



## AIOTI WG06 – SHORT REPORT

### Broadband Requirements for farming and rural uses

29 August 2016

#### What is this Report about, in short

- AIOTI Working Group 06 (Smart farming and food security) has collected feedback from different actors on examples and use cases of IoT/ICT associated to farming and the rural economy that are demanding or will presumably demand broadband connectivity.
- This Report summarizes the inputs collected from voluntary contributions from different actors ranging from farmers and cooperatives to smart farming technology providers and telco operators.

#### Scope of this Short Report

The progressive uptake of IoT applications in the rural Europe, possibly related to the agrifood sector –but not only—may have an impact on the connectivity requirements in rural areas. AIOTI WG06 has performed a small survey and collected a number of relevant use cases / examples of such IoT applications that are likely to demand good connectivity. Wherever possible, we have tried to provide some (estimated) broadband connectivity requirements associated to those cases.

The lack of proper broadband coverage in rural areas is widely regarded as a barrier locking the growth of rural businesses. Whereas broadband penetration in rural Europe is continuously improving [2], the foreseen increased adoption of smart farming technologies (many of them based on IoT) by European farms, and in general all the actors in the agrifood chain, will most likely raise the bar additionally in what regards the demand for broadband coverage and broadband service in rural Europe.

Our AIOTI WG06 Recommendations Report published last year [1] already lists broadband coverage as a potential barrier for the massive adoption of smart farming in Europe, although it does not provide much detail neither what kind of broadband nor how new farming applications are demanding broadband. This short report tries to shed some initial light on this issue by collating and summarizing a few current and future examples of farming applications demanding broadband.

#### General findings

Almost all of responses received agree on the fact that farming activities demand a better performing broadband service in rural areas.

Data rate requirements vary depending on the application, but some use cases have been gathered demanding speeds in the order of Gbps.



Latency requirements also vary depending on the specific application, although many of the collected cases do not require low latency.

Ubiquitous coverage is required for many applications.

Satellite coverage: We haven't found a clear agreement on the need for satellite-based service, but some use cases have listed it as a real possibility for extremely remote areas where it can become cost-effective.

### Most relevant use cases

We provide a selection of the most relevant use cases / examples gathered from the internal survey. The table at the end of this section provides an overall overview of the main features of each use case in terms of broadband requirements.

Most of the examples provided relate to farming activities. An exception is the case of wind farms. Although not related to farming, we have included here the general demand for quality broadband by rural population and businesses, given its recurrence in the feedback received from farmers' associations and cooperatives.

List of use cases:

1. **(High) Precision farming.** We have received a large number of examples of precision farming applications that will require varying requirements for broadband service. Some of these example applications are:
  - a. Live mapping of soil moisture and environmental conditions, requiring a meshed network of sensors deployed in the field performing continuous measures in combination with off-farm data sources (meteo data, satellite imagery).
  - b. Variable rate fertilization or spraying. The use of different sensing techniques, such as the so-called N-sensors, allows farmers to map the local nutrient and mineral requirements across their fields with high accuracy, which are then applied. There exist a number of solutions currently, but the trend in farm data integration will require that fertilization data be integrated into a central (cloud-based) system.
  - c. Smart irrigation systems use a combination of sensors and actuators that allow fine monitoring of the crop irrigation needs and control of the irrigation process. These applications typically require smaller bandwidths than other examples provided in this report, and could possibly be served by LP-WAN solutions at the edge in some cases, although broadband will be required at control centers.
2. **Wirelessly connected agricultural machinery.** As tractors, combines, harvesters and other agricultural machinery become smarter and more autonomous, connectivity becomes more important. Tractors and other machinery are generating more and more data as more sensors are being integrated or opportunistically added to them (for example N-sensors allowing for variable rate fertilization). Some specific applications such as autonomous machine steering are, similarly to automated driving in cars, likely to bring much stricter requirements (large bandwidth, low latency) than other applications.



3. **Data-centric farm management.** Farm activities rely more and more on digital data, given the increasing take-up of smart farming techniques that include the automatic collection of crop or cattle data from sensors, and the use of specific software for farm management and decision support. Such solutions will require to manage data coming from the different systems in use in the farm (machinery, sensors, digital reports generated off-site, etc.). Many of these application are/will be cloud-based, thus requiring proper broadband connectivity, but even local (non-cloud) solutions will need broadband for accessing off-farm data sources (databases, meteorological data, commodity prices, satellite imagery).
4. **Video surveillance and videoconferencing for farming applications.** We refer here to the professional use of video in land or sea farm operations, for example for remote monitoring of crops or livestock/fish health status or behavior. We include also here videoconferencing applications for remote veterinary diagnostics or veterinary aid (remote calving), and even standard remote training or telehealth services for farmers. Video applications are of course bandwidth hungry, especially those related to multispectral cameras (capturing not only visible light but other bands such as infrared or UV) and/or high-resolution applications.
5. **Connectivity to wind farms.** Wind power plants must have a data connection with remote wind farms, typically located far away from towns or villages and often in harsh environments. Low latency and high data rates reaching Gbps are required for such applications. Fiber might appear as a proper choice to meet the previous requirements.
6. **Rural citizens and businesses.** Citizens and businesses based in in rural (regardless of their activity) clearly want to have access to quality high-speed broadband (both fixed and mobile) for their daily use, just as people and businesses based in cities. In small farms, it is common that the same computer, smartphone or tablet are used both for farm operation and personal/family use. Population in rural areas with no proper broadband connectivity face difficulties in their use of e-Administration services, not to mention leisure use of broadband. A few contributors have mentioned telemedicine and remote health assistance as a need of farmers based in remote areas, but this need is shared by all citizens in those areas, not just farmers.

The following table tries to provide some relevant connectivity requirements for each of the cases above as collected from our survey.



Use case	Relevance	Status	Bandwidth Download /Upload	Latency	Ubiquity / Coverage	Need for fixed/backhaul vs. wireless solutions	Satellite connectivity needed?	Demands a better performing broadband service?
1.a Precision farming: Live mapping of soil moisture	High	Planned	Mbps order	Not critical	Ubiquitous	-	No	Yes
1.b Precision farming: variable rate fertilization (including N-sensing)	High (economy- and environment-wise)	In place / Planned	-	Not critical	Ubiquitous	-	No	Yes
1.c Precision farming: Smart irrigation	High (economy- and environment-wise)	In place / Planned	Kbps order	Not critical	Rural areas where irrigation is used	No	No	No
2. Wirelessly connected agricultural machinery	Medium-high	In place / planned	Kbps-Mbps (depending on application)	Critical / Non-critical, (depending on application)	Ubiquitous	Depending on market evolution	-	Yes (efforts already underway at standardization level)
3. Data- centric farm management	High	In place / planned	Mbps order	10's milliseconds order	Ubiquitous	Depending on aggregated demand in a rural area	Yes, if only affordable solution	Yes
4. Remote video monitoring and videoconferencing in farming	Medium	Planned / Potentially needed	Mbps order	Non-critical (monitoring)	Large area coverage	Depending on aggregated demand in a rural area	Yes, if cost-effective for remote areas with no proper wireless connectivity	Yes



Use case	Relevance	Status	Bandwidth Download /Upload	Latency	Ubiquity / Coverage	Need for fixed/backhaul vs. wireless solutions	Satellite connectivity needed?	Demands a better performing broadband service?
5. Connectivity to wind farms	Medium	In place / planned	Gbps order	Critical	Localized (fiber) connectivity	Fixed	No	Yes
6. General broadband use by rural citizens and businesses	High	In place	Gbps order	Varying (depending on application)	Populated rural areas	Depending on aggregated demand in a rural area	Yes, if only affordable solution	Yes



# AIOTI

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## References

- [1] AIOTI Smart Farming and Food Safety Internet of Things Applications – Challenges for Large Scale Implementations. Available online: [http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc\\_id=11818](http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=11818)
- [2] DG Communications Networks, Content and Technology. Broadband Coverage in Europe 2014 – Mapping progress towards the coverage objectives of the Digital Agenda. Available online: <https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2014>



### Annex - Questionnaire used for gathering the inputs to this report

Your details	
Your Name	
Your Company / Responding on own behalf	
Your role in your Company	
Your email address	
Is your Company member of AIOTI? (Y/N; If Y, in which WGs are you personally participating?)	

Please fill in the table below with at least one example/use case of your choice, trying to provide all the details as required. Feel free to add additional examples by replicating the use case table. If you have further ideas or comments, please use the last table "General comments".

IoT Use Case / Example #1	
Description of use case / example (200 words max.)	
Already in place / Planned / Potentially needed	
Economic / commercial relevance of this use case (High/Medium/Low)	
Bandwidth requirements	Download: Upload:
Latency requirements	
Ubiquity (coverage) requirements	
<b>BACKHAUL</b> To what extent does this use case require for fixed/backhaul links vs. wireless solutions?	



<b>SATELLITE</b> Is satellite connectivity an option for this use case? If yes, please explain briefly how/why.	
Overall, does this use case demand a better performing rural coverage?	

(Replicate the table above if necessary)

General comments