

# Ideotyping agroecological systems: a framework for the design of system innovations

Summary proposed as an introduction to the special session  
"From vision to action: structuring the agroecological transition with ideotyping".

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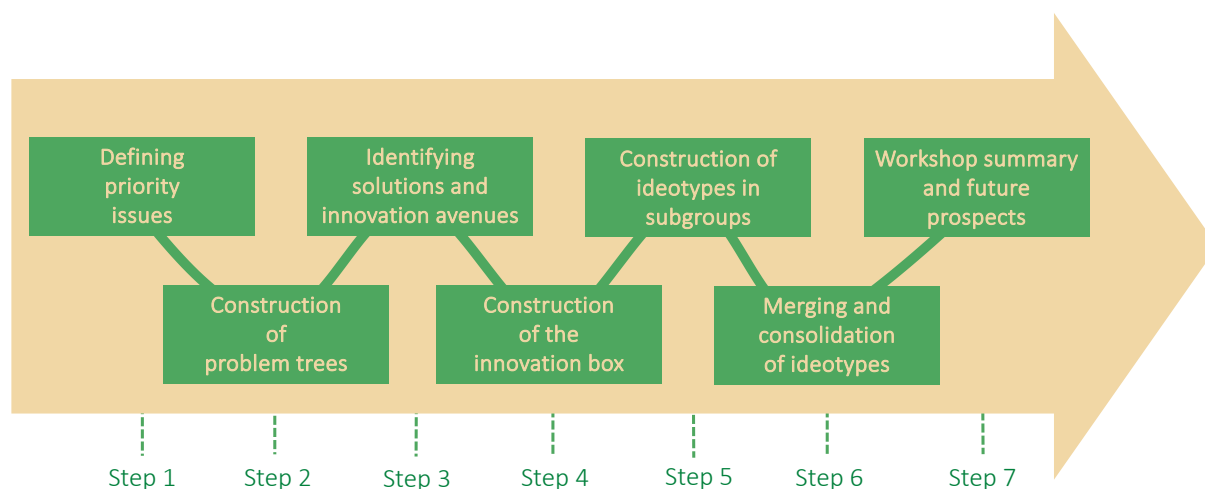
## Introduction

The sustainability issues affecting agriculture and food are closely intertwined, resulting in existing solutions being hampered by lock-in phenomena. In this context, researchers working on agroecological transitions need to be equipped with new design methods capable of generating complex, high-performance systems. In particular, agroecology encourages researchers to rethink crop and livestock systems as a whole, optimising the interactions between plants, animals, humans and the environment. It also calls for imagining the conditions for reconfiguring value chains and rethinking the institutions and policies that govern agriculture and food (Belmin et al. 2022).

In this paper, we offer an initial assessment of "ideotyping agroecological systems", a new co-design method being developed by CIRAD and its partners between 2021 and 2025 in West Africa. This method is designed to engage transdisciplinary collectives in a multi-dimensional, multi-scalar analysis of the problems that affect them, and to work with them to develop systemic solutions. By analogy with varietal ideotyping (which seeks to optimize crop plant models, Debaeke et al 2014), agro-ecological system ideotyping involves defining a set of ideal properties - agronomic, social, institutional, etc. - that an agricultural and/or food system should possess to maximize its performance and sustainability in a given context.

## Method

The ideotyping method offers a framework for rethinking agricultural systems in their entirety, by coupling innovations relating to agriculture, value chains, territories and public policies. It involves bringing together different stakeholders (researchers, stakeholders, experts, resource persons, etc.) in workshops lasting 3 to 5 days, and guiding them step by step through a series of collective exercises leading to a shared vision of an agricultural system whose properties are deemed satisfactory by these same stakeholders (Figure 1).



**Figure 1:** Typical stages in an ideotyping workshop.

## Results

The first ideotyping experiments were carried out in Senegal and Côte d'Ivoire as part of several research-action projects (Santés & Territoires, Fair Sahel, Initiative Agroécologie, Safoods, Marigo and PRATAM). **Table 1** shows that, for each case study, ideotyping approach was used to address specific transition challenges and made it possible to envision desirable objects of very different kinds (cropping systems, integrated farms, city-countryside food systems, and agroecological territories). The key outputs of each workshops were: (i) a causal layer analysis of the problems experienced and perceived by the actors; (ii) an innovation box containing a number of innovation pathways, each with proposals for action; (iii) an ideotype of the desired innovative system, expressed in the form of systemic diagrams, textual narratives and/or synthetic drawings. To facilitate demonstration and illustrate the type of output obtained through ideotyping, we have chosen to use the example of the workshop in Fatick, Senegal (**Figure 2-4**, extracted from Belmin et al. 2024a). Complete empirical data on the results of the method are provided in the reports and articles cited in the last row of **Table 1**.

In the various projects where the method has been tested, ideotyping has contributed to socio-technical change dynamics by: (i) initiating co-design processes for innovative agricultural systems with groups of experimental farmers, (ii) strengthening the organisational and governance capacities of sectoral or territorial innovation platforms.

**Table 1:** Key information on the various ideotyping workshops conducted in West Africa between 2021 and 2025.

Work scale	Plot	Farm	Food system	Territory
Case studies	Ndiob (Senegal)	Mbane (Senegal)	Yamoussoukro (Ivory Coast)	Fatick (Senegal)
	Koussanar (Senegal)		Bouaké (Ivory Coast)	Lower Casamance (Senegal)
Transition challenge	Ecological intensification and diversification	Improving overall health in a Living Lab	Uncontrolled use of pesticides and health risks in the vegetable industry	Global pressures and changes affecting territorial balance

<b>Designed objects</b>	For each case, a range of 4 to 5 agroecological cropping systems	An integrated agro-ecological production system combining diversified crops, livestock and fish farming	For each case, an innovative urban-rural food system based on the principles of agroecology	An agro-ecological, resilient and innovative region
<b>Place in the innovation process</b>	Initiation of on-farm experiments	Initiates a support system for volunteer farmers	Initiating an interprofessional structure	Strategic planning for regional platforms
<b>Project concerned</b>	Fair Sahel	Santés & Territoires	Marigo, Safoods	One-CGIAR Agroecology Initiative PRATAM
<b>References</b>	Belmin et al. 2022; Mboh et al 2021	Belmin et al 2023	Belmin et al 2024; Deletré et al. 2024	Belmin et al 2024;

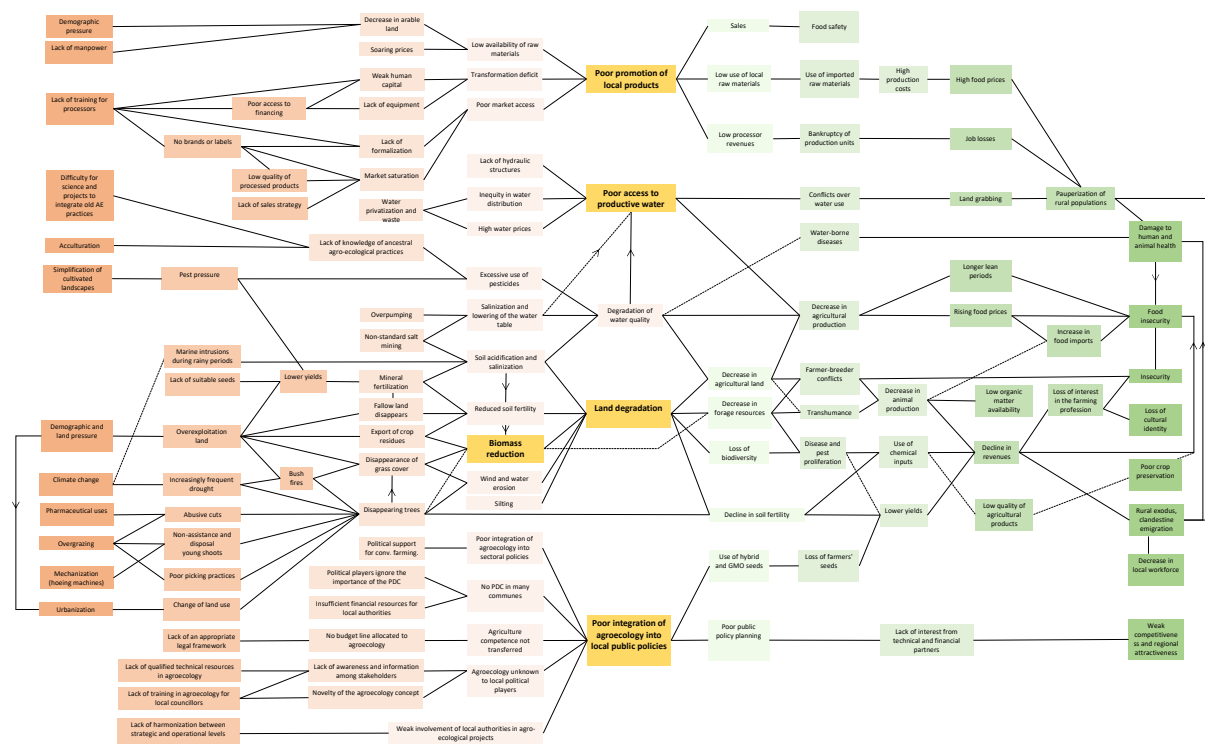
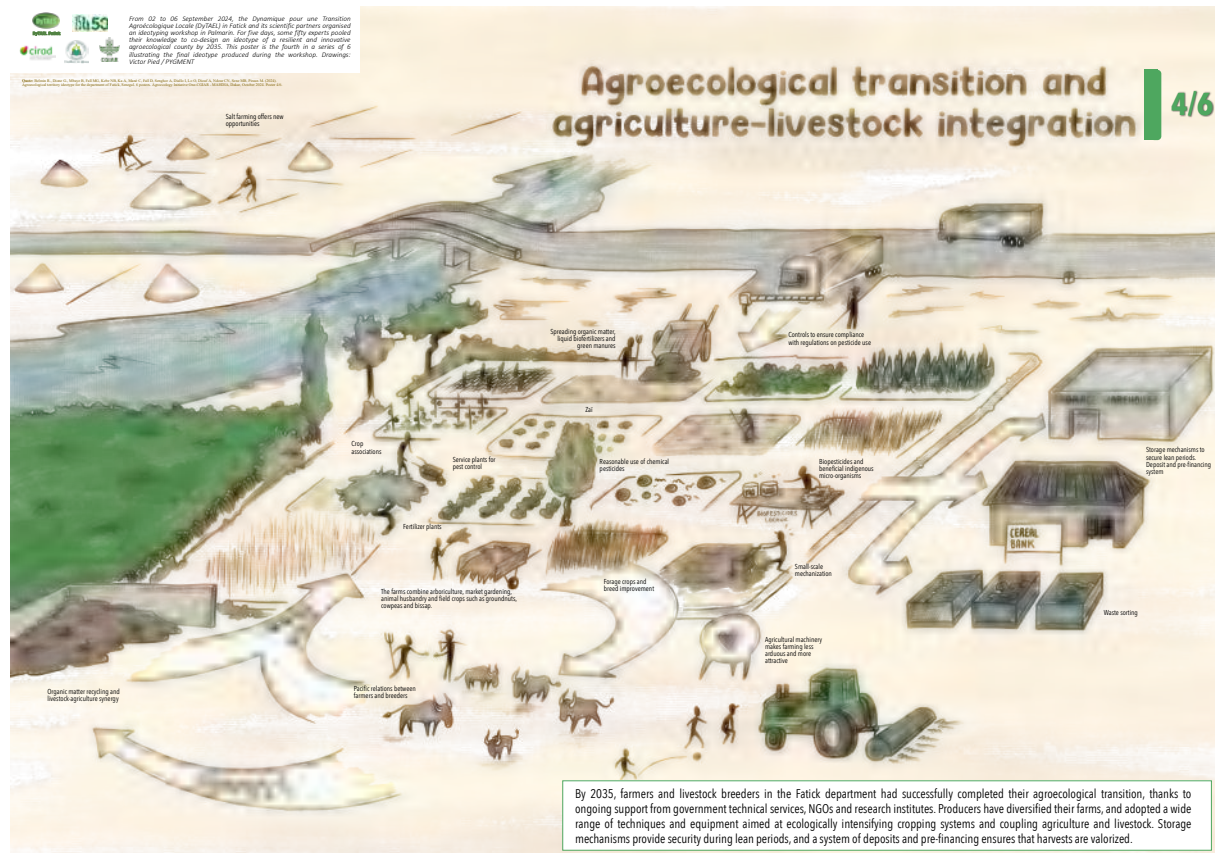


Figure 2 : Example of problem tree resulting from an ideotyping workshop (Belmin et al. 2024a).

Innovation avenues	Option 1	Option 2	Option 3	Option 4	Option 5
V1 Organic inputs (continued)	Organic matter collection	Spreading organic matter	Raising awareness of organic matter	Organic matter fermentation	
V2 Agriculture livestock integration	Liquid fertilizers	Green manure	Compost	Beneficial indigenous micro-organisms (BIM)	
V3 Reasonable use of pesticides	Parking controls	Agriculture livestock rotation (perennial)	Farmer broader relations	Farm-livestock relation (dms)	
V4 Cropping control	Responsible training	Service plants	Pesticides awareness	Pesticides awareness	
V5 Groundwater management	Stone strips	Watered shrubs	Herbaceous waterways	Crop residues	
V6 Pollution agent advancing self	Water quality	Water quality	Water transfer network	Fertilization agent utilization	
V7 Super view of soil mining	Anti-soil dyes	Reforestation of self-affected areas	Perennial shrubs and phytosystem	Self-mining awareness	
V8 Ecological intensification of livestock farming	Storage warehouses	Self-trails	Animal health	Animal health	
V9 Ecological intensification of agriculture	Parking	Forage crops	Agro-ecological techniques	Forage crops	
V10 Reforestation	Participatory innovation	Support and advice	Defending	Participatory shares	Alternating benefits
V11 Reforestation (continued)	Shrublands	Conventional and native reforestation	Defending	Choice of tree species	Reforestation by soil type
V12 Associated natural regeneration (ANR)	Fertile trees	Monitoring young trees	Risk Committee	ANR training	
V13 Good management of forest resources	Identification young trees	Forest awareness	Subsiding forests	Forest resource management	Application of the forestry code
V14 Training in timber and non-timber operations	Grilling advocacy	Training in good cutting practices	Early fire	Integrating trees into building permits	
V15 Biofuel control	Isolation of forests	Biofuel awareness	Integrating trees into building permits	Anti-soil reforestation	
V16 Creating green belts and villages	Raising awareness of green cities	A plan for green cities	Integrating trees into building permits	Use of crop residues	
V17 Combating soil salinization	Anti-soil dyes	Maritime reforestation	Anti-soil reforestation	Green jobs	Promotion of forage crops
V18 Compliance with laws and regulations	Bar on marine sand mining	Rigorous application of laws	Forage implementation techniques		
V19 Forage crops	Forage plant identification	Forage species			
V20 Forage crops (continued)	Crop associations and forages	Forage processing units			
V21 Promoting renewable energies	Biogas development	Village wind-energy production	Improved feedstocks		
V22 Upgrading forest management plans	Forest code awareness	Land use information	Defending		
V23 Setting up FSC	FSC advocacy	Quintessence	Defending		
V24 Forest resource management plan	Local forestry agreements	Forest innovation platforms	Forest management committees		
V25 Local land use and development agreements	Local agreements	Awareness and information meetings	Land zoning	Definition of conversion rules	Adoption of the agreement
V26 Agronomy training courses	Information and awareness raising meetings	Training offers	Training partnership agreements	Agronomy training guidelines	Leaver training
V27 Access to land	Raising awareness of access to land	Deliberate gathering of issues and solutions	Land development	Analysis crops	
V28 Diversification of income-generating agricultural activities	Arboriculture	Vegetable growing	Administration training	Seed installation	
V29 Efficient water management system	Inclusive water management	Water management training	Target beneficiaries	Skills transfer	
V30 Reconciliation of animal agri-food practices	Grove restoration	Restoring conventional and village woods	Substitution of structures	Water reclamation	
V31 Raising awareness of cultural identity among younger generations	Directors of essential practices	Selection of essential practices	Dissemination plants		
V32 Rationalization and modernization of hydraulic infrastructures	Identification of structures	Strengthening management capabilities			
V33 Extension and modernization of hydraulic networks	Drinking water supply	Extension of water networks			
V34 Self-reliance	Self-reliance	Agroecological surveys	Capitalization		
V35 Applying water-saving practices	Economical farming practices	Consensus in water prices			
V36 Productive water price reduction policy	Water pricing consultation framework	Technical and material support			
V37 Promoting family farming	Training household heads	Farmer's seed banks			
V38 Promoting farmers' seeds	Training in seed bank construction	Delayed and pre-financing			
V39 Securing loan periods	Welding storage	Administrative and financial management training			
V40 Training and follow-up	Transformation training	Banking partnerships			
V41 Setting up an inter-profession	Value co-creation prospecting	Setting up an inter-profession			
V42 Technical and financial partnerships	Micro-partnerships	Banking partnerships			
V43 Development of a social economy	Strengthening self-managed cooperatives	Voluntary contribution in kind and/or in cash			
V44 Diversification of financing mechanisms	Partnerships for financing	Self-financing mechanisms			
V45 Creation/strengthening of processor cooperatives	Awareness and leadership	Grouping/Union of transformation players			
V46 Agreement with processors	Search for reliable partners	Sample presentation and analysis			
V47 Innovative marketing and distribution strategies	Market research	Market research			
V48 Creating market niches	Niche market partnership agreements	Niche market partnership agreements			
V49 Opening up	Open-up partnership agreement	Trade construction			
V50 Attractiveness of the agricultural sector	Attractiveness partnership agreements	Attractiveness partnership agreements			
V51 Labeling of processed products	Union by sector	Inter-professional Union			
V52 Promoting local consumption	Inter-professional Union	Inter-professional Union that signs agreements			
V53 A plan to increase subsidies for organic materials	Institutional support by DytMEL	Identification of production players			
V54 Agronomy in Community Development Plans (CDPs)	FSC awareness	Financial mobilization capabilities			
V55 Transfer of agricultural powers to local authorities	Legal advocacy	A plan for the transfer of resources			
V56 Raising awareness of agroecology	Farm and school fields	Raising awareness of agroecology through community media			
V57 Co-designing agro-ecological projects with local authorities	Harmonizing actions	Mapping the players			
V58 Agronomy in public sector policies	Strengthening advocacy	Creation of communal entities			
V59 Training players in agro-ecological practices	Agronomy training courses	Training courses in partnership with USSEIN			
V60 Building a farmers' seed industry	Community guarantee in the communes	Collaboration with agricultural research institutions			
V61 Promotion and enhancement of agroecological products	Market for agroecological products	Tax exemption for agroecological products			
V62 Sustainable Land Management (SLM) programs	Training in Sustainable Land Management techniques	Provision of work equipment for producers			
V63 Territorial marketing strategy	National and international trade fairs	Digital platform dedicated to agroecological products			
V64 Promotion of Products of Terrestrial Interest (PTI)	Capacity building for processors	Beneficial storage and preservation facilities			
V65 Education in eco-responsible behavior	Advocating agroecology in sectoral programs	Revitalizing school environmental clubs			
V66 Education in eco-responsible behavior (continued)	Agronomy Awards				

**Figure 3 : Example of innovation box resulting from an ideotyping workshop (Belmin et al. 2024a).**



**Figure 4 :** Example of synthetic drawing produced at the conclusion of an ideotyping workshop (Belmin et al. 2024a).

## Discussion

Based on these initial experiences, we can affirm that ideotyping represents an innovative approach to exploring radical, systemic changes in the social, economic and material structures involved in agroecological transitions. Unlike other approaches that have been tested in the past, ideotyping stands out in several ways: (i) it allows for the combination of numerous agronomic innovations to build integrated, context-specific production systems; (ii) it allows for the simultaneous design of both agronomic and institutional conditions for change, enabling the identification of unlocking pathways. The method makes it possible to rethink agricultural systems in their entirety, by articulating innovations relating to agriculture, value chains, territories and public policies. This approach thus helps to operationalize the "coupled innovations" approach proposed by French agronomists (Meynard et al. 2017) to build sociotechnical niches that bring about radical change.

Secondly, ideotyping seems to be a useful way of initiating co-design and/or support the agroecological transition. In this respect, the ideotypes designed in the workshop can play different roles in a design process:

- **Ideotype as a vision of the future:** in workshops on food systems and territories, the ideotype has been interpreted as a vision of a future to be achieved, guiding strategic planning activities for multi-stakeholder platforms active in advocacy and territorial governance.



- **Ideotype as an agronomic model:** in other cases, the ideotype has been interpreted as a theoretical model of a farming system, and has thus served as a reference point to guide in situ experimentation as part of a step-by-step design process. The design process progressed in successive iterations, with a gradual convergence between ideotypes and prototypes.
- **Ideotype as an idea box:** In other cases, ideotypes have been used in a more flexible way, serving as a resource to identify specific actions, or change strategies limited to a sub-system.

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