



Recommendations for overcoming barriers to crop diversification towards sustainable agriculture

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- The diversification of cropping systems is still limited due to barriers occurring at the farm level, along value chains as well as in the coordination between actors.
- Different barriers affect niche and mainstream value chains.
- Future policies should address barriers using a systems approach and should differentiate between innovations in niche and mainstream value chains.
- Barriers can be addressed by monitoring the uptake of crop diversification, reallocating public and private resources towards agroecological practices and value chains based on minor crops, providing financial support to actor networks to mitigate innovation risks, and communication campaigns to promote minor crops.

Introduction

Crop diversification is recognised as a central strategy to improve productivity, delivery of ecosystem services and resilience of cropping systems [1]. It can be achieved by including more crops in existing rotations or cultivating several crops together in a field. Ecosystem services provided by crop diversification include the conservation of biodiversity, preservation of water quality, pesticide-free pest and disease control, improved soil quality, and climate change mitigation [2-5]. Crop diversification can thus be considered key to reaching the EU environmental sustainability targets.

Although multiple benefits of crop diversification have been proven, the development of diversified cropping systems is still limited due to several barriers in the agri-food system. Conventional crop rotations typically last only 3 to 5 years [6], which indicates that a limited number of crops are being cultivated. At the EU level, 70% of the annual agricultural cropping area is cultivated with only eight species¹.

In this context, a detailed analysis of barriers to crop diversification was undertaken by the DiverIMPACTS project. The analysis aimed to highlight the factors limiting the development of more diversified cropping systems and identify enablers to facilitate the shift to more sustainable food systems. To be effective, these enablers have to be rolled out using a systems approach [8], which takes into consideration all stages and actors in the value chains as well as the interactions between them.

¹ The eight species are: Common wheat and spelt, barley, grain maize, rape and turnip rape seeds, sunflower seeds, and green maize. The annual cropping agricultural area was 85 744 ha, 82% of the EU-28 arable land [7].

Approach: Detailed analysis of the barriers to crop diversification

A detailed analysis of barriers to crop diversification was undertaken based on a scientific literature review, participatory workshops and interviews with the 25 DiverIMPACTS case studies² across Europe [9]. Based on the literature review, a preliminary framework was developed to identify the barriers to crop diversification. Participatory workshops were then carried out with the DiverIMPACTS case study teams. They aimed to investigate the barriers that could limit or impede the diversification process, and the causes behind the difficulties faced in each context. During a second-round of interviews, case study innovation teams were asked to deepen the description of barriers to diversification at different levels of value chains. Finally, a qualitative analysis of this material was undertaken using thematic coding and matrix tools.

The general aim of this approach was to build categories on the basis of an iterative cross-analysis of interview contents from the multiple cases. In total, two rounds of interviews were conducted with the innovation teams and a qualitative analysis of the discussions was made to identify the barriers (see Morel et al., 2020 [9] for further methodological aspects).

Results: barriers to crop diversification are interrelated and context dependent

Barriers to crop diversification exist at all stages of value chains

46 barriers to crop diversification were identified from farm to fork. Key actors and examples of the barriers are provided below.

Stages of the agri-food system	Main actors	# of barriers	Examples of barriers
Farm	Farmers, Advisors, Input suppliers	20	<ul style="list-style-type: none">➤ Lack of technical and economic knowledge or references regarding crop diversification;➤ Machinery innovations are needed for new field activities;➤ Cultural barriers and divergence from previous farming practices;➤ New practices require investment (time & funding).
From harvest to retail	Intermediaries, Food processing companies	12	<ul style="list-style-type: none">➤ Product volumes too limited to be profitably or easily collected;➤ Equipment for processing the new crops require innovation & investment;➤ Uncertainties, risks and variability of processing new crops/products hinder willingness to invest in new value chains.
Market	Retailers, Consumers	4	<ul style="list-style-type: none">➤ No pre-existing market for new crops/products;➤ Poor competitiveness with imported products.
Across value chains	All	10	<ul style="list-style-type: none">➤ Need for new contract designs to address variability of production in the first years of innovation;➤ Lack of coordination between actors developing new value chains.

² More information on the DiverIMPACTS case studies is available on the DiverIMPACTS project website at <https://www.diverimpacts.net/case-studies.html>.

Barriers to crop diversification are interrelated

- Horizontally: e.g., at the farm level, the lack of access to innovative technical knowledge, the lack of resources and cultural/cognitive barriers may reinforce each other and impact the farmers' ability to undertake crop diversification.
- Vertically: e.g., in the value chains, the high variability of yields and quality of new crops at the farm level make investments in processing risky, and vice versa: the lack of reliable opportunities for processing crops and marketing innovative products discourage farmers from investing in crop diversification. Lack of coordination between actors also increases the difficulty of setting up new value chains and marketing opportunities.

Three innovation settings for accelerating crop diversification

The 25 Case Studies and the crop diversification literature show that crop diversification can be developed in various innovation settings (figure 1):

- Mainstream value chains: Crop diversification undertaken by conventional farmers, selling to commodity markets. For example: large scale pea production as a temporal diversification, to be sold for processed feed value chains.
- Niche value chains: Crop diversification strategies typically undertaken by organic farmers, with marketing in local markets. For example: small-scale organic production of hemp, to be processed on-farm and sold directly to high-end restaurants.
- Farmer innovation networks: Crop diversification strategies leading to arrangements between farmers without directly challenging the vertical organisation of value chains. For example: diversification crops produced by arable farmers are used by livestock farmers for grazing at the local level.

The research done in the context of DiverIMPACTS shows that barriers apply differently depending on the socio-economic context of farms and value chains [9]. Thus, specific support should be designed to effectively address barriers in these three innovation settings.

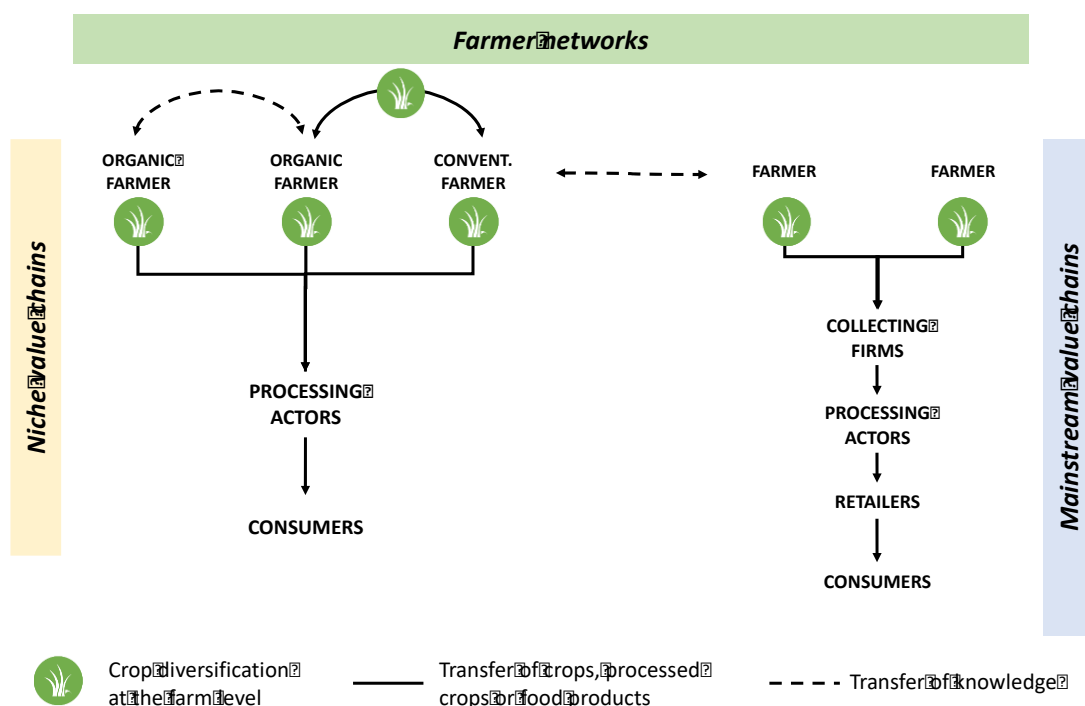


Figure 1: The three innovation settings for developing crop diversification. Crop diversification can occur in: (a) niche value chains; (b) mainstream value chains; and (c) farmers' networks of innovation. Examples of these innovation settings are provided in the text above. (Adapted from Morel et al 2020).

Recommendations for policy makers to foster crop diversification

- › **Monitor the development of crop diversification at regional, national and EU levels.**
 - Better monitoring at the regional, national and EU level would highlight progress, challenges and opportunities and enable proper support policies and advisory strategies to be designed.
 - Crop diversification data is still scarce; no statistics are available at the EU level;
 - Specific indicators could be included in Eurostat or FADN datasets.
- › **Adapt the CAP Policy to support innovative agroecological practices.**
 - Proper support for diversification would accelerate the uptake, thus increasing the environmental benefits and facilitating economies of scale in new value chains;
 - The CAP should be adapted to account for the specificities of crop diversification, e.g., updating the CAP information system to allow farmers to report more complex crop patterns;
 - Subsidy rules should be clarified for farmers willing to cooperate at the territorial level (e.g. land exchange, direct sale of crops between farmers).
- › **Reallocate public and private R&D resources towards minor and diversification crops.**
 - Innovative knowledge, techniques and technologies need to be further developed in order to implement new practices and value chains; in particular:
 - Further R&D is needed on breeding and farming practices³, as well as to assess the impact of the new practices and support technological and organisational innovations at the value chain level⁴.
- › **Offer financial mechanisms to mitigate or share the innovation & investment costs and risks during the first years of innovation.**
 - The implementation of new practices and value chains requires investment (time & funding);
 - The innovation and investment costs and risks are linked both to acquiring new knowledge or techniques, and to innovative equipment required for farming, post-harvest and processing operations;
 - Example of relevant financial mechanisms include subsidies, incentives and private funds.
- › **Support cooperation among actors in undertaking crop diversification or developing innovations.**
 - While competition tends to make actors work separately, networks of actors can support each other both horizontally and vertically (Morel et al, 2020):
 - Farmers groups (peer-to-peer) can facilitate access to machinery and knowledge about new practices; they can ease value chain negotiations and decrease power asymmetries;
 - Networks of processing actors enable sharing of innovations regarding equipment and processing techniques in order to address challenges like reducing impurities from intercropping;
 - Networks of actors along the value chains can foster equipment co-innovation to add value to the new crops in a sustainable and fair way;
 - Increased public procurement of protein crops at scale would promote crop diversification.
- › **Undertake wide communication campaigns promoting the advantages of minor crops and the consumption of related products.**
 - The awareness of the benefits of minor crops and legume crops is still limited; greater awareness by end-users and intermediaries will increase demand;
 - Communication should be directed to consumers as well as to agro-food industry and catering actors.

In addition to the general recommendations, special attention should be paid to the specificities of the different innovation settings (farmer innovation networks, niche and mainstream value chains) when applying the recommendations.

³ Examples of R&D aspects to be further developed include: specific breeding criteria to address the needs of intercropping and develop minor crops; techniques and technologies for strip cropping and intercropping; tools to assess the benefits of longer rotations in conventional farming; and management tools to support farmers' decision making.

⁴ Examples of technological and organisational innovations needed at the value chain level include: post-harvest management and processing technologies for mixed crops or new crops; new contracts, logistics and organisational modes adapted to crop diversification innovation settings; collection and analysis of value chain success factors.

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This policy brief was elaborated in the DiverIMPACTS project and will be further elaborated in a series of dedicated policy briefs. The project is running from June 2017 to May 2022. The goal of DiverIMPACTS - Diversification through Rotation, Intercropping, Multiple Cropping, Promoted with Actors and value-Chains towards Sustainability - is to achieve the full potential of diversification of cropping systems for improved productivity, delivery of ecosystem services and resource-efficient and sustainable value chains.

