Industrial IoT

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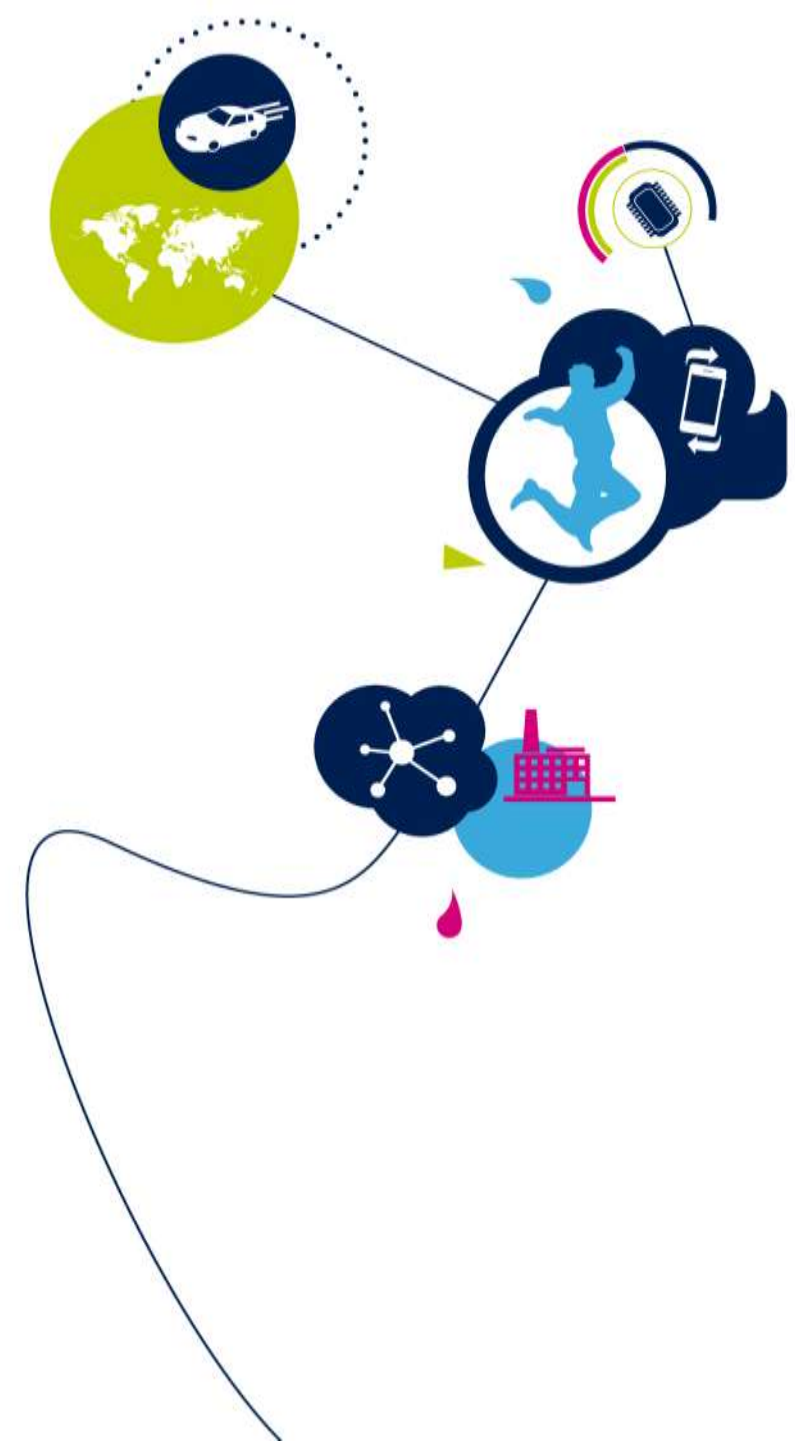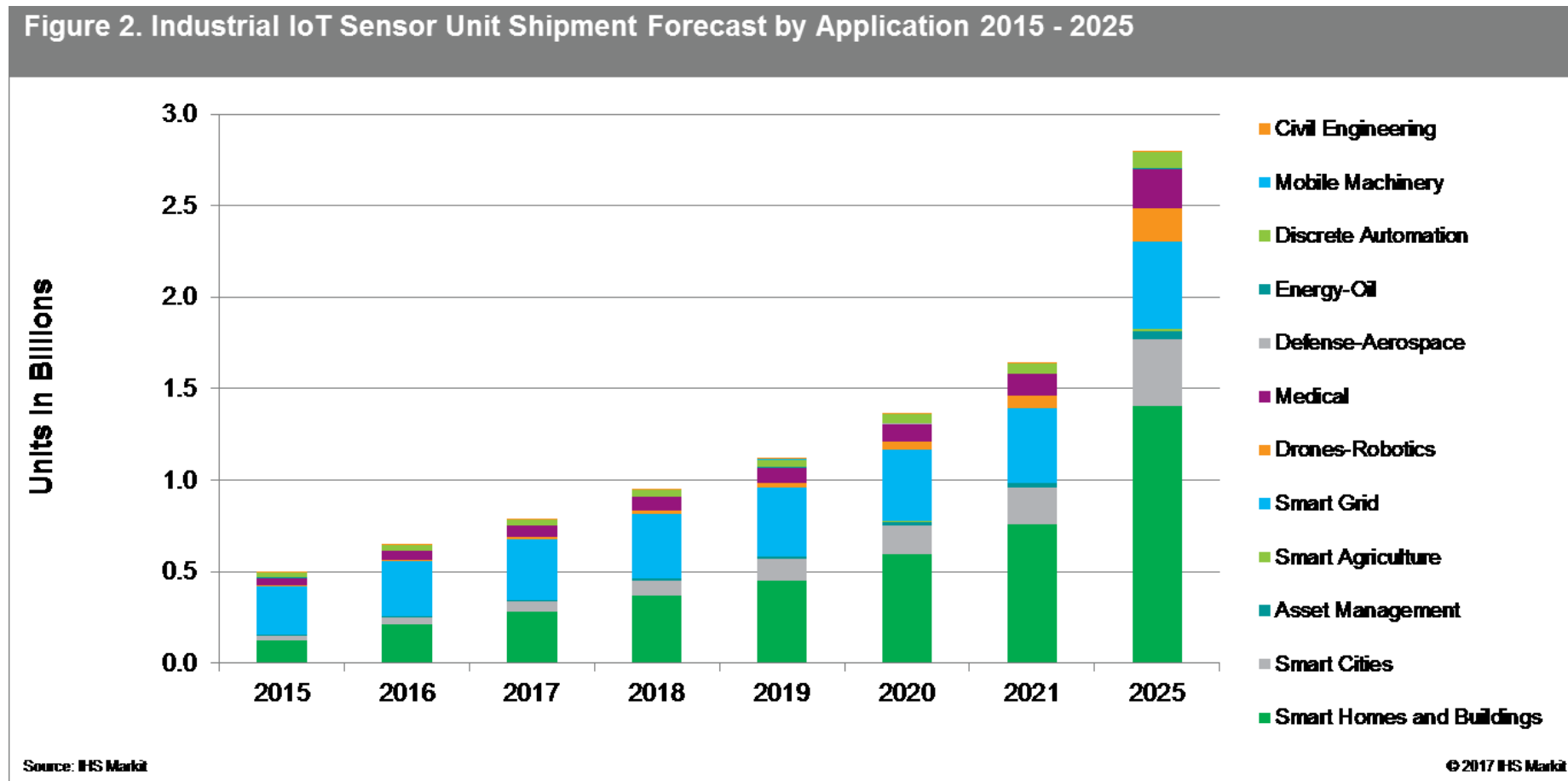# Industrial IoT

- Industrial IoT is a system where sensors collect, compute and connect to Cloud/Internet via wired or wireless medium

- Generally Industrial category includes Asset Management, Smart Cities, Smart Buildings, Smart Agriculture
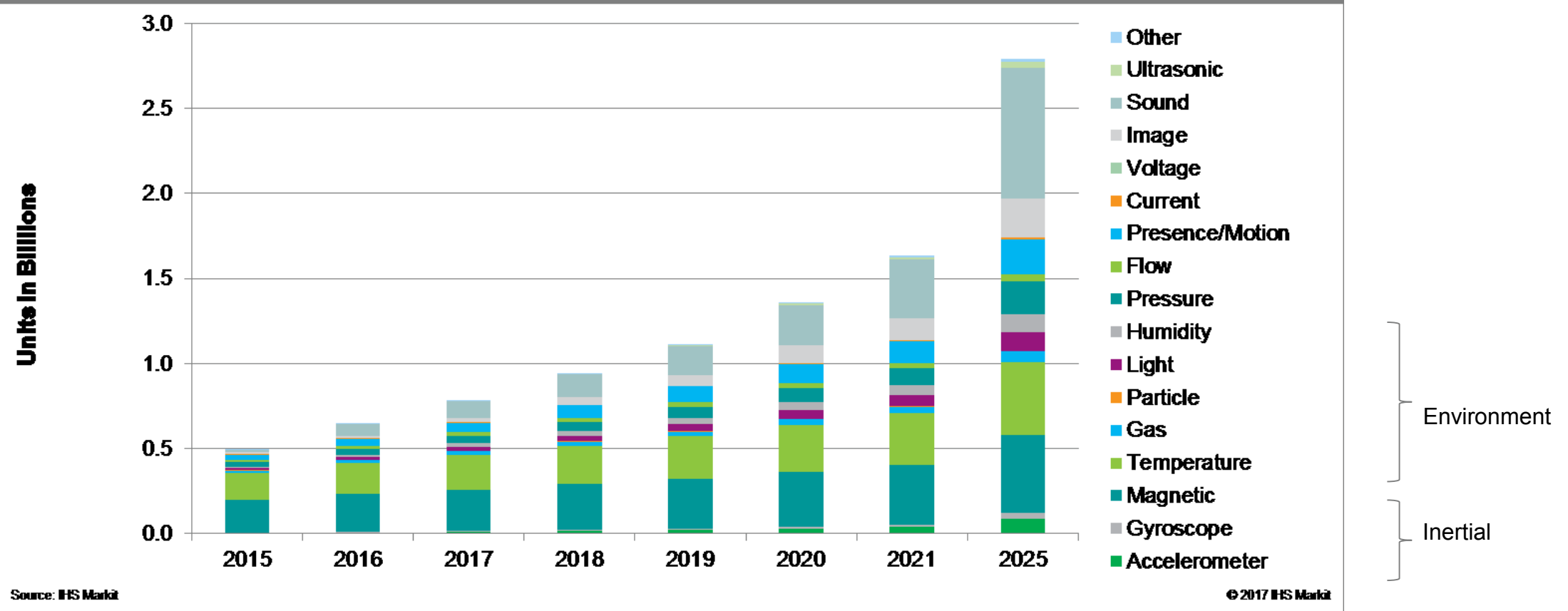
Industrial Sensors for IoT

- How big is the market ?
  - Unit Shipment Forecast of Industrial IoT Sensors by Application 2015 - 2025

Figure 2. Industrial IoT Sensor Unit Shipment Forecast by Application 2015 - 2025

Industrial Sensors for IoT

- The industrial market is dominated by two applications: smart homes & buildings and smart grid
    - Smart homes and buildings include sensors in both homes as well as commercial buildings.
        - Sound grew rapidly in 2016 due to explosion of the home smart speaker market.
        - Temperature sensors found in both markets in thermostats.
        - Motion sensors driven by HVAC and lighting control in smart buildings.
    - Smart grid is driven by magnetic, temperature and flow sensors in smart electricity, water and gas meters.

Figure 3. Industrial IoT Sensor Unit Shipment Forecast by Sensor Type 2015-2025

Industrial Sensor by Type

- Some of the fast growing Industrial Sensors are
  - Pressure: features prominently in medical equipment, smart cities (for weather stations), and drones/robotics.
  - Motion: used in smart homes and buildings to control lighting systems and heating, ventilation & air conditioning (HVAC), and in smart cities to track outdoor motion to trigger street lights and cameras.
  - Image: used for security cameras in smart homes & buildings, smart cities, and drones & robotics.
  - Humidity: used increasingly in smart thermostats, as well as for weather stations in smart cities and in smart agriculture.
  - Gas: CO2 sensors used in smart buildings and medical applications, while particle and gas sensors are used in smart cities

Industrial IoT and Ecosystem

- The below image show case the complete eco-system from components to consumer

Automation Components	Machine Builders/OEMs	Automation Solutions	IT Infrastructure	Connectivity	Cybersecurity	IoT Platforms	Industrial Software	Systems Integrator	Applications	Customer

Example technologies and services

Automation Components	Machine Builders/OEMs	Automation Solutions	IT Infrastructure	Connectivity	Cybersecurity	IoT Platforms	Industrial Software	Systems Integrator	Applications	Customer
• Micro controllers • Connectors • Wireless ICs • Sensors	• Processing machines • Packaging machines • Material Handling • Robotics	• PLCs • Operator terminals • Remote I/O • IPC's • Motion control products	• Servers • Routers • Switches • Computers	• Networking • Industrial protocols • 5G • LoRaWAN	• IP protection • Equipment downtime prevention • Regulation compliance • Worker safety	• Cloud • Connectivity management • Data management • Device management • Application enablement	• PLM • MES/MOM • ERP • SCADA	• Technology expertise • IT and OT collaboration • Change management	• Remote Monitoring • Predictive maintenance • Plant visualisation • Design and simulations tools	• Enables new business models (seller of XaaS) • Enables new operations (customer of XaaS)

Example Stakeholders

Automation Components	Machine Builders/OEMs	Automation Solutions	IT Infrastructure	Connectivity	Cybersecurity	IoT Platforms	Industrial Software	Systems Integrator	Applications	Customer
• Intel • Qualcomm • Infineon • Toshiba • NXP • Balluff • SICK	• Bosch Packaging Tech • ProMach • ITW • Tetra Laval • Krones • FANUC • KUKA	• GE • Rockwell • Siemens • Schneider Electric • Emerson • Mitsubishi Electric	• Cisco • Belden • Dell • HP	• Vodafone • AT&T • Huawei • Ericsson • Orange	• Symantec • McAfee • Lockheed-Martin	• Microsoft • IBM • SAP • GE • Siemens • Bosch	• Oracle • Dassault • PTC • SAP • Honeywell	• Accenture • Capgemini • Maverick Technologies • PwC • Tata?? • M+W Automation	• IBM • GE • Siemens • PTC	• Coca-Cola • BMW • Foxconn • Samsung • Shell • BASF

Source: IHS Markit – Smart Manufacturing Intelligent Service 2017

Asset Management (1/3)

- Asset tracking is monitoring the condition of valuable items while they are in the process of shipment or if they are difficult to track

- The primary sensors that go into the asset tracking are
  - Temperature & Humidity
    - To record the temperature and humidity in which the shipment is sent
  - Pressure
    - Condition of the shipment under which it sent
  - Motion
    - Did not move beyond a permissible limit
  - Light
    - Was the light allowed

Asset Management (2/3)

- There is a transition from data logger where data can be extracted at the destination to continuous retrieval of data a interval

- Different types of connectivity
  - Low power asset tags with sensors and short range connectivity (RFID/BLE)
  - Low power asset tags with sensors and long range connectivity (LoRA, Sigfox)

- Location is the king. All parties need to know the current location of the asset via Cloud / Internet

Asset Management (3/3)

- Data loggers dominated over IoT in 2016, with data stored on route, and data logger collected at destination

- IoT should gain ground over the length of the forecast as sensors connect to cellular hubs in shipping container or at remote location via short-range radio, such as Bluetooth.

- IoT sensors were less than half the market in 2016; in revenue terms; will grow to just under 90% by 2025

Smart Agriculture (1/4)

- Smart Agriculture also known Precision Agriculture

- This includes crop monitoring and agriculture maintenance

- The sensors includes general sensors such as humidity and temperature sensor and specifics sensors for micro-nutrients

- A lot of work is done in this segment but still most of them are academics

- More penetration is expected

Smart Agriculture (2/4)

- Air temperature, humidity, light, soil temperature and moisture are primary concerns for smaller farmers, and primary targets for sensor makers
  - Air and soil temperature key for plant health
  - Soil humidity determines if farmer is over- or under-watering
  - Light sensors, track visible, UV light, in fields or green houses
  - Others:
    - Accelerometer can inform farmer if sensor knocked over
    - Sound: microphones to track wind
    - Soil chemistry is interesting – would let farmer know about soil nutrients, but not currently available

Figure 12. Smart Agriculture IoT Sensor Shipment Forecast 2015-2025

Smart Agriculture (4/4)
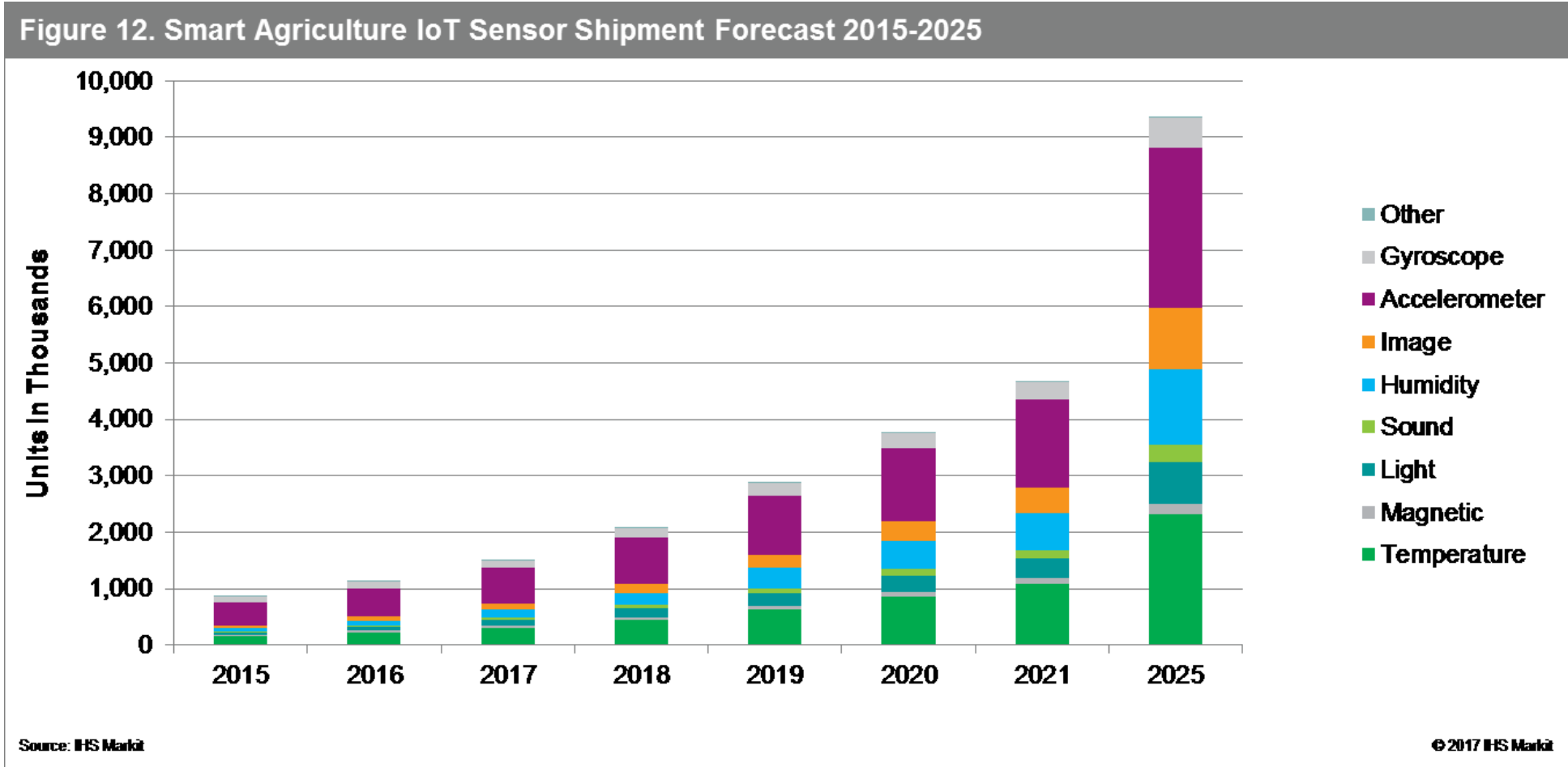
- Market dominated by sensors for agricultural machinery: accelerometers and gyroscopes.

- Soil and crop monitoring is emerging markets

- IoT dominates smart agriculture (or precision farming) because of size of investments: agricultural machinery and crops
  - Variety of connectivity found in smart agriculture, including Bluetooth for short range, Wi-Fi for longer ranges, and LoRa/ISM band radio or cellular for longest distances.
  - Data loggers found in some academic research farms, where students are available to collect data.