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Enhancing on-farm diversity: drivers and constraints. A review.

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Enhancing and maintaining on-farm diversity represent a potential strategy to improve farming systems sustainability, by reducing the pressure on the natural environment, alleviating farmers' risks and vulnerabilities, and increasing farms resilience. However, farms are complex systems and on-farm diversification, intended as the production of multiple crop, trees and/or livestock species, is not a panacea and it is driven or constrained by different factors and dynamics that vary across environmental, socio-economic and political contexts.

We argue that identifying indicators that reflect these drivers, constraints and contexts at farm scale is crucial to create favourable conditions for the farmers to increase on-farm diversity where doing so is likely to be beneficial. Therefore, the aim of this paper is to identify and clarify some of the patterns behind the process that lead farmers to adopt farm diversification strategies in order to understand where investments and interventions to support diversification are likely to be appropriate and effective, and how they should be targeted.

In this review, we analysed 97 articles, selected from the screening of 2,312 articles retrieved from Web of Science and Scopus, and published in English in peer-reviewed journals since 2010. Our selection criteria required that the articles focused on the analysis of drivers and constraints of agricultural diversification, intended as crops and/or livestock systems, agrobiodiversity and agroforestry systems, at farm and household scale.

From the selected studies, we identified and extracted a total of 239 different variables that were statistically assessed as potential drivers and constraints of farm diversity at farm scale. For each of the variables we counted the times they resulted as positive, negative and statistically significant, or not statistically significant. To present and discuss the results, we followed the Sustainable Rural Livelihood Framework, classifying the extracted variables as external (agroecological context, the political and institutional context, and exposure to environmental and market risks and shocks) and internal factors (human, economic/financial, socio-cultural and physical capitals), or other livelihood options (i.e. off-farm income).

Our findings show that the decision to maintain or increase on-farm diversification is a common strategy to cope with environmental and market risks, but that it is often alternative and negatively correlated to the adoption of off-farm livelihood. Overall, the drivers and constraints of

diversification were highly context-dependent and contingent. For some relevant variables, such as farm size, household head's age, rainfall level and education, we also found some evidence of the presence of non-linear (e.g. inverted-U) relationships.

These results enforce the hypothesis of the complexity of land uses decision and the importance of understanding farms' and farmers' characteristics, and their local and wider context when it comes to design policies and research projects for sustainable rural development.