The Future of Smart Farming
with Nordic wireless technology at heart

Challenges and solutions of putting 'Smart' in Biotechnology

Alf Helge Omre / Business Development Manager

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Table of Contents

- Why Smart Farming

- Opportunities

- Smart Agriculture Use Cases

- Market Dynamics

- Value Chain

- Applications of IoT in Smart Agriculture

- Telecom Operators' Role in Agriculture

- End User Analysis

- Future

What is a Smart farming?

- A farm that can adjust to optimum operation with little or no need for human interaction.

- Maximum yield with minimum recourses

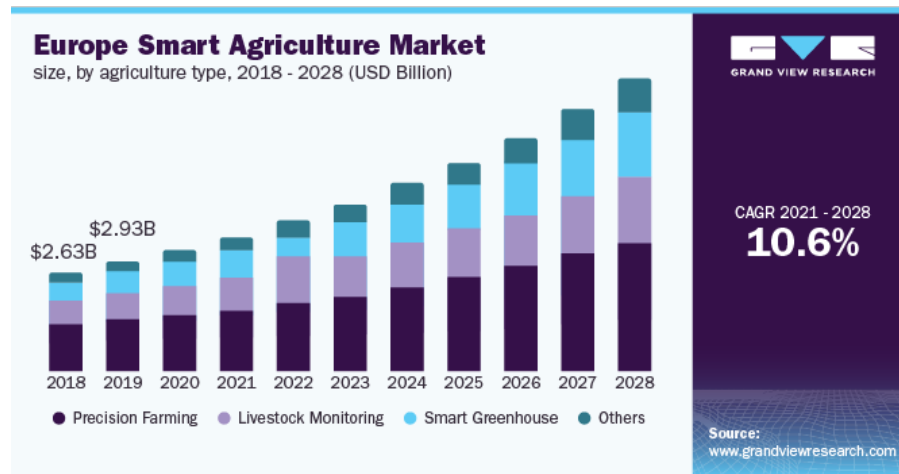- Higher yield is needed to feed a growing population

Why Smart Farming

- Enhancing efficiency

- Environmental impact
  - Climate Change

- State of farm
  - Making operational improvements

- Maintenance
  - Predictive/Preventive

- Better yield

- Cost-saving

Opportunities

- Compound annual growth rate (CAGR) of 10.6% from 2021 to 2028

Europe Smart Agriculture Market
size, by agriculture type, 2018 - 2028 (USD Billion)

GRAND VIEW RESEARCH

$2.63B
$2.93B

2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028

● Precision Farming ● Livestock Monitoring ● Smart Greenhouse ● Others

CAGR 2021 - 2028
10.6%

Source:
www.grandviewresearch.com

Source: https://www.grandviewresearch.com/industry-analysis/smart-agriculture-farming-market

Use cases

- Smart-building and -equipment management

- Smart Crop Monitoring

- Smart Livestock Monitoring

- Drone farming

- Autonomous farming machinery

Smart-building and -equipment management

- Stare of buildings

- State of equipment/machinery

- Predictive/Preventative Maintenance

- Decrease risk of mold, fire, and other threats

- Tank levels
  - Petrol/Water/milk etc.

- Solar powered and mobile operated pumps

Smart crop monitoring

- Connected irrigation and nutrient-distribution equipment

- Connected sensor data and imagery analysis

- Horticultural lighting

- Optimizing resource usage
  - Water, fertilizers, seeds, feed etc.

- Optimizing yield
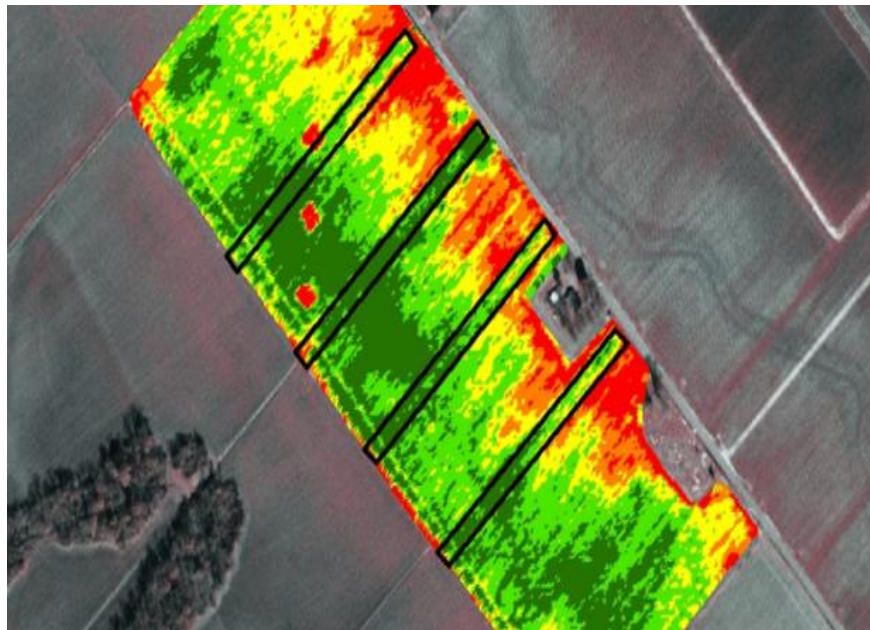
Vertical farming

- In-door

- Horticultural lighting

- Sensors

  - Humidity, Fertilization, temperature

- Automation

- Yield optimization

- Cost-saving

Smart Livestock Monitoring

- Individualized feeding-and-care plans
- Body sensors
  - Monitoring health and movement
  - Optimal feed and medicine mix
- Maximize growth
- Geo Fencing

Drone farming (UAV)

- Surveillance

- Image analysis

- Connected sensors communicating data with the drone

- Providing more frequent, cost-effective remote monitoring

Autonomous farming machinery

- Self-operated machinery and robots

- Able to perform targeted interventions based on connected-sensor data, GPS data, and imagery

- Reducing labor requirements

- Boosting yield through more precise and individualized interventions

Market Dynamics

Drivers

- Climate Change

- Power/fuel conservation

- Need for water conservation

- Emphasis on Enhancing Efficiency

Restrains

- Fragmented Agricultural Market
  - Many small players

- Lack of Connecting services

- High Capital investment

- Data management
  - Lack of standard
  - Lack of local knowledge

- Data security/Hacking

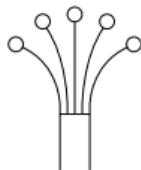# Smart Farming – Connectivity spectrum

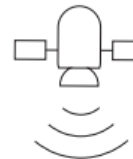| **Short range** (eg, RFID/ Bluetooth)	**LPWAN**[1] (eg, NB-IoT, LoRa, Sigfox)	**Fiber/ DOCSIS 3.x**	**Wi-Fi 6**	**Low- to mid-band 5G**	**High-band 5G** (eg, millimeter wave)	**LEO constellation**
Short-range, efficient device-to-device connectivity, storage, and identification	Low-power, low-maintenance networks that support high densities of connected devices	High-speed, low-latency fixed networks that support other connectivity	Next generation Wi-Fi with improved speed, device density, and features to increase device efficiency	High-speed, low-latency cellular-connectivity overlay on existing 4G infrastructure	Highest-speed, low-latency, and highly secure cellular connectivity	Global coverage with significantly reduced latency vs existing satellite offerings

ADVANCED · FRONTIER

Source: McKinsey

Smart Farming - Value Chain

Device/ Equipment Manufacturers → Connectivity providers (LPWA, WiFi, BLE, ZigBee → Mobile Network → Connectivity Platforms → Application provider → Data analytics → System integrators → End user

Source: Huawei.com

Applications of IoT in Smart Agriculture

- Precision Farming

- Variant rate Technology

- Smart Irrigation

- Agriculture Drones

- Smart Greenhouse

- Yield Monitoring

- Farm Management Systems

- Soil Monitoring Systems

- Precision Livestock Farming

Data transmission and end user analysis

Who will:

- Gather data

- Transmit data

- Store data

- Analyze data

- Data Management

- Decide/Act on data

- AI

Source: https://www.mdpi.com/2073-4395/10/2/207/htm
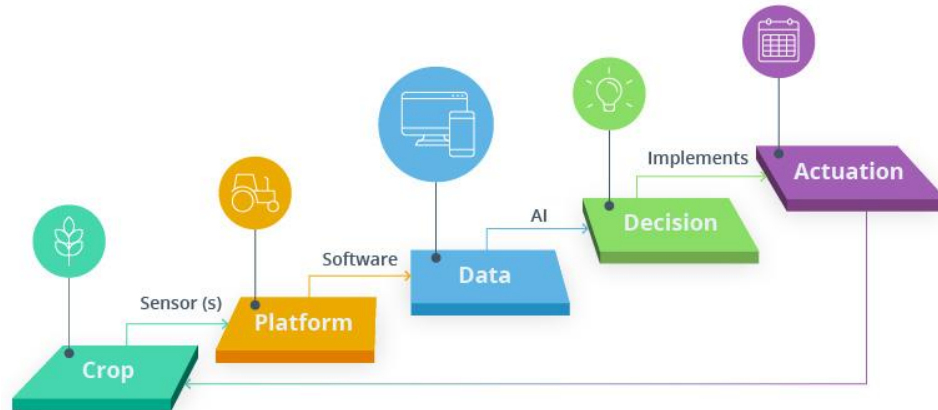
Future

- Higher yield with less recourses
  - Cost optimized

- More people will live in cities
  - Workforce shortage
  - More effective robots

- Higher yield
  - Growing population, more food needed

- Environmental
  - Less waste and energy use
  - Less Greenhouse footprint

A globally leading IoT enabler

Simplifying lives through all things connected

Map locations:

HEAD OFFICE TRONDHEIM, OSLO, STOCKHOLM, LUND, OULU, TAMPERE, ESPOO, TURKU, KRAKOW, WROCLAW, MÜNCHEN, DÜSSELDORF, EINDHOVEN, HATFIELD, SWINDON, BERKSHIRE, BRISTOL, ILLINOIS, INDIANA, MINNESOTA, PENNSYLVANIA, MASSACHUSETTS, NEW JERSEY, SOUTH CAROLINA, GEORGIA, FLORIDA, OREGON, CALIFORNIA, ARIZONA, COLORADO, TEXAS, BEIJING, SEOUL, YOKOHAMA, SHANGHAI, TAIPEI, ZHUBEI, SHENZHEN, HONG KONG, MANILA, HYDERABAD, BANGALORE, SINGAPORE, SYDNEY

- Leading ultra-low-power wireless connectivity solutions

- Short-range, medium-range and long-range technologies
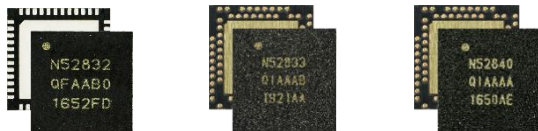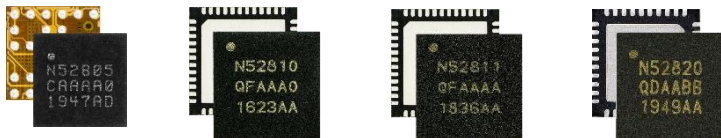
Integrated circuits (ICs)   Embedded software   Development tools

- Broad products and solutions portfolio

- Common software platform and development tools

- Excellent technology support

Founded	Employees	Oslo listing	Market Cap
1983	1,155 (~77% R&D)	OSEBX:NOD	~$6bn

20

Product Portfolio Snapshot

Low power short-range SoC
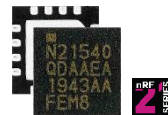Decades of low power connectivity experience

nRF Connect SDK

Low power cellular IoT SiP
Future proof and global platform
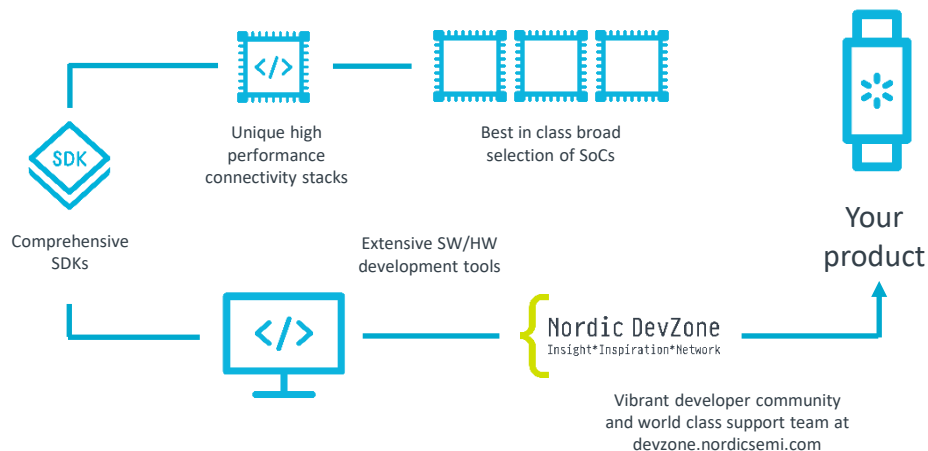

Complementary

nRF21540 RF FEM
2.4GHz

nPM1100 PMIC
Charger+Buck

nRF Cloud
Location Services

DevZone – class leading tech support

Comprehensive SDKs

Unique high performance connectivity stacks

Best in class broad selection of SoCs

Extensive SW/HW development tools

SDK

</>

Nordic DevZone
Insight*Inspiration*Network

Vibrant developer community and world class support team at devzone.nordicsemi.com

Your product

- devzone.nordicsemi.com -> Leading support community in the industry

- >80K developers, 3Mill site visits last 6months

- Strong tech support team

- Nordic Tech Tours, Tutorials and webinars

- Blogs, guides, Wireless Quarter

- Strong 3rd Party Module Partners-offering

- New Nordic Partner Program launched

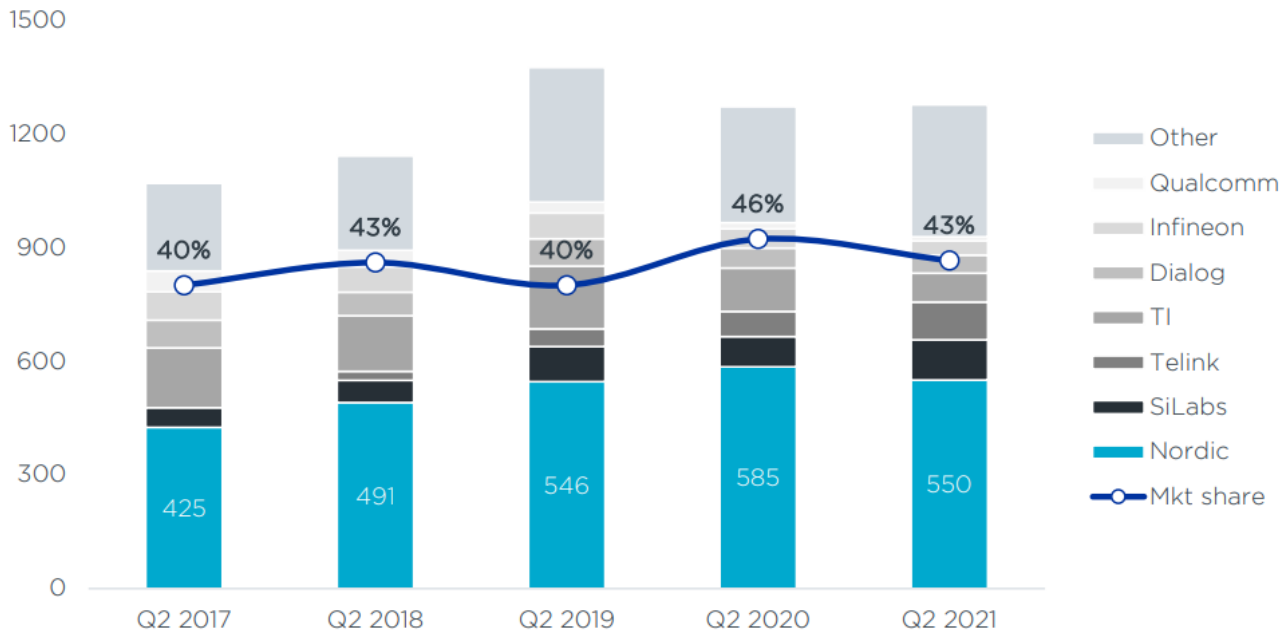# 3rd Party Module Partners

- Huge Variety in Form, Fit and Function
  - nRF52, nRF53 & nRF91 series available
  - 30+ Module partners
  - Modules + sensors variants available

- Module solutions are:
  - Minimized development efforts
  - Pre-qualified
  - Tele-regulatory approved
  - Very competitive option even in medium level volumes

- World-Wide Coverage

https://www.nordicsemi.com/modules

Market leader in Bluetooth

Bluetooth/FCC certification*

Bluetooth Low Energy end-product certifications, last 12 months

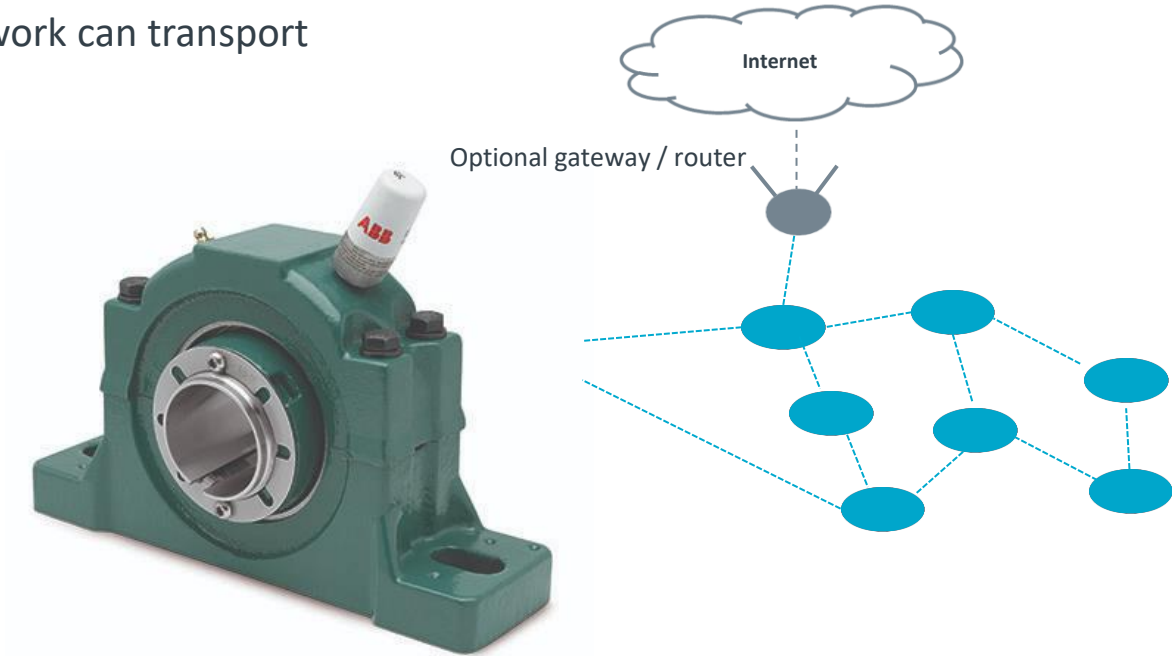

*Source: DNB Markets/FCC

*Source: DNB Markets/FCC

Bluetooth mesh

- Bluetooth mesh 1.0
- SDK with all models available*
- Provisioning App
- Mesh source code
- EnOcean Switch integration
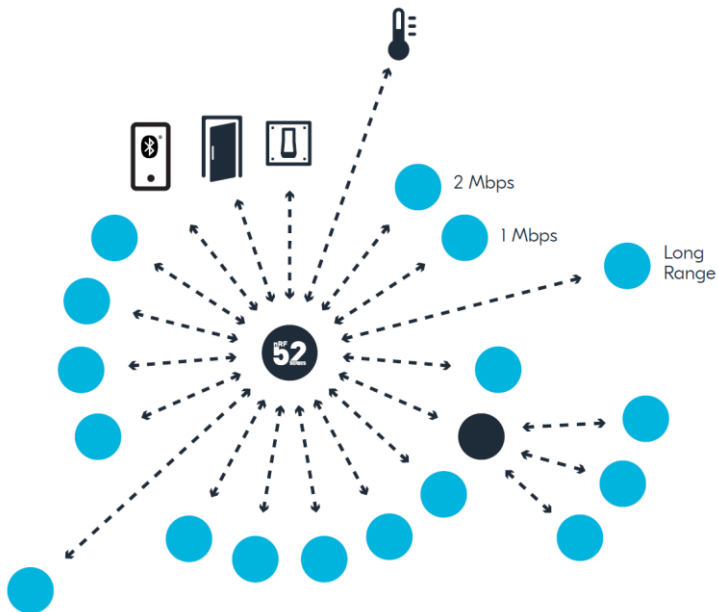- NFC
- Strongest 3rd party module lineup

* http://developer.nordicsemi.com/nRF_Connect_SDK/doc/1.6.1/nrf/include/bluetooth/mesh/models.html

Bluetooth mesh Sensor Network

- Wireless mesh network can transport sensor data
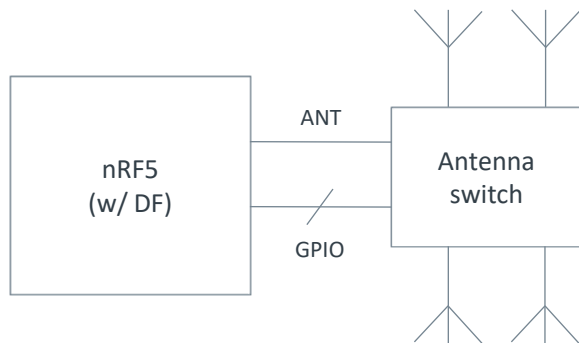
Bluetooth mesh or Multilink? Or both?

- Multilink strengths
  - Low power consumption
  - Low 1:1 latency
  - High throughput
- Bluetooth mesh strengths
  - Low 1:many latency
  - Supports large distributed networks
  - Interoperability
- Combine to get the best of both

Direction Finding (AoA/AoD) Bluetooth 5.1

Direction finding offering

- Code example
  - From IQ samples to Application (according to SIG spec.)
- Direction finding algorithm with example
  - Proprietary
- Antanna kit/switch with SW
- Availabile through DevZone

Supported parts:

- nRF52811
- nRF52820
- nRF52833
- nRF5340

Asset tracking with nRF9160

- **On-Board GPS**
  - Cloud connectivity

- **Assisted GPS (A-GPS)**
  - Assisted GPS acquires and stores information about the location of satellites using the cellular network, so the information does not need to be downloaded by satellite.

- **Predicted GPS (P-GPS)**
  - Similar to A-GPS, device downloads up to two weeks of predicted assistance data.

Low power Cellular IoT SiP

Future proof and global platform

nRF9160

10mm

16mm

LTE-M   NB-IoT   GPS
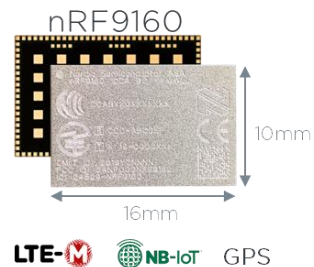
Cellular for sensor data

Low power Cellular IoT SiP

Future proof and global platform

nRF9160

10mm

16mm

LTE-M   NB-IoT   GPS