

How sustainable is the Brazilian agri-food system: assessment from a novel indicator framework

It is estimated that a 70% increase in food production will be needed to feed the future global population by 2050. Hence, the consumption and production of food can be expected to result in positive and negative impacts on the economy, society and environment around the world, with profound consequences for producing countries like Brazil. The challenge to simultaneously increase food production and reduce its negative social and environmental impacts is a significant one. The establishment of a more sustainable agri-food system is crucial to overcome these challenges. However, how can sustainability in agri-food systems be assessed? How can one apply a complex concept such as sustainability to a complex topic like agri-food systems in a way that brings new knowledge and is relevant for actors in the field? Three steps were considered to contribute to answering these questions: (1) describing the agri-food system, (2) defining how sustainability concepts can be applied to it, and (3) proposing a mechanism to connect indicators of sustainability of agri-food system to policy proposals and goals. In order to answer the first question, a conceptual model to describe the agri-food system was adapted from the literature. Agri-food systems are defined as all interactions involving the activities from production through to consumption of food, from field to table; the stakeholders involved, as well as outcomes of these activities that influence the status of human welfare, food security and environmental quality. This concept includes two essential perspectives of the agri-food system not well represented in traditional assessments of sustainability: multidimensionality and multi-functionality. Multidimensionality takes into account the social, environmental and economic dimensions of the system. Multi-functionality recognizes agri-food system as a multi-output activity producing not only commodities, but also non-commodity outputs such as environmental services, landscape amenities and cultural heritages. In this context, a sustainability assessment can be linked to the status of the outcomes delivered by the agri-food system. In other words, the better the performance in terms of human welfare, food security and environmental quality, the more sustainable an agri-food system will be. Based on the literature, an indicator framework was established to produce a representative picture of the performance of the three outcomes listed above: human welfare, food security and environmental quality. In order to guarantee the policy relevance and applicability of the indicator framework, the indicators were used to evaluate the agri-food system compliance with the targets for sustainable development assumed by Brazil in two international agreements: the Millennium Development Goals and Aichi Biodiversity targets. Besides the

fact that these agreements represent the Brazilian government's commitment to contribute to the achievement of planetary sustainability, the indicators recommended by them also are highly compatible with the agri-food system indicators found in the literature. The analysis of the indicators suggests that the Brazilian agri-food system is unsustainable, not contributing effectively to the Millennium Development Goals and Aichi Biodiversity targets. Better performance is observed for indicators related to the access of food, like hunger eradication and increase in the quality of the Brazilian diet. On the other hand, improvements are required for indicators related to environmental over-extraction and degradation, GHG emissions, use of fertilizers and pesticides and social inequality. For instance, despite of some positive results, the Brazilian small scale family farmer governmental programme is still timid in relation to the huge change necessary to guarantee a more prosperous and equal rural population. Likewise, it is necessary more support to the practice of sustainable agriculture such as agroforestry, organic production (less than 1% of total agricultural area in Brazil), sustainable forest extraction, etc that it would improve the performance of the outcomes of the whole agri-food system. The indicator framework developed in this research found and compiled important information that can be used to guide the design of policies to monitor and improve the sustainability of the Brazilian agri-food system. This information also can be used by civil society to monitor, press and help the government to tackle the goals of sustainability. Nevertheless, new efforts have to be done to increase the quality of data, concepts and methodology consensus, robustness, standardization, accessibility, communicability, etc. Scientists and practitioners have to work together to address gaps, produce and integrate new knowledge with the objectives of policy instruments and social movements to promote sustainability.

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Summary

The production of food has to be 70% higher in order to feed the future global population in 2050. The challenge to simultaneously increase food production and reduce negative social and environmental impacts of agricultural production is significant. An indicator framework is created to assess sustainability and evaluate the Brazilian agri-food system's compliance with the international targets for sustainable development in two relevant international agreements: the Millennium Development Goals and Aichi targets. The indicators suggest that the

Brazilian agri-food system is unsustainable, not achieving effectively the Millennium Development Goals and Aichi targets. Better performance is observed in indicators related to the access of food, like hunger eradication. Improvements are required for environmental over-extraction and degradation, GHG emissions, use of fertilizers/pesticides and social inequality. Scientists and practitioners have to work together to address gaps, produce and integrate new knowledge with the objectives of policy instruments and social movements to promote sustainability.

Suggested themes:

3. Development, consumption and well-being

This theme addresses the challenge of enhancing human well-being within planetary boundaries, including:

3.1. Resource use, health and human well-being

3.2. Distribution, equality, and social justice, including the rural-urban divide