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Innovative design of agricultural systems

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ALIMENTATION AGRICULTURE
ENVIRONNEMENT

Innovative design of agricultural systems :

1. The need for innovative design

1.1. What is innovative design?

1.2. Consequences for the organisation of innovative design in agronomic research

2.The pathways to innovative design

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✓**Researchers in management operate a distinction between two design regimes (Le Masson, Weil, Hatchuel, 2006):**

✓ **Rule-based design:**

- ✓**The design goals are clearly defined in advance : gradual modifications to products or existing technologies.**
- ✓**Skills and validation processes are unchanged from one innovation to another.**

✓**Innovative design:**

- ✓**The design frame is called into question**
- ✓**The goals take shape during the design**
- ✓**Il is not possible in advance to specify the required skills and the validation methods**

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- **The improvement of agricultural systems clearly calls for a considerable effort of innovative design**

  - **Environmental and social concerns gain in importance; new stakeholders; approaches at the landscape level**

  - **A major change in the knowledge to be mobilized: ecology, egonomics, management sciences, sociology, geography, …**

  - **A revision of evaluation methods and criteria**

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- **Consequences for the organisation of innovative design in agronomic research**

  - **The classic project-based financing of research seems to be an obstacle to innovative design.**

  - **The design activity must at least partially direct the acquisition of knowledge.**

- **There is no question of looking for an illusory consensus on the types of desirable innovations or ideal farming systems.**

- **We propose to consider that the priorities are:**
  - **To prepare a diversity of solutions, to leave the choice to farmers and other stakeholders;**
  - **To help the farmers and other stakeholders to build their own systems, adapted to their own situation and to build their own compromises.**

Innovative design of agricultural systems :

1. The need for innovative design

2.The pathways to innovative design

2.1 Supporting farmers to design systems adapted to their situation

2.2 Supporting collectives of players to design new ways of managing a resource

- **2.1. Supporting <u>farmers to design systems adapted to their situation</u>**

- **Two sets of approaches for innovative design of cropping or farming systems: “de novo” approach and “step by step” approach**

  - **<u>De novo approach</u> : designing cropping and farming systems that break away from existing ones, without worrying about transition.**
    - **Use of agronomic models:** a very popular method among researchers
    - **Collective design workshops** (five different key roles identified by R. Reau et al, 2012: facilitator, domain expert, local expert, change bellwether, assessment operator)

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  - **De novo approach :** designing cropping and farming systems that break away from existing ones, without worrying about transition**.**

  - **Step by step approach: the focus is not on the future system, but on the organisation of change; the existing system is gradually modified to arrive at an innovative system which was not known in advance.**

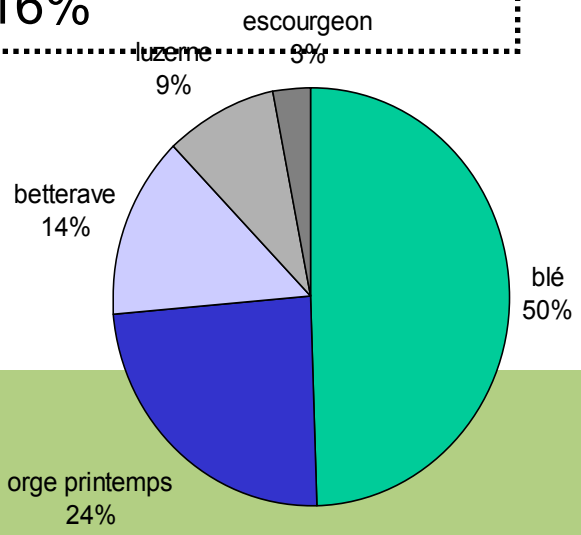
  diagnosis / evolutions of the systems are imagined, and implemented / new diagnosis … Spiral of continuous improvement.

Example of step by step approch on a farm in Picardie

(réseau de 8 fermes Programme Protection Intégrée, P. Mischler et al).

2002 : Agronomical and environmental diagnosis

- TFI : 8.08
- 5 crop species
- wheat / wheat : 16%



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RESSOURCES ET TERRITOIRES

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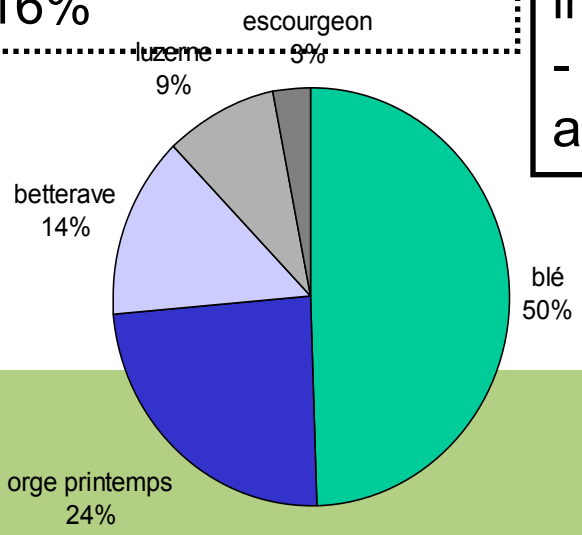

Change in practices

- Spiral of continuous improvement
- Crop diversification, new crop management
- mobilisation of a « Library of innovations »
- combination of local and scientific knowledge

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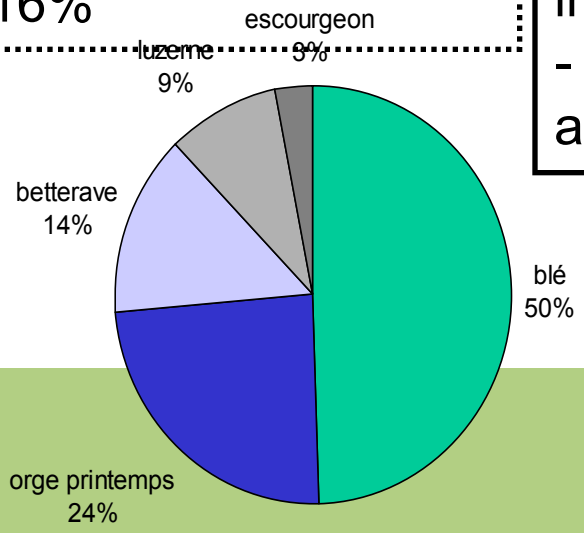


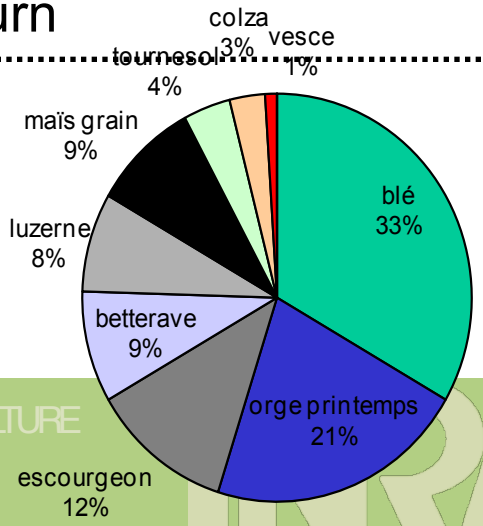
Change in practices

- Spiral of continuous improvement, learning
- Crop diversification, new crop management
- mobilisation of a « Library of innovations »
- combination of local and scientific knowledge

2008 Agronomical and environmental diagnosis

- TFI : 3.65
- 9 crop species
- wheat / wheat : 0%

No change in economic return



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2.2. Supporting collectives of players to design new ways of managing a resource

- **Collective design at territory level**
- **The interests of the various stakeholders can be contradictory, their representations of the situation irreconcilable, or their information asymmetrical.**
- **Territorial innovation often results from the combination of innovations designed at different scales.**

Design of landscape mosaics favouring biodiversity (from Berthet 2013)

- ✓ **To protect several species of birds of the plains, ecologists have shown the importance of grasslands and of their distribution over the landscape,**
- ✓ **Collective design has turned towards the joint design of**
  - ✓ **an alfalfa hay supply chain, managed by a cooperative, designed to supply the livestock farmers of a neighbouring area;**
  - ✓ **crop management systems of alfalfa fields reconciling production and the protection of biodiversity,**
  - ✓ **alfalfa production contracts, enabling its spatial distribution to be spread out, maximising its contribution to biodiversity conservation.**



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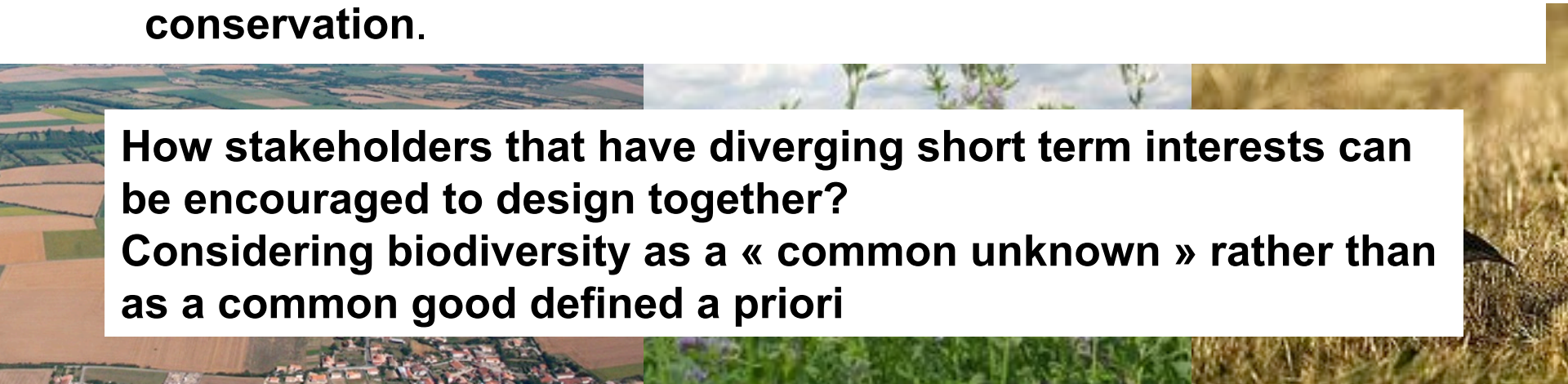
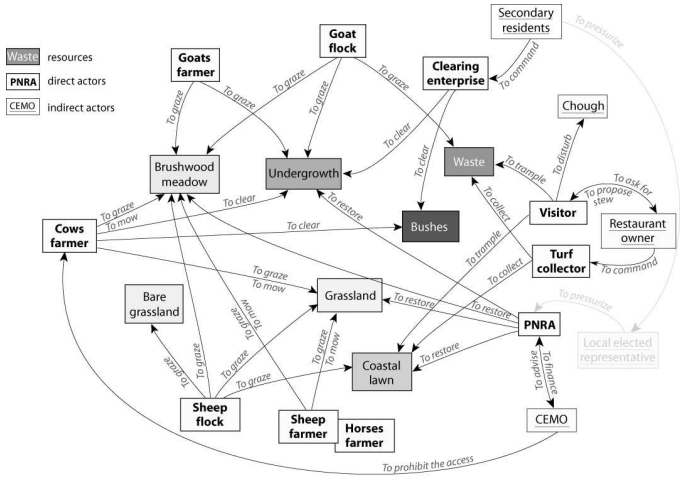


How stakeholders that have diverging short term interests can be encouraged to design together?
Considering biodiversity as a « common unknown » rather than as a common good defined a priori

The organisation of co-design:
Example of companion modelling, focused on the relations between livestock farming, tourism and biodiversity on Ouessant island off Brittany (Groupe ComMod, M. Etienne et al, 2006).

Companion modelling is based on a 3 step approach

- **Eliciting a common representation of the territorial processes to be steered jointly;**
- **Acting in situation, with a role-playing game, to experience this complexity from inside.**
- **Visioning adaptive management options**



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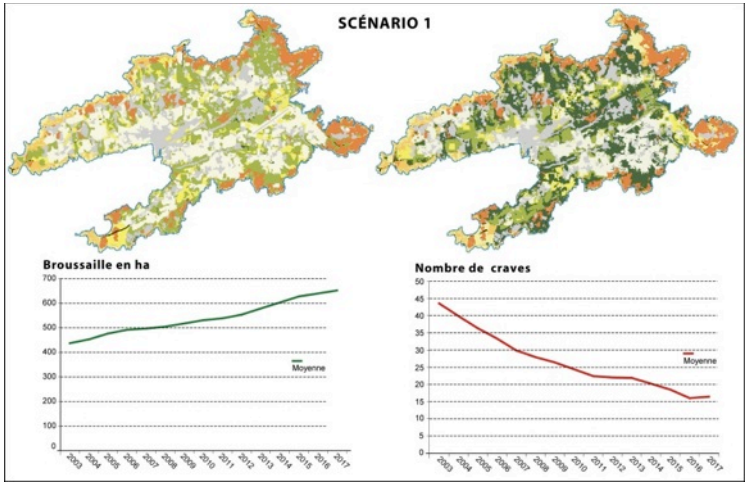
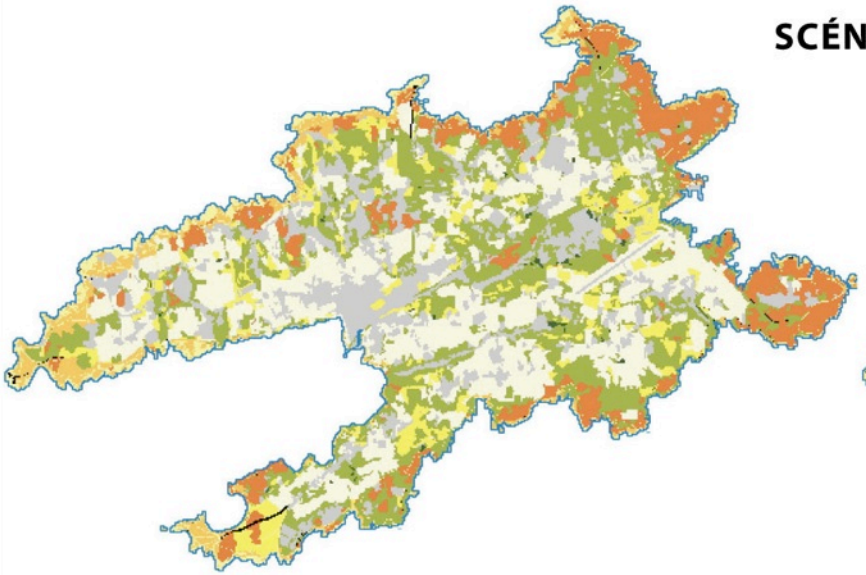
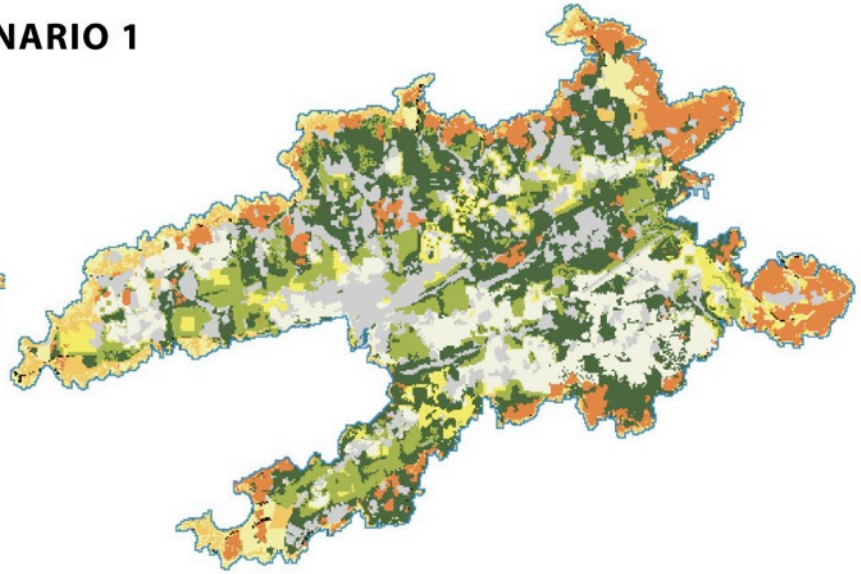


SCÉNARIO 1





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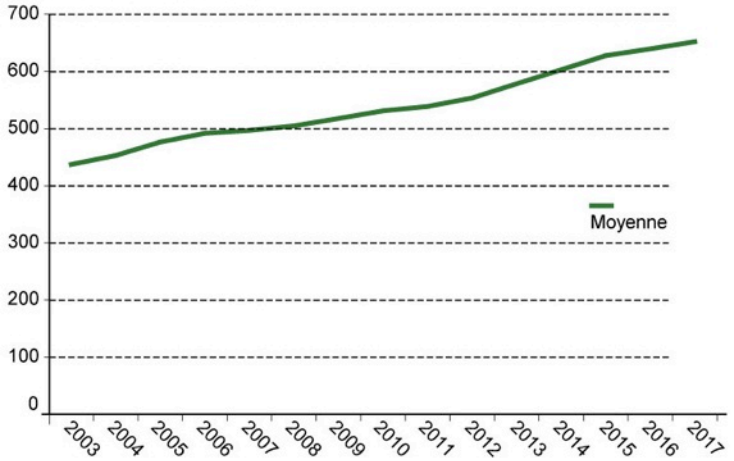

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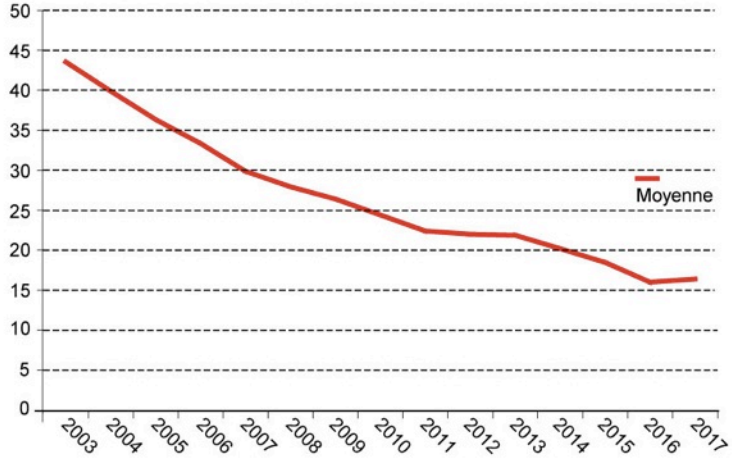

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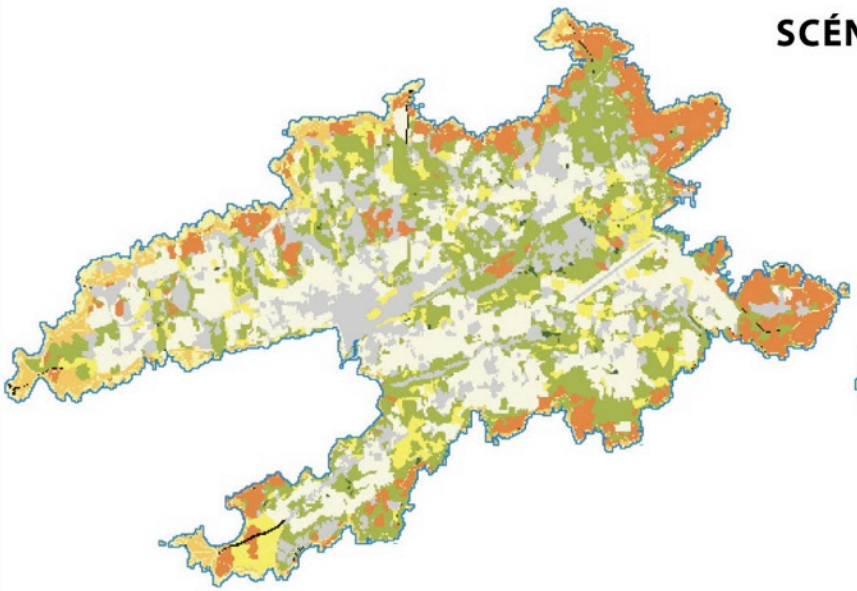

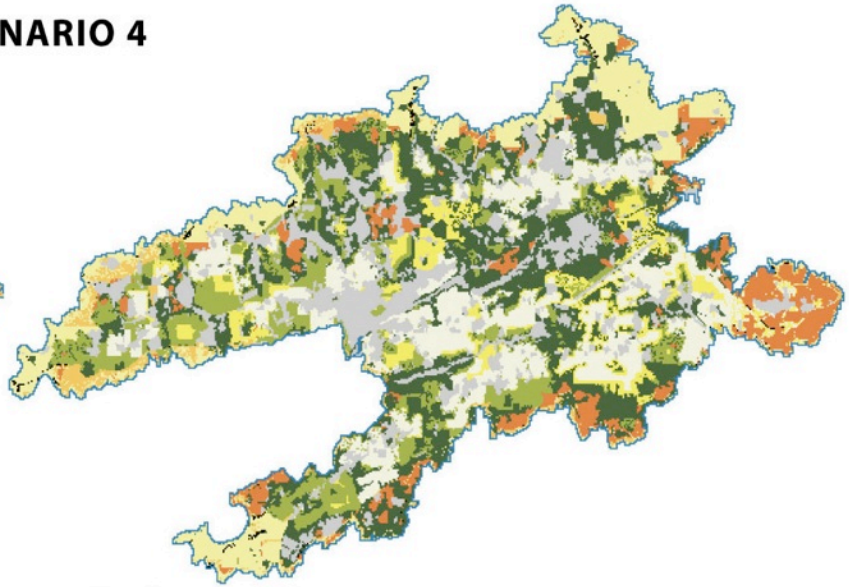

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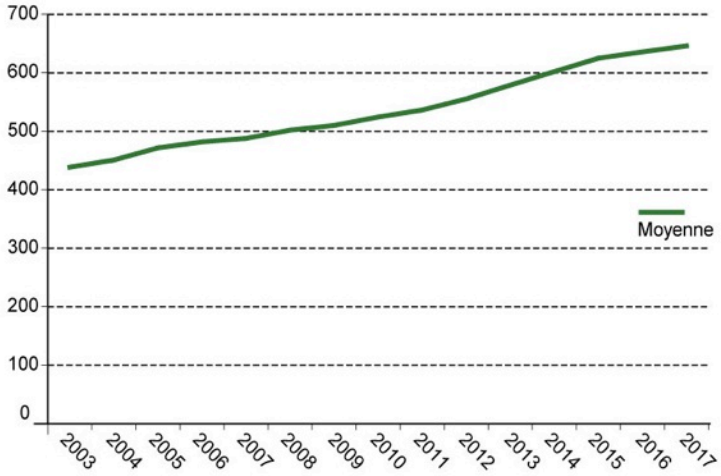

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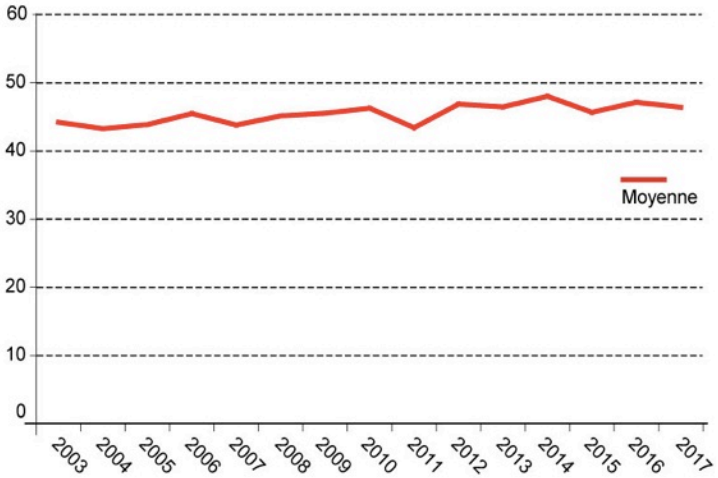

Conclusion

- **Because today agriculture needs radical innovations, i.e. innovative design, we agronomists need to increase our contribution to the design activity**
  - Move forward our methodology
  - Evolve our scientific collaborations, our scales of approach, and our partnerships.

Conclusion

We are faced with a paradox :

- **the activity of innovative design must be fully identified in the programmes of universities and research bodies, and must contribute to the prioritisation of the activity of knowledge production**
- **innovative design cannot be pre-programmed (by definition)**

An imperative need of innovative design in the field of governance and functioning of research bodies !

Thank you for your attention