Technology Readiness Levels (TRL)

Area 3 – Social and Economic Aspects

Lesson 10 – Policy and Management

Sequence ID – 36

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A3.L10.T5 Stage of Development, Technology readiness levels (TRL)

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Table of Contents

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Overview

Technological revolutions require time, investments, training, analysis to be reliable, profitable, and wide spread effectiveness.

Science requires years of knowledge modelling. After the first enthusiastic but critical step of a research discovery, deployment needs time and skills: be ready to get your hands dirty, literally. It happens even more if we are in the chaotic development of a universe of technologies to be straightened out.

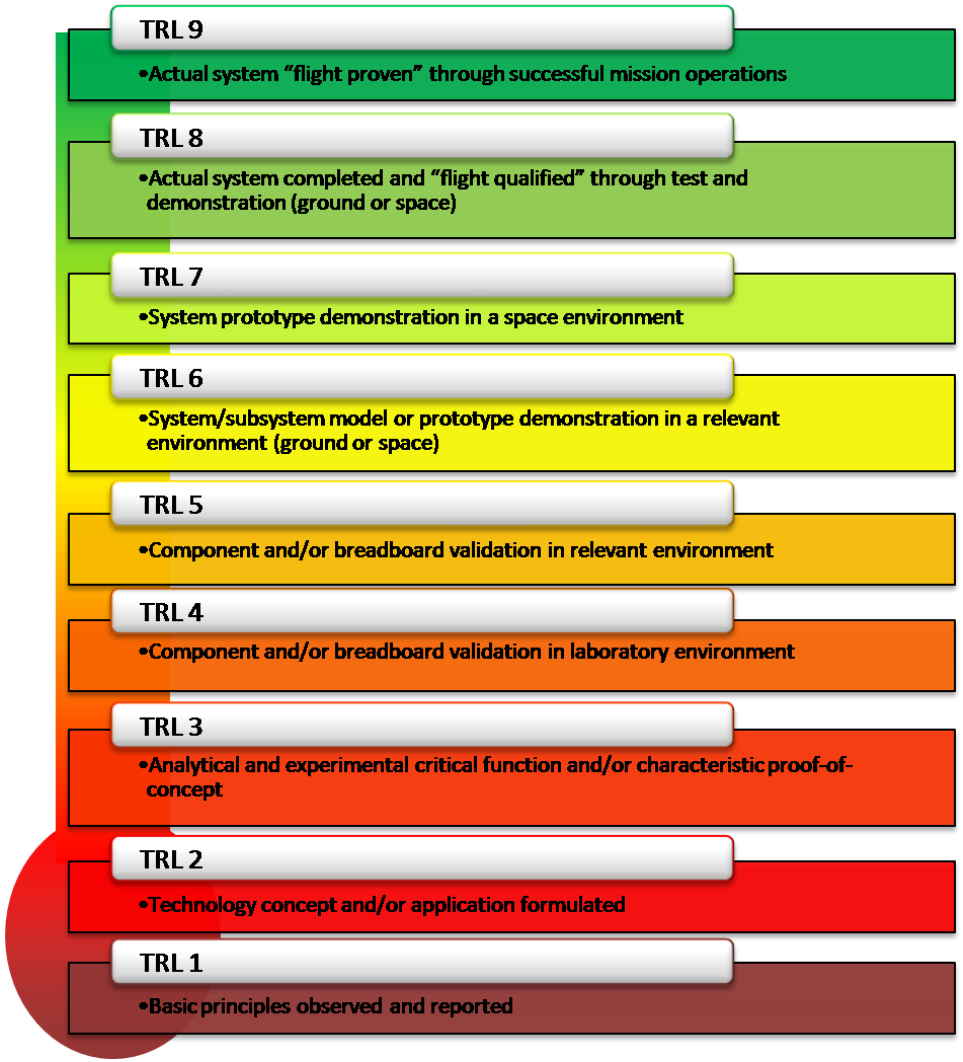
Of each new technology, its Technological Readiness Level (TRL) has to be assessed.

The added value of additional technology to the technical adsorptive capacity of the farm system should be assessed, as well as its effect on the Business model of the farm enterprise.

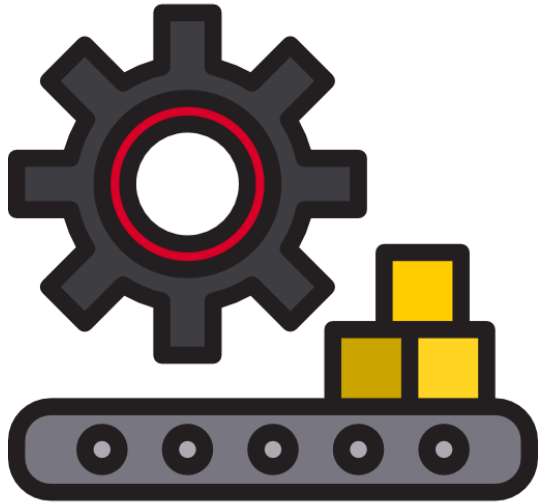
1. Technology Readiness Level (TRL)

Technology Readiness Levels (TRLs) are a type of measurement system used to assess the maturity of a particular technology.

For the entrepreneur, it is fundamental to identify the TRL of a new technology. Readiness is not only related to the product, but to all supporting systems of that technology.



TRL		
	9	Commercialized
	8	Pre-production
	7	Field Test
	6	Prototype
	5	Bench / Lab Testing
	4	Detailed Design
	3	Preliminary Design
	2	Conceptual Design
	1	Basic Concept



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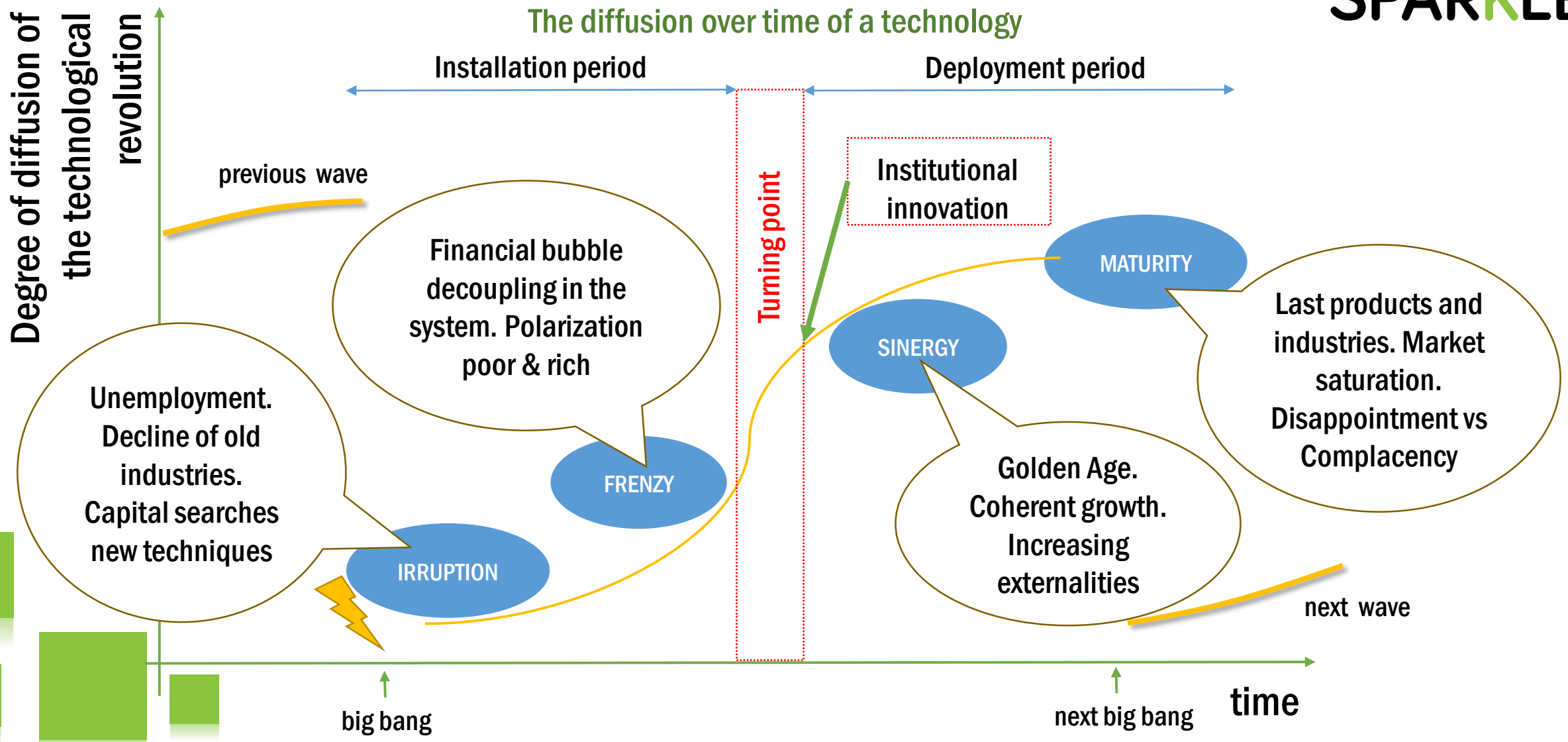
2. Behaviour of the innovation process



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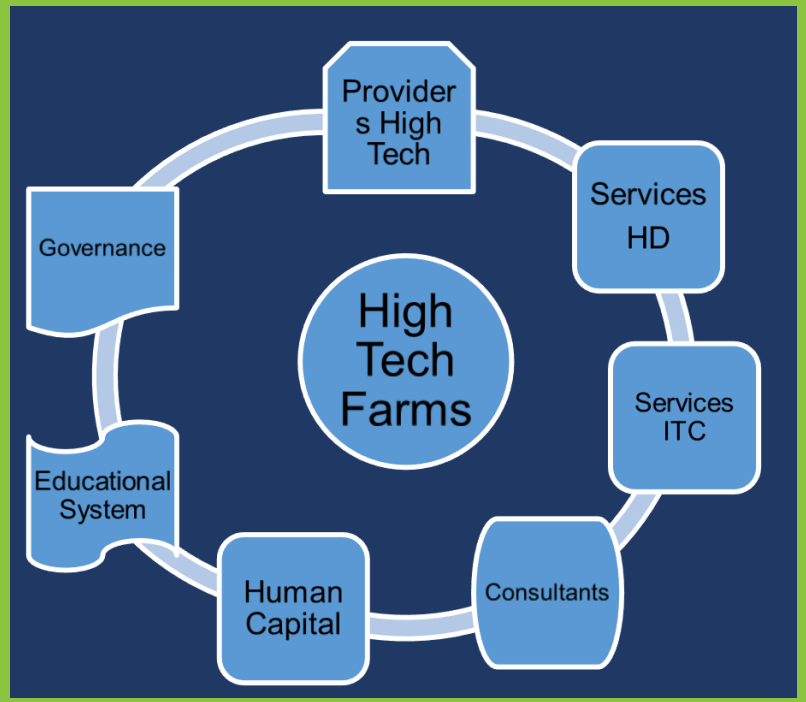
3. Holistic vision in introducing innovation

- defined in the Business Model, with a reference in the introduced technology must be well the Key Activities, Key Resources, and Key Partners.
- It must be supported by a specific Local Ecosystem that guarantees the best use and efficiency by providing consultancy, services and training system.



4. Introducing innovation in the farming enterprise

The proper introduction of High Tech Farming (HTF) in the farming process and in the related agri-businesses requires specific attention, and it can be summarized in 3 essential steps:

A. the integration and compatibility of the introduced technologies in the production process

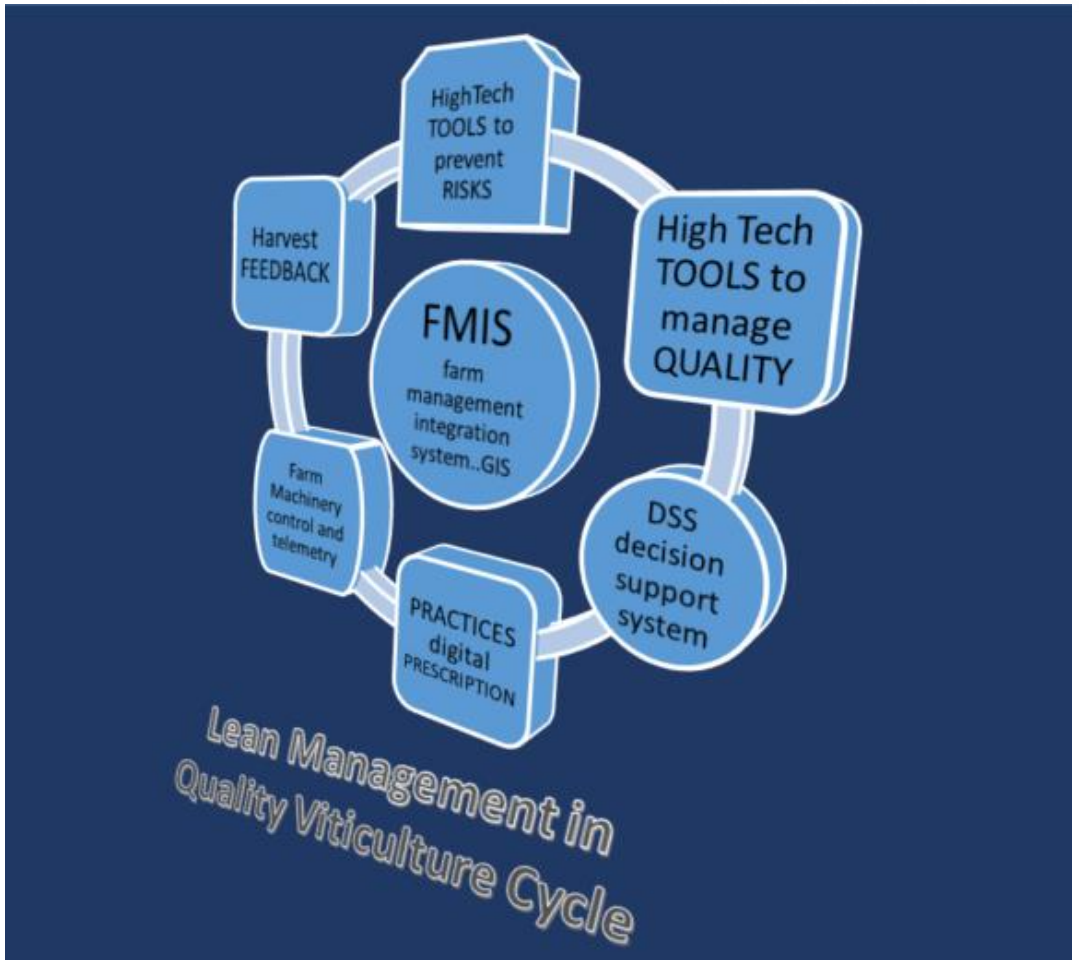
B. the choice of an appropriate technology, in terms of type and dimension, for the business model *analysis*

C. the evaluation of the local ecosystem which supports the profitable introduction of a new technology in the farming process (key factors and key actors).

4. Introducing innovation in the farming enterprise

The choice of an appropriate technology, in terms of type and dimension, is essential for the business model analysis (ERP Enterprise Resource Planning or BM business Model).

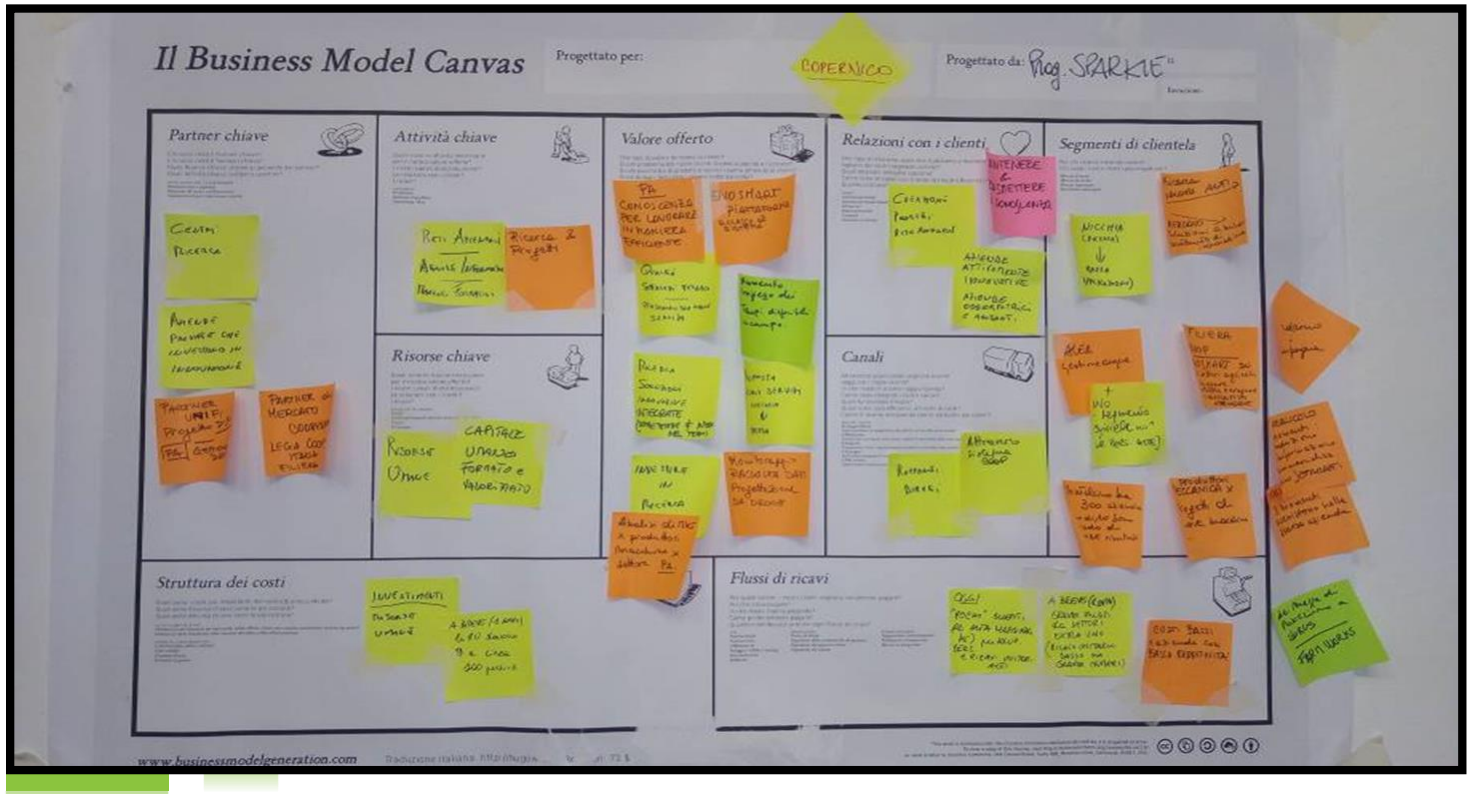
Type and dimension of technologies have the same importance in the production process and in farming, so a technology should be selected according to the necessity or the need to satisfy.



"*Spades and satellites have the same level of importance in the different farming scenarios*"

4. Introducing innovation in the farming enterprise

The business model is an intuitive assessment method to verify whether a new technology is beneficial.



Customers, Channels, Revenues

Added value

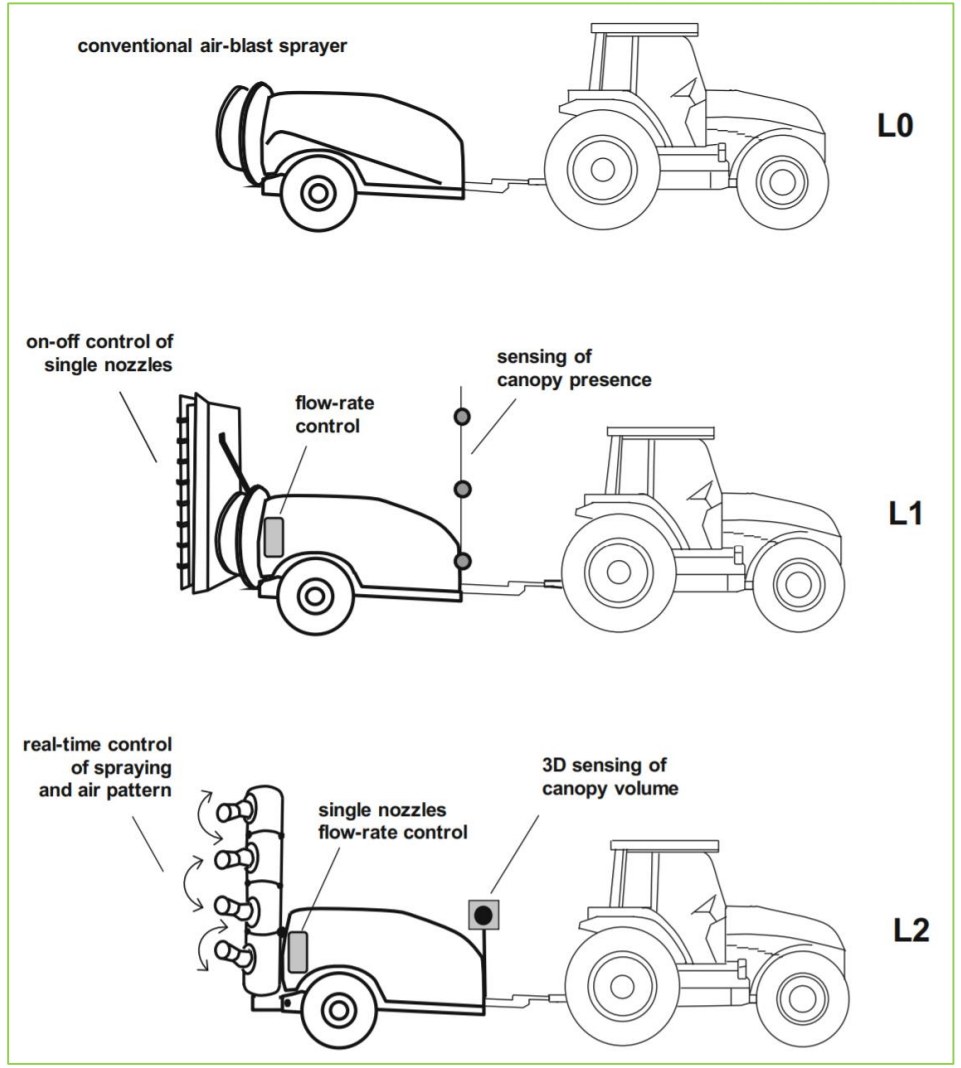
Key activities
Key Actors
Key Resources

Costs structure

4. Introducing innovation in the farming enterprise

In the Business Model assessment the entrepreneur has to define its technological level. In the example the appropriate choice for 0-10, 10-100, over 100 hectares.
In the lower technological levels the quality control may be reached by manual BAT (best application practices).

Technological level example of sprayer

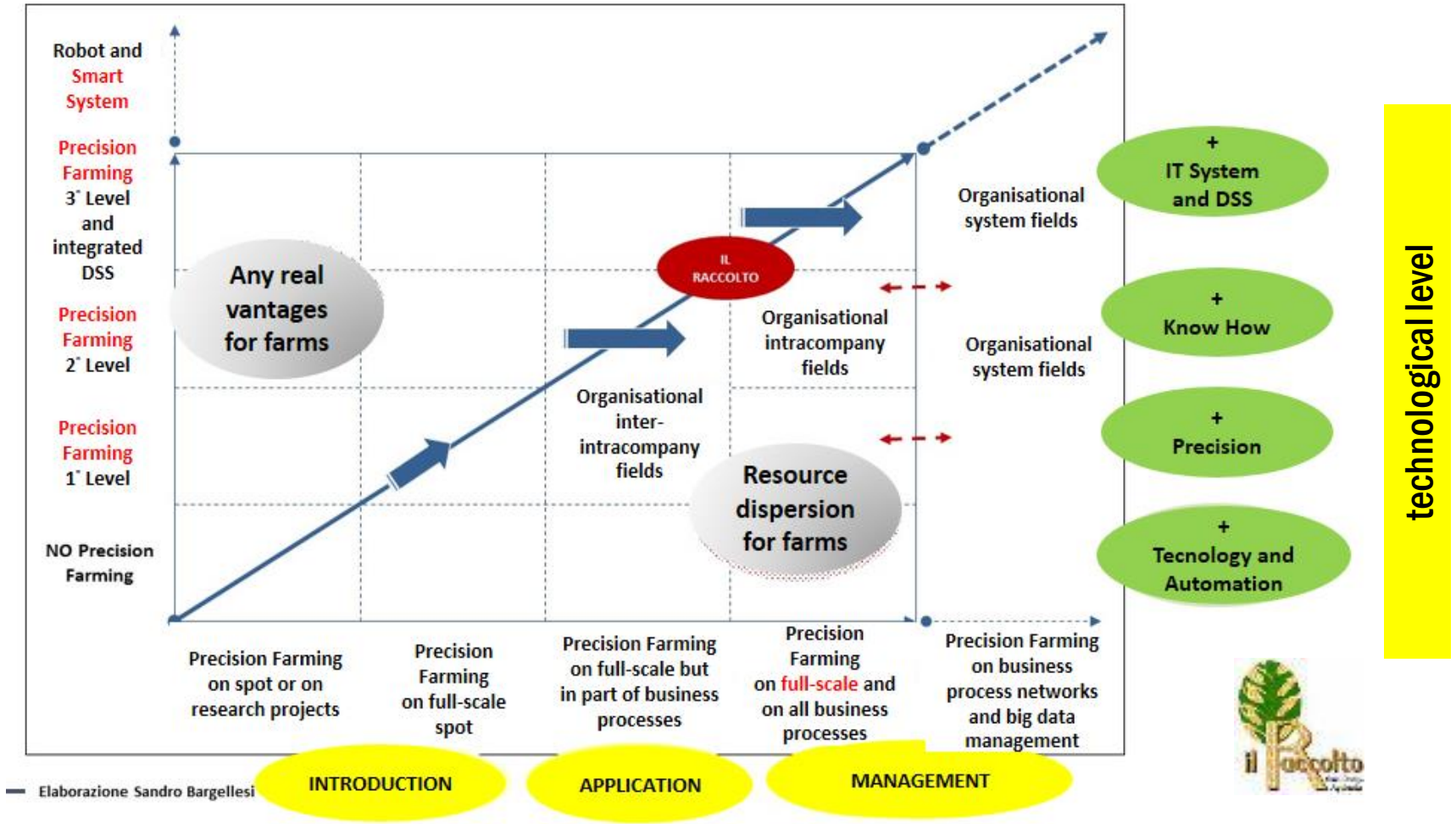


Tona, E., Calcante, A. & Oberti, R. Precision Agric (2018) 19: 606. https://doi.org/10.1007/s11119-017-9543-4

4. Introducing innovation in the farming enterprise

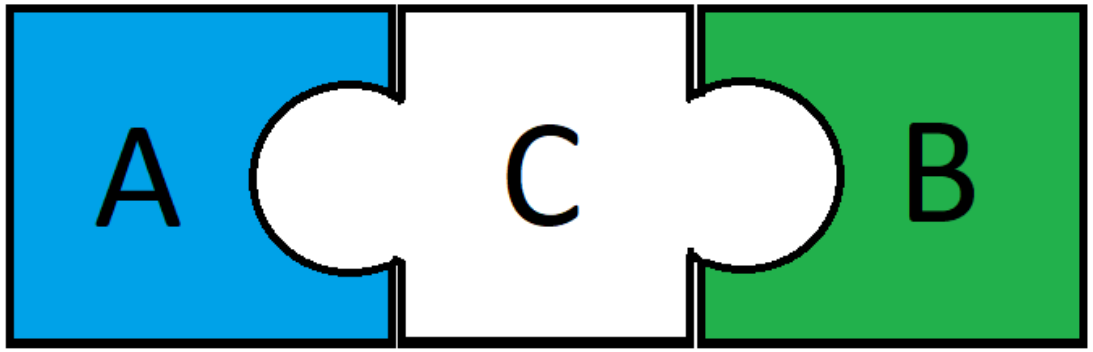
The Coop Il Raccolto Case (Bologna, Italy, 4.000 ha) has been managed with Precision Farming Technologies for over 20 years.

MATRIX ANALYSIS OF THE FARM POSITIONING AND ORGANISATIONAL NEEDS (2)



5. The research system in the TRL approach

In the Precision Farming, there are already examples of mature integrated innovation systems, such as the automatic guidance in tractors. The Tractor System (A) and the satellite positioning system (B) are mature and well connected with the automatic navigation system (C). The innovation is perfectly appropriate, reliable and profitable for the farming system in open field operations.



5. The research system in the TRL approach

As in any innovation process, a chaotic scenario of new technologies arises, which must be properly developed in specific actuation steps and appropriate competencies and actors.

It is extremely necessary to carry out an approach that is:

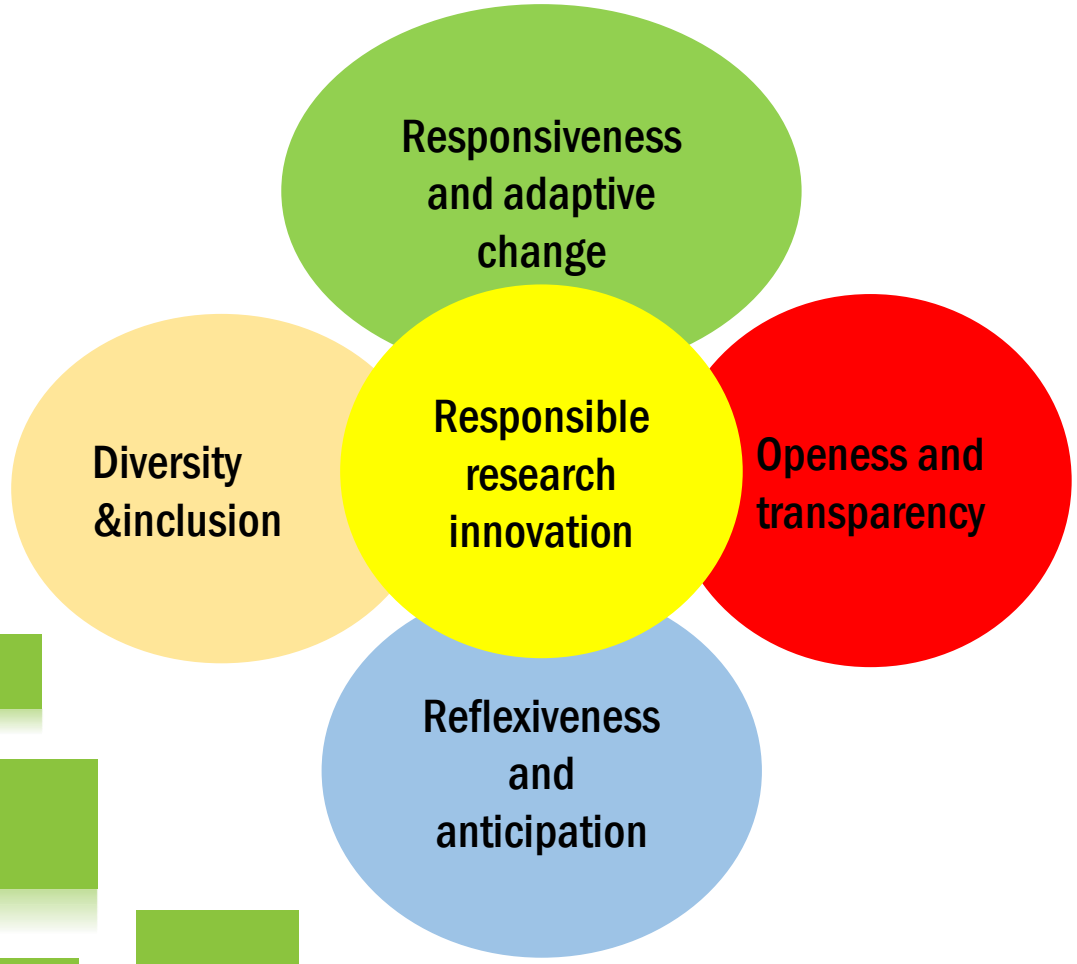
- integrated.,
- collaborative and multi-competent, and
- multi-agent.

This ensures an effective and profitable innovation development.

Chain of technology development in High Tech Farming

	Product type	Problems and needs	Who does what
satellite, airplane, drone, terrain station, on-board system	vector	resolution, frequency	engineering companies
photonics	sensors	direct or indirect measure – real value or index	physics researchers
digital data	raw data	interconnectivity	informatics competencies
data communication	telecommunication	broad band	engineers researchers
data mining	normalized data	applications (apps)	informatics competencies
informative digital systems	GIS + territorial digital hubs	hubs and services	agroinformatic & informatics systems
data analysis	biological and environmental models	agronomic, biological and environmental science knowledges	agronomy researchers
decision support systems	manager interface	development of effective decision support System	agronomers agroinformatic
mission plan for variable rate treatment automatism	data meaning and managing	agro-electronics and agroinformatics training	agricultural machinery engineers agroinformatics agroelectronics
AVT machinery set up	automation	agro-electronics and agroinformatics training	agricultural machinery engineers , agroinformatics

5. The research system in the TRL approach



The four principles of Responsible Research and Innovation
(source: https//www.rri-eu/research-community)

Diversity and Inclusion: Be sensitive to research biases, include diverse voices and make results beneficial to a wider community.

Anticipation and Reflection: Think on the purposes and possible implications of your research and its outcomes, and envision all possible strategies and methods.

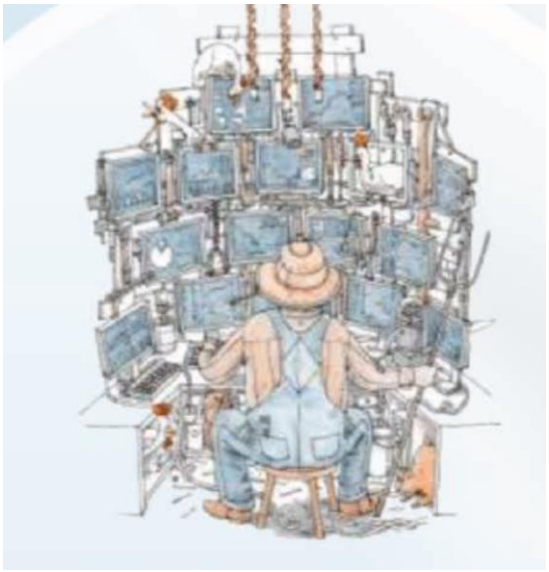
Openness and Transparency: Share objectives, methods and, whenever possible and appropriate, results, and inform about potential conflicts of interests

Responsiveness and Adaptive Change: Be responsive to changes and external inputs, adapting your research plans to changing social values and Expectations.

5. The research system in the TRL approach

The available technologies (which will get better and cheaper to use) are able to cover the agronomic needs, there is no need to develop new ones.
Let's focus on the current knowledge.

Quote: «*Let's create another sensor, instead of making sense of those that already exist*», Miel Hostens



5. The TRL ancillary keys

Dissemination, knowledge and educational system networks are fundamental

implement

experiment

listen

design

system innovation - social innovation

the previous agricultural revolutions teach us that innovation is in vain without accompanying instruction and demonstration

Further Reading

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