

Artificial Intelligence for Agriculture

Vision,
Research,
Technology Transfer



Global context and Challenges

World population

9.8 billion by 2050

11.2 billion by 2100

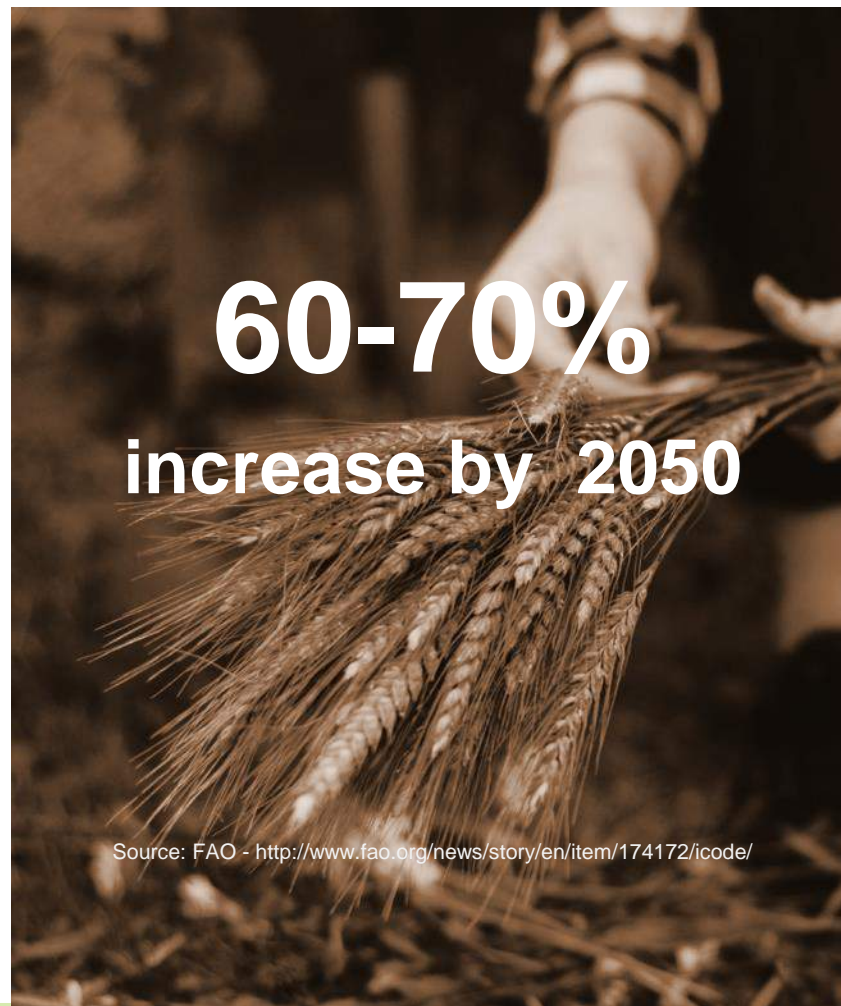
Source: UN DESA - World Population Prospects The 2017 Revision



Food demand

**60-70%
increase by 2050**

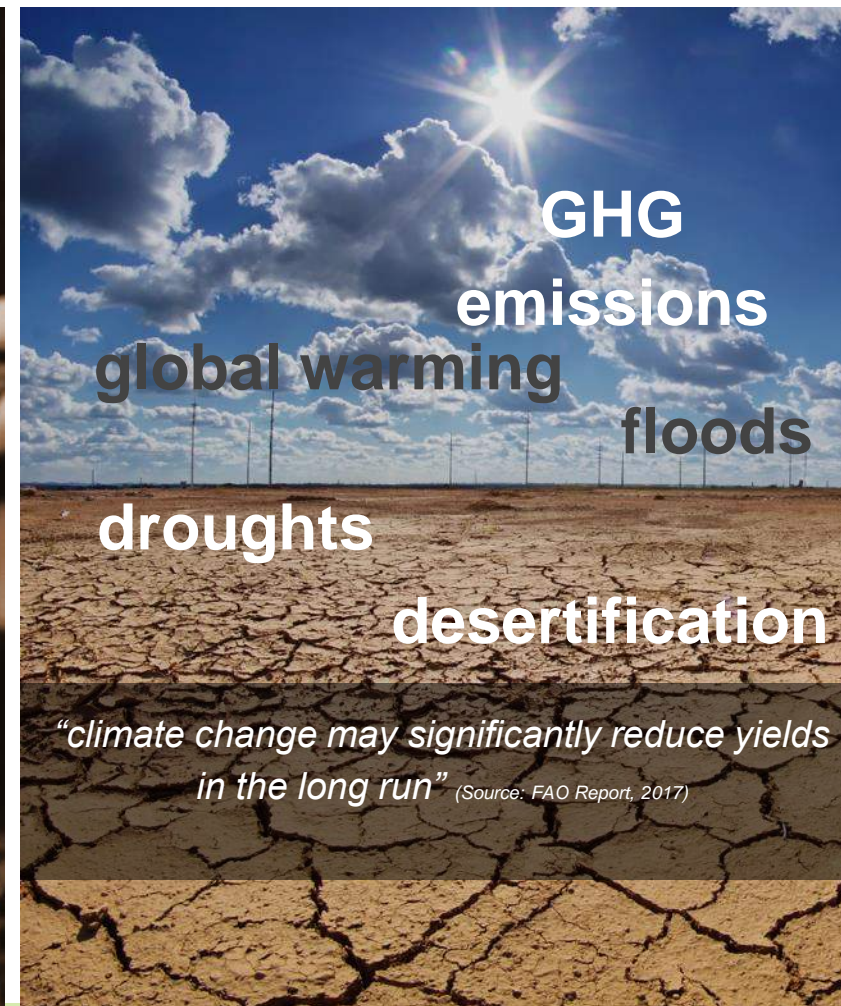
Source: FAO - <http://www.fao.org/news/story/en/item/174172/icode/>



Climate change

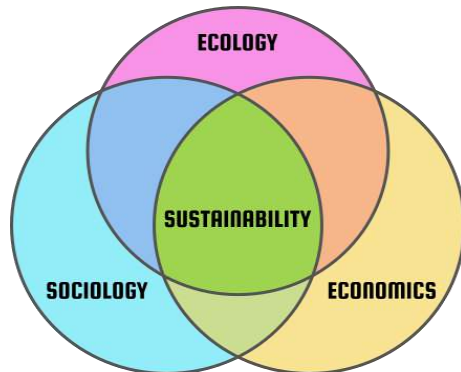
**GHG
emissions
global warming
floods
droughts
desertification**

*"climate change may significantly reduce yields
in the long run"* (Source: FAO Report, 2017)



Need for a smart(er) agriculture

- **optimize** processes
- minimize repetitive **manual work**
- increment **yields**
- **reduce inputs** and reduce **waste**
- improve **product quality**
- aim at **sustainability**



**Adapt
and tackle
the challenge**



AgriTech - Technology in agriculture

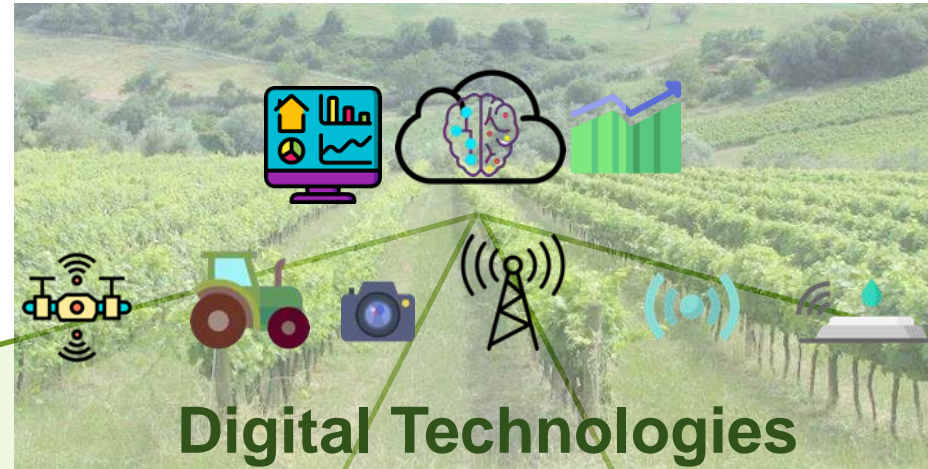
Measure > Analyze > Take action

“do the right thing in the right place at the right time”

Pierce e Novak, 1999



Digital Agriculture – FBK Application Areas



Internet of Farming

*Supply Chain integration
Traceability*

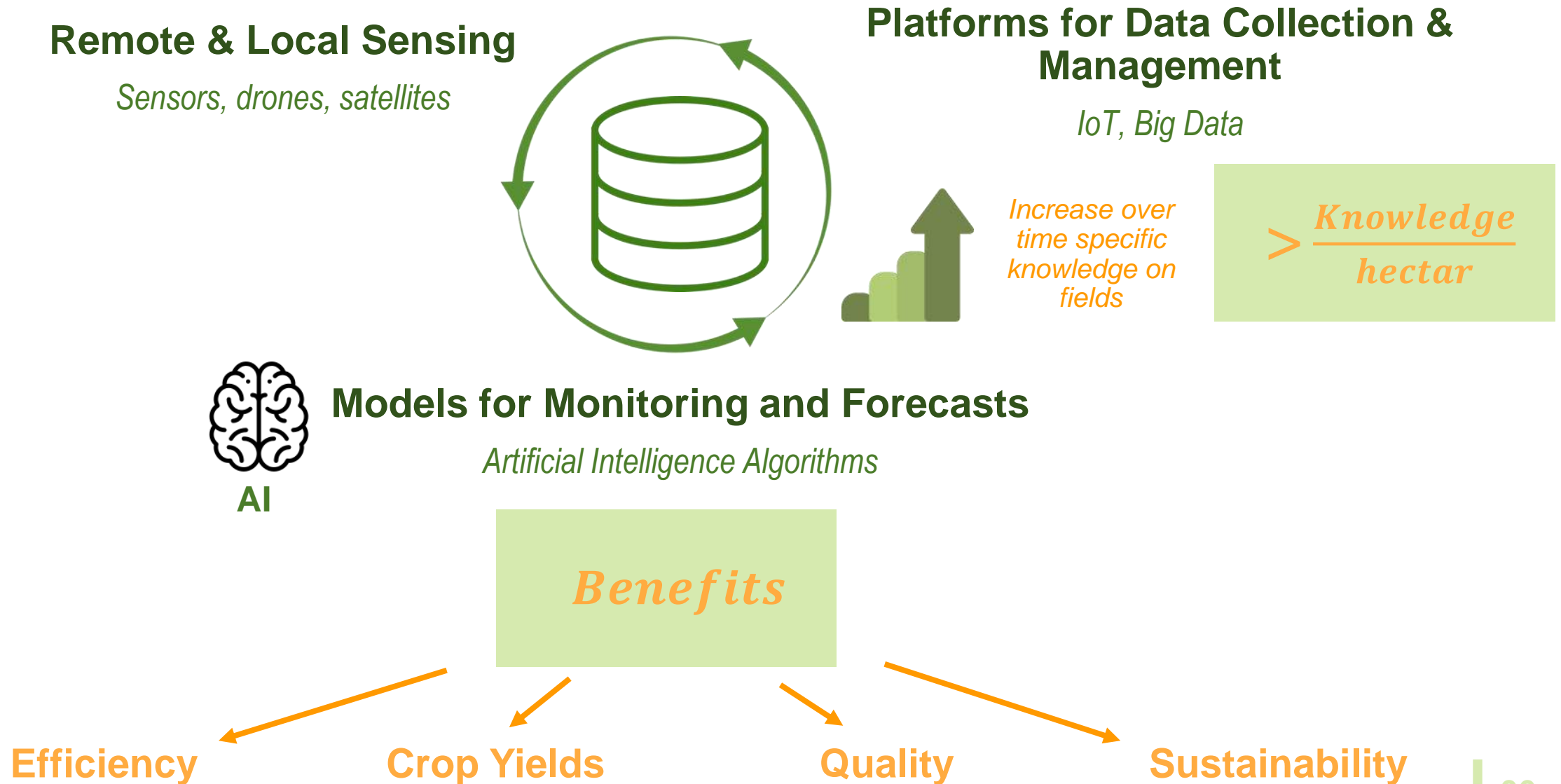
Sustainability

*Reduction of impact on
human work and on
ecosystem*

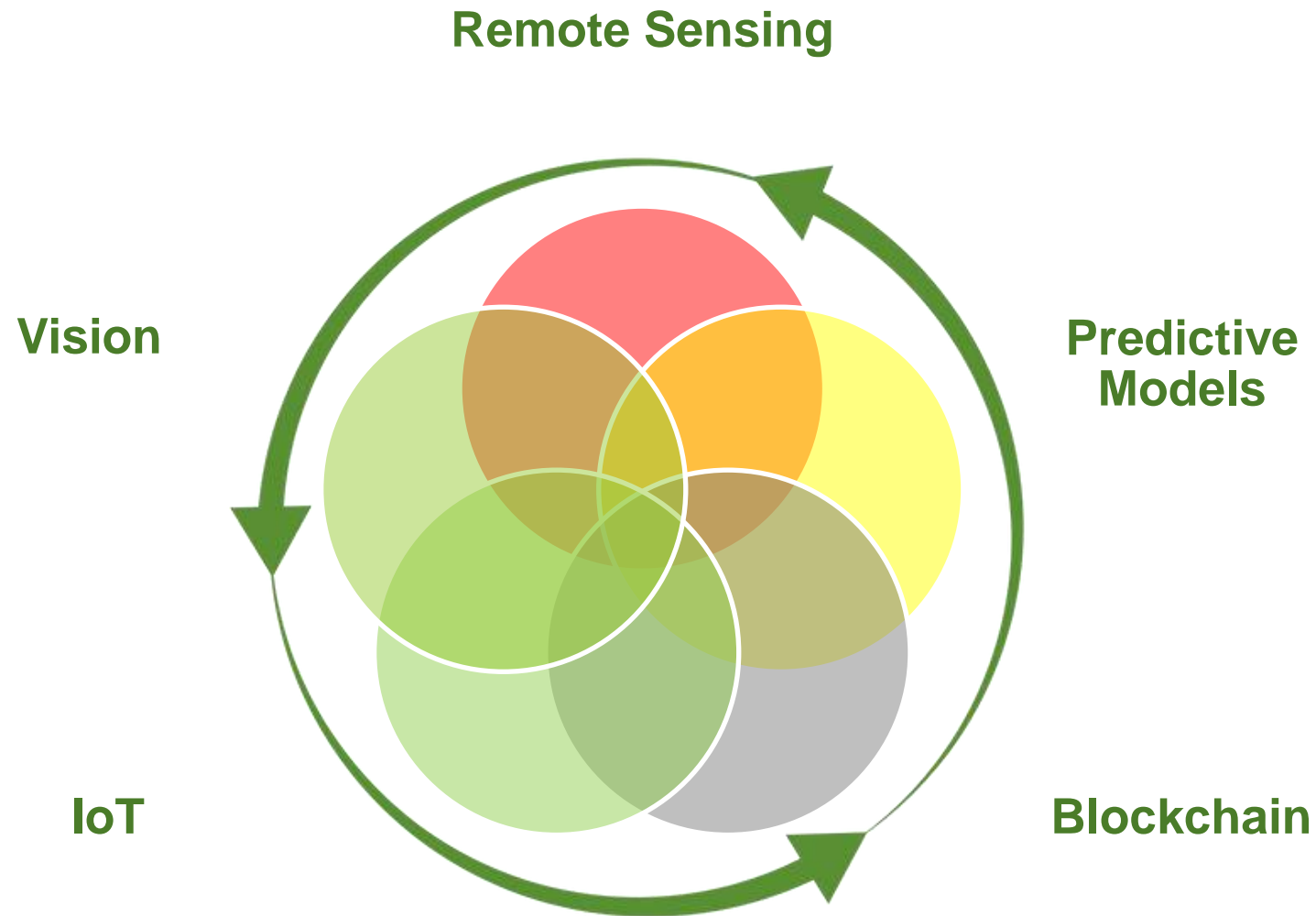
Precision Agriculture

“the application of modern information technologies to provide, process and analyze multisource data of high spatial and temporal resolution for decision making and operations in the management of crop production” (National Research Council, 1997)

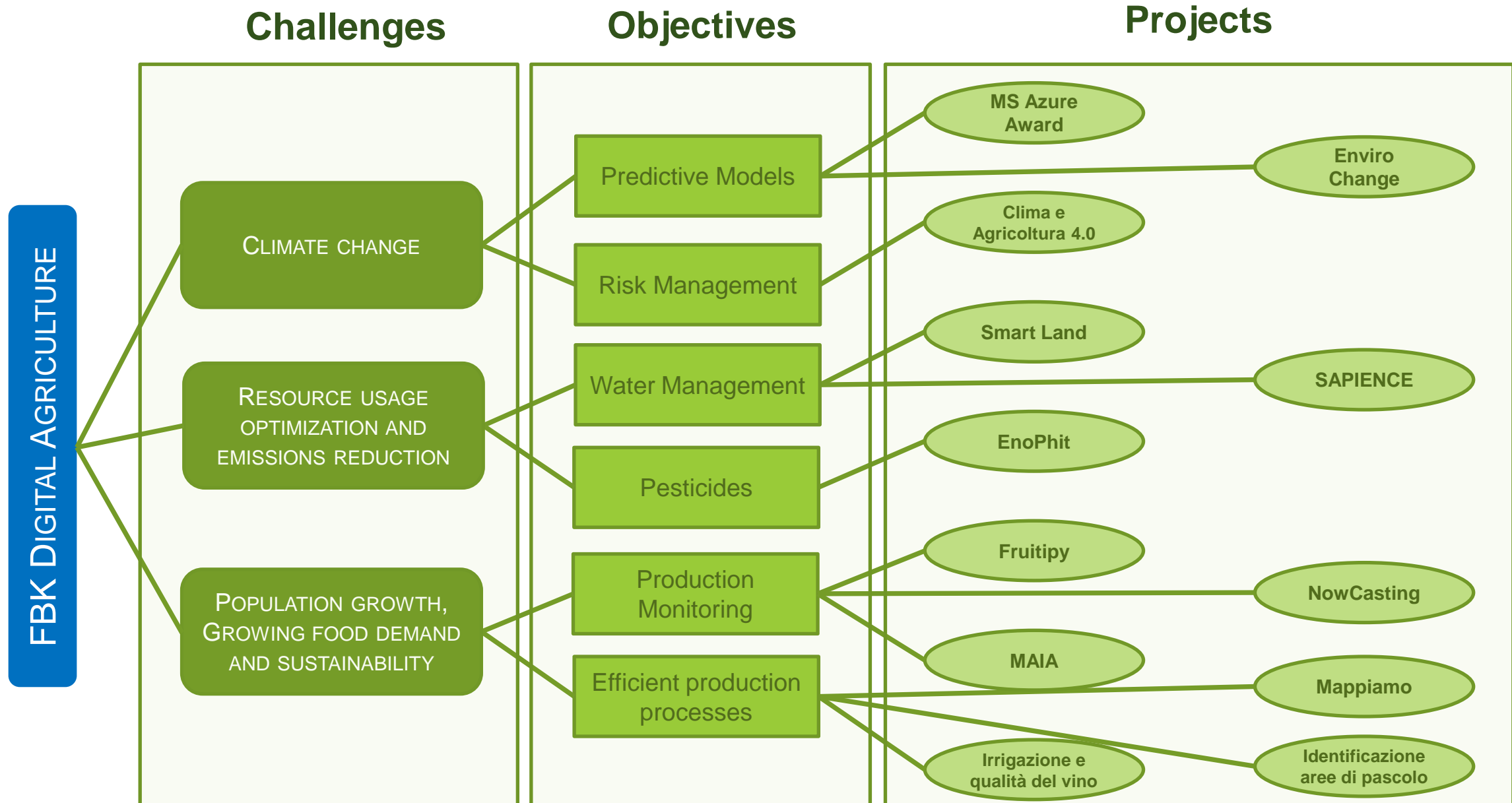
Digital Agriculture – Transforming Data into Tangible Value through AI



Digital Agriculture in FBK – Convergence of different Research Skills



Digital Agriculture – FBK Main Projects



Project Examples



Digital Agriculture – Predictive Models

Frost Risk Forecast

BIG DATA FOR AGRICULTURE
YEAR 2016



41 apple varieties



> 17 layers (terrain, varieties, weather, ...)



> 44 k frost events



> 27 k cadastral particles

INPUT



Structured files, XML, csv, ...

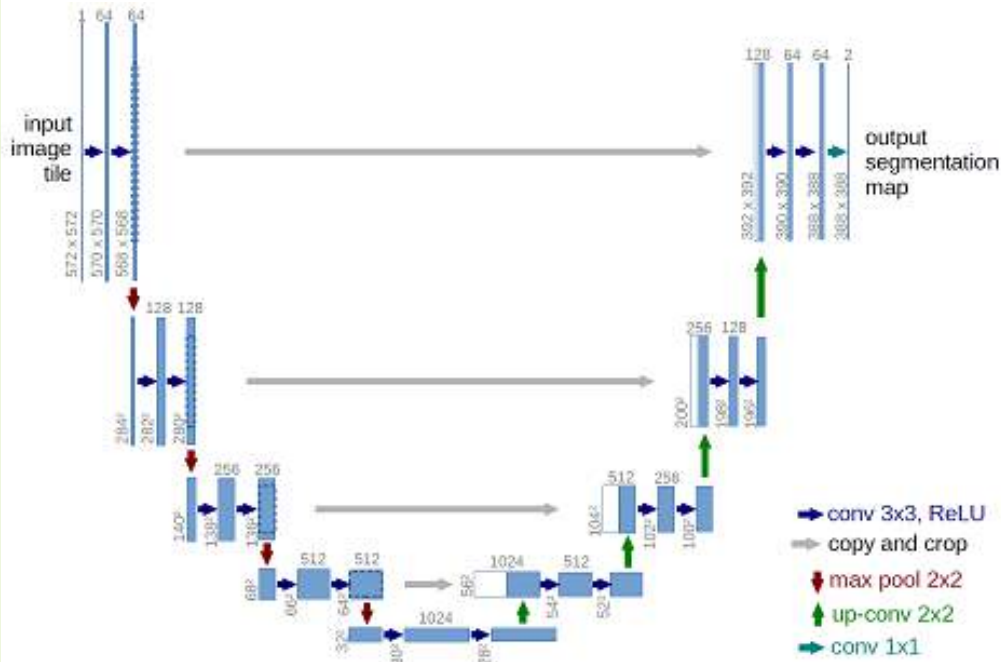


cadastral, DTM, ...

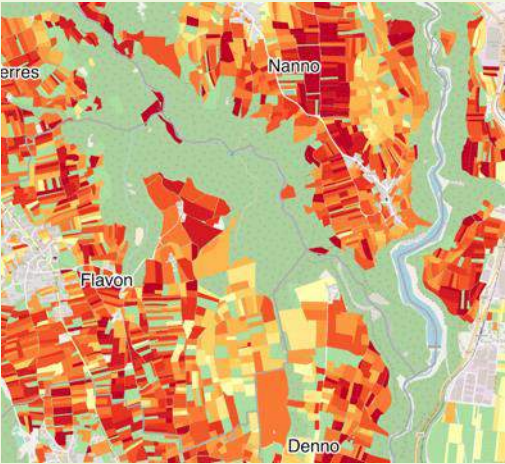
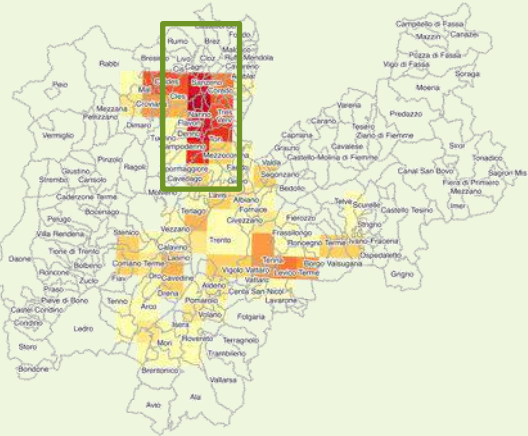


Temperature, radar, satellite, ...

METHOD: DEEP LEARNING
U-NET BASED ARCHITECTURE



OUTPUT:
RISK PREDICTION AND
ENVIRONMENTAL IMPACT



Data and expertise from:



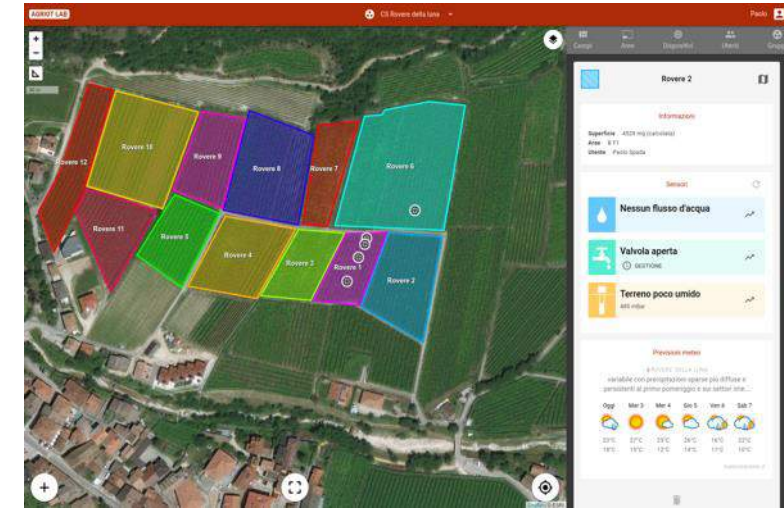
Digital Agriculture – IoT and Production Quality Control

Water Management and Grapes Quality Control

Water stress in proper *phenological phases* helps to improve **grape quality**.

Water management balancing quality and impact on grape status requires *precise monitoring and control*.

- Development of forecasting models for water stress determination
- Granular and semi-autonomous actuation
- Water and energy savings (pumping)



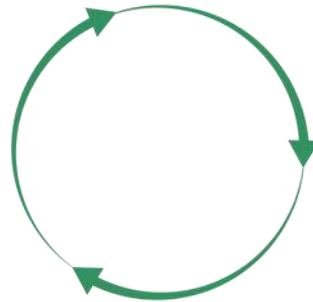
FBK and Technology Transfer – Collaborative Research



Collaborative research project on Sustainable Grape Pest Management

Optimization of pesticide treatments thorough integrated production and data analysis (AI)

- *Development of platforms for vineyard management and precision viticulture*



- *AI: predictive models on grapevine phenology*



FONDAZIONE
EDMUND MACH



- *Frontier agronomic skills*

FBK and Technology Transfer – Spin-off

FBK Spinoff:

AI in Agriculture: from Research to Innovation



*Innovative solutions and services for **precision agriculture** by applying the latest results of research and experimentation in the field of **AI and IoT technologies** to the agricultural domain.*

- *In-field smart IoT devices*
- *ultra-local models and machine learning to predict local crop condition*
- *DSS to assist farmers in taking the best decisions*