

New Skills in SPA

Area 4 – Entrepreneurship in Farming
Lesson 11 – Entrepreneurship in SPA
Sequence ID – 47b

Erre Quadro S.r.l.





DISCLAIMER

A4.L11.T5b New skills of sustainable precision agriculture

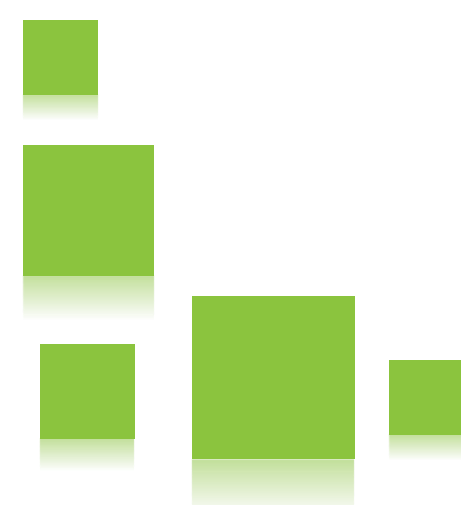
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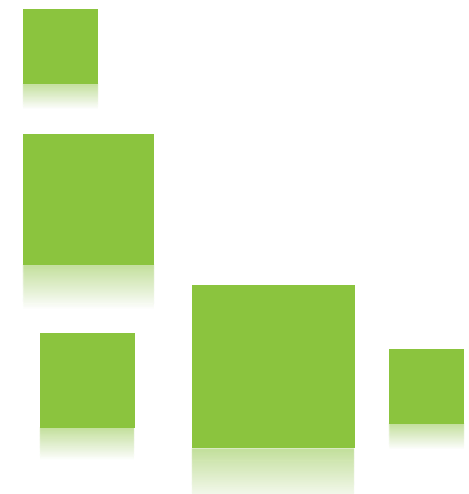


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INTRODUCTION





New Skills

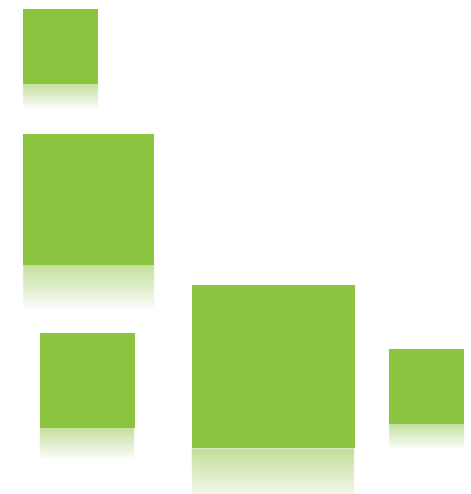
New Precision Agriculture technologies require new human accomplishments to be managed.

For this reason, an in depth-analysis has been performed, in order to discover the skills that new agripreneurs need to develop, to be ready for the challenges of Precision Agriculture.





METHODOLOGY

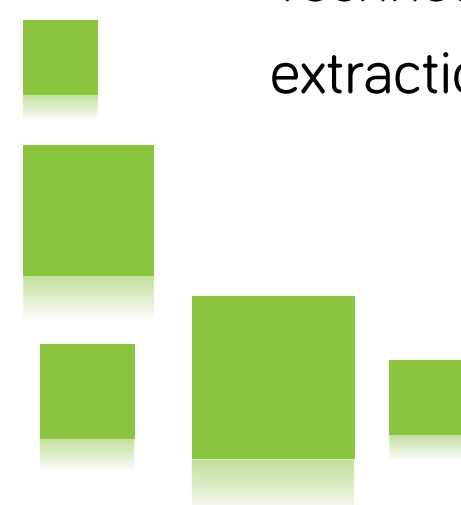


The adopted methodology



From an analysis of patents and scientific papers, the most common Precision Agriculture technologies in viticulture and arable crops have been extracted.

Technologies represent the guidelines for the extraction of skills.

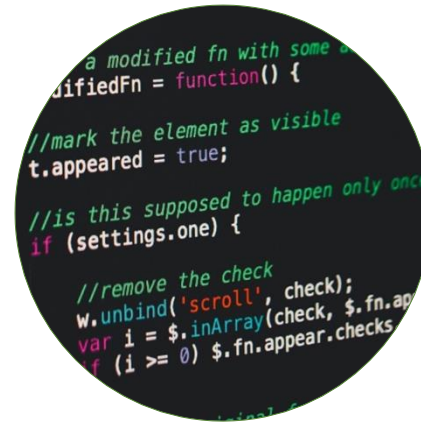


The adopted methodology

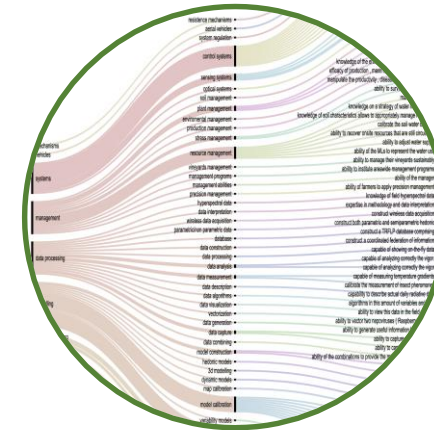
The adopted methodology is consists of **three macro-phases**:



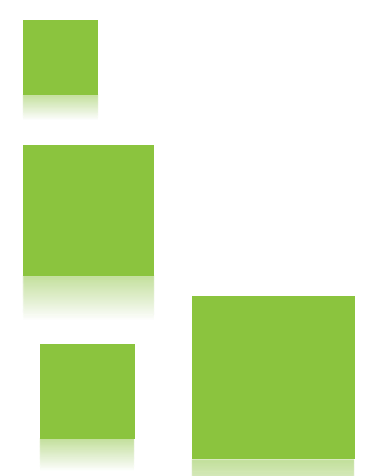
1. Data extraction



2. Automatic text analysis

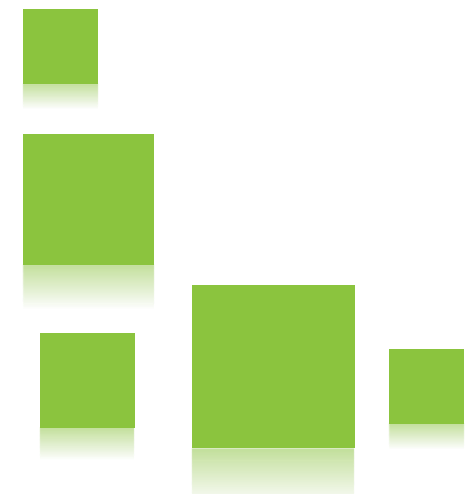


3. Results' rationalization

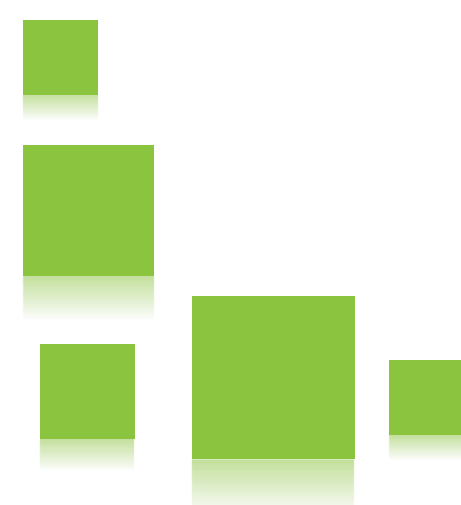




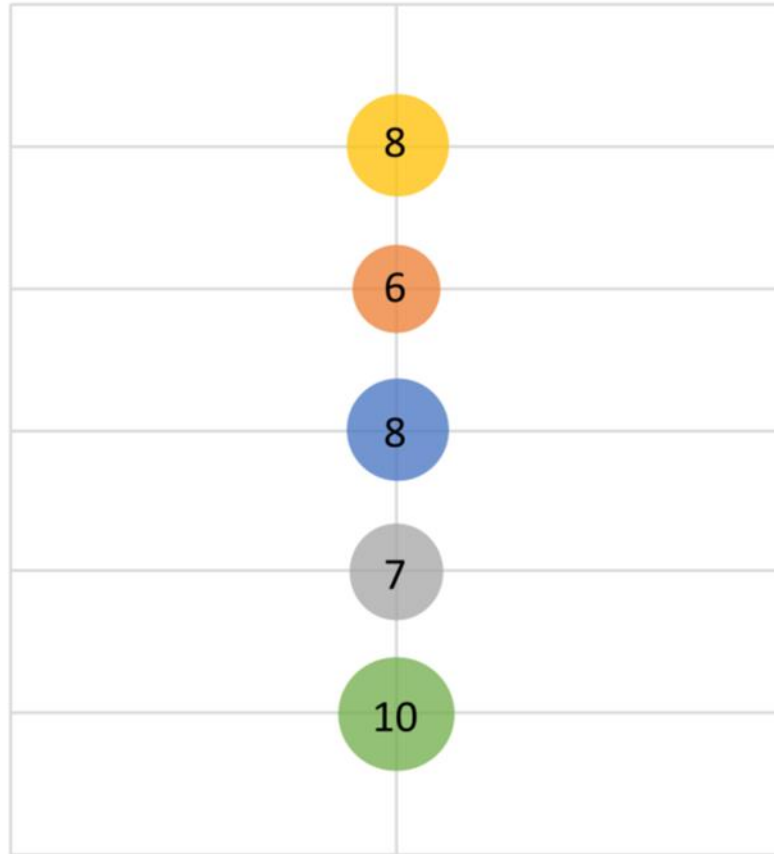
NEW SKILLS



Skills Macro-Clusters

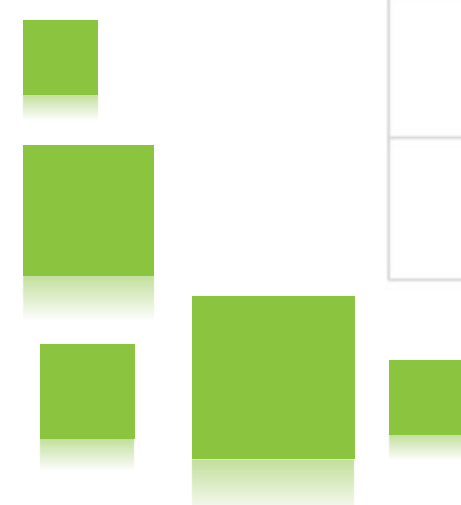


Skills Macro-Clusters



- Soil Knowledge
- Crop Knowledge
- Resource Management
- Image and Data Processing
- Knowledge of Predictive/Simulating Models

New Skills

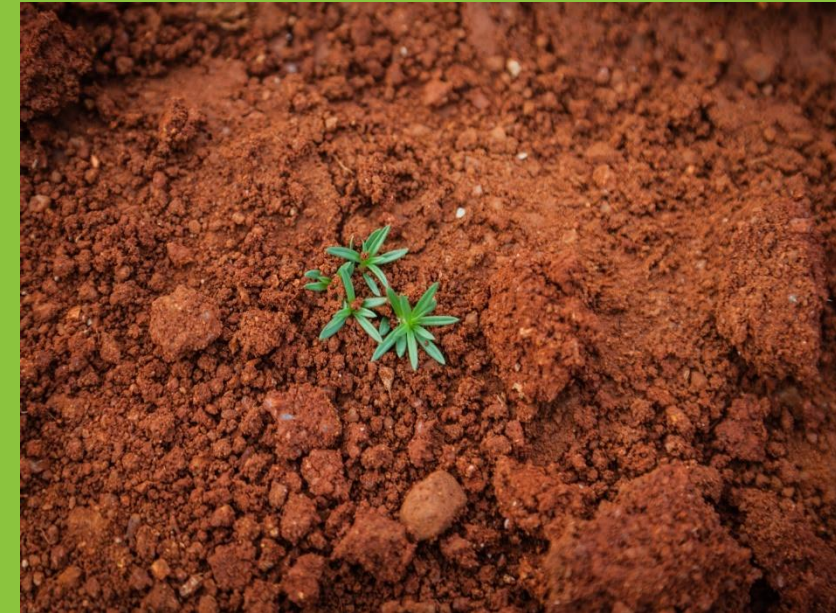




Soil Knowledge

It is common knowledge that a deeper awareness of soil properties strongly influences the ability to cultivate crops. Furthermore, management of soil quality is an essential element of the whole agricultural value chain.

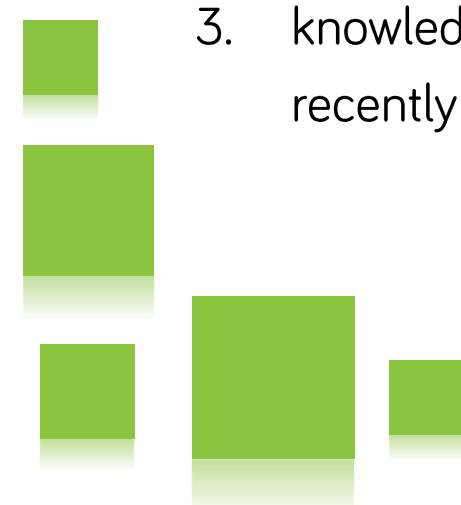
Today, farmers increasingly rely on digital technologies to monitor and analyse soil variables with the aim of improving its productivity.



Soil Knowledge



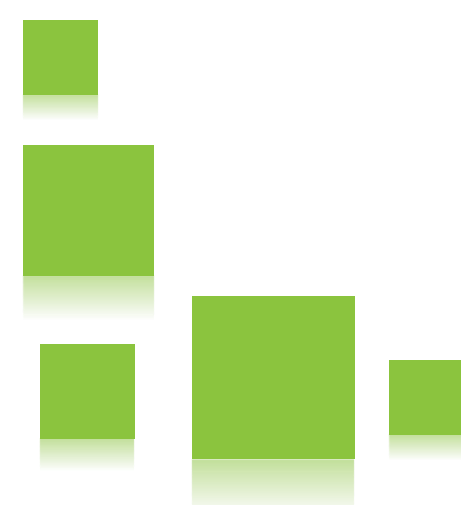
1. knowledge of the target **area's soil-landscape**, converting the existing soil-landscape models into a **computer model**, applying it to the environmental variables using the **expert system**, and performing **predictive mapping**;
2. knowledge of the **physical/chemical/biological** interactions that occur in the **soil-water-plant matrix**, and the rise of **high-speed computers**, resulted in **models** to take the **dynamic interactions** into account;
3. knowledge of the **soil's hydraulic properties** is of crucial importance for reliable **application** of recently developed distributed models to environmental studies and **land-use planning**;



Soil Knowledge



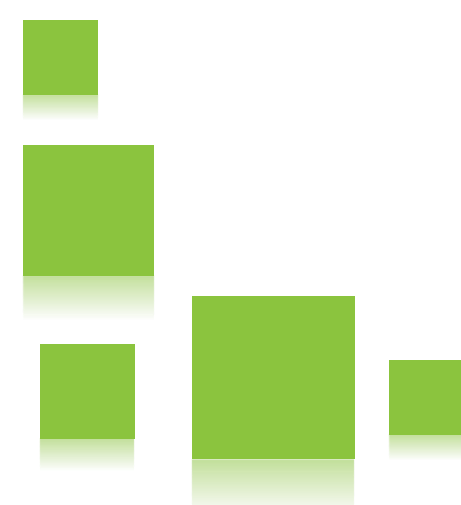
4. knowledge in **soil science** and **computer science** to develop a spatial database and **soil/crop management system**;
5. knowledge of the target **area soil-landscape** refining existing **graphic soil-landscape models**;
6. knowledge of the target **area soil-landscape** selecting suitable environmental covariates compatible with a geographic information system (**GIS**) with **3D visualization**;



Soil Knowledge



7. knowledge of hydrologic, nutrient, and energy cycles and **soil erosion**, which is being incorporated into land and water management, including **computer simulation** models, to help assess cumulative watershed effects;
8. knowledge of the **soil-plant-water continuum**, irrigators will adopt “prescription” irrigation.





Crop Knowledge

Understanding crop behaviour is a fundamental aspect of agricultural management.

It enables farmers to implement adequate and timely interventions, with the objective to ensure optimal yield.

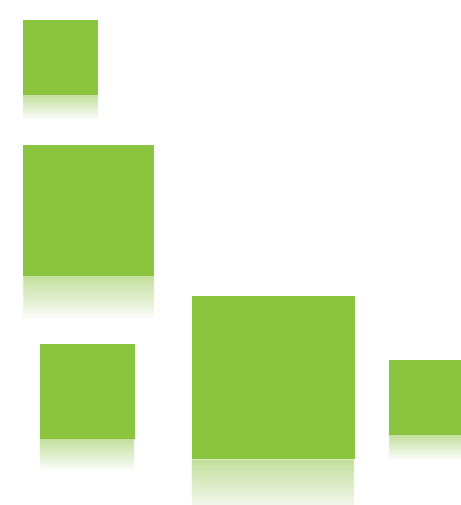
Furthermore, crop knowledge combined with current data-driven approaches allows constant monitoring, resulting in an increase in crop profitability.



Crop Knowledge



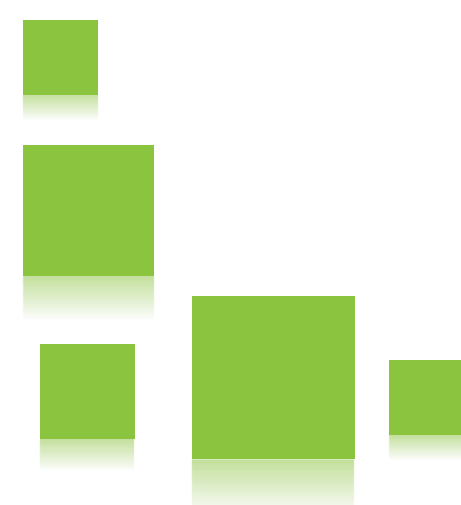
1. knowledge of colour information of **crop's pest images**;
2. knowledge of **traits** embedded within **crop growth** and **development models**;
3. knowledge on how **precision agriculture** and **variable rate technology** can **keep water** and **nutrients** in the **root zone** of horticultural crops, thus facilitating maximum uptake **efficiency**;



Crop Knowledge



4. knowledge on how to include less sensitive crops into **rotation systems** as a response to **climate change**;
5. knowledge of **crop water use** and **available technology** to **control** the **timely application of water**;
6. knowledge of **empirical engineering approaches** that use a crop coefficient to relate **crop water use** to an evapotranspiration reference.





Resource Management

Crop knowledge as well as soil knowledge have higher value when there is efficient resource management, which has always been a fundamental prerequisite for a companies' competitiveness.

Today, new technologies provide a view on real-time data, which allows the reduction of costs and time in decision making activities.



Resource Management



1. capability of **simulating** the full **soil-water-atmosphere** transfer system is needed to improve **agricultural water management** at the plot scale;
2. ability to **manage different resources**; possession of **experience in problem solving**;
3. knowledge of **variability** is an important input to allow **variable management practices** and evaluate the **health status of crops**;
4. knowledge of **irrigation management** and crop yield is becoming increasingly important as **water salinities** increase;



Resource Management



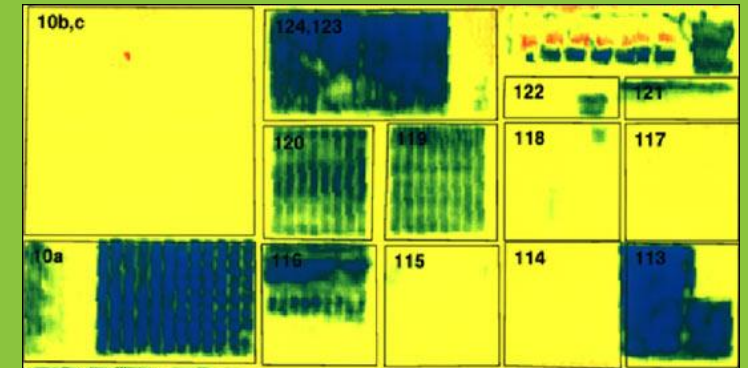
5. knowledge of **crop residue management** and performance of **planting equipment** for conservation systems in specific farm situations;
6. knowledge of making **agricultural management decisions**, not only for the **current climatic variability**, but for the anticipated **climate changes** of the **future**;
7. knowledge of **crop growth and development**, to be included in the computer code of **crop simulators** that mimic the essential features of **plant-soil-atmosphere-management interactions**;
8. capability of giving **water resource managers** accurate **predictions** of the impact of changes in land-use and climate.



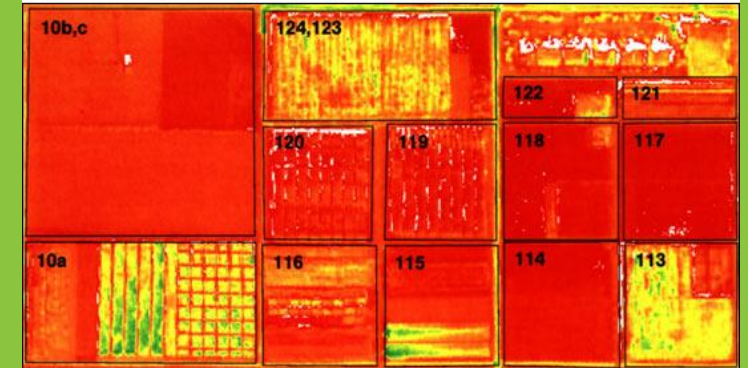
Image and Data Processing

Technologies provide a new way to approach the traditional paradigm of agriculture.

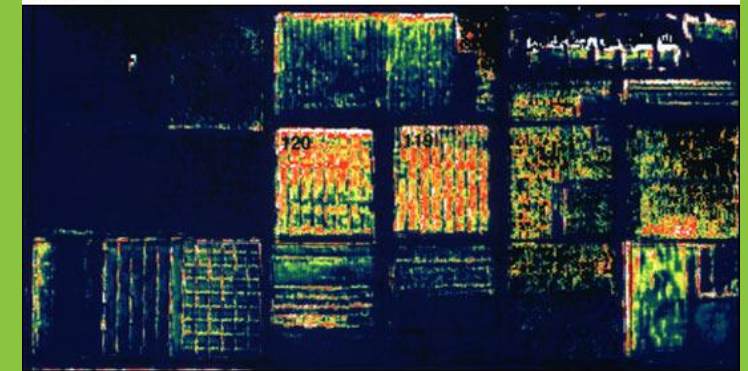
Thanks to data processing and image analysis, farming has taken a step towards digitalization resulting in a substantial increase in crop productivity. In addition, aforementioned technologies are acting as expert systems that provide support in planning and operational activities.



Vegetation Density



Water Deficit



Crop Stress



Image and Data Processing

1. expertise in the **interpretation of remote sensing data**;
2. expertise in **image processing, field data collection, and data integration approaches**;
3. knowledge of the **radiometric properties of the digital data**;
4. develop a procedure using **multi-temporal satellite image information**, aiming to construct a **single synthetic image** which would **represent the soils**;
5. calibrate a model with the **remote sensing imagery**;

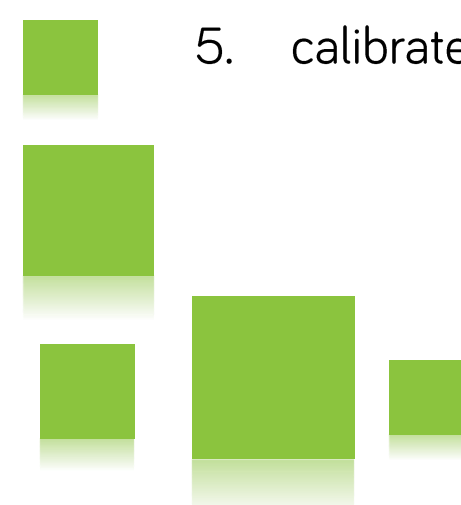
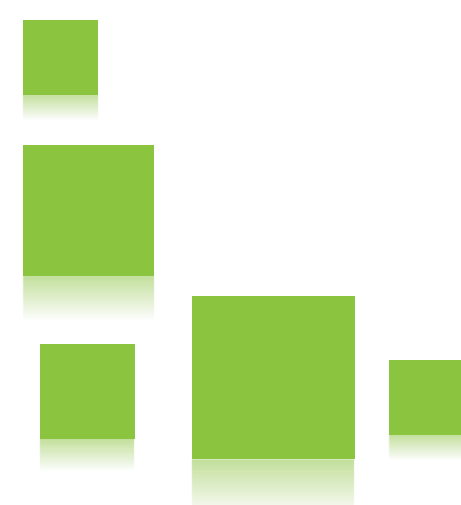


Image and Data Processing



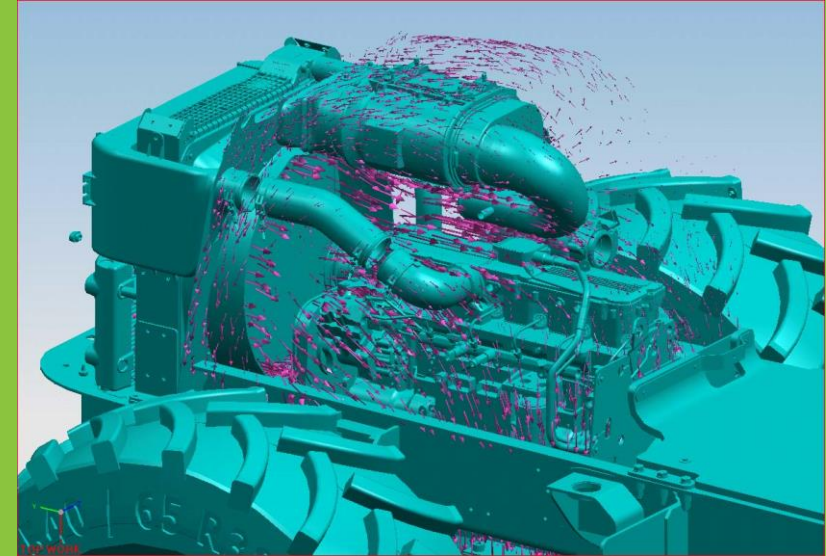
6. experience in **applying video image analysis** in monitoring plant growth;
7. knowledge of **developing computer vision systems** used in automated weed management.





Knowledge of Predictive/Simulating models

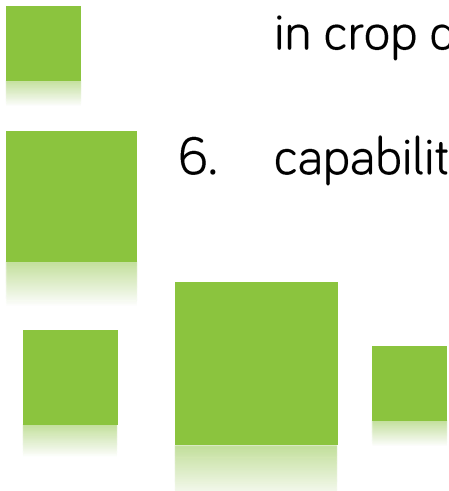
Predictive and simulating models are gaining considerable importance in the agricultural field, as they provide the possibility to predict future scenarios, and consequently prevent crop loss.



Knowledge of Predictive/Simulating Models



1. development of an efficient procedure for **estimating soil properties** for a **model**;
2. calibration of the **soil-crop simulation model**;
3. ability to rapidly create a **metamodel** of a previously **unmodeled area** to allow forecasting;
4. ability to construct a **temporal extraction model** of the **cropping system**;
5. ability to **model parameters** during a growing season could be useful to understanding changes in crop development;
6. capability of **producing 3D models** of plants;



Knowledge of Predictive/Simulating Models



7. capability of **simulating** the effects of **management** or **landscape position** on **crop yields**;
8. ability to construct **computer simulation models** to aid integrated land-use planning;
9. capability of **simulating** many crop species through **parameterisation**;
10. ability to **simulate watershed-scale processes** within a **spatially digitized computer-based environment**.

