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BIOFRESH CLOUD

ENHANCING MEDITERRANEAN FRESH PRODUCE SHELF LIFE USING SUSTAINABLE PRESERVATIVE TECHNOLOGIES AND COMMUNICATING KNOWLEDGE ON DYNAMIC SHELF-LIFE USING FOOD CLOUD SERVICES AND PREDICTIVE MODELLING

BIOFRESH CLOUD

www.biofreshcloud.eu

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BIOFRESHCLOUD PROJECT SYMPOSIUM

NOVEMBER 18, 2022

ANKARA UNIVERSITY
FACULTY OF AGRICULTURE CONFERENCE HALL
ANKARA, TÜRKİYE

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"Enhancing Mediterranean Fresh Produce Shelf-life using Sustainable Preservative Technologies and communicating knowledge on dynamic shelf-life using Food Cloud Services and Predictive Modelling"

BIOFRESHCLOUD

Prof. Dr. Fernando Pérez Rodríguez
BIOFRESHCLOUD coordinator
University of Córdoba (Spain)

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BIOFRESHCLOUD CONCEPTS

BIO-BASED SOLUTIONS

DIGITAL SOLUTION

DEMOSTRATION

PRIMA PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

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Section 2 "Topic 2.3.1 RIA Extending shelf-life of perishable Mediterranean food products by sustainable technologies and logistics and by optimized pest and microbial control".

Coordinating country

Spain

Participating countries/ 5

Research Units/ 7

PRIMA - Funded Projects 2019 | 118

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||VEGETABLES||

Environment

Profit

Consumer

Food quality

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||ENHANCING SHELF-LIFE||

(Sonoco Institute, 2018)
$1.8 billion

+1 day +2 day

Produce shelf-life

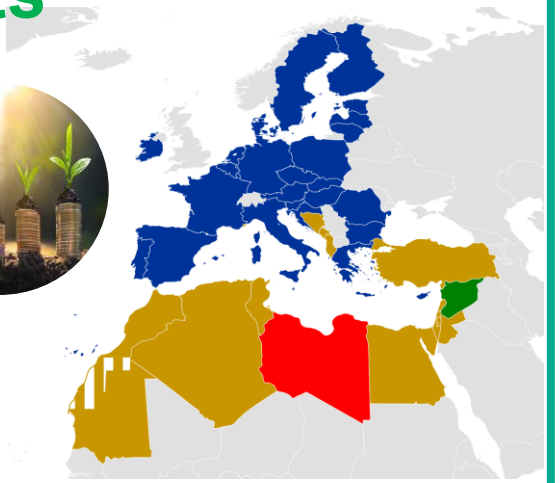
Profit/markets

BIO FRESH CLOUD

Food waste

Turkey
Morocco
Spain

Top producers



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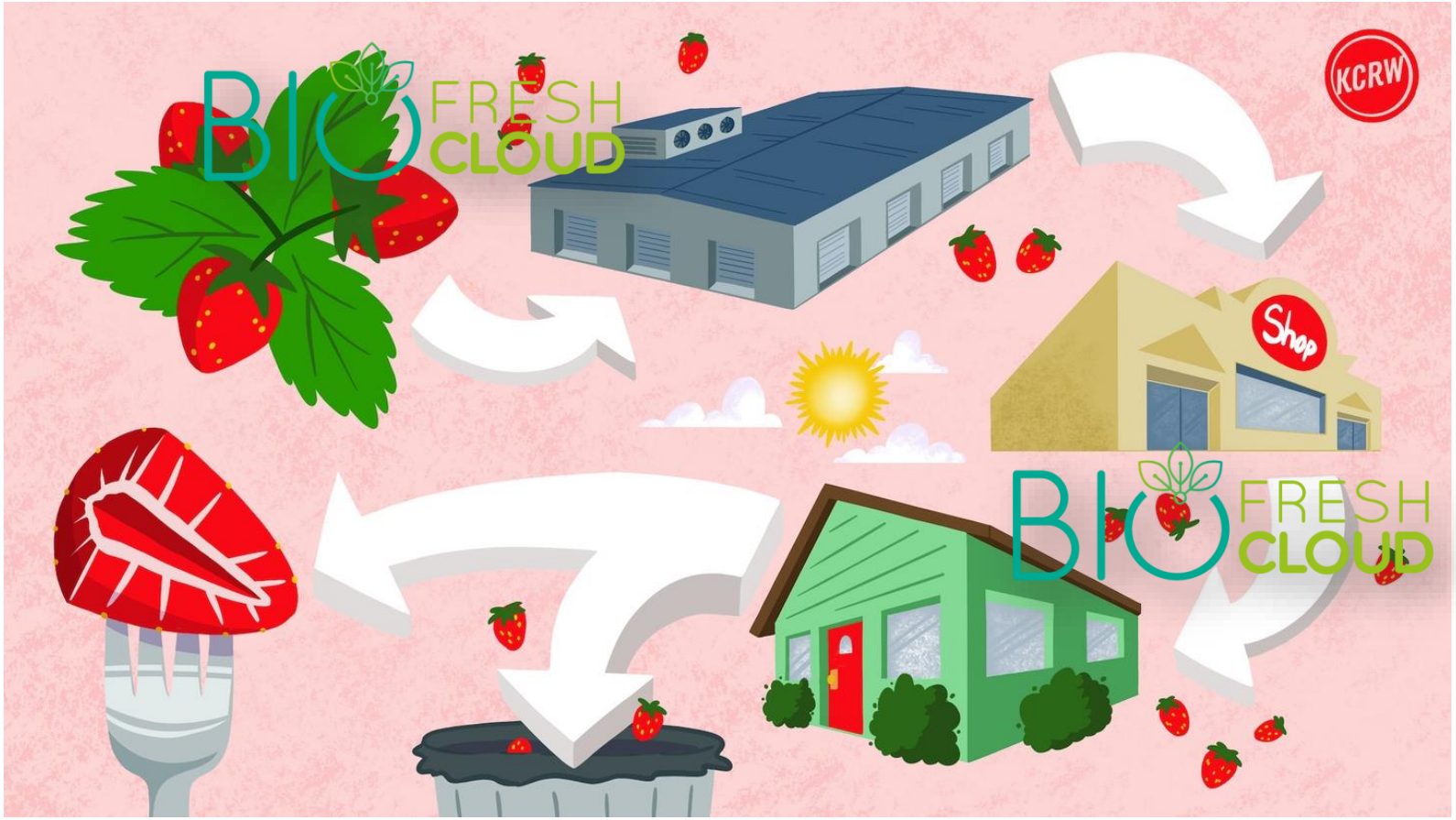
||SPOTLIGHT ON…||



To illustrate California's food waste crisis, KCRW follows a strawberry as it begins on a farm and finally ends up in a person's meal or trash can.

Image by Mike Royer.

FOOD WASTE

Produce does not meet quality standard

Plant diseases

Produce deterioration

Stock management

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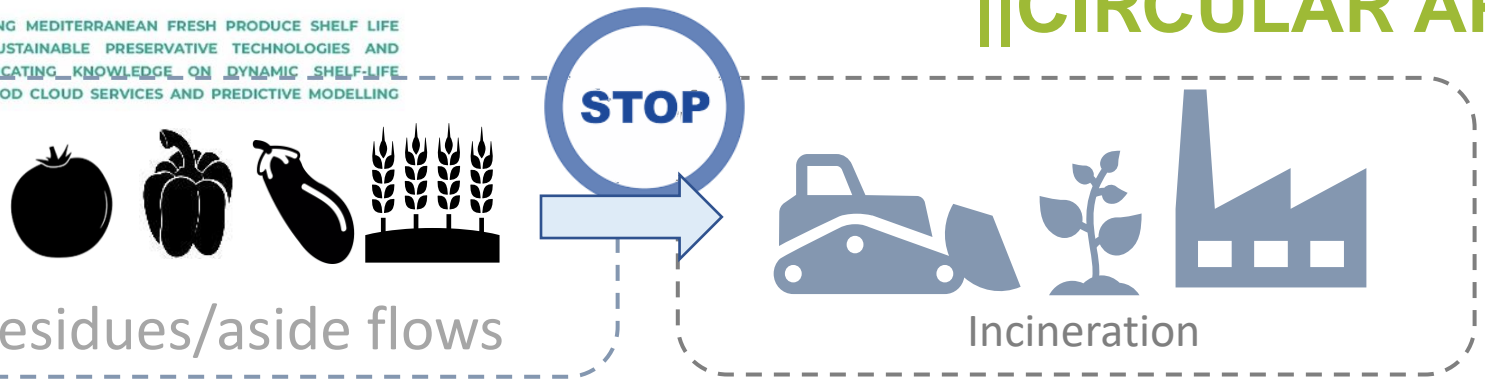
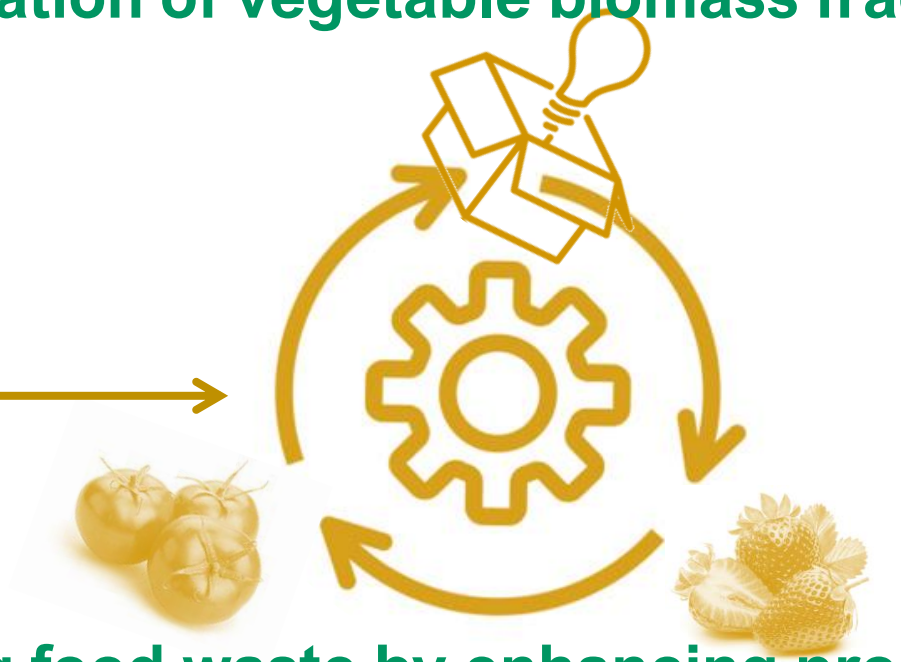
||CIRCULAR APPROACH||



Valorization of vegetable biomass fractions



Reducing food waste by enhancing produce quality

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Exploring the path to a biodigital approach in the vegetables sector to improve food quality and safety

#BIODigital

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||CREATING SYNERGIES||

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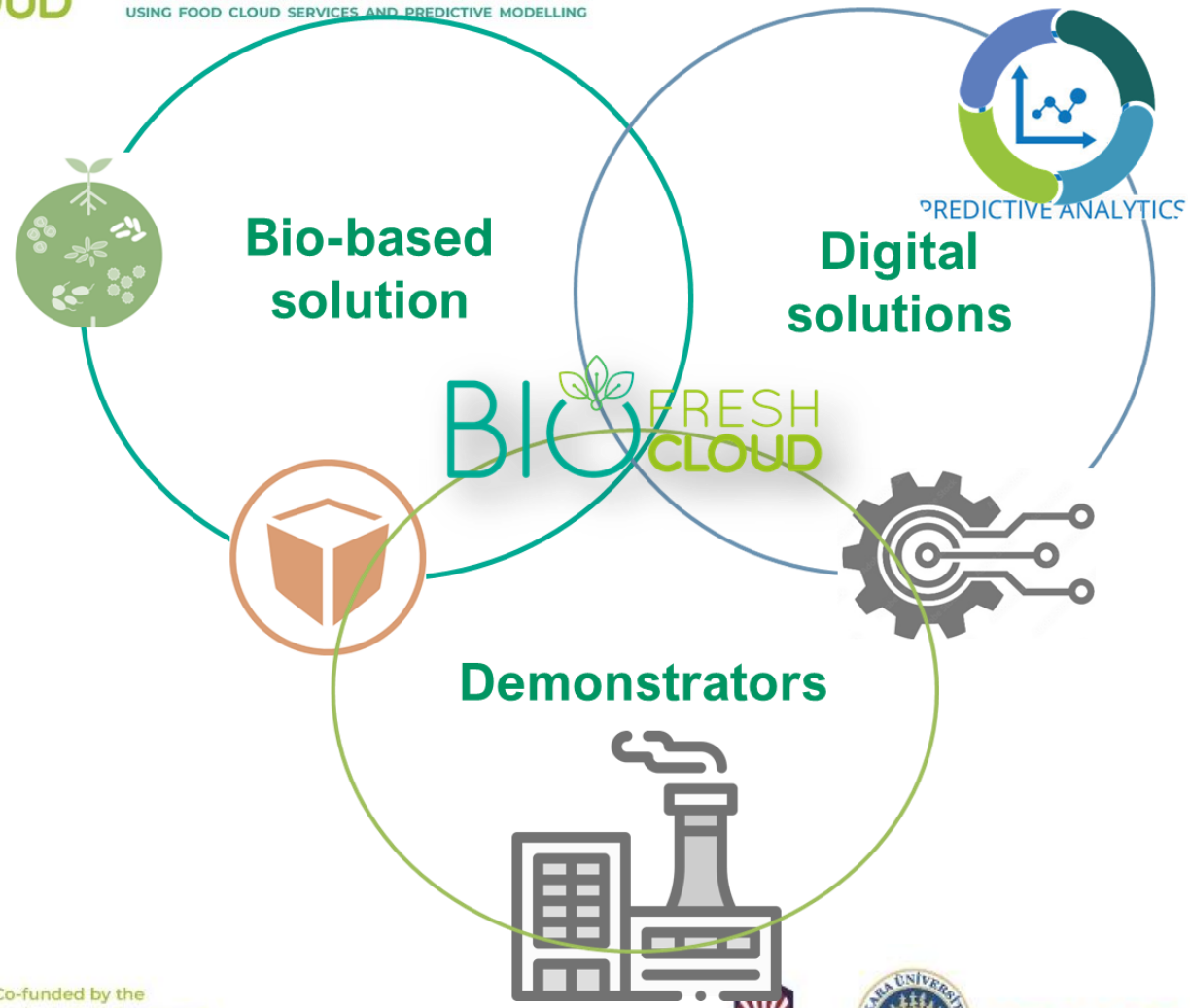

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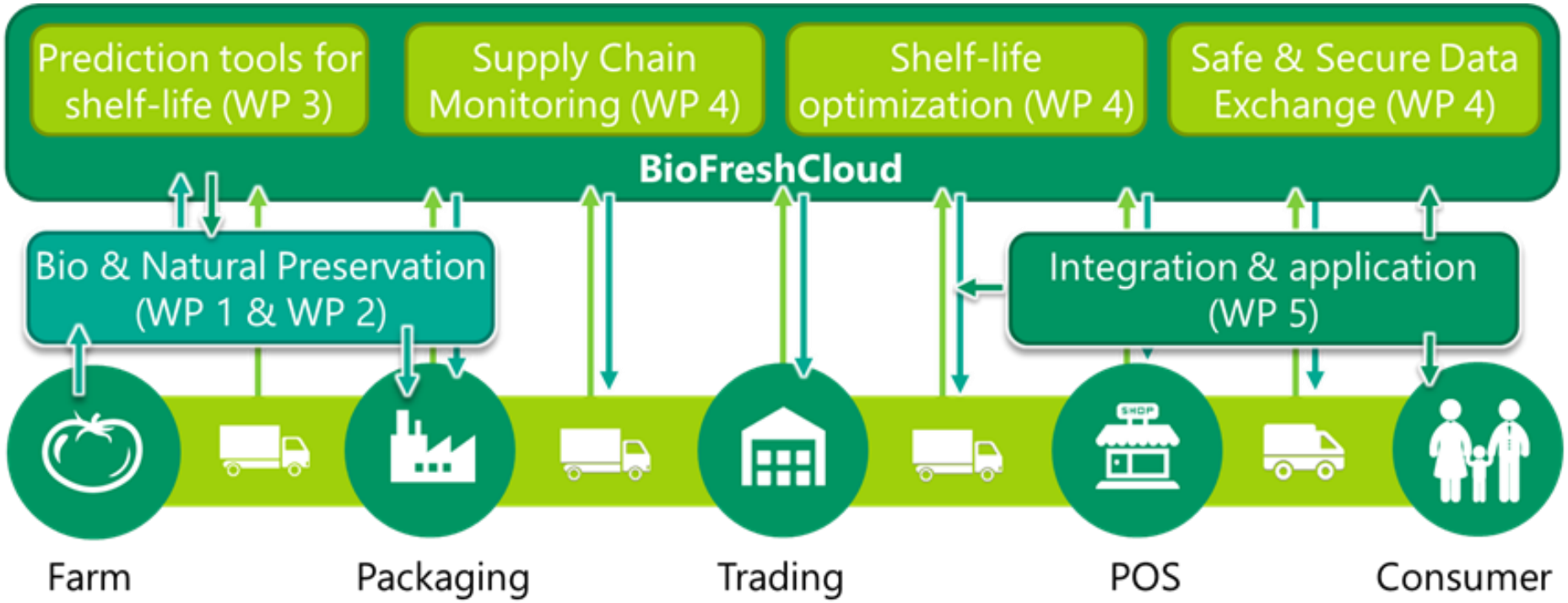
BIOFRESHCLOUD working structure



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||BIO-BASED SOLUTIONS||

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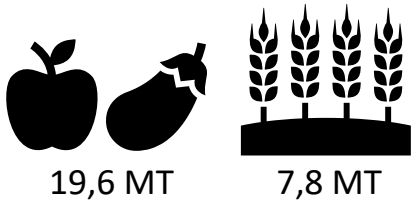
||BIO-BASED SOLUTION||

Designing active packaging systems

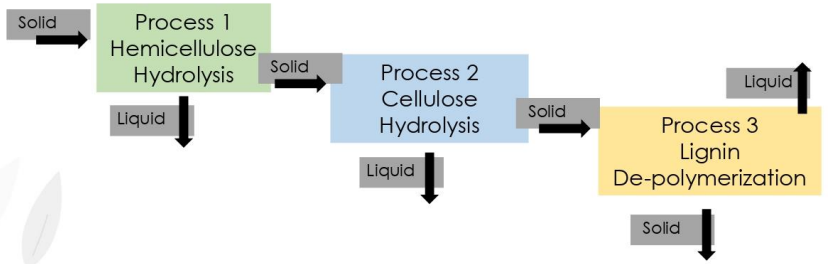
Europe 2020

First producer of vegetables and fruits and wheat in the world



Use of a biorefinery approach to generate packaging materials/additives

Cascade Valorization of Exhaust Leaves



Source:OLEAF4VALUE

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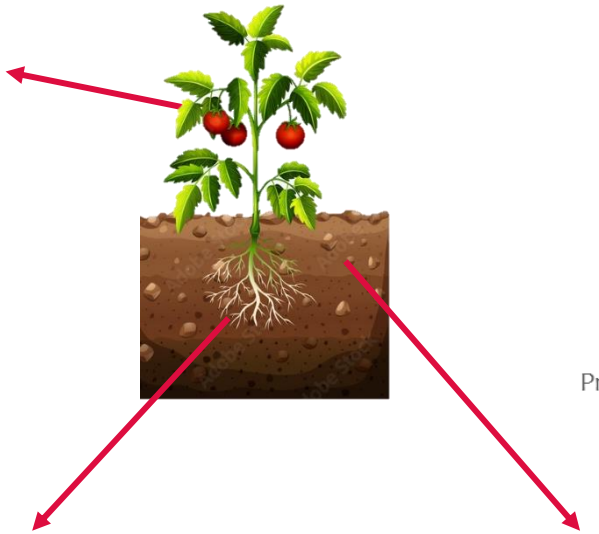
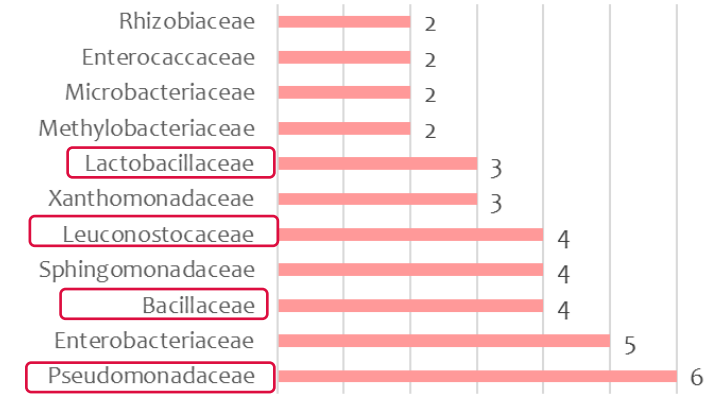
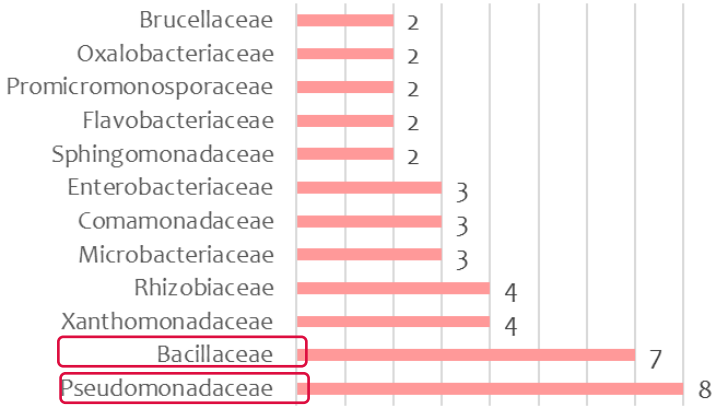
||BIO-BASED SOLUTION||

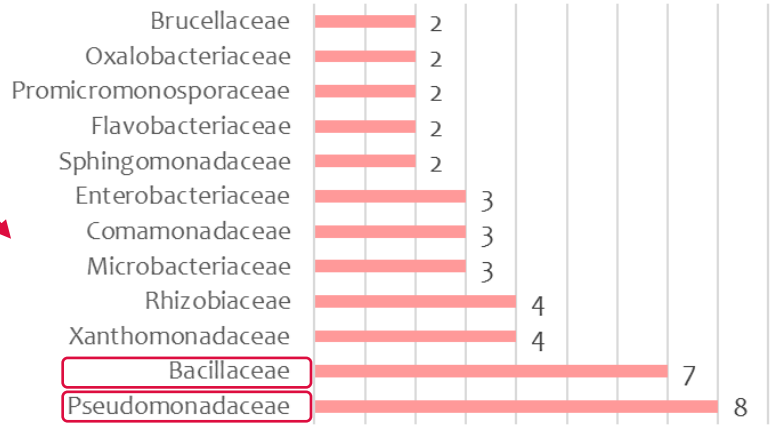
Vegetable biomass as a source of functional (bioprotective) microorganisms

Systematic review









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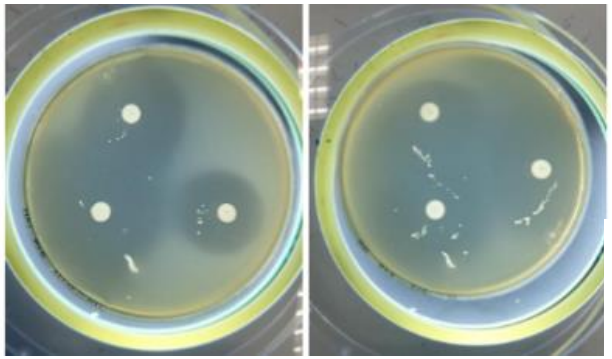
||BIO-BASED SOLUTION||

Valorization of different residue fractions: towards zero-waste



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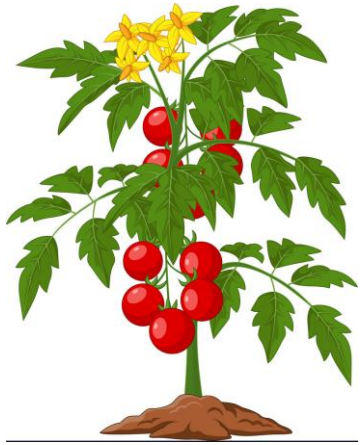
Bioprotective microorganisms



Packaging materials

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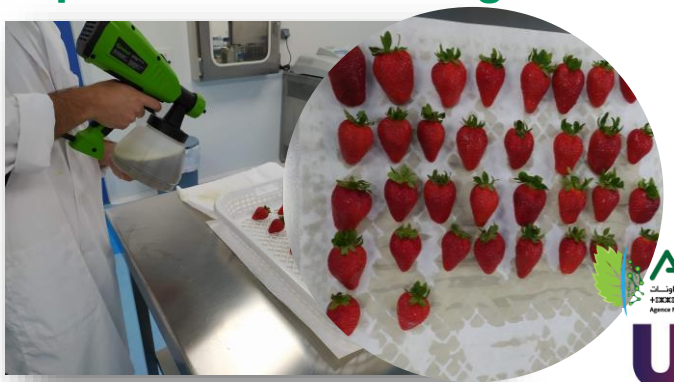

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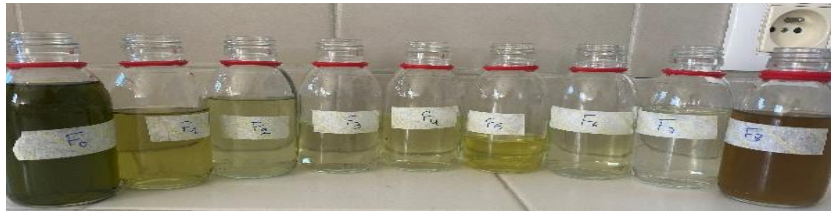
Coating materials



Bioactive compounds

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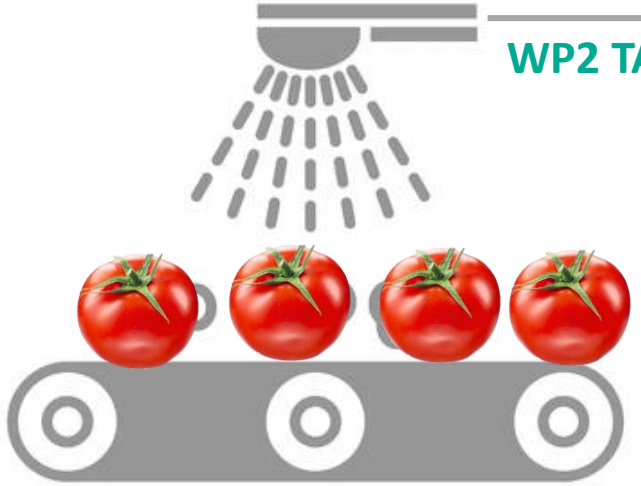
||BIO-BASED SOLUTION||

Industry-adapted solutions for (var. *Cherry*) tomato

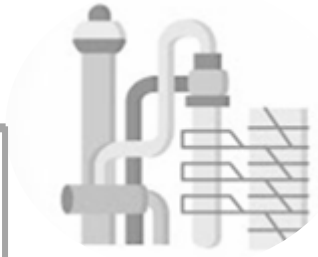
No coating for tomato



Washing with bioactive compounds

WP2 TASKS

Extracts from BIOFRESCLOUD



Alternatives:

Hydroxityrosol

Ilex extract

Cannabidiol/Cannabigerol

Bacteriophages

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||DIGITAL SOLUTION||

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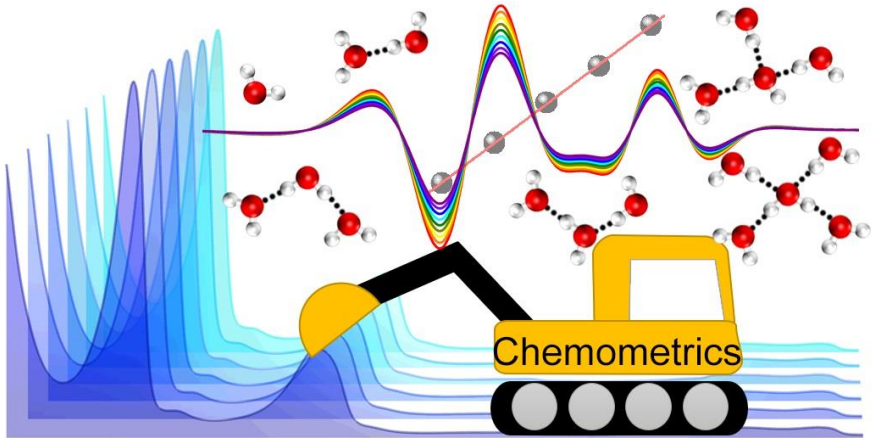
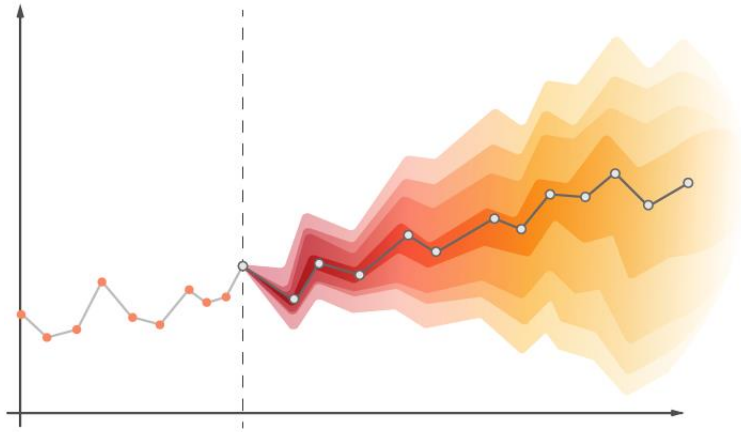
Predictive models for Food quality and safety

Produce status



Anticipation



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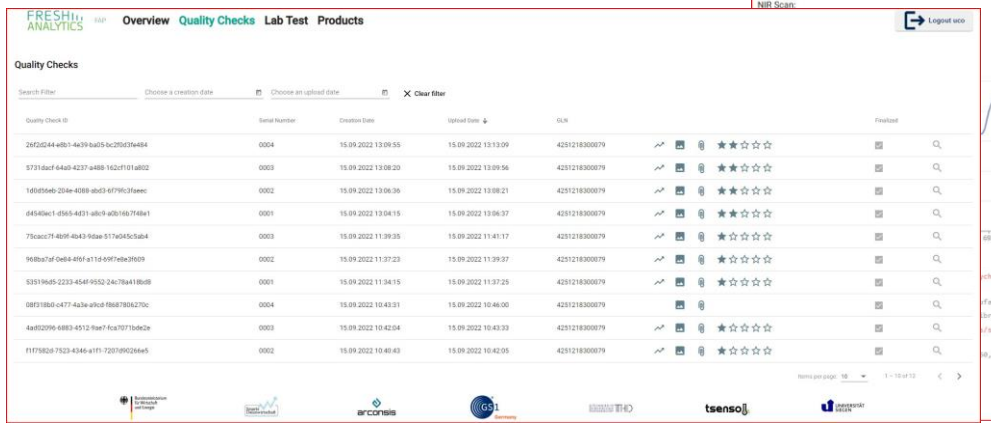
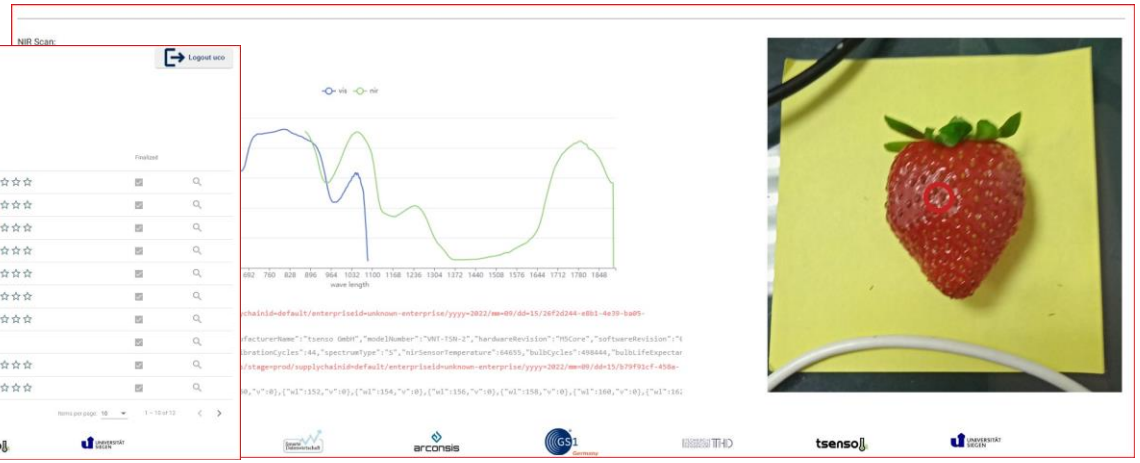
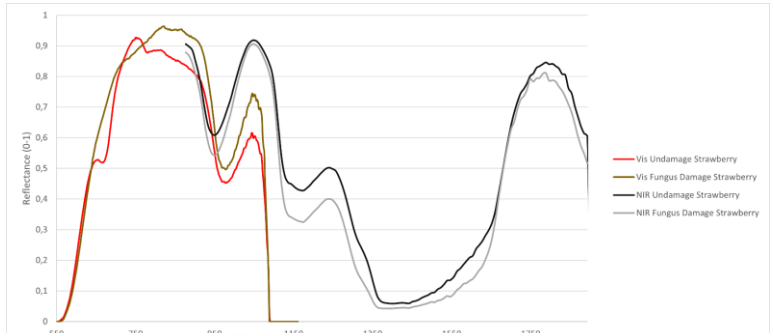
||DIGITAL SOLUTION||

Gathering information in line: USE of NON-TARGET METHODS

VIS-NIR







- Colour
- Firmness
- Water content
- ºBrix
- Fungal growth

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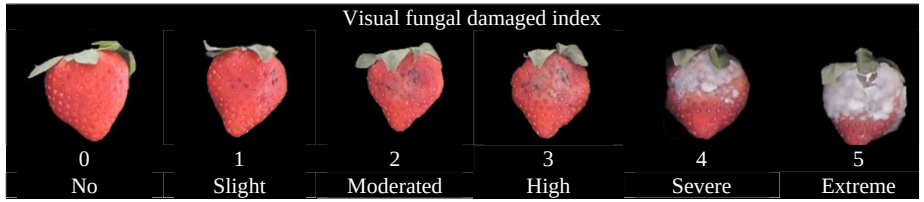
Image-based models for different visual parameters

Fungal damage index by image analysis (FFDIia) $= \frac{A_1}{A_2} \times 100$

Size loss by image analysis (SLIia) $= \frac{At_0}{A_{tn}} \times 100$

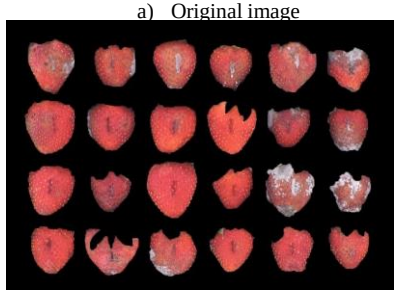
Fungal damage index by visual estimation (FFDIve)

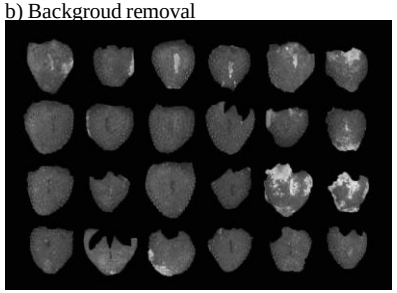
$$= \frac{0 \cdot X_0 + 1 \cdot X_1 + 2 \cdot X_2 + 3 \cdot X_3 + 4 \cdot X_4 + 5 \cdot X_5}{X_0 + X_1 + X_2 + X_3 + X_4 + X_5}$$

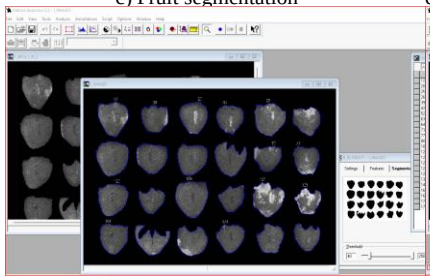


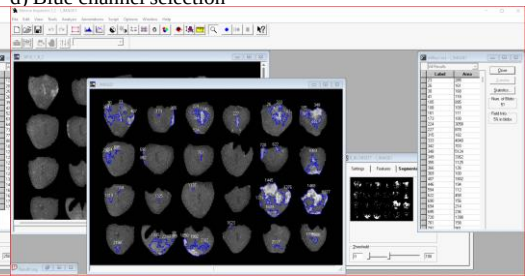

a) Original image


b) Backgroud removal


c) Fruit segmentation


d) Blue channel selection


e) Fruit area estimation


f) Fungal area estimation

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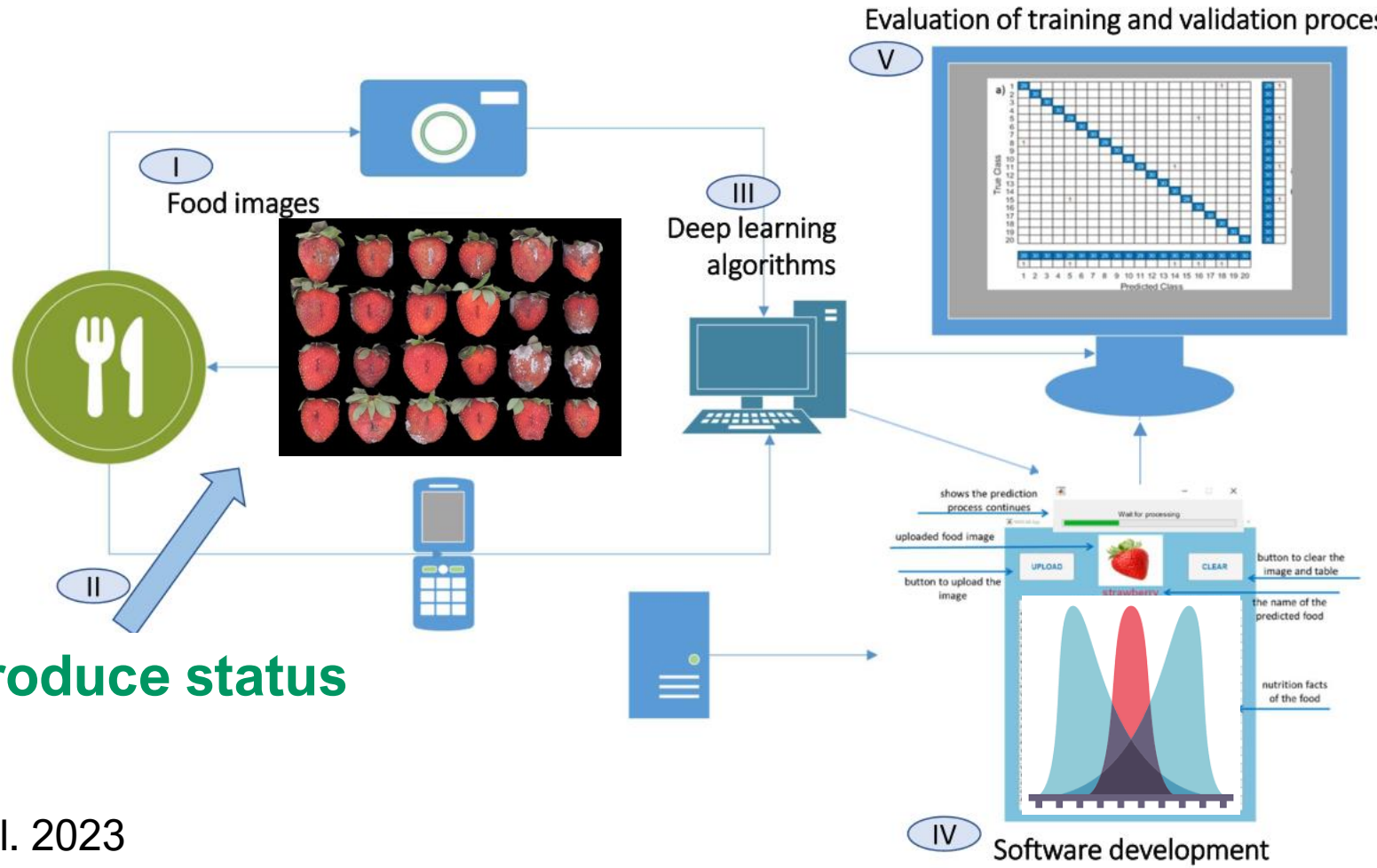
||DIGITAL SOLUTION||



Fatih et al. 2023

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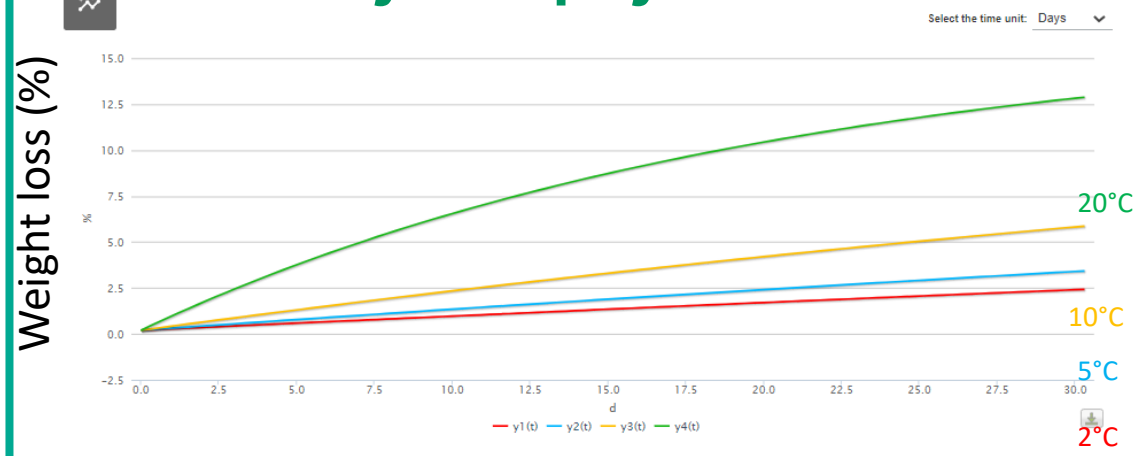
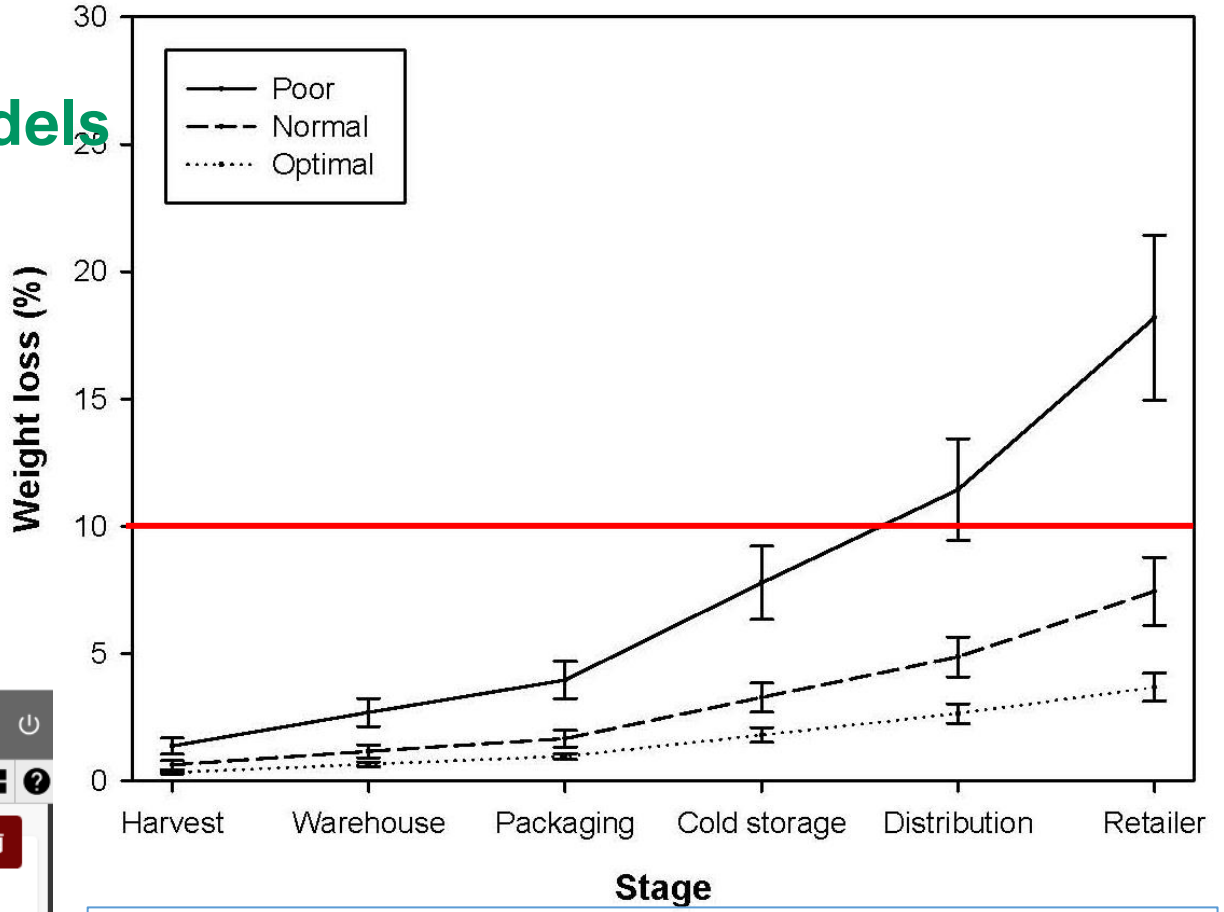
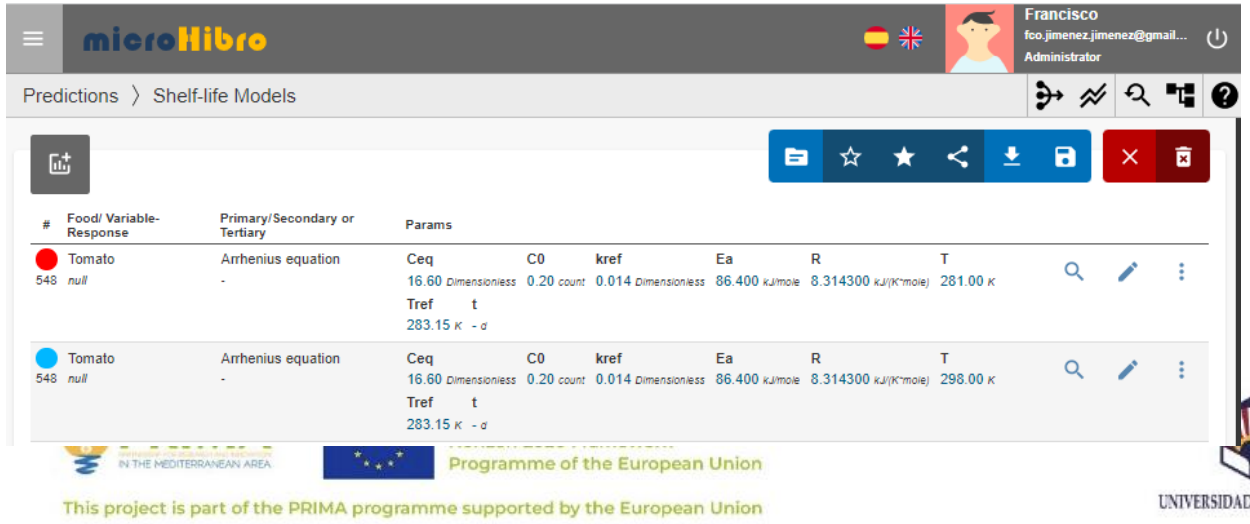
Sensory and physico chemical models







$$WL_{nT} = C_{eq} + (C_0 - C_{eq})e^{\left[-k_{ref}\, e^{\left[\frac{E_a}{R}\left(\frac{1}{T}-\frac{1}{T_{ref}}\right)\right]_t}\right]}$$

Programme of the European Union

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BIO FRESH CLOUD

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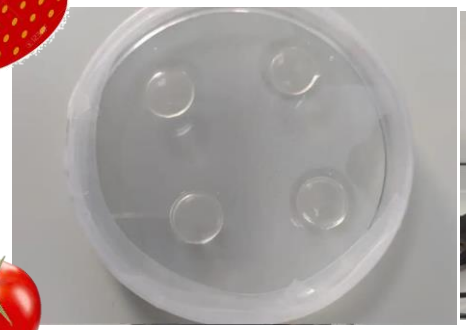
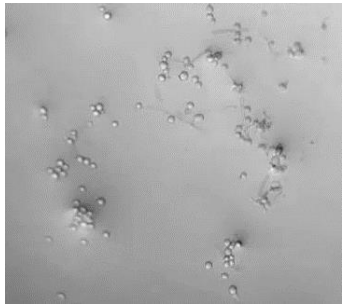
||DIGITAL SOLUTION||

"Looking inside" mold germination with predictive models

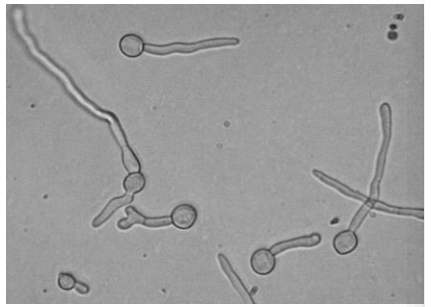
Monitoring Botrytis germination



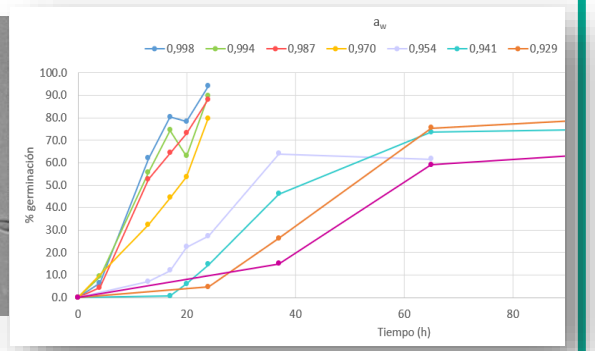
Monitorization system



Conidia



Germ tubes



Temperatures

5, 10, 15, 20, 25 °C

a_w

0,995-0,920

$$P = P_{max}\left[1 - \frac{1}{1 + \left(\frac{t}{\tau}\right)^{d}}\right]$$

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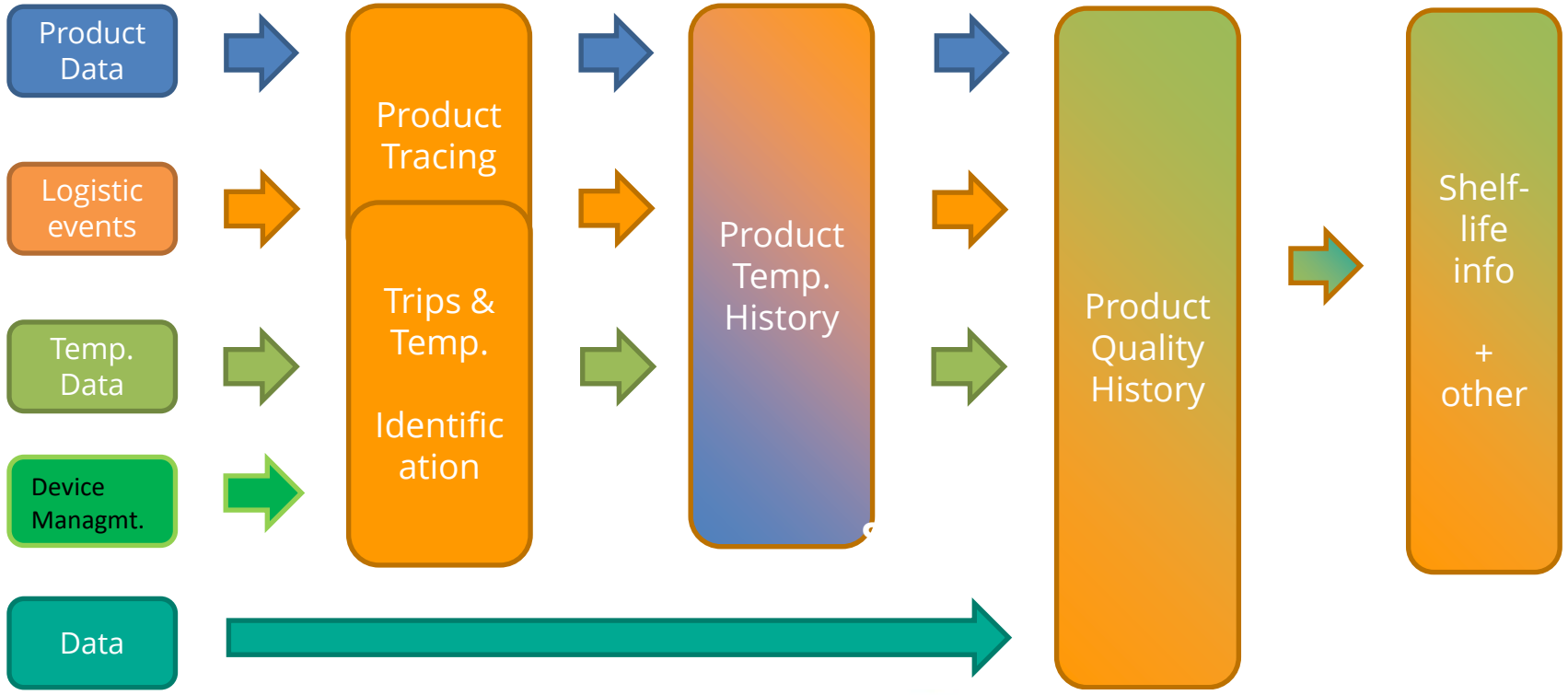
||DIGITAL SOLUTION||

Cloud system: integrating different data flows

Sketch of data flow:



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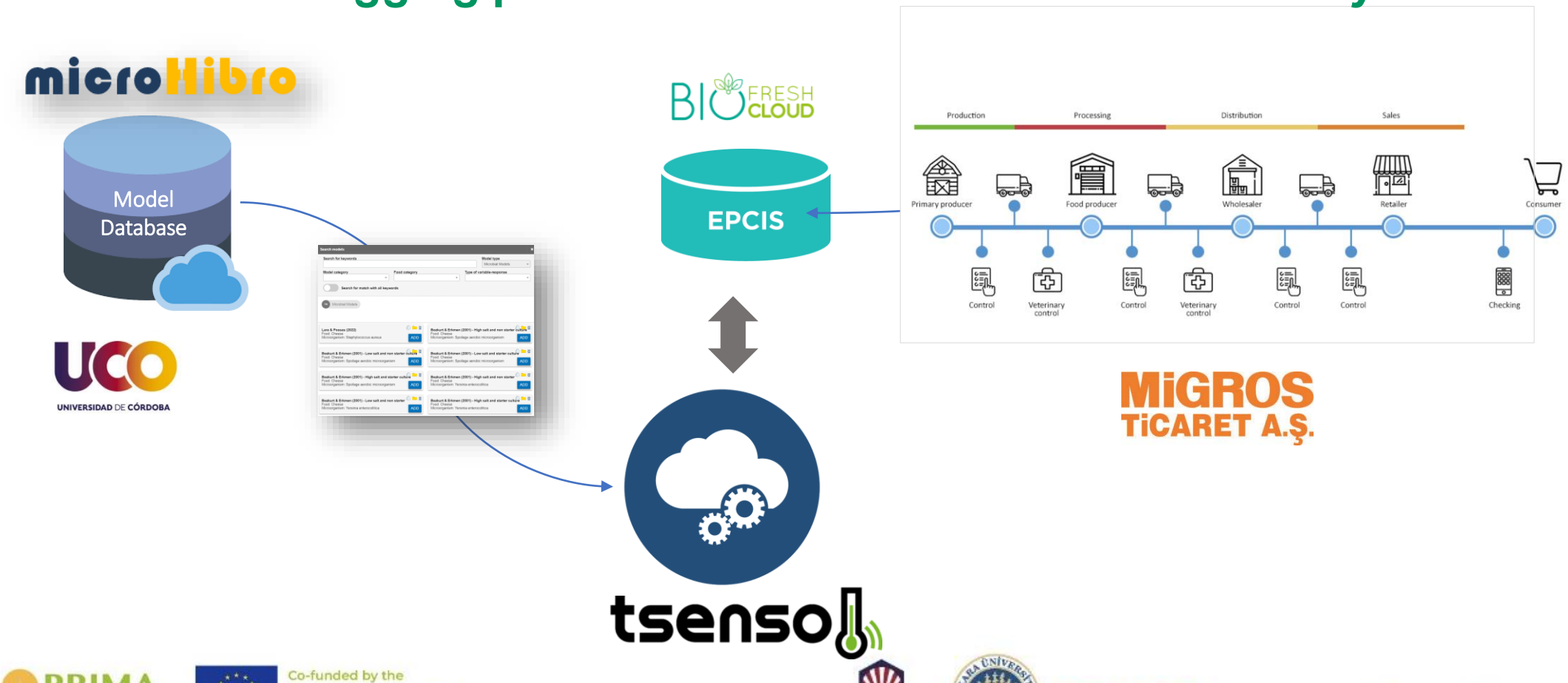
||DIGITAL SOLUTION||

Plugging predictive models into the BFC cloud system



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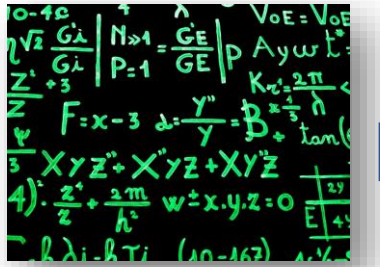
||DIGITAL SOLUTION||

Fresh index: a consumer-validated index



FRESH INDEX

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||DEMONSTRATION||

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||DEMOSTRATION||

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Planasa INNOVATION IN PLANT VARIETIES

foodiverse

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||DEMOSTRATION||

Testing the digital solution under real conditions???

MiGROS

Testing the bio-based solutions under simulated conditions:

Data integrations

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||DEMOSTRATION||

- NIR spectra
- Imaging (AI)
- Rating
- EPCIS event

microHibro

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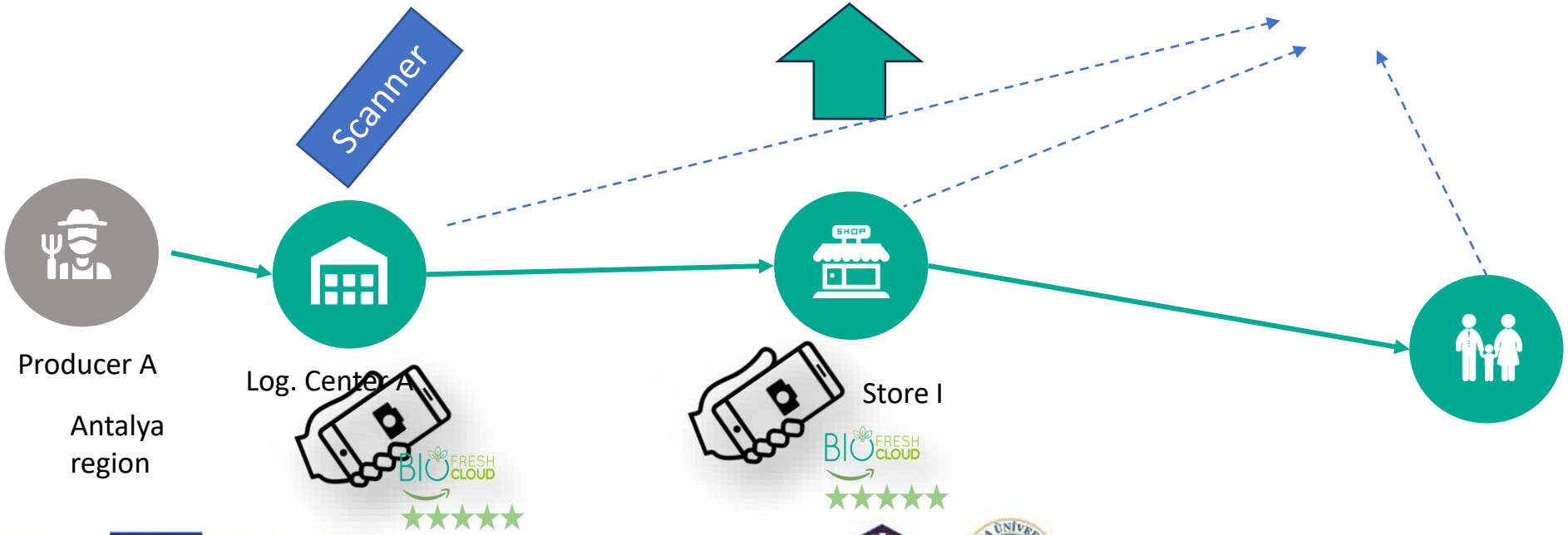
Projected Dynamic shelf-life



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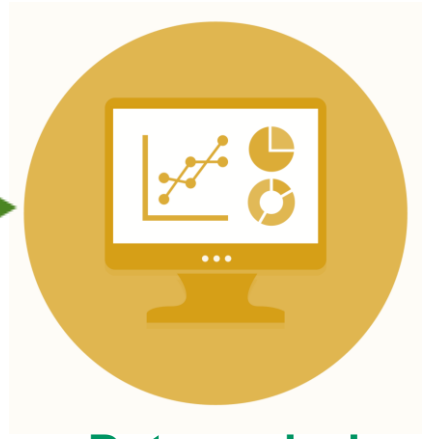
||DEMOSTRATION||

Data integrations



Data analysis

- **Food loss and waste**
- **Carbon footprint**
- **Shelf-life extension**
- **Economic impact**

||PERFORMANCE||

- ✓ Minimizing food losses because of of food distribution factors by 25%???
- ✓ Reducing costs of logistic tracking by standardized components in the Cloud Computing system compared to data loggers by 30%

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