as higher capacity microwave and next-generation satellites to satisfy service expectations.

Further, localised micro-data centres, following the concepts of MEC with local break-out, may reduce some of the stringent requirements on backhaul.

To ensure that lack of access to the radio spectrum does not prevent innovation, Ofcom have introduced a new licensing approach to provide localised access to spectrum bands that can support mobile technology. Ofcom are making spectrum in the 3.8-4.2 GHz, 1800 MHz and 2300 MHz spectrum bands available through local licences. They are introducing a new way to access spectrum that is already licensed to mobile operators but which is not being used or planned for use in a particular area within the next three years.[5]

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https://www.ofcom.org.uk/__data/assets/pdf_file/0033/157884/enabling-wireless-innovation-through-local-licensing.pdf

Annex D: Key considerations for the selection of use cases

5G offers wide-ranging capabilities. This includes, but is not limited to: enhanced mobile broadband (eMBB), which offers the capability to facilitate higher speeds and seamless user experience; and massive machine type communications (mMTC) to facilitate the connection of a large number of connected devices and facilitating applications that are heavily dependent on Ultra-Reliable Low-Latency Communication (URLLC).

These, and other 5G and advanced networking capabilities have the potential to unlock several categories of use cases and innovations, including technical and business models, across multiple industry verticals throughout the rural economy and society. However, the potential benefits for the various use cases will need to be carefully balanced against the associated technological and commercial costs.

For rural use cases to be successful, they need to consider not only market demand but also the wider benefits provided to the different stakeholders. These include: enabling economic and social development; serving existing or new customers, and meeting the connectivity requirements that will enable other advanced digital technologies.

These drivers and considerations are summarised in the table below:
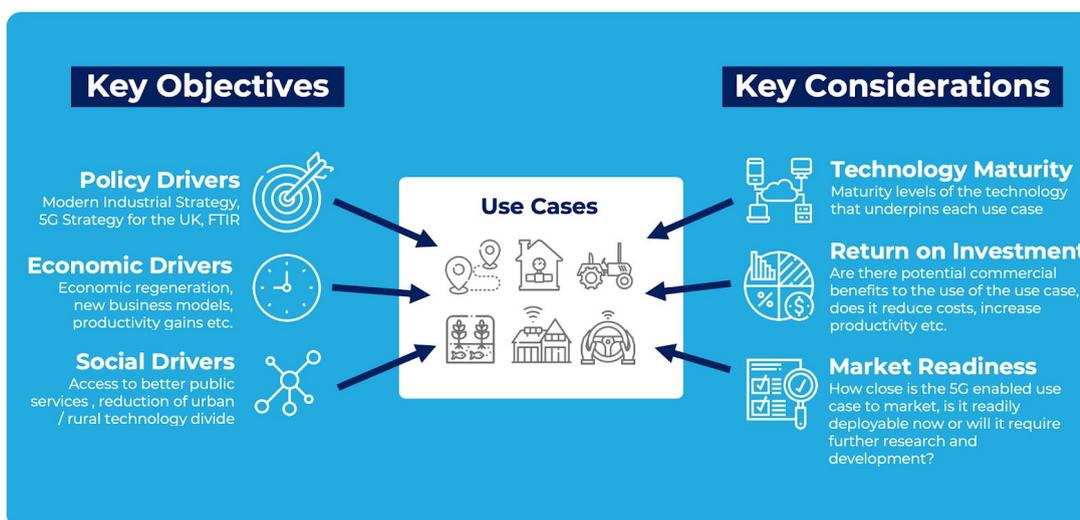
Key Objectives

Whilst there are several use cases emerging on the back of 5G development, **each potential use case needs to be assessed against the main objectives for rural communities**. Some of the objectives to be considered are outlined below. While not exhaustive, they provide a framework against which potential use cases for rural communities could be developed and assessed.

Area	Key Objectives
Policy	5G is viewed as an enabler to the government's policy objectives, as set out in the FTIR, to ensure world class connectivity for all. 5G deployment in a rural environment underpins key components of the "Industrial Strategy: Building a Britain fit for the future" and its underlying sector deals (e.g. Made Smarter, the Creative Industries Sector Deal, the Artificial Intelligence Sector Deal, etc.). It will help to drive the new business models, products, applications, services and experiences of the future into sectors that meet government priorities in key industry sectors and sub-sectors (construction, manufacturing, creative / cultural tourism etc.) that will increase productivity and drive the UK's 4th Industrial Revolution.
Economic	**Productivity:** Various studies have highlighted the impact of high speed mobile connectivity in enhancing business productivity and increase in operational efficiencies[6]. Economic research undertaken by IHS identified global productivity gains from 5G use cases to exceed $2.1 trillion (between 2020 – 2035)[7]. At a GVA of £20,500 per resident, productivity levels in rural areas are relatively lower than the national average (GVA £25,400 per resident)[8]. As such, increased productivity is seen as a key driver for multiple 5G use cases. A number of current 5G rural use cases focus on enhancing farm productivity, reducing manual intervention, subsequently driving cost efficiencies amongst others. **New Business Models:** 5G is expected to be a key enabler of low-cost, mMTC-capable smart public infrastructure which is envisaged to lower costs and enable new revenue models amongst other socio-economic benefits. 5G is seen as an enabler for the deployment of sensors in public infrastructure which could enable new ownership and management models based on flexible usage and preventative maintenance (for example, smart utility infrastructure), and for remote inspections and maintenance using technologies such as drones. This could open public infrastructure to a family of use cases that is aimed at reducing operational costs in delivering public services and introduce new revenue streams. [2]

[6] The impacts of mobile broadband and 5G, A literature review for DCMS by Deloitte, 2018
[7] The 5G Economy: How 5G technology will contribute to the global economy, IHS Economics, 2017
[8] Unlocking the digital potential of rural areas across the UK, Amazon, SRUC, Rural England Partnership, 2018

	Economic Regeneration: Surveys commissioned by Amazon UK on rural SMEs, identified that 56% of those surveyed indicate 5G networks and IoT as significantly relevant to their business growth[4]. The connectivity and innovative use cases enabled by 5G could complement Local Industrial Strategies for economic development and regeneration of rural SMEs clusters. Innovative 5G use cases could potentially provide rural communities with a platform to leapfrog the rest of the UK with regard to Industry 4.0, E-Commerce and Technology applications subsequently attracting private sector investment and growth. In order to achieve this it is crucial that RCC identifies use cases and commercial models that improve the case for investment in rural connectivity infrastructure and drive innovative new use cases of 5G in rural environments, so that all communities – not just the most economically active urban communities – benefit from early 5G deployment and adoption.
Social	A lack of reliable and consistent mobile network coverage in rural areas significantly reduces connectivity and can lead to people living in these areas feeling socially isolated and/or excluded as they miss out on contact and social plans with friends and family, particularly when that contact is spontaneous rather than planned in advance.[9] Aside from this social exclusion challenge, which could also be tackled by improving 4G coverage, there are also significant societal benefits and considerations from introducing ultra fast connectivity through 5G. In particular this could include better public safety, e-health and e-learning applications, and reduced urbanisation by making rural areas more attractive for residents to live and work. This will help to reduce the digital divide between regions.

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[9]
https://www.ofcom.org.uk/__data/assets/pdf_file/0021/108129/jigsaw-mobile-coverage-qualitative-research.pdf

Annex E: Connectivity data sources

Local authority-level data

Local authority data is available here:
https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-update-spring-2019. The following metrics should be used:

Coverage type	Description	Syntax (Mobile / Fixed)
Geographic coverage	4G services, geographic (outdoor) at -105dBm threshold	TNS 4G_geo_out_0 PNS 4G_geo_out_1 4G_geo_out_2 4G_geo_out_3
Roads coverage	Data services, motorways and A-roads, at -105dBm threshold	TNS Data_mway_ard_in_0 PNS Data_mway_ard_in_1 Data_mway_ard_in_2 Data_mway_ard_in_3
Premise coverage	4G services, premises (outdoor) at -105dBm threshold and 4G services, premises (indoor) at -95dBm threshold	TNS 4G_prem_out_0 PNS 4G_prem_out_1 4G_prem_out_2 4G_prem_out_3 TNS 4G_prem_in_0 PNS 4G_prem_in_1 4G_prem_in_2 4G_prem_in_3

| Fixed broadband | % of premises unable to receive 2Mbit/s | Percentage of premises that do not have access to services above 2Mbit/s |
| | Number of premises unable to receive 2Mbit/s | Number of premises that do not have access to services above 2Mbit/s |

Postcode-level data

Postcode-level data is here:
https://www.ofcom.org.uk/phones-telecoms-and-internet/advice-for-consumers/advice/ofcom-checker

Bidders should have a good understanding of their intervention area, so should demonstrate poor connectivity at premise level (both fixed and mobile broadband), using the Ofcom coverage checker. The 'map view' is recommended, to illustrate connectivity across an area (not just postcode) by each operator.

Other info

Bidders should demonstrate any other aspects of poor connectivity not captured by the metrics above.