Tech Innovation Systems in Agriculture

Area 1 – SPA Overview

Lesson 1 – Introduction to SPA

Sequence ID – 4

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Overview

The technological models of agricultural machinery have evolved differently in relation to structural and social conditions. On the one hand, we have an American (U.S.A) - Western model, capital intensive, with large machines. On the other hand the Asian one, labour intensive, with small even sophisticated machines suitable for small and family farms.

Even on large scale machinery, implementing new technologies requires an investment. All farm technical management system may have advantages by adopting new technology in:

a) measuring parameters and processes,

b) assessing data by informatics models giving optimization information, and

c) tools to manage the single specific resource

... that is Precision Farming!

1. Farm machinery development models

The technological evolution in agriculture, especially during the 20th century, several “models” have been employed:

- The American (U.S.A) model
  - Capital intensive, developed large machinery
- The Asian Model
  - Labour intensive, developed low scale machinery technologically advanced
  - European model (intermediate)
  - Developed medium scale machinery thanks to the strong mechanical industry

1. Farm machinery development models

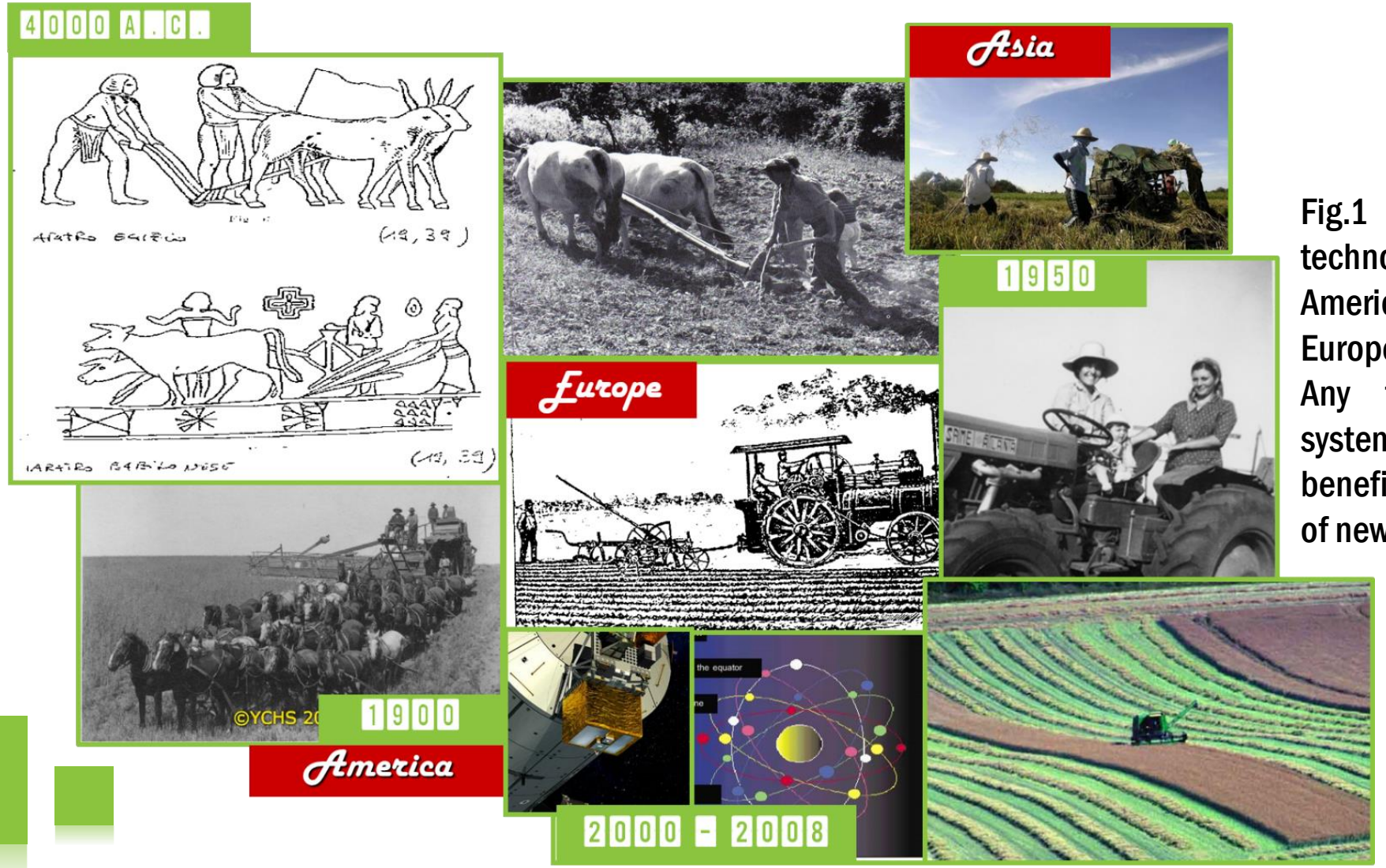

Fig.1 - Evolution of technological models: American (U.S.A), Asian, and European.

Any technical management system, large or small, can benefit from the introduction of new technologies

2. Acquisition levels in High Tech SPA

Seven PA system levels reached over the last decade

1. Guidance Systems	• Global Navigation Satellite System (GNSS) • Autonomous steering
2. Control Systems	• Variable Rate Technology (VRT) for Planting and Population • VRT for Fertilizers, Soil contitioner, Pesticides • Robotics
3. Monitoring Systems	• Yield and Quality Sensors • Drones • Electric Conductivity (EC), Moisture and Nutrient Monitors • Soil Samplers, Testing
4. Spatial Relationship Systems	• Satellite Imagery • Remote Sensing and Data Collection • Geographic Information Systems (GIS) Databases

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2014 FarmSmart Agricultural Conference
University of Guelph
January 18th, 2014

Dr. Jim Budzynski, Managing Partner
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2. Acquisition levels in High Tech SPA

Seven PA system levels reached over the last decade

5. Interpretation Systems	• Agronomic Response Curves • Correlation Development • Statistical Analysis
6. Decision Support Systems	• Recommendations: • Crop, Population, Variety, Depth • Nutrient Rates, Timing, Forms • Crop Protection • Harvesting or Water Management
7. Communication Systems	• Remote Access, Cloud Systems • Smartphone and Apps • Tablets and Apps • Asset Tracking

3. The “Use Cases” rule and its added value

Innovation is mainly dissemination of knowledge. “Use Cases” give added value for farm technicians, manufacturers, dealers and operators to assess and compare technologies and procedures.

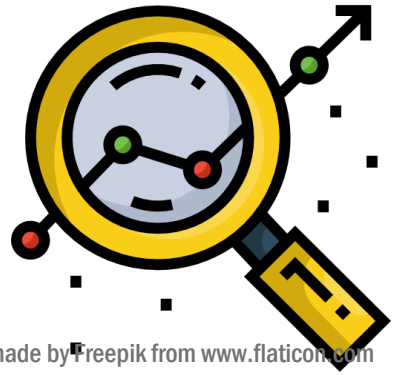
During field demonstrations, it is possible for the participants to compare the performances expressed by the new technologies over the conventional:

- Identification of «utilities» derived from the specific technological features of the proposed yards (tractors and equipment) compared to new mechanical workings but with conventional technologies
- Data and performance on income impacts
- Data and performance on agronomic impacts
- Data and performance on the operating impacts in terms of simplification and setting of the yards in order to vary the working conditions
- Data and performance on the containment of unproductive times and inefficiencies
- Data and performance on environmental impacts

3. The “Use Cases” rule and its added value

Furthermore Use Cases provide insights in:

- The domain of work sites, in accordance with the working time windows defined by agronomic needs and seasonal trends
- Definition of territorial, typological and dimensional basins for the best economic sustainability of worksites
- Balancing of the economic and/or qualitative improvement of agricultural production processes and to contribute to the improvement of the sector
- Financial investment support, Ordinary and subsidized agricultural credit, *Rural Development Programmes(RDP’s)* industrial incentives 4.0 with over-depreciation for the agricultural sector
- Tax Credit Research in Agriculture, *European Innovation Partnership (EIP)* and *Operational Groups (OG)*, Horizon 2020
- Technological innovation and interaction with agricultural policy



3. The “Use Cases” rule and its added value

Assessing the sustainability of investments
They can activate modality of management with companies on the net if the sustainability of the costs is not reached individually

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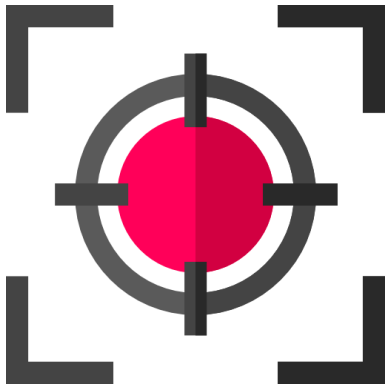

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Defining the focus
The main objective must be sustainable intensification, including the increase in production yields and the quality of agricultural production

Create benefits for the whole supply chain
Through a comparison and collaboration between all actors

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Developing internal expertise
Acquire, maintain and directly improve the know-how

4. High Tech Introduction using a Holistic Approach

The proper introduction of High Tech Farming (HTF) in the farming process and in the related agri-businesses requires a particular attention. To guarantee high quality, deontological and ethical issues, and effective enhancement, HTF 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. High Tech Introduction using a Holistic Approach

For the integration and compatibility of the introduced technologies in the production process is important to clearly define the position of the introduced technologies in the farming production process (practice flow). The objective is the opportunity to check compatibility, interoperability and synergy with other blocks of the flowchart. In the proper experiences for case of rural crops productions activity, 8 macro-blocks can be defined in the flowchart process:

1. Process management tools such as FMIS (Farm Integration Management System) -GIS, with layers of spatial knowledge of the field and product (soil, water, crop, diseases, fruit quality); it should always be updated with the following factors;
2. Control and risk management tools for crops [frost, pests, water stress];
3. Quality monitoring management tools through the creation of soil, crop, fruit, and microclimate maps;
4. Decision Support System (DSS) on risks control and quality factors management;
5. Farming prescription maps;
6. Machinery fleet control;
7. Automation and robotization of machinery;
8. Harvest feedback (spatial quality and quantity)

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5. Choosing appropriate technology

for the current business model, w.r.t. type and dimension

Hoes and satellites have the same level of importance in different farming scenarios. Since type and dimension of technologies have the same importance in the production process and in farming, they should be adopted choosing the proper solution.

SPA is mainly a mindset, a lean procedure that gives priority to sustainability. Each productive enterprise size could find appropriate size and graded solutions. Today, open source software and hardware make it possible to adopt innovative technologies.

5. Choosing appropriate technology

for the current business model, w.r.t. type and dimension

Like any revolution, there is a chaotic phase of enthusiasm and therefore also of failure in which the farmer finds himself faced with a chaotic universe of proposals and instruments that, in the era of smart technologies evolve and even age very quickly. Therefore, it is necessary to sort and size them according to their area of use. It is necessary to identify and make available a system of suppliers, skills and services that make them effective and profitable for agriculture and especially for farming.

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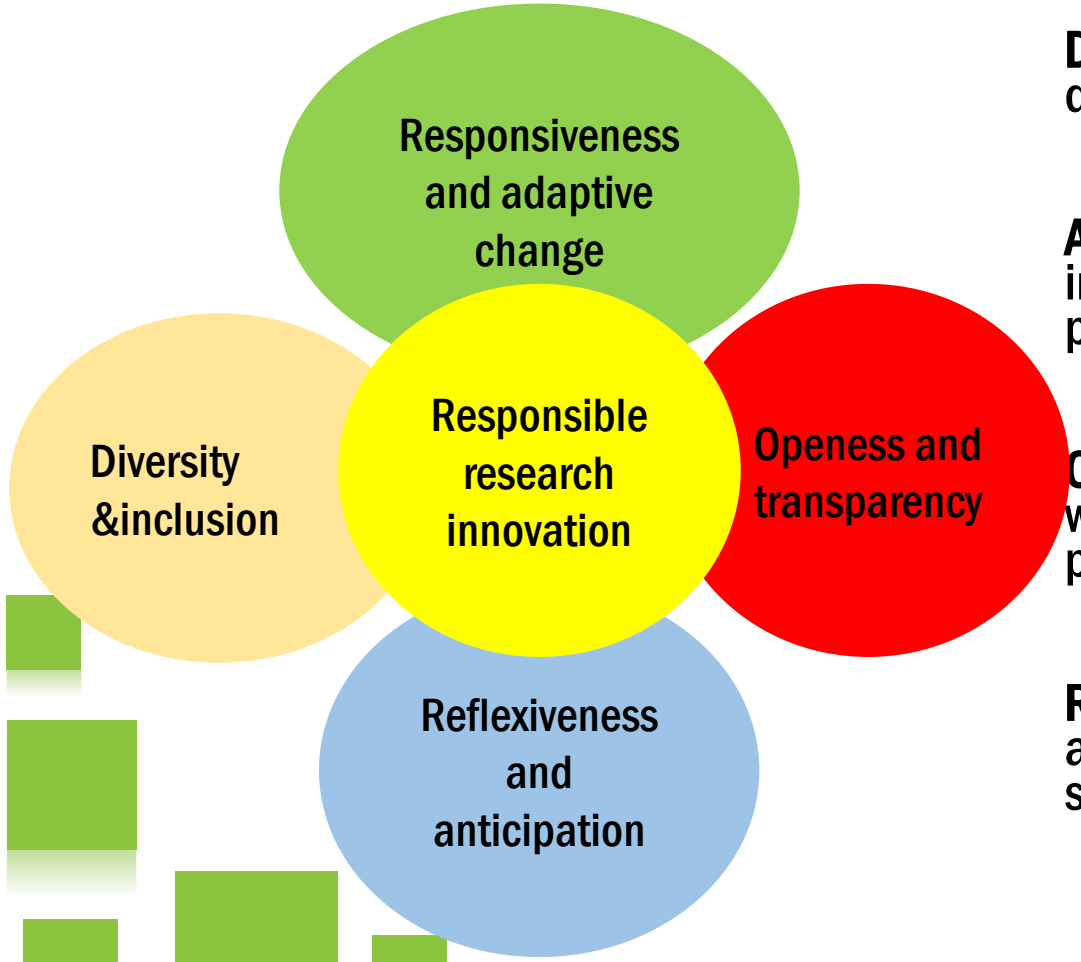
5. Choosing appropriate technology

for the current business model, w.r.t. type and dimension



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 envisage 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.

Fig. 2 – The four principles of responsible research and innovation (Source: https//www.rri-eu/research-community)

6. Invention and Innovation: Deontology and Care

- Talking about innovation requires placing oneself in a vision of system (of processes, productivity chain, territorial and global system). This means, being aware that we are doing something that is not neutral.
- A successful innovation requires a "*thoughtful thought* " (Luigina Mortari, 2011), definable as evaluation, reasoned analysis in a system view.
- It is necessary to evaluate today the introduction of the various technologies, often more proclaimed than actually applicable, by adopting a deontological analysis that requires the transition from "to know" to "to think" (Luigina Mortari, 2011)
- Distinguishing innovation from technological or scientific "novelty"
- Technological or scientific innovation is a neutral concept of important results. It does not constitute itself in the action nor an advantage nor a damage and it is a constituent part of the world of research. The transfer in the production processes requires attention and precautions often not taken into account.

6. Invention and Innovation: Deontology and Care

In the objective of increasing the effectiveness and efficiency of the processes in the agricultural enterprises and in the territory, it is necessary to have a systemic vision or as it is common to say nowadays, “ecosystem”.

In research and transfer experiments aimed at improving the productivity and efficiency of agricultural holdings in particular in farm scenarios in inland and marginal areas, with their own specificities (structural difficulties, low training, Besso investment profile) the need to adopt a system vision often assumes an attitude of “care”.

The action of caring is learnt with experience and goes with a deep knowledge of techniques and practices in addition to the conditions of the productive ecosystem in which it takes place. An experienced caring action is “unboosted”. The care action is carried out with a multi-actor cooperation and multi-competencies process, in which the method of shared experience and systemic analysis is comprehensive of the specificities of each culture, territory, and its entrepreneurs. It translates into what is called a “community of care practices” or even a “community of practice”. Within these there is a generative process of relationality, which in the past was constituted by the territorial training schools or educational figures, advice and dissemination.

Further Reading

❖Innovation and New Technology Relationship

https://en.wikipedia.org/wiki/Technological_innovation

❖Technological Innovation, Entrepreneurship, and Development

http://www.europeanbusinessreview.com/technological-innovation-entrepreneurship-and-development/

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