Methods for systemic design in agrifood systems

Marie-Hélène Jeuffroy, Marianne Cerf, Margot Leclere, Lorène Prost, Jean-Marc Meynard, Chloé Salembier

Agricultural systems by design

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ideas
INITIATIVE FOR DESIGN IN AGRIFOOD SYSTEMS

Agricultural systems by design

Session B6: From design to scale of agriculture and food innovations: frameworks for capacity building

Methods for systemic design in agrifood systems

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The urgent need of systemic innovation processes

Numerous wicked issues in agriculture and food domains require **systemic innovations** … at different scales

We describe as **“systemic” an innovation** whose properties are linked to interactions and feedbacks between its components: ex cropping systems, farming systems, pest management systems, agroecosystem, agrifood system, …

plot

farm

landscape

territory

Value chain

And others …

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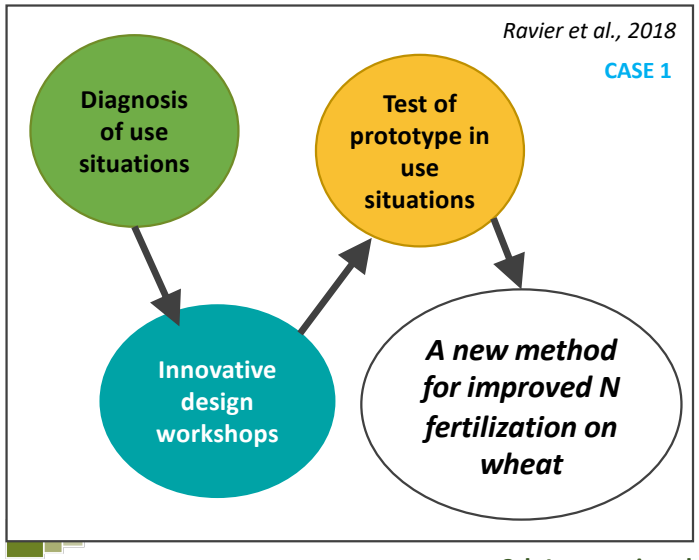
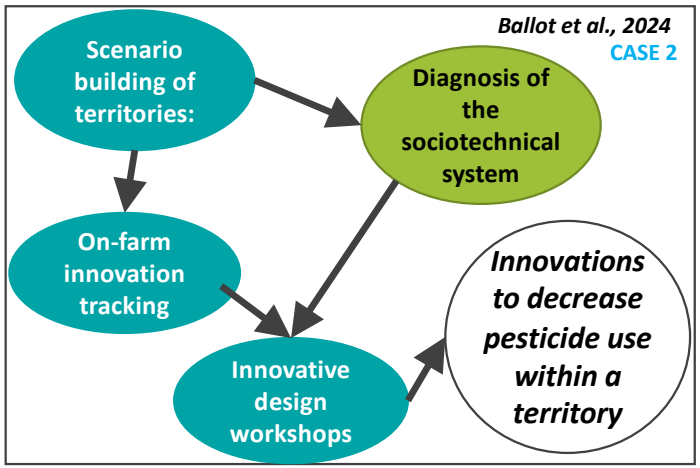
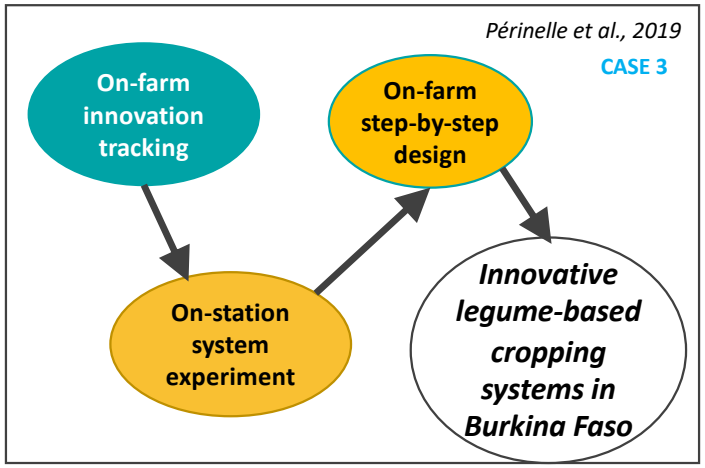
➔ **how the systemic character of the designed objects was reached, through the choice of the design methods, and their linkages throughout the design process ?**

Material and methods

- Cross analysis of **13 case studies**, involving multi-actor design processes
- Covering **a diversity of systemic objects to be designed**
- All implementing **methods known to fuel multi-actor design processes** (8 methods used)… : **formulating the design problem/target** + **generating solutions** + **assessing/tayloring solutions to the situation.**







Results (1/5)

In the various cases, the systemic character of the designed object was linked to :
(i) the interactions between the designed object(s) and the situation(s) in which it was to be implemented

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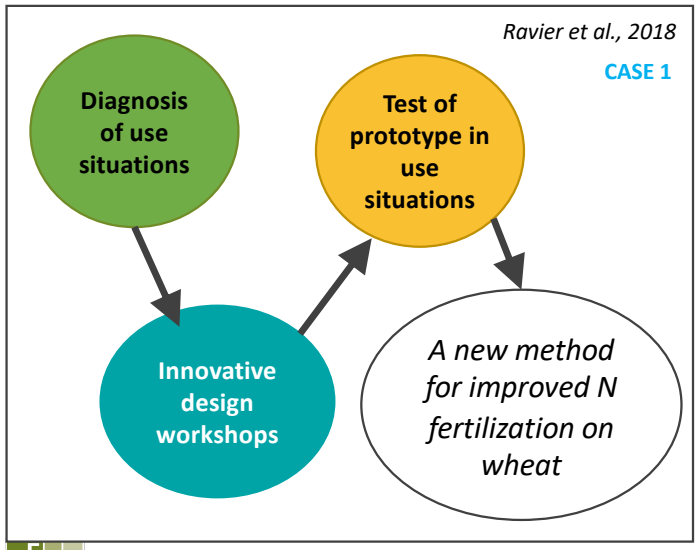
- Ex CASE 1



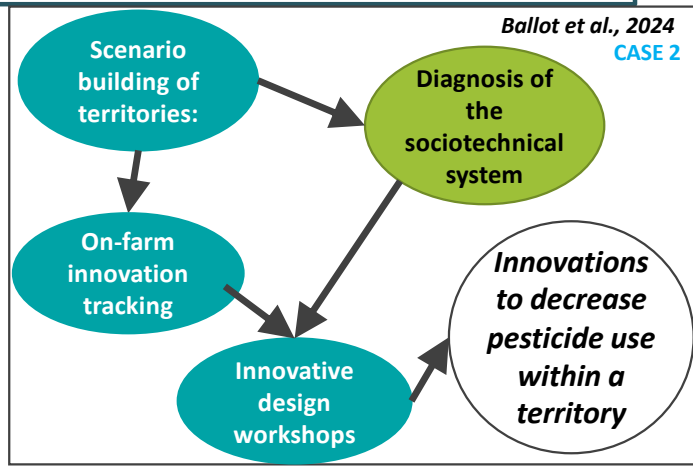
A ***diagnosis of use situations*** *(Cerf et al.,2012)* was implemented to capture the diversity of the situations in which the designed object is to be used, and consider this diversity while designing a method adapted to all of them.

A ***Test of prototype in use situations*** *(Cerf et al.,2012)* was implemented to assess the 1st version of the designed method in a diversity of real-world situations, with actors

Results (2/5)

In the various cases, the systemic character of the designed object was linked to :
(ii) the coordination between actors, which contributes to reinforce such interactions

- Ex **CASE 2**: designing pesticide-free cropping systems within a territory requires a coordination between various types of actors



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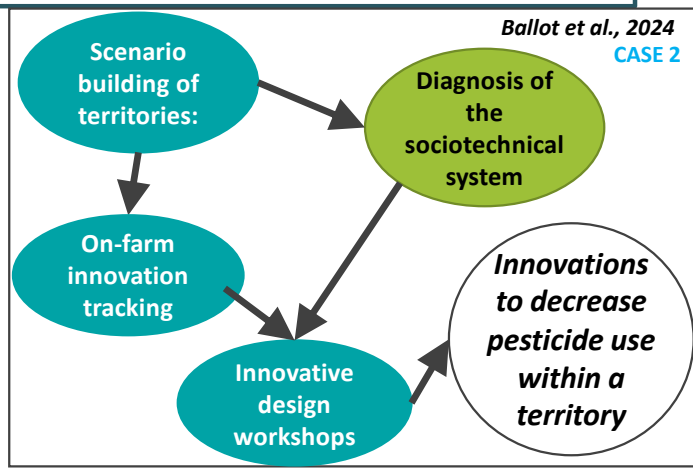
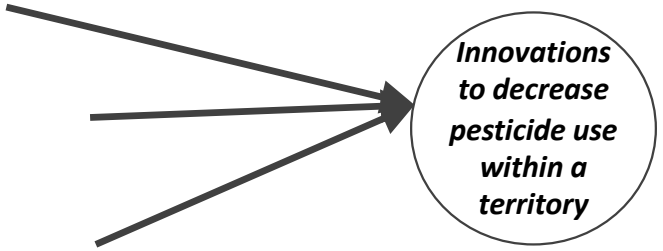


Initial status of the Territory :
50% grasslands (livestock farming)
20% organic farming

Trends within the territory :
Decrease of livestock farming
(no transferee after retirement)
Crisis of organic farming



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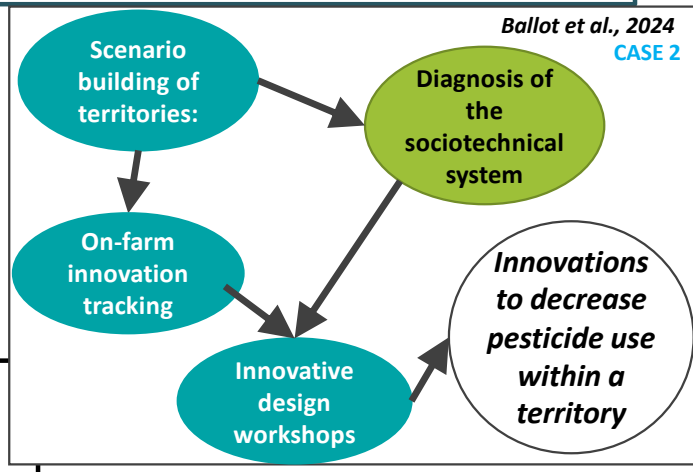

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Innovations to be developped with:

Farmers : to develop profitable organic farming ?

Consumers: to enhance the purchase of organic products

Dairy factories : to increase the price of organic milk paid to the farmers

Innovations to decrease pesticide use within a territory

Results (3/5)

In the various cases, the systemic character of the designed object was linked to :
(iii) some characteristics of each method used for design

- Three ex from **CASES 1, 2, 3**:
  - The ***on-farm innovation tracking*** *(Salembier et al., 2021)* resulted in shedding light on the systemic links between innovative practices under study and the situation components in which they were designed and successfully implemented by farmers **(ex CASE 2, 3)** ;
  - The ***diagnosis of use situations*** *(Cerf et al.,2012)* allowed to analyze the problems actors face when implementing a task in their own situations, thus taking into account the systemic links between a practitioner, the object of his/her action, and the context in which it takes place **(ex CASE 1)** ;
  - The ***system experiment*** *(Debaeke et al.,2009)* allowed to assess and improve combinations of practices in real-life situations **(ex CASE 3)**

Results (4/5)

In the various cases, the systemic character of the designed object was linked to :
(iv) the tailored choice of the methods used in each situation

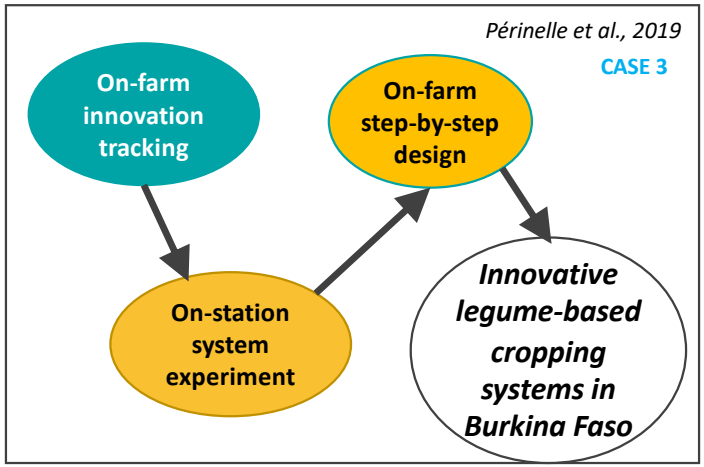
- When the design process was hampered by strong interconnected barriers from a diversity of actors ➔ a ***sociotechnical diagnosis*** *(Casagrande et al., 2024)* was implemented (*ex **CASE 2** : pesticide reduction and development of organic farming hampered by various actors from the value chains)*
- When generating solutions was hindered by fixation effect ➔ a ***workshop for innovative design*** *(Jeuffroy et al., 2022)* was organized to foster collective exploration (*ex **CASE 1** : a more performant fertilization method was hindered by 40 years of R&D on the balance-sheet method)*
- When the design of an innovation could not be reached unless being confronted to its real environment and use ➔ a ***step-by-step design process*** *(Meynard et al., 2023)* was conducted (i.e. a progressive design, during which confronting the designed object to the real situation generates learning, used to improve the designed object) (*ex **CASE 3** : the legume-based cropping systems adopted by farmers were improved and adapted through on-farm tests)*

Results (5/5)

In the various cases, the systemic character of the designed object was linked to :
(v) the articulation of the methods along the design process

➢ Ex **CASE 3**: various legume-based cropping systems were adapted by farmers from common prototypes in Burkina Faso

- The ***on-farm innovation tracking*** was followed by a ***system experiment*** ➔ the systemic links highlighted in the innovative practices were valued during the experiment.
- A ***system experiment*** was followed by ***a step-by-step design process*** ➔ the interactions between practices, determinant for high performance, were highlighted in the experiment, and still considered in the step-by-step design of new practices.



Conclusion

- When systemic objects are to be designed and anchored in real-world situations, their systemic character can be reached through :

(i) the use of specific system-oriented methods,

(ii) the tailored choice of methods in relation to main systemic barriers to address in the design process,

(iii) and the ways to combine methods to address the systemic issues and barriers throughout the innovation process.

- In the future, it would be essential to enhance the use of such design approaches, by a diversity of actors, to scale up innovation in agrifood systems.

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