5G

SUPPORTING RURAL COMMUNITIES

Rural Mobile Coverage Background

1. Rural communities in the UK are currently undersupplied with mobile connectivity. Only 67% of the country have access to a reliable signal. Improved mobile connectivity could bring numerous benefits to rural areas and help reduce the digital divide. Socially and economically it is important for all areas of the UK to be connected.

2. 5G could bring countless economic benefits to areas which currently have little or no mobile connectivity. Rural areas boast a large amount of economic activity, The Office for National Statistics states that in 2017/18 there were 545,000 businesses registered in rural areas which made up 24% of all businesses in England. These rural businesses employ a total of 3.6 million people. Improved connectivity can help improve the efficiency of these businesses and open new doors for innovation.

3. Some specific economic benefits could aid the agricultural sector. Currently 72% of the UK's land area is utilised for agricultural production. 5G technology could help provide solutions to some of the economic problems faced by the agriculture industry. For example, milk prices remain volatile and therefore farmers need to look for cost efficient resolutions to maximise their profits. 5G technology could provide these new cost-efficient methods.

4. There are currently more than 23 million connected sensors across the world in agriculture but in less than ten years there is predicted to be over ten times that. 5G technology will enable these sensors to have the positive impact envisaged in farming technology.

5. Robots and quantum technologies could be the answer to improving productivity and profits. These innovations could become an everyday part of the British farming landscape in decades to come. Market intelligence suggests that the global market revenue for agricultural robotics will grow from £2.4 billion in 2015 to £58 billion in 2024. Robotics will have numerous positive impacts on crops such as: crop care, selective harvesting and crop scouting.

Robotics could also have a positive impact on livestock farming by aiding milking, feeding and abattoirs.

6. Improved mobile connectivity could also have positive impacts on health. People in remote and rural areas often don't have immediate access to healthcare facilities. 5G technology can provide opportunities for people to access healthcare online through tele-consulting or other new innovations. In addition to helping improve physical health, improved connectivity could also have a positive impact on mental health. Staying connected to friends and family can be difficult when living in isolated parts of the country. It is important for people's mental health to keep in close contact with loved ones. 5G technology can ensure that a reliable method of connectivity is in place to ensure people in rural areas are always connected.

How can 5G help Rural Areas?

Improved social interaction and health benefits:

7. Many rural households are in isolated locations where social interaction is limited. Improved mobile connectivity can help people in these areas stay connected to friends and family in other parts of the country. This is becoming increasingly important due to the nature of the modern rural lifestyle. The number of people working on farms since the Second World War has reduced from 900,000 to 180,000; where a large piece of land would have previously been home to several farming families, there is now often just one. This results in the community aspect of farming being reduced. 5G technology can help these people in remote areas to stay in touch with people that live in other areas of the country. Therefore, 5G could provide benefits which improve the mental health of those who live in rural communities.

8. Improved connectivity can bring significant health benefits to those living in rural areas. People who live in the countryside are faced with numerous issues when they need to get required healthcare such as long travel times, costly travel and a lack of healthcare options. 5G technology can help alleviate some of these difficulties by providing opportunities for healthcare professionals to monitor and treat patients online. Patients could stay at home and obtain the necessary healthcare they require such as online consultations, tele-surgery, or remote patient monitoring. This means patients don't have to travel many miles to the nearest hospital or surgery and can receive care from their own home.

Everyday tasks made easier and the potential to work from home:

9. Efficiency of everyday life can also be aided by 5G technology. The technological advancements of modern society have enabled tasks such as shopping and banking to be completed online; in urban areas, these online processes are taken for granted but some rural communities are unable to utilise these online benefits due to poor connectivity. Online connectivity is particularly useful for those in isolated areas because it saves people from having to travel long distances to get shopping or complete banking tasks. In order for these tasks to be completed online, reliable mobile connectivity is required and this can be provided by 5G technology. This will make common tasks easier to complete for those living in rural areas.

10. Other potential benefits could be realised by improved connectivity. Rural connectivity projects in the past have brought rural communities out of the dial-up era to benefit from services such as online education, car taxing, banking and telehealth. 5G technology projects will bring these benefits to more rural areas than ever before. The increased bandwidth means more devices can be connected at any given time. The scope for 5G to help more communities is greater than any previous generation of mobile technology.

11. Increasingly, on the back of improved internet connectivity, more people are able to work from home. This can bring numerous benefits:

- No need for travel to the office. This means more time can be spent working which increases productivity. In the UK, the average commute time is over 58 minutes, this time could be used to complete more job-related tasks which means working from home can improve the efficiency of the working day.
- Eradicating the commute to work can have a positive environmental impact because less people are driving to work. This can reduce an individual's carbon footprint.
- Since less time is spent commuting, more time can be spent doing important parts of your life outside of work such as spending time with friends and family. As a result, improvements are made to an employee's social life.

- No limitation on the hours you can work. The working day schedule is not dictated by the hours the office is open. For instance, if the office closes at 6pm, it would not be possible to complete work tasks after this time. Working from home enables more flexibility with regards to when people can work.

Improvements to the Agricultural and Livestock Farming Industry:

12. 5G could also bring major progressive developments to the agricultural sector. New technology can improve the efficiency of farming techniques by increasing profitability, output and making life easier for farmers.

13. One piece of technological benefit 5G could enable is the Agriculture Modelling Model. This model is suitable for large areas of farmland. The system provides the farmer with periodic and precise monitoring of physical parameters (e.g. temperature, air pressure, humidity, plant illness conditions, etc.) for the real-time control of the plant area as well as for fire alarm. This data is collected using 5G powered drone sensors. Using this monitored information, it is possible to increase the quality and amount of production, cut costs, and reduce the pollution caused by weed-killers.

14. A further innovation could by utilising Unmanned Aerial Vehicles (UAVs). 5G makes the use of drones for sensing or mapping a viable option in the agricultural sector. At the moment, technology only allows drones to operate within visual lines of sight which is typically around 500m, 5G will enable these drones to go beyond this distance. These 5G solar powered drones are capable of staying airborne for days and capturing real-time information on pests and weather. The drones could be fitted with imaging sensors which could be used to detect the early onset of disease and stress in livestock or they could even be used for the remote collection of ecosystem information. These drones can reduce the time farmers need to spend out on the field every day. For example, there could be scenarios where farmers have to drive miles to shut a gate; with 5G technology a drone could complete this task which he could operate from his home.

15. Nano sensors strategically placed to gather a constant stream of information can be used in agricultural production. These sensors will be able to collect information such as soil data and water status. Sensors linked to smart applications can send out alerts and reduce daily routine jobs such as checking fuel levels and temperatures. The automotive industry is already utilising this type of technology; adopting these technology principles for agriculture is an entirely realistic ambition. This innovative technology can help improve farming efficiency and increase productivity.

16. 5G powered machinery can improve the efficiency of farming techniques. Smaller and lighter driverless tractors and other machinery are some of the innovations which can help improve farming practice. The machinery could provide numerous benefits:

- Help reduce soil compaction which maintains an oxygen-rich soil resulting in farming land producing an increased yield.
- Enable 24/7 operation which will improve productivity. Fears about the countryside being blighted by noise and light pollution will be allayed through night vision and quiet electric engines.

- Removing arduous physical tasks by replacing manual labour with machinery. This could result in an increase in efficiency.

Improvements to the Dairy Industry:

17. The dairy industry is an important and historical part of many rural communities. In the south-west of England, the dairy industry remains an important sector. Home to more than 38% of England's dairy cows, the south-west's economy needs the dairy industry. The dairy industry faces many problems which makes the livelihoods of farmers difficult. The profit margins on milk is very poor and any innovation to improve productivity and efficiency would be welcomed and encouraged. A number of different 5G powered innovations could make dairy farming a more productive industry:

    - Cows given 5G connected collars and ear tags that transmit biometric data on their health. This means farmers can keep tabs on their herds while letting them roam freely. This reassures farmers that their livestock are healthy without having to constantly make physical checks.

- Robotic milking sensors. When cows want to be milked they go to the robotic milking area where the system will decide whether the cow is ready to be milked. The system will then direct it either to the milking machine or to a different area. This robotic sensor can determine how much milk the cow is expected to give based on previous sessions. After milking, the milk's colour, temperature, flow and quantity is recorded and analysed. This system allows cows to choose when they are milked which increases productivity and profit because cows get milked more often than the traditional twice-a-day system. Instead the average using robotic milking sensors is 2.7 times per day.

- Hyperspectral imaging can be used to collect and analyse visual information to allow precision grazing techniques. Precision grazing allows cows a very specific area of grazing every day which meets their exact dietary requirements. Grazing cattle can provide cost effective ways of raising cattle, hyperspectral imaging would inform the farmer how much grass there is in an area and its feed value. 'Moocall' is a calving sensor which is strapped to a pregnant cow's tail to predict when she is most likely to give birth and prevent any problems, thereby preventing the need for a farmer to be at her side 24 hours a day.

18. The Future of Food 2040 report by the National Farmers' Union suggests a number of 5G powered innovations could be used for farming. One piece of technology is 'fencing without physical barriers'. Livestock with collars or intelligent ear tags will ensure the safety of livestock and also ensure their movements are controlled. These sensors will allow earlier warning of any potential health issues as well as real-time monitoring of weight and fertility. These collars and tags could also at like virtual electric fences which could ensure livestock are forced to stay in a designated area. This will help ensure livestock don't overgraze certain land, don't encroach on sensitive soils, watercourses or crops and stay away from dangerous land.

Helping to reduce the Agricultural sector's Environmental burden

19. The agricultural sector is one of the largest consumers of water and the main source of nitrate pollution of groundwater and surface water in the world, as well as the principal source of ammonia pollution. 5G technology can help the farming industry achieve a 'net zero' contribution to climate change by 2040. 5G technology will enable farmers to carry out operations more precisely and with less resources, further reducing the impact on the natural environment. One specific method to help achieve this is through the use of robotic AI technology. Robots could be used for precision weed elimination; 5G powered drones can be used to immediately distinguish between a crop and a weed, this allows the robot to target a weed for chemical elimination. The weed killing chemicals can be harmful to the environment but this 5G powered robot system means the entire process is more efficient and only specific weeds are being targeted, this results in less chemicals being used and farmable crops aren't targeted which has a positive impact on the rural environment.

Improvements to the Fishing Industry:

20. 5G test trials have shown to have huge potential benefits for the salmon fishing industry. 5G trials have taken place in Orkney, a rural area of the UK made up for twenty islands with a population of 22,000. Orkney has consistently ranked as one of the most under-connected areas in the country. The 5G Rural First Project could help businesses in these areas of poor connectivity to overcome challenges faced in their industries. One of the biggest industries in Orkney is fishing; Salmon is the UK's second biggest food export, worth over £720m per year. 5G technology could help improve this multi-million pound industry by improving efficiency and safety. Remote monitoring sensors could monitor the health of fish; sensors in the water measure the salinity, temperature and oxygen levels to work out the best times to feed the fish. This could help fish farmers to get the highest fishing yield possible. This would also be a useful innovation given the dangerous conditions and offshore locations fishermen have to contend with, fishermen will not have to physically carry out these

tasks which makes their job safer. Overall, more of the tasks connected to fishing can be carried out from a remote location by using 5G technology.

Planning and Government Support

21. The government recognises that rural connectivity is an important part of the UK infrastructure which can help improve lives socially and economically. This has been shown by the significant funds allocated to rural 5G test-beds and the introduction of planning policies which encourage telecommunications development in previous contentious areas such as the countryside. In England, for example, the NPPF states that:

> *"Local planning authorities should not impose a ban on new electronic communications development in certain areas, impose blanket Article 4 directions over a wide area or a wide range of electronic communications development, or insist on minimum distances between new electronic communications development and existing development."*

The NPPF suggests the government wants to encourage the development of 5G technology and have amended planning policy to help facilitate this development. Similar policy support exists across all the Devolved Nations.

22. The UK government has committed to delivering accessible broadband for all. Building Digital UK (BDUK) is a part of the Department for Digital, Culture, Media and Sport and has a range of programmes to deliver connectivity to all corners of the UK. One of which is the Rural Gigabit Connectivity Programme which is funded through to March 2021. This programme will help rural communities receive the digital infrastructure which has previously been lacking.

23. Former Digital Secretary Nicky Morgan, who left the post in February 2020, has emphasised the need for 5G technology in rural areas by pledging significant funding for innovative technology:

> *"The British countryside has always been a hotbed of pioneering industries and we're making sure our rural communities aren't left behind in the digital age. We're investing millions so the whole country can grasp the opportunities and economic benefits of next generation 5G*

technology. In modern Britain people expect to be connected wherever they are. And so we're committed to securing widespread mobile coverage and must make sure we have the right planning laws to give the UK the best infrastructure to stay ahead."

This further emphasises that planning legislation should try and facilitate the implementation of 5G technology in all areas of the UK, specifically areas which are currently under-connected to ensure they are not digitally left behind

24. Another MP who has emphasised the importance of rural connectivity is the former Minister of State for Housing and Planning, Rt Hon Esther McVey MP. Esther McVey has recognised the important role planning laws have on the rollout of 5G in rural locations:

"We're committed to delivering the homes people across the country need, and that includes delivering the right infrastructure such as broadband connectivity and good mobile coverage. There is nothing more frustrating than moving into your new home to find signal is poor. That's why we are proposing to simplify planning rules for installing the latest mobile technology – helping to extend coverage and banish more of those signal blackspots, particularly for those living in rural areas."

Further support from other organisations:

25. In addition to government support, other organisations have also explained the importance of a connected rural UK. Mark Bridgeman, the Deputy President of the Country Land and Business Association has emphasised that the rural economy needs excellent connectivity to fully thrive:

"The vast potential of the rural economy will only be fulfilled when everyone in the countryside has full mobile connectivity, and we welcome DCMS's intent to deliver the Prime Minister's promise of internet access for all. The current situation, where only 67% of the country can access a decent signal, is unacceptable and Government is

right to focus on planning reform as a means to removing current barriers but there must also be a balance between the interests of landowners and mobile operators."

26. The University of Surrey's 5G Whitepaper: Meeting the Challenge of "Universal" Coverage, Reach and Reliability in the Coming 5G Era, explains the need for adequate infrastructure to make best use of the innovations 5G can bring to rural communities. The paper explains:

"There may be lessons to be learned from innovative approaches in India and Africa in taking cost out of infrastructure in areas of intrinsically low revenue such as rural areas. Some of these approaches, such as infrastructure sharing and outsourcing, are already being used by some UK mobile operators. The use of public networks by the emergency services and for connecting smart meters shows another route to improving the economics of better public coverage if any extra coverage put in for these specialist uses also becomes available for public use (even on a lower priority basis). Partnerships with local authorities or community groups could reduce the costs for operators to deploy while enhancing the digital credentials of a given location and therefore attracting greater inwards investment. This is only a superficial flagging of possibilities at this stage to stress that it requires more than just technical innovations to maximise the rural coverage."

A collaborative approach is needed to effectively implement 5G mobile connectivity in rural areas. Compared to urban areas, these rural areas are not seen as profitable to digital companies. As a result, these areas may not be targeted for 5G upgrades, therefore a collaborative approach with government and community support is needed to ensure mobile connectivity is delivered to these rural areas.

Cellnex