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Wageningen Economic Research | Supporting paper 4

Transforming Food Systems

Food system performance under different conditions of structural and rural change

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Preface

The UN Food Systems Summit UNFSS and the many dialogues and extensive research preceding it create the momentum to re-define and re-think our food systems. Acknowledging that many trade-offs in current food systems are structural and leading to unacceptable outcomes, and that many global goals as reflected in the SDGs will not be met, implies our food systems need profound transformations. This can only be achieved when we understand how our systems evolve, interact and can be steered towards more desirable outcomes.
During 2019 and 2020 Wageningen University & Research (WUR) coordinated and implemented background research that informed IFAD's 2021 Rural Development Report. In addition to 23 background papers, a modelling paper and a regional consultation report, five supporting papers were prepared. These are published as standalone papers: 'Transforming Food Systems supporting paper 1, 2, 3 and 4.' The papers were written from the perspective of an overall report and refer to concepts, examples and recommendations in the final RDR report.

- Key messages: these are the key findings, possibilities and priorities Wageningen University & Research sees coming out of all the background research, reports and papers.
- Supporting paper 1 provides more extensive explanation of the need for food systems transformation, in particular due to structural undesirable trade-offs between nutrition, livelihoods and environment. It places possible responses in the context of the need to focus on rural transformation broadly, beyond a focus on primary agricultural production.
- Supporting paper 2 provides greater detail on the governance necessary to drive urgent and accountable implementation of food system agendas.
- Supporting paper 3 provides more detail on possible pathways to food systems transformation in different contexts, which consider integrated, desired outcomes of health, inclusion and sustainability.
- Supporting paper 4 provides an overview of how four categories of food systems perform against key system indicators.

The research and papers are the result of a fruitful collaboration between Wageningen and IFAD. The main objective was to generate and share insights, peer-reviewed information and robust evidence on impacts of different strategies to support improvements in the performance of agri-food systems in the dimensions of safe and healthy nutrition, inclusiveness, sustainability/resilience and efficiency. All background work thus contributes to insight into the impact of different types of innovations and investments on multiple food system dimensions and for specific target groups (children, women, young people).

A special thanks goes to Romina Cavatassi and Leslie Lipper from IFAD for their intellectual contribution to and strict but indispensable and professional process guidance during the analytical and writing steps.

We are very grateful to IFAD for the grant that made the background research and these publication possible

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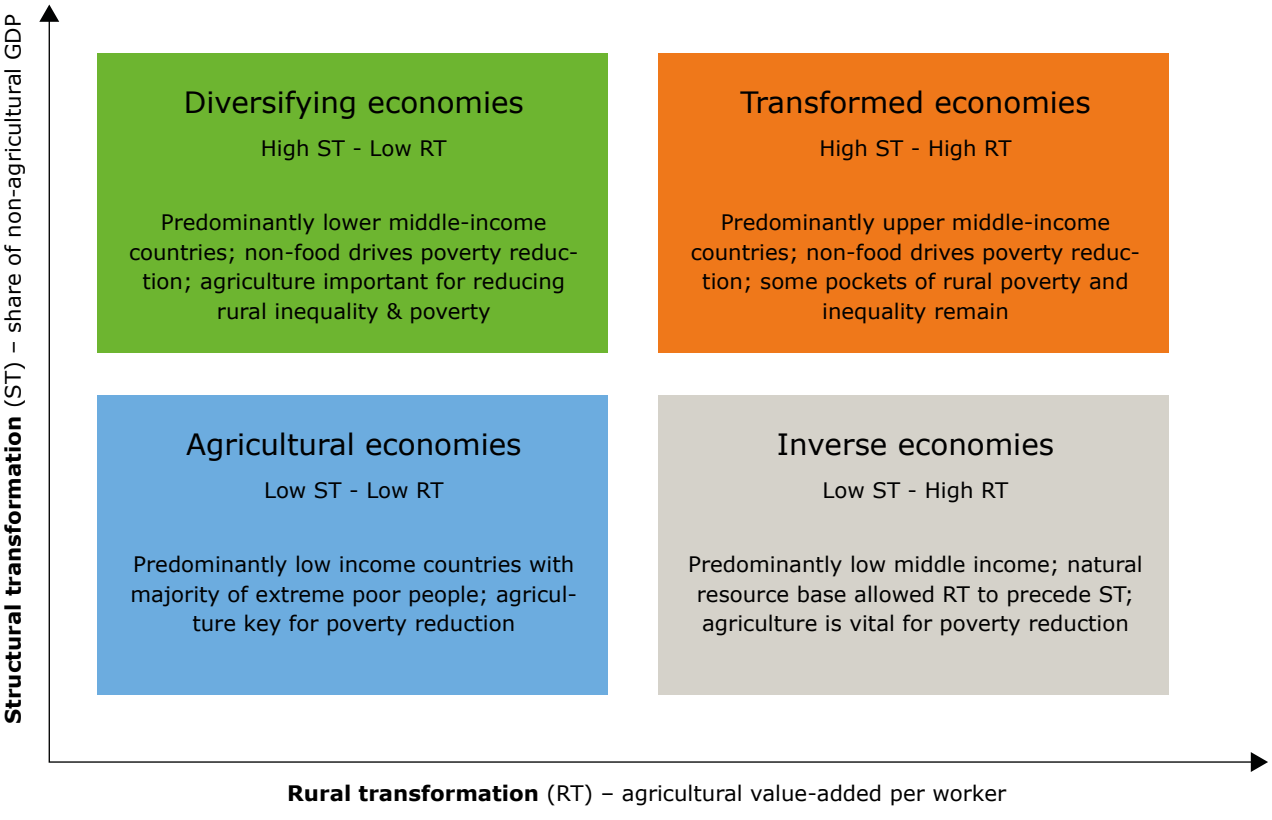
Introduction

Opportunities for food system transformation largely depend on two processes. One is the process of **rural transformation** (RT) focussing on exploiting potential agricultural productivity (by reducing yield gaps and improving labour productivity). The other is the process of **structural transformation** (ST), comprising shifts in labour use from agriculture to non-farm employment in trade, processing, manufacturing and service sectors.
Both transformations imply changes in farm size, on land use patterns and cropping systems and adjustments in input, output and labour markets.
Both transformations imply effects on food production, consumption and trade that afford diverse opportunities and potential pathways to food system transformations for low and middle income countries. The levels of rural and structural transformation also determine the trade-offs that appear among desirable food system outcomes for nutrition, livelihoods and the environment. Various types of food systems face specific challenges for guaranteeing healthy, sustainable and affordable diets.
In this paper we identify different country types according to their degree of rural and structural transformation, and we discuss their comparative performance on key food systems indicators (Fanzo et al., 2020). This paves the way for defining some initial hypothesis on the potential linkages between economic and rural development with food system transformation processes.

Approach

We use the agricultural value added per worker as key variable for rural transformation (with the median value of US$ 3,838/worker as cut-off point) and the share of non-agricultural value added in GDP as key variable for structural transformation (using 80% as cut-off points)
This enables an international comparisons of food systems dividing developing countries in four categories (Figure 1):

We used the country data from the food systems dashboard (https://foodsystemsdashboard.org/) and selected the variables of interest from the indicator definition in the metadata of the Dashboard (see: FSD_Indicator_Metadata_M03_21). We report mean values and standard deviation of these variables.
Based on the distribution of low- and middle income countries alongside the segments of rural and structural



economic transformation, we identified four different food system types (Kuiper et al, 2021):

1 Agricultural economies: countries with low level of ST and low level of RT (N=24), primarily agricultural economies with low level f urbanisation and high degree of rural poverty;
2 Inverse economies: countries with low level of ST and a high level of RT (N = 11), countries involved in rural transformation that still depend largely on agricultural activities;
3 Diversifying economies: countries with a high level of ST and a low level RT (N = 11), countries that are developing non-agricultural activities but still depend on cheap rural labour;
4 Transformed economies: countries with a high level of ST and a high level of RT (N = 25), countries that adjusted their economic structure and reach higher returns from agriculture.

Framework

Food system transformations follow various pathways anchored in specific constellations of food supply and demand, food value chains and markets and food system governance. Depending on the rhythm of rural and structural transformation, different types of food systems are likely to emerge that are characterised by their production, demand, availability, accessibility and affordability, by the food policy and business environment, and by their implications for nutrition, health, and livelihoods.

To identify structural and institutional differences and to outline spaces for food policy and governance, the High Level Panel of Experts on Food Security and Nutrition (HLPE, 2017) looks at key dimensions of food consumption, food production, processing and trade, and the governance of the food environment (Figure 2).

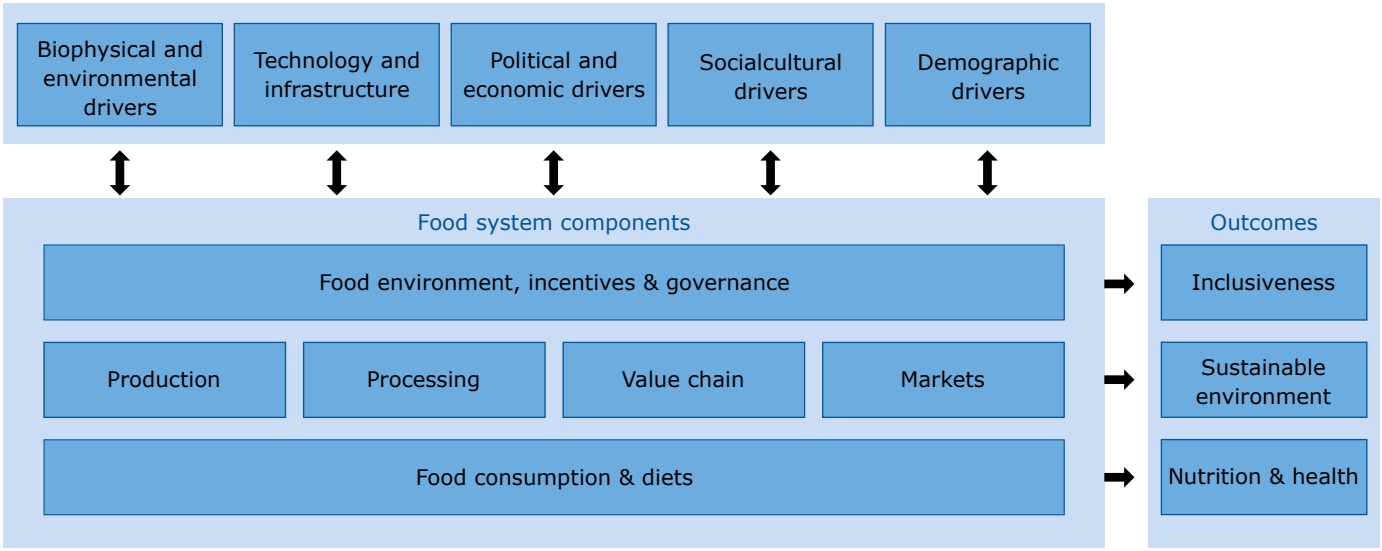


Figure 2 Key dimensions of food system framework

The final analysis includes 71 low- and middle-income countries with sufficient data availability that can be plotted against the RT/ST dimensions (see Figure 3 on next page). This also reveals that country performance on the newly developed Food System Index (van Berkum and Ruben, 2021) strongly associates food systems change with progress in structural and rural agrarian transformation, even while notable variation in food system status over different rural transformation levels persists.

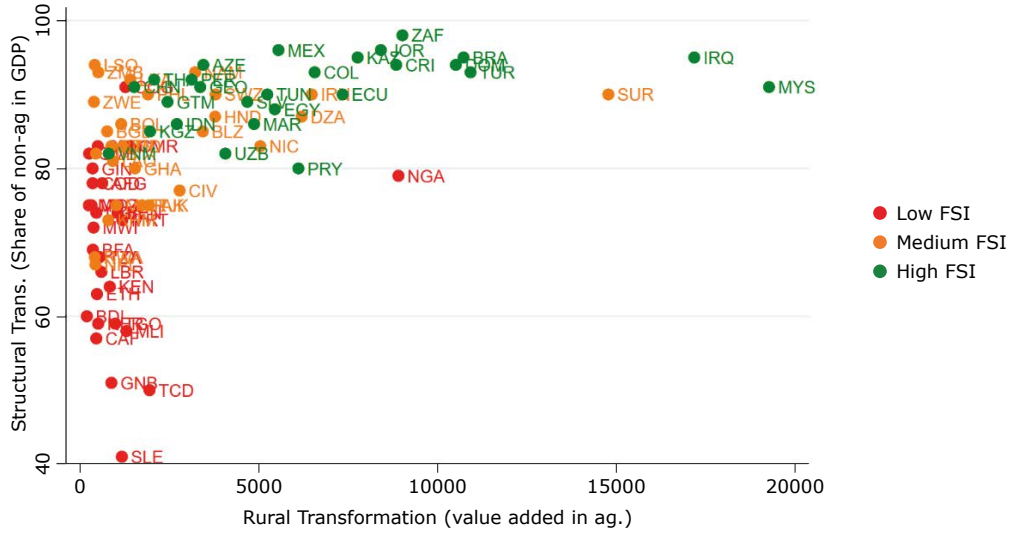
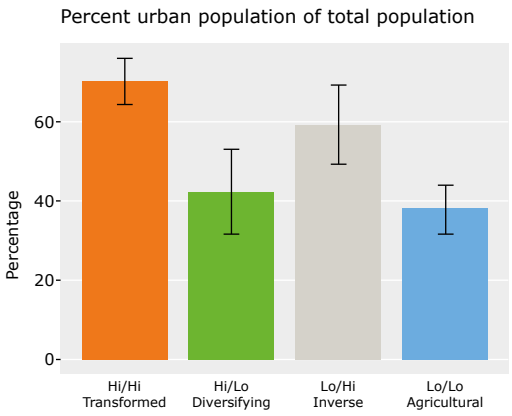
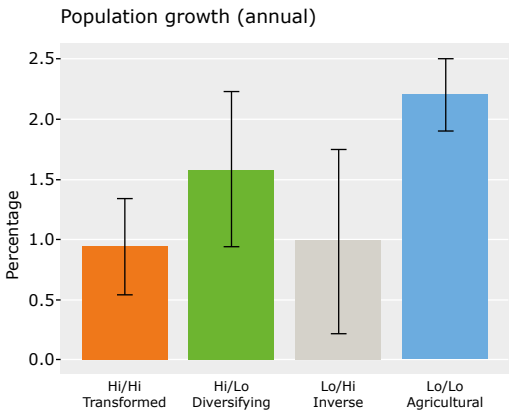


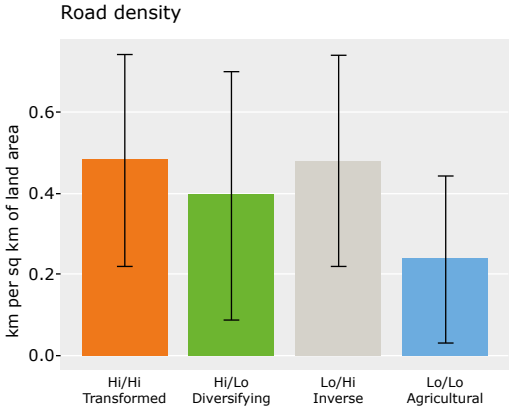
Figure 3: Countries according to their degree of rural & structural transformation

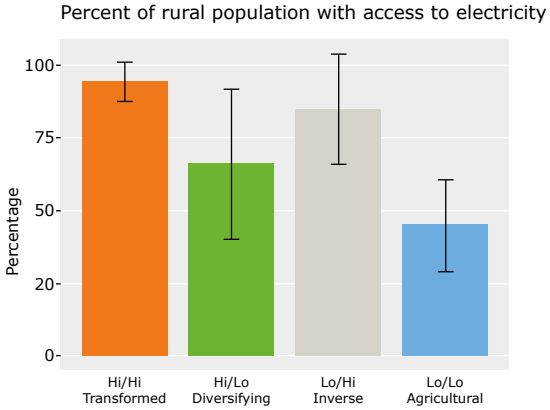
Countries that are more advanced in their structural transformation also exhibit a higher degree of food system transformation. At the same time, around half of highly structurally transformed economies (21 out of 47 countries) are still delayed in their food system development mainly due to resource constraints or policy deficiencies. Structural transformation is thus a necessary but not a sufficient condition to foster a highly performing food system. Finally, a third of the countries report both low levels of rural transformation and low structural transformation and are therefore facing major problems in their food system performance (Arslan et al., 2021).

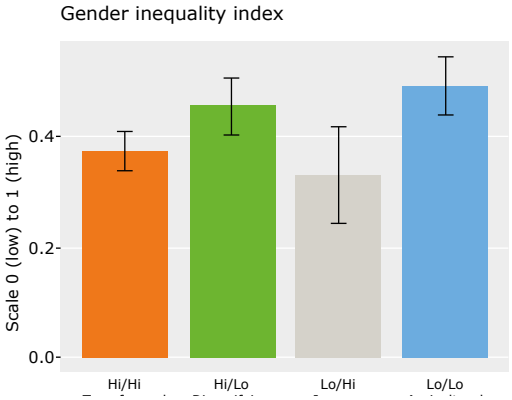
Food system drivers

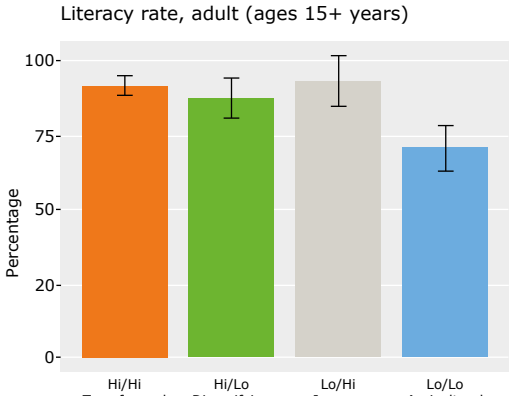








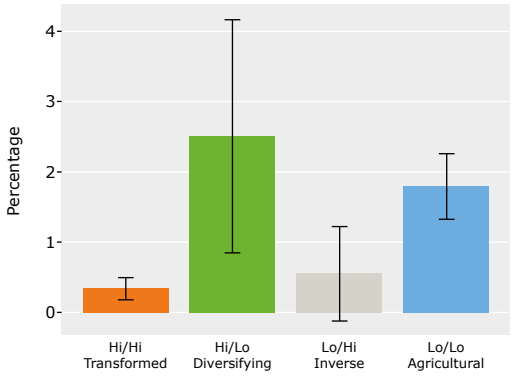




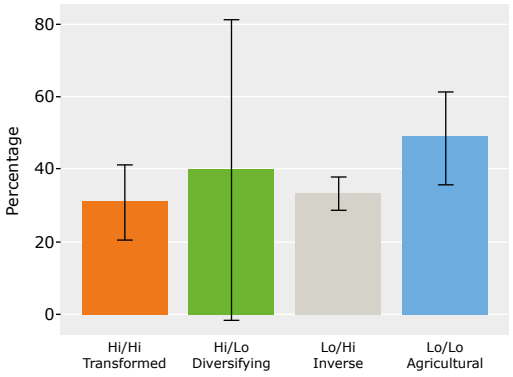
Structural drivers determine the opportunities for food system transformation. Transformed economies are substantially more urbanised, have better road density and more access to water and electricity services. On the other hand, agricultural economies face higher population growth and more gender inequality while experiencing substantially lower literacy rates that hinder progress in food systems change.

Nutrition, diets and health

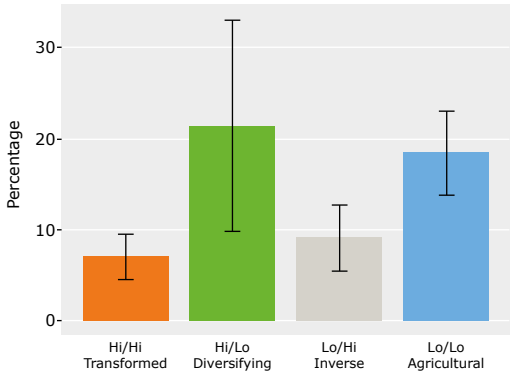
Waisting and stunting in children under 5 years



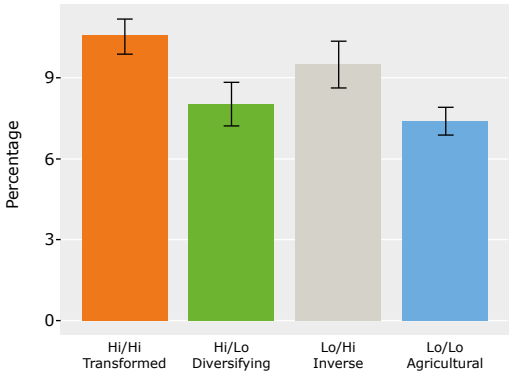
Prevalence of moderate or severe food insecurity



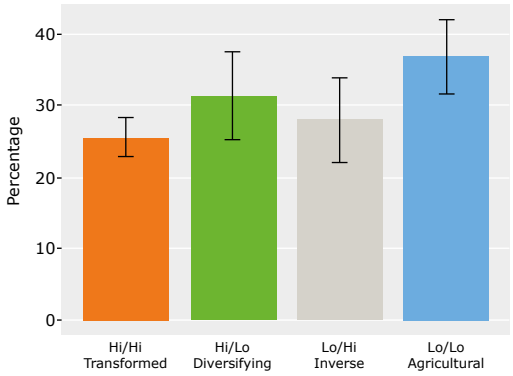
Prevalence of undernourichment



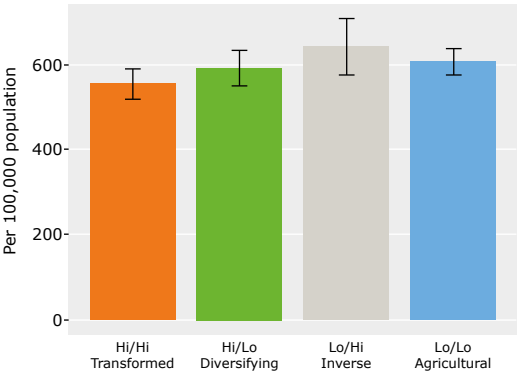
Adult diabetes prevalence



Anemia in women 15-49 years



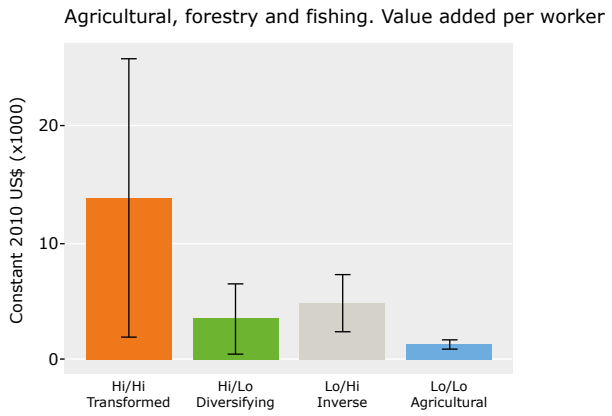
NCD mortality rate

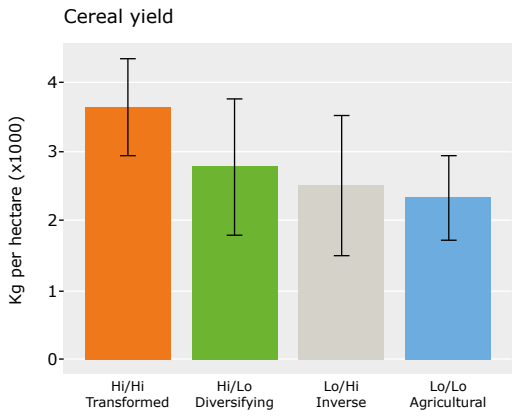


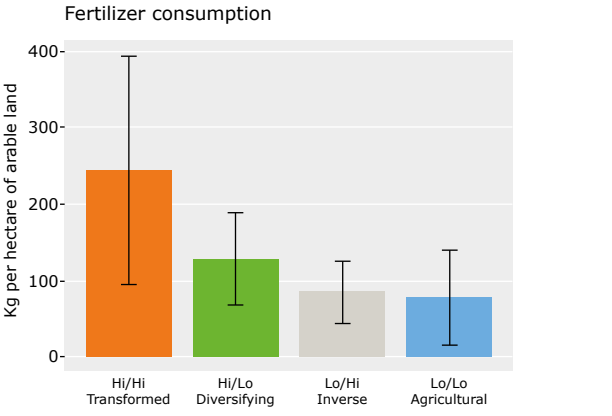
Major problems related to the functioning of food systems are related to the triple burden of malnutrition: undernourishment and underweight (leading to child wasting and stunting), micronutrient deficiencies and overweight/obesity. Inadequate diets cause major health problems related to become particularly visible in increasing rates of anemia and high NCD mortality rates. Most countries in their early stage of diversification face major problem with child stunting and wasting as well as adult overweight. More agriculture-based economies are generally poorer and face severe levels of food insecurity, but their rural activity base and informal exchange systems cushion to a certain extent the implications for undernourishment

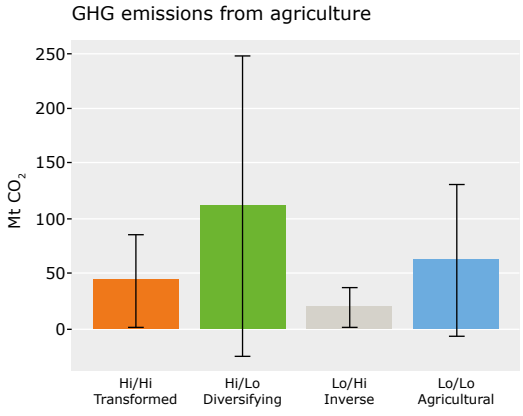
More transformed economies suffer from increasing rates of overweight and high incidence of diabetes. This marks the transition towards higher intake of processed foods and more out-of-home consumption.

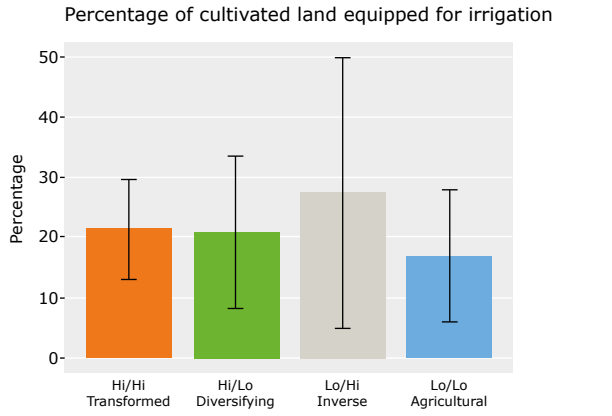
Food production

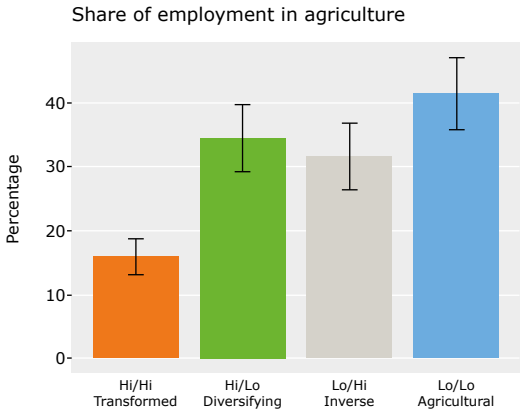








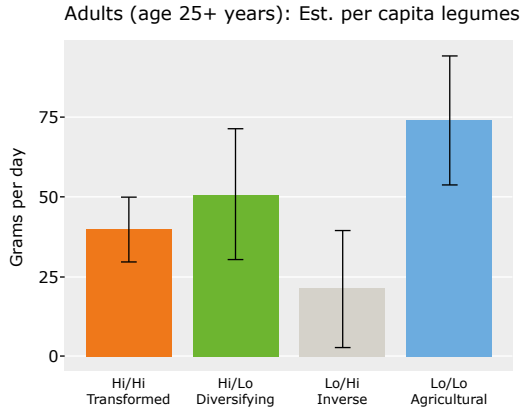


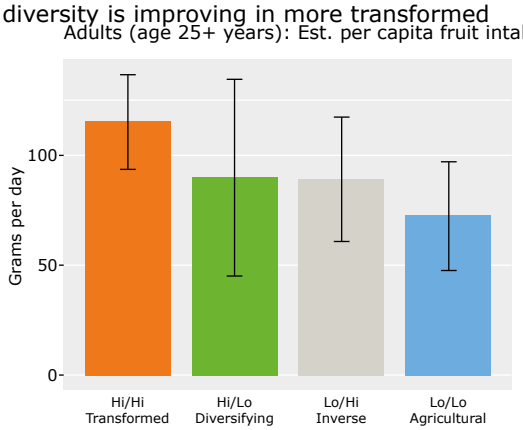


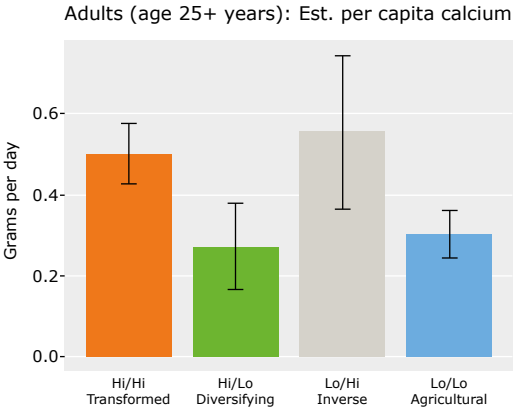
Food production in terms of cereal yields and agricultural added value per worker remains stagnant in many agricultural economies, mainly due to lower levels of intensification. Transformed economies are characterised by twice as much fertiliser use per unit of arable land, whereas the potential for irrigation is highest in the inverse type of economies that largely remain dependent on agriculture. Agricultural economies rely most on labour use, but the employment share in agriculture is rapidly declining in more transformed economies. Interestingly enough, GHG emissions are highest in diversifying economies that still rely more on horizontal growth, whereas transformed economies are better capable to invest in more input efficient and resource-saving production technologies.

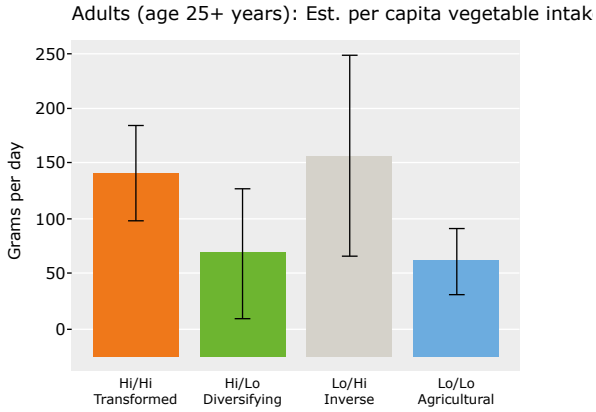
Food consumption

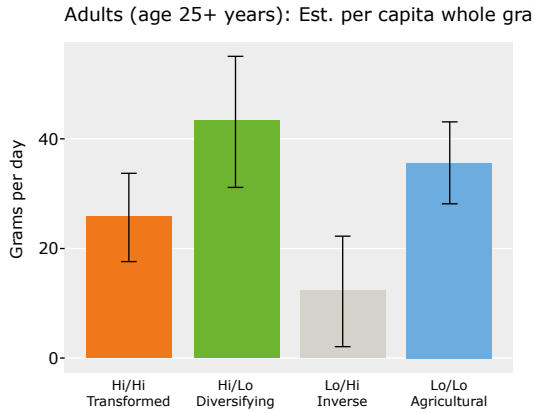
Dietary diversity is improving in more transformed

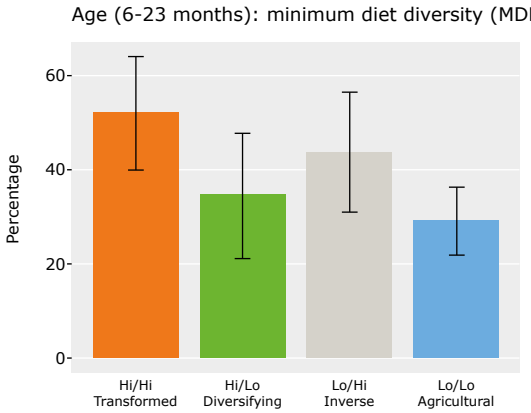










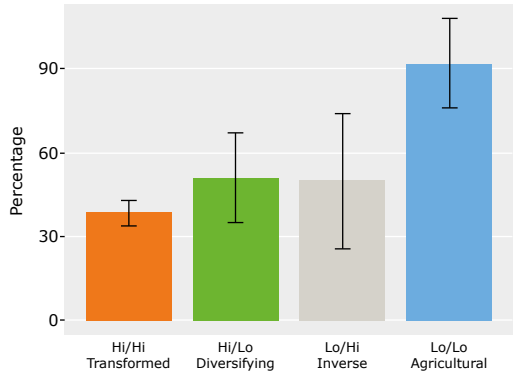


Consumers in low-income agricultural economies rely on diets that are characterised by a high intake of staple grains (maize, wheat, rice) and legumes that are produced locally. Otherwise, fruit and vegetables intake is growing most in transformed economies and slightly improve in middle-income countries that still remain dependent on agriculture.

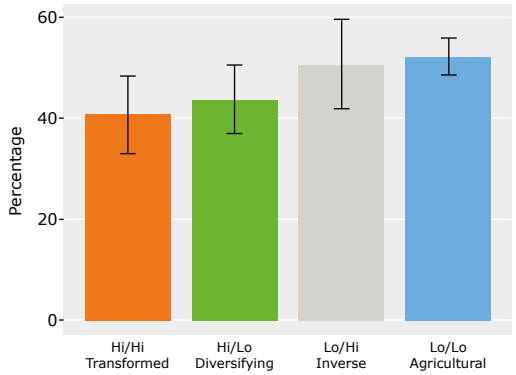
economies but is still below recommended MDD levels. Diversifying economies suffer from low dietary diversity during their initial stage of transformation. Comparative statistics on micronutrient deficiencies (responsible for 'hidden hunger') are notable scarce. In both agricultural and early diversifying economies, deficiencies in iron, zinc and calcium remain critical for guaranteeing nutrition.

Food trade & markets

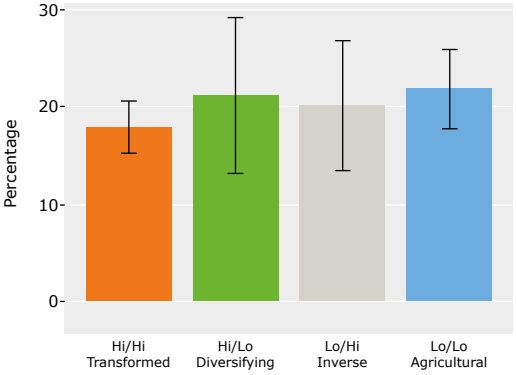
Cost of nutrient adequacy (CoNA)
as a percent of houshold food expenditure



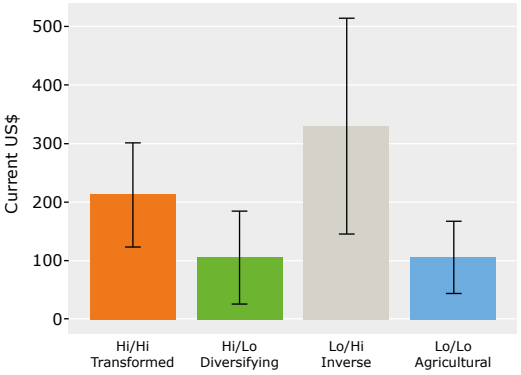
Proportion of household consumption
spent on food and beverages



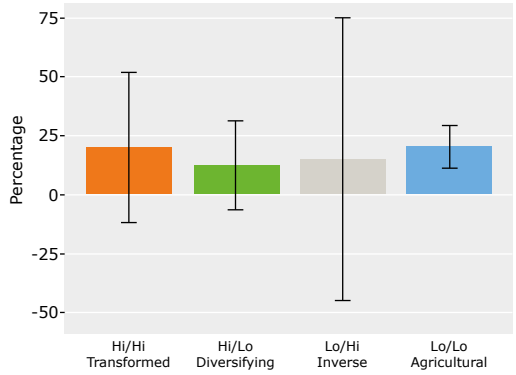
Proportion of houshold food and beverage consumption
spent on fruits and vegetables (all households)



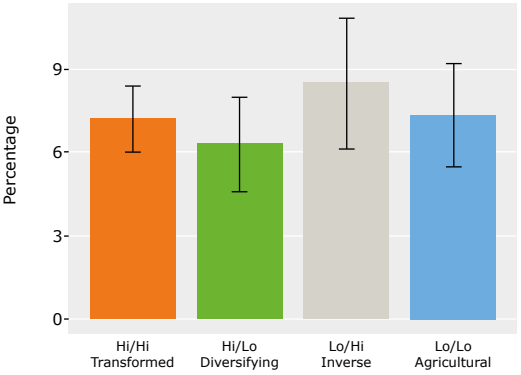
Personal remittances received per capita



Cereal import dependency ratio, 3 year average (cereal import
minus export as percentage of total domestic supply)



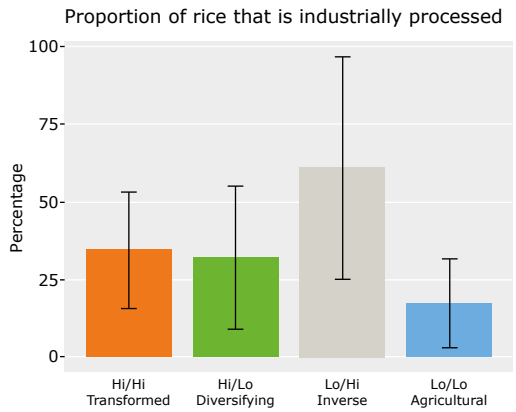
Trade as percentage of GDP

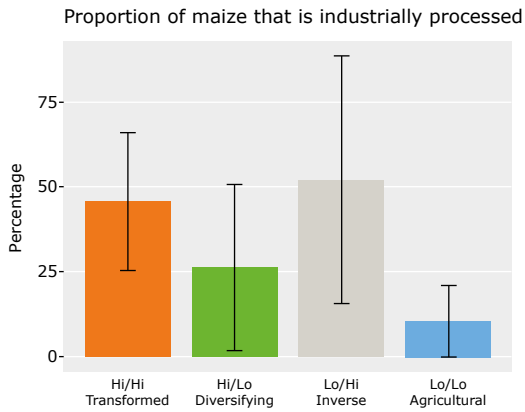


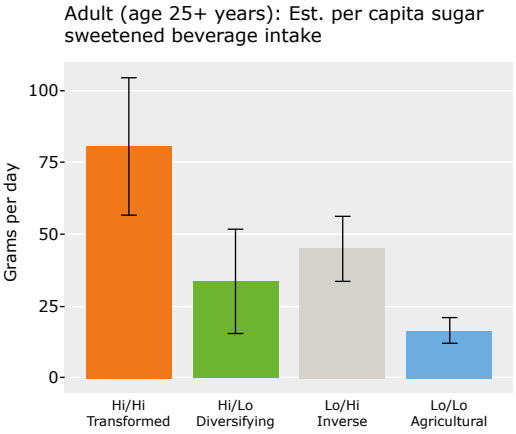
A large part of the food markets in agricultural and inverse economies maintain rather informal exchange mechanisms, based on relationships and trust. Poor households in agricultural economies spent a large share of their household income for purchasing basic food, and consequently the costs of nutrient adequacy are substantially higher. Minor differences in income shares devoted to fruit and vegetables are observed.

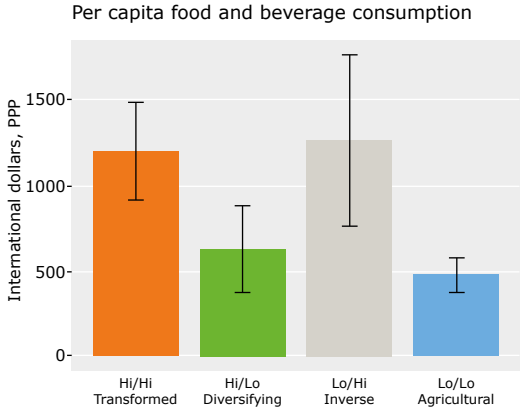
Food trade in agricultural economies is more local, supplemented with some cereal imports. In inverse and transformed economies international trade becomes more important, and import dependency increases. Households in inverse and transformed economies also receive higher amounts of remittances that may afford them access to more purchased food.

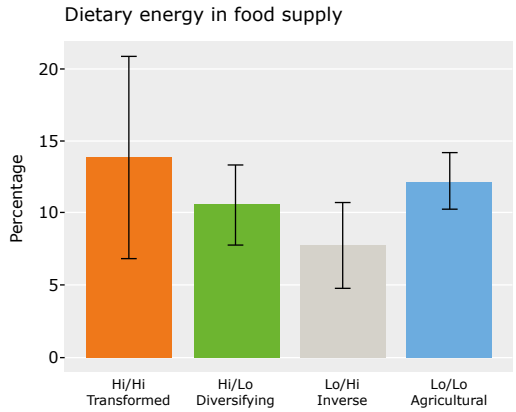
Processed foods

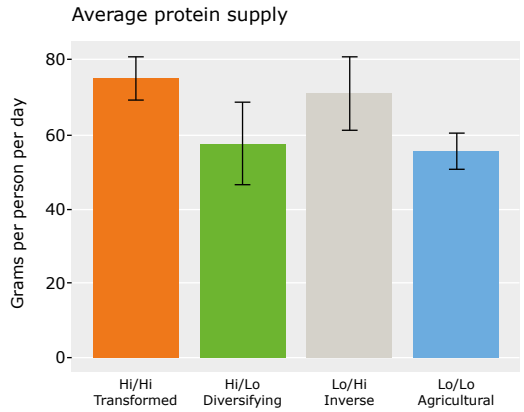






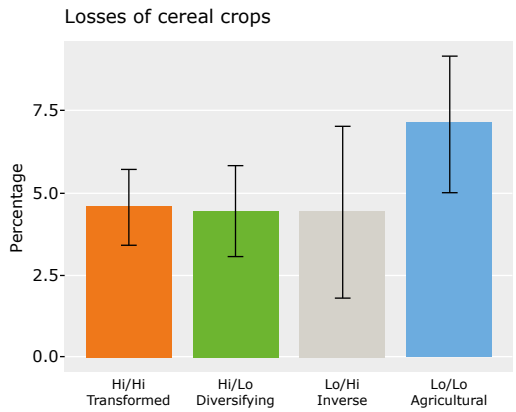


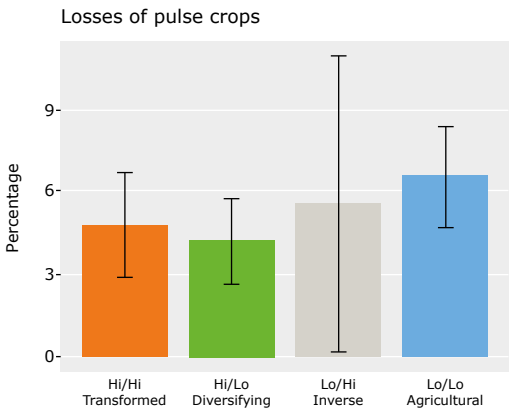


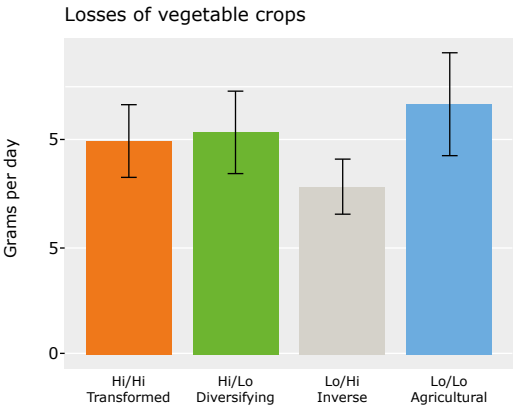


Processed foods represent a growing share of consumption in more transformed economies, but are also becoming increasingly important in diets in inverse economies with rising rural incomes that are used for the purchase of processed food or out-of-home consumption. Consequently, food supply in becoming more energy-dense in more transformed economies, while protein supply is increasing as well in inverse economies. The fast growing consumption of sweetened beverages represents a key challenge for the intake of sugar, fat and salt, and is - to a large extent – responsible for the higher incidence of obesity/overweight and related risks for NCDs.

Food loss & waste

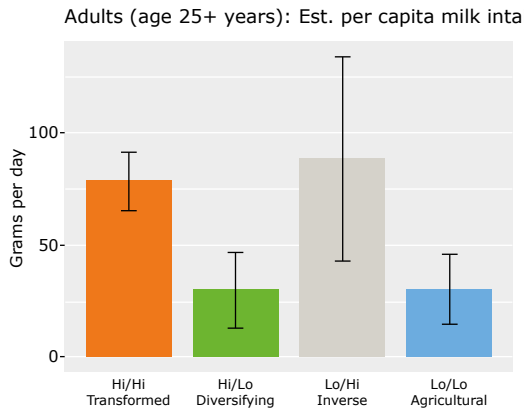


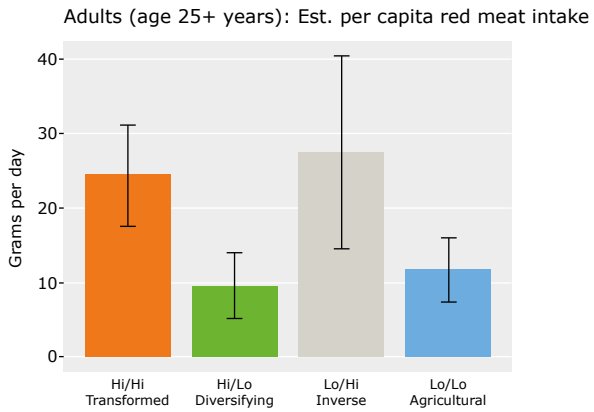


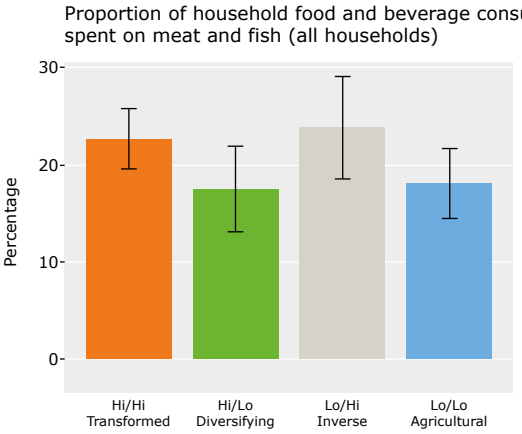


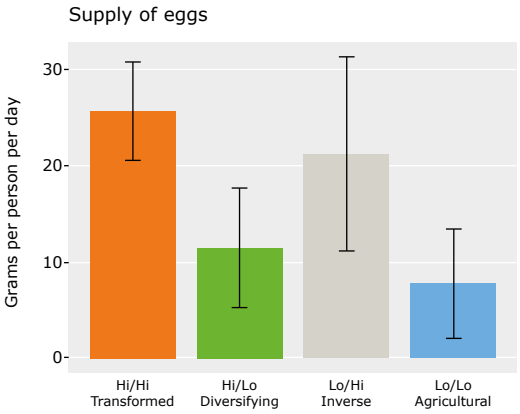
Post-harvest food losses and household waste represent large inefficiencies in the food supply chain. Cereal losses are highest in agricultural economies that rely on rudimentary technologies and traditional transport and storage facilities. The same holds for the supply chain of pulses and vegetables where loss reduction in more diversified and transformed economies still remain highly relevant.

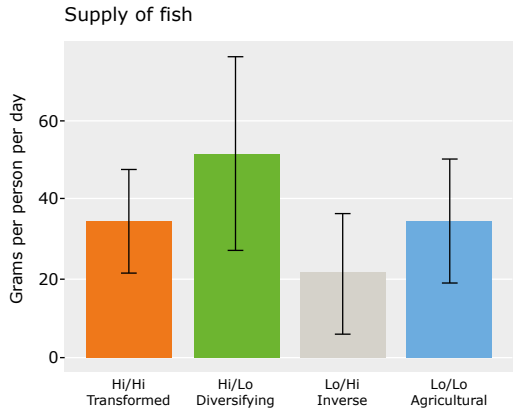
Animal-based products

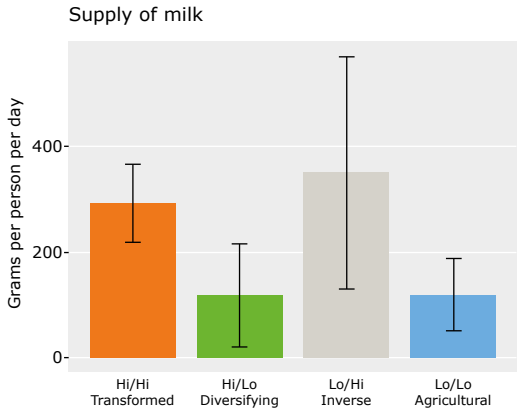






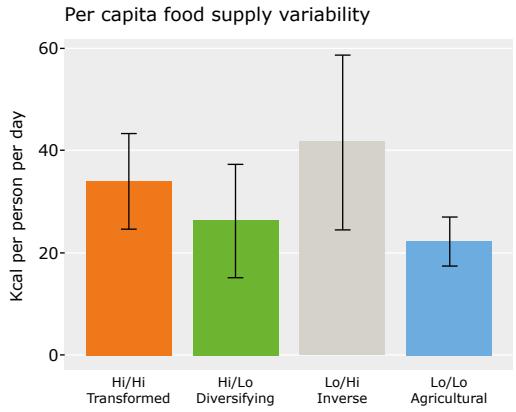


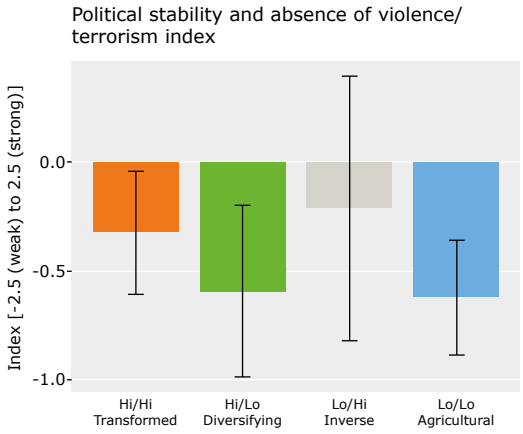


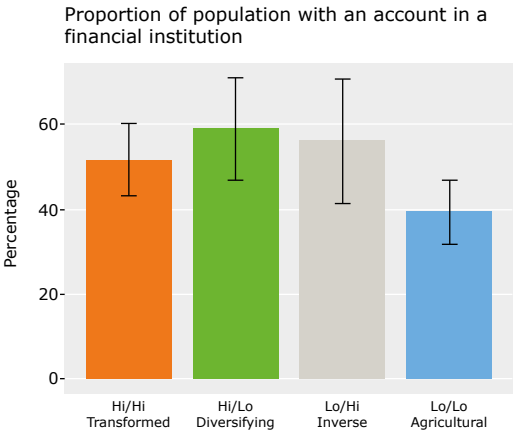


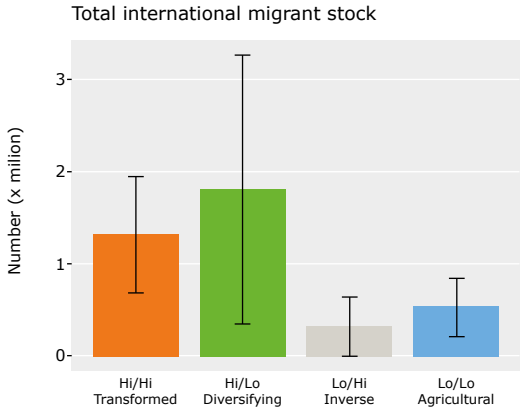
The importance of animal-based products is strongly increasing in the production package and the diets of more transformed economies, but particularly in many of the inverse economies non-rural income growth is rapidly translated into a growing share of animal-based foods in diets. The commercial supply of dairy, eggs and fish is rapidly increasing in diversifying and inverse economies in order to meet the higher demand for animal-based products in early stage of nutrition transition.

Food system governance









Changes in production, consumption and trade patterns are strongly influenced by the organisation of economy and the institutions in the society at large. Countries where people have better access to financial institutions and/or where international migrant linkages provide access to information and resources have more opportunities for investing in food system transformation. In addition, political stability and rule of law are generally considered as key conditions for food system innovations.

Food system transformations require broad participation of societal stakeholders and an open space for different voices in the societal debate. During the transition, this can lead to tensions and therefore variability in food supplies may become more uncertain. Food system transformation processes are by no means a linear process and inclusive outcomes are largely dependent on participatory governance structures.

Pathways for further analysis

The comparative country type analysis for specific food system parameters cannot be used directly for an analysis of the dynamics of food system transformation processes. This would require more time series data as well as an in-depth analysis of the underlying causal relationships. Different food system model simulation approaches are available that provide insights in the opportunities and constraints for healthy and sustainable diets (Springmann et al., 2018).

Simple inspection of the presented data permit us, however, to identify a few salient features of food systems performance across different types of countries that invite to further analysis:

1 Structural changes in infrastructure and service provision together with trends towards urbanisation may initiate processes of structural transformation, but need to be accompanied by progress in basic education and women empowerment that are critical to support inclusive rural transformation processes.

2 Contrary to common beliefs, it seems possible to

improve food systems through early attention for structural transformation that may subsequently lead to further investments in agricultural intensification and rural transformation.

3 Reduction of undernutrition is mostly observed in countries at higher stages of structural transformation, but this is easily accompanied by higher intake of processed foods associated with rising overweight and high diabetes incidence (especially in inverse economies).

4 Diet diversification is mostly triggered by structural transformation when household are also allowed to devote a smaller share of household income to food consumption.

5 Improvements in diets and nutrition are only partially stimulated by changes in agricultural production and also depend on progress in market development and governance.

6 Crop losses are highest in agricultural economies but only slightly reduce during the process of structural transformation.

7 Food systems integrity can be guaranteed under quite different regimes of (local and international) trade.

8 Wide diversity in food system governance is accompanied by large differences in food system performance.

Acknowledgements

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