

The dynamics of rural transformation, household income, and poverty reduction: Case study in North Sumatra, Indonesia

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Abstract. Rural transformation (RT) is a process in which the agricultural system undergoes transformation towards off-farm, commercial, and market-oriented ones. The research objective is to analyze the dynamics of rural transformation, farmer incomes, and poverty in rural areas in North Sumatra. This study used secondary data from Statistics Indonesia and analyzed using descriptive and tabular methods. The results show that the agricultural structure has shifted over the last two decades from low-value commodities (food crops) to high-value commodities. At the same time, non-farm employment opportunities also showed an increase. The development of high-value commodities and non-farm sectors has also contributed to reducing rural poverty rates. The plantation sub-sector is the highest contributor to agricultural GDP in North Sumatra and tends to increase yearly, in addition to the livestock and horticulture. The non-agricultural industry began to increase and contributed significantly to GDP. Per capita income in 2011-2020 has increased. Poverty depth and severity are still below the national average, meaning that efforts to alleviate poverty have been relatively successful to increase incomes and reduce poverty in rural areas, one of the strategies that need to be taken is to encourage the development of high-value commodities and expand non-agricultural employment opportunities in rural areas.

1 Introduction

Rural transformation is the gradual transition of agricultural systems from subsistence (primarily cereal-based) to off-farm and more commercial and market-oriented activities. Urban areas are growing, and rural areas are evolving into larger, more consolidated communities. As land, labor, and other resources move in this direction, productivity rises, rural income rises, and poverty falls [1]. Rural transformation includes agricultural transformation and the expansion of livelihood and income-generating opportunities in the rural non-agricultural sector—increases in rural access to services and infrastructure result

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in an increase in non-agricultural employment and businesses. The interdependence of agriculture, the rural non-farm economy, manufacturing, and services creates a more significant structural shift than a rural transformation in isolation. The transformation of rural areas is necessary for structural transformation to occur. Countries undergo a comprehensive process of economic structural transformation, which includes rural transformation. It involves increased agricultural productivity, commercialization, diversification of production patterns, and rural non-agricultural livelihoods. Agriculture's productivity rises, and the rural non-farm economy provides food to meet the needs of urban development and transformation, freeing up labor for other sectors such as manufacturing and services. The outcomes of agriculture and rural non-farm economic activity determine the direction of structural transformation [2].

The reallocation of economic activities from primary sectors (agriculture and natural resources) to secondary sectors (industry and services) is known as structural transformation. It stands out for its rising productivity across sectors, urbanization, declining share of agriculture in GDP, expanding domestic and international trade, and higher specialization and division of labor. Raising agricultural production will promote fundamental economic transformation without jeopardizing food security, essential for poverty reduction. In addition, closing the productivity disparity between agricultural and non-agricultural productivity is essential for reducing the income gap between rural and urban populations. Long-term productivity gains in the agricultural sector will probably result from structural transformation. The industry's long-term productivity growth necessitates increased demand from the non-agricultural economy and farm labor reductions [3].

The relationship between the rate of rural transformation (RT) and the rate of poverty reduction. From 1990–1999 (40.6%) to 2000–2009, the proportion of the total production value of high-value agricultural commodities increased significantly. Nonetheless, the observed data suggests that the value has exhibited consistent stability, maintaining a constant rate of 50.2% from 2000 to 2009 (with a minor deviation of 49.8%) and remaining unchanged from 2010 to 2019. During the first two decades of agricultural production, there was a significant transition from staple foods and low-value agriculture to cultivating high-value crops. During the same period, however, there was a relatively slow increase in the production of staple foods. Significantly, rice production increased by 1.8%, while maize production increased by 5%, primarily due to the substantial demand for maize as animal feed. Non-agricultural employment in rural locations is the second indication of rural transformation. From 1990 to 1999, 51.9% of all employment opportunities were in agriculture, making it the most prevalent occupation. Between 2000 and 2009, 58.1% of the total labor force was employed in non-agricultural industries. During the subsequent period from 2010 to 2019, this percentage increased to 66.1%. Rapid urbanization, coupled with the expansion of the non-agricultural sector, has played a crucial role in the emergence of new employment opportunities, particularly in the services industry [4].

The dynamic of rural transformation may vary across regions, which motivate the need to investigate this concept at the regional level (provinces). This research delves further into the topic by examining the structural transformation in Indonesia's North Sumatra, which has led to economic growth. To ensure the success of RT in the North Sumatra region in particular, this research aims to investigate its characteristics, drivers, and effects so that improvements may be made to the institutions, policies, and investments (IPIs) surrounding it.

2 Research Method

This study utilizes secondary data from the publication "Gross Regional Domestic Product of Indonesian Provinces by Business Field," particularly for the North Sumatra Province.

The accumulated data spans the years 2011 to 2020. Table 1 depicts the proportion of Gross Regional Domestic Product (GRDP) in the province of North Sumatra based on the GRDP source subsector from 2011 to 2020. The presentation of data utilizes line and bar graphs.

Table 1. The proportion of average GRDP contributed by each sector from 2011 to 2020 (%)

Sector	Agriculture, Forestry, and Fisheries	Manufacture	Construction	Whole seller and Retail	Mining
2011	25.65	20.62	11.87	17.16	1.05
2012	25.38	20.46	11.90	17.39	1.10
2013	25.05	20.23	12.07	17.31	1.31
2014	24.85	19.80	12.25	17.59	1.31
2015	24.96	19.58	12.30	17.39	1.32
2016	24.84	19.55	12.35	17.40	1.32
2017	24.88	19.03	12.55	17.52	1.32
2018	24.81	18.76	12.58	17.68	1.32
2019	24.79	18.05	12.83	17.97	1.32
2020	25.54	18.09	12.52	17.82	1.30

Typology analysis employs the Klassen Typology theory with some modifications. Klassen Typology is utilized to understand each region's economic growth pattern and structure. Klassen Typology categorizes regions based on two key indicators: economic growth and per capita income. This study measures economic growth by the proportion of agricultural GDP and the proportion of high-value commodities GDP [5]. The following are the Klassen Typology criteria:

- a. Developed and rapidly expanding regions, characterized by both high growth and high income, exhibit higher rates of economic growth and per capita income compared to other areas within the country.
- b. Developed yet depressed regions refer to geographical areas characterized by relatively higher per capita income levels, but lower rates of economic growth compared to the national average.
- c. Fast-growing regions, characterized by high growth rates but low-income levels, exhibit a more rapid pace of economic expansion compared to the national average. However, these regions also experience a lower per capita income.
- d. Comparatively underdeveloped regions can be characterized as locations exhibiting lower levels of economic growth and per capita income in comparison to the national average.

3 Result and Discussion

The inclusive rural transformation promotes the entire rural society by allowing everyone to express their economic, social, and political rights, improve their skills, and take advantage of local opportunities. Improvements in agricultural production and the rural non-farm sector should raise rural people's earnings, particularly for people experiencing poverty, diminishing the "push" factors that cause out-migration [6]. Migration may still occur but as an active choice rather than a result of a lack of choices. Inclusive rural development promotes human mobility across areas and sectors, increasing production and advantages for migrants and their communities of origin and destination [7]. Economic structural transformation is characterized by increases in productivity, particularly in labor, and changes in the relative importance of sectors due to the reallocation of production elements such as labor and capital. Over the last 50 years, agriculture's relative contribution to GDP and employment has declined almost everywhere as economic activity has shifted progressively towards the industrial and service sectors. The process has resulted in a

reallocation of labor across sectors, advances in sectoral productivity, and a narrowing productivity gaps between sectors [8].

Expanding high-value agriculture and non-agricultural sectors has also contributed to reducing rural poverty [9]. Between 2000 and 2009, poverty declined in both rural and urban areas. On the other hand, rural poverty has decreased considerably more rapidly than urban poverty. North Sumatra's poverty rate in 2011-2021 is still lower (9.01%) than the national average (10.14%). The depth and severity of poverty in North Sumatra remain lower than the national average, indicating that poverty reduction initiatives in North Sumatra are somewhat effective [10]. North Sumatra's average annual wage in the village, from 2011 through 2020, per capita income increased based on current prices. From 2018 to 2020, the increase in income per capita is expected to be moderate based on constant pricing. In terms of income, urban areas earn more than rural areas. From 2018 to 2020, the increase in income per capita is expected to be moderate based on constant pricing at around IDR 800,000-1,200,000.-.

3.1 Rural Transformation and Its Impact

From 2010 to 2018, the agricultural sector's GDP remained constant. However, during the Covid-19 pandemic, the agricultural sector's GDP tends to rise. During the Covid-19 epidemic, farm GDP tends to expand, whereas industry, trade, and construction tend to decline. Even though its contribution to GDP is only about 1%, the mining sector is growing. This industry is expected to grow further (Figure 1).

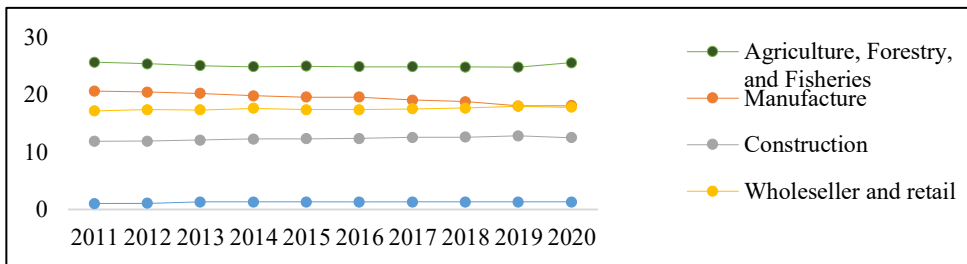


Fig. 1. Five Major sectors of GDP in North Sumatra 2011-2020

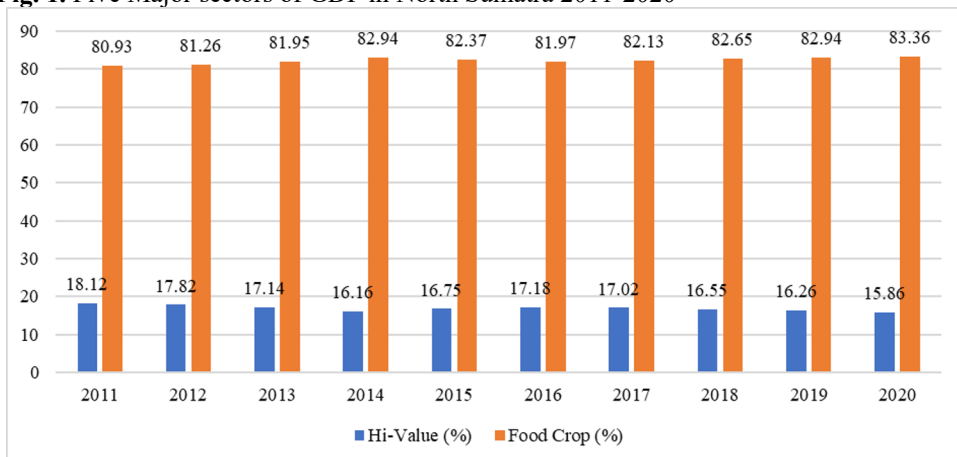


Fig. 2. Comparative Analysis of Food Crop and High-Value Commodities

High-value commodities dominate the agriculture sector of North Sumatra. The share of high-value items grows year after year. According to Figure 2, high-value commodities

increased by 80% between 2011 and 2020, whereas food crops increased by just 15.86%. Changes in agricultural structure, a shift from low-value to high-value commodities, and an increase in non-farm employment in rural areas are the defining characteristics of rural transformation. In the agricultural sector, examples of high-value agriculture include horticulture, livestock, and fisheries [7].

North Sumatera's annual plantations are the most significant contributor to the agricultural sector's gross domestic product and tend to expand annually. The livestock and horticulture sectors contribute equally to the agricultural sector's gross domestic product. The livestock sector may develop faster than horticulture due to the less favorable geographical conditions for horticultural crops in North Sumatra (Figure 3). The agricultural gross domestic product decline is more severe than agricultural labor. The non-agricultural sector is beginning to multiply and contribute significantly to GDP. Estate crops sector employees typically have relatively low working hours and are less intensive than those in horticulture or seasonal crops.

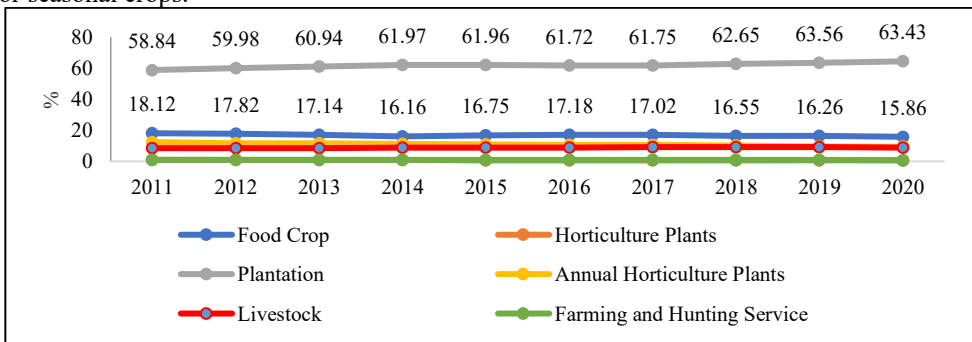


Fig. 3. Contribution of the Agricultural Sub-Sector to the GDP of North Sumatra

The agrifood industries play a crucial role in promoting sustainable development and ensuring fair access to food. However, it is imperative to undertake additional measures to enhance these sectors further. Enhancing the efficiency of agricultural labor and land is a fundamental prerequisite for achieving economic development. However, it should be noted that it does not inherently serve as a direct driver of economic expansion. The agricultural sector, encompassing crops, cattle, fisheries, and forests, significantly generates job opportunities and contributes to global GDP. As a result of the escalating levels of capital and information intensity within the production and distribution processes of the economy, these sectors must offer a greater number of job and income-generating prospects. The establishment of robust institutions and effective fiscal systems is vital for facilitating the growth of various sectors, guaranteeing ample income-generating prospects across the economy, providing adequate social security, safeguarding savings for capital accumulation, and promoting broad asset ownership [11]. Rural transformation development will also favor regional per capita GDP, and the two are mutually beneficial [12]. Many developing countries are attempting to develop the manufacturing sector in the hope that industrialization will accelerate productivity growth while providing much-needed jobs for their expanding workforce [3].

3.2 The speed and patterns of structural change and agricultural transformation

Rural transformation encompasses many elements, including but not limited to social, economic, and several other forms of rural change. Nevertheless, when considering the subject from an economic perspective, RT often focuses on agricultural modernization and

job opportunities in non-farm sectors in rural areas. According to the International Fund for Agricultural Development (IFAD), rural transformation (RT) encompasses the augmentation of agricultural productivity, the promotion of commercialization, and the expansion of production patterns and livelihoods within the agricultural sector, as well as towards the non-farm sector in rural areas [9, 10, 11]. Based on the data shown in Table 1, it can be observed that North Sumatra has a sluggish performance in terms of both structural transformation (ST) and slow rural transformation (RT) provinces, as well as in provinces with poor rural income growth (as indicated in the final row of the table). Slow structural transformation (ST) and slow rural transformation (RT) factors have a role in the sluggish or moderate increase in rural income. The poverty level on Sumatra Island is higher than in other regions. The rural regions exhibit a notable disparity in expenditure inequality in relation to the poverty line and among those classified as poor, which is significantly greater compared to metropolitan areas. The impact of the human development index (HDI) on poverty levels in both rural and urban areas of Sumatra Island is significant. Simultaneously, it is seen that the Gross Regional Domestic Product (GRDP) and per capita spending do not exhibit any noticeable influence. The significance of human resource quality in poverty reduction cannot be overstated. The successful alleviation of poverty through economic growth necessitates concurrent human resource development.

Table 1. The typology of rural transformation is categorized according to structural transformation (ST) rates and rural income growth (RT1)

Share of non-agricultural GDP	Share of high-value agriculture	Rural Income		
		Fast	Moderate	Slow
Fast ST	Fast RT1		Bengkulu	DI Yogyakarta
			Central Java	Bali
			East Java	
			NTT	
	Slow RT1	Southeast Sulawesi	South Sulawesi	West Sumatera
				South Sumatera
				Lampung
				Maluku Utara
Slow ST	Fast RT1	Banten	West Java	Aceh
		Papua	West Papua	Central Sulawesi
			North Sulawesi	
			East Kalimantan	
	Slow RT1		Central Kalimantan	Bangka Belitung
				Jambi
				Kepulauan Riau
				Riau
				North Sumatera
				West Kalimantan
				South Kalimantan
				North Kalimantan
				Gorontalo
				Maluku
				NTB

Moreover, quantitative and qualitative infrastructure insufficiencies impact rural areas' income levels. The quality of Southern Sumatra's provincial and district/city roadways significantly reduces the economic disparities across provincial administrations in rural areas. An increase of one unit in the ratio of well-maintained provincial highways to district/city roads is associated with a reduction of 0.00083 points in rural income disparity. A decrease in travel time is associated with a reduction in travel expenses and a decrease in the number of accidents resulting from inadequate road conditions. The presence of infrastructure has the potential to enhance the investment climate and foster entrepreneurial activity, contributing to the overall improvement of the economy [15]. This raises GDP per capita while creating a favorable climate for poverty reduction [16].

North Sumatra Province comprises thirty-three districts/cities, and the province's economic development is inextricably linked to the economic development of the districts/cities. Because each district/city has different resources, the development of each district/city will be unique. Some areas are rapidly developing, while others are gradually developing. This instance results in inequity or imbalance in economic development between regions. Inequality in regional development is a prevalent feature of a region's economic activities. This imbalance is primarily caused by disparities in natural resource content and geographical conditions in each location. The primary factors contributing to regional disparities are notable variations in natural resource content across different regions, divergent demographic conditions, limited mobility of goods and services, the concentration of regional economic activities, and the allocation of development funds among regions [16].

3.3 Agricultural Policy in North Sumatera

Agricultural policies have a crucial role in promoting economic well-being for individuals living in poverty. There are several potential avenues through which productivity and profitability might be enhanced. These include the provision of effective extension and agricultural consulting services, enhancing coordination throughout value chains, and facilitating market integration to ensure equitable benefits for all segments of the chain. In contrast, pro-poor growth encompasses sectors outside agriculture [17]. Thus far, the ongoing phenomenon of sustained economic expansion has led to several instances of a decline in the agricultural labor force due to the prevailing trend of urbanization [18]. Achieving sustainable poverty reduction necessitates implementing comprehensive measures encompassing both rural and urban domains. These measures include but are not limited to enhancing top-tier education availability, promoting economic diversification in non-agricultural income-generating activities within rural areas, facilitating employment opportunities across various sectors, and augmenting impoverished individuals' saving and investment capabilities. Additionally, it is imperative to establish robust social protection mechanisms to safeguard the welfare of the underprivileged population adequately [8].

Rural communities have the challenges of experiencing fast population growth, inadequate employment and entrepreneurial opportunities, underdeveloped infrastructure, limited financial resources, and constrained availability of social services. Consequently, policies and investments must be directed towards generating quality employment opportunities within the agrifood and nonfarm sectors. Enhanced delivery of fundamental services strengthened social welfare systems, improved accessibility to vital services, and promoting a healthier environment can broaden the chances for improved livelihoods. Implementing public policies and allocating investments aimed at enhancing agricultural productivity, promoting diversification in agricultural output, and fostering the development of agrifood value chains can generate improved employment opportunities in rural areas and enhance overall nutrition and well-being. Government investments in agricultural research, rural education, and infrastructure successfully mitigate poverty in India and China.

Moreover, progress in information and communication technologies (ICTs) is facilitating the accessibility of remote services. Furthermore, the advent of novel technology aimed at capturing renewable resources, like wind, solar, and biomass energy, has contributed to the increased affordability and accessibility of power. The promise of these technical improvements lies in their ability to enhance the attractiveness of vocations and mitigate the phenomenon of rural-to-urban youth mobility. Nevertheless, it is essential to acknowledge that rural transformation should not just revolve around agriculture and agrifood systems. In order to achieve its overarching objectives of enhancing the quality of life in rural areas, the transformation process should focus on reinforcing the connections between rural and urban areas while also utilizing these connections to generate employment opportunities outside of the agricultural sector. Additionally, it is imperative to enhance rural governance and guarantee the widespread availability of fundamental services and infrastructure, including but not limited to water, sanitation, transportation, healthcare, education, and a sustainable environment. Rural transformation refers to a development approach that prioritizes the enhancement of rural-urban linkages to enable rural communities to capitalize on emerging markets and services [19].

4 Conclusion

The speed of rural transformation has an impact on poverty reduction. Inclusive rural transformation has the potential to benefit the whole rural community by facilitating the expression of economic, social, and political rights, fostering skill development, and enabling individuals to capitalize on local opportunities. Economic structural transformation is characterized by gains in productivity, particularly in labor, and changes in the importance of sectors due to the allocation of production inputs such as labor and capital. In North Sumatra province, the high-value agricultural sector dominates and contributes significantly to the region's gross domestic product (GDP). However, the agricultural sector's GDP has remained constant from 2010 to 2018. During the COVID-19 pandemic, the farm sector grew as the industry, trade, and construction sectors shrank. This highlights the significance of maintaining sustainable regional development and fair food access. It is also critical to have strong institutions supported by an effective fiscal system to offer broad economic income opportunities, adequate social protection, savings protection for capital accumulation, and broad asset ownership. The slow pace of structural and rural development has led to a delayed rise in rural income and high levels of rural poverty. In addition, the level of expenditure inequality in rural regions is significantly greater than in urban regions. As a result, efforts are needed to accelerate the rural and structural economic transformation to boost rural economic growth, reduce poverty levels, and improve the welfare of rural communities.

5 Recommendation

The policy implications suggest that rural transformation should be addressed within broader policies to reduce poverty and inequality and promote sustainable development. Governments must promote structural transformation, in which productivity increases by reallocating production elements across sectors, and inclusive rural transformation, allowing everyone to exercise their economic, social, and political rights. In addition, policymakers should ensure that the agri-food sector offers more employment and income opportunities and that rural residents can access social protection, savings, and property ownership. Lastly, there must be an emphasis on developing robust institutions supported by an efficient fiscal system that can provide adequate support for the emergence of other sectors, ensure comprehensive economic income opportunities, and promote sustainable development.

6 References

1. World Bank group, *Policy Input for an Indonesia Jobs Strategy Indonesian Economic Transformation and Employment* (Washington, DC, 2016).
2. IFAD (International Fund for Agricultural Development), *Rural Development Report 2016: Fostering Inclusive Rural Transformation* (2016).
3. K. Kim, A. Sumner, and A. A. Yusuf, *Is Structural Transformation-Led Economic Growth Immiserizing or Inclusive? The Case of Indonesia* (Oxford University Press, 2018).
4. M. Boynton Tobey, S. Chang, R. Brent Binder, and Y. Yamagata, *IOP Conf. Ser. Earth Environ. Sci.* **294**, (2019).
5. S. Katti, D. Pratiwi, and R. Setiahadi, *IOP Conf. Ser. Earth Environ. Sci.* **347**, (2019).
6. M. Langan and S. Price, *Glob. Aff.* **7**, 505 (2021).
7. P. Huang, J. and Shi, *China Agric. Econ. Rev.* (Forthcoming). **13**, 278 (2021).
8. UN Food and Agriculture Organization, *The Future of Food and Agriculture Trends and Challenges* (2017).
9. L. M. Beyene, *Implications of High Commodity Prices on Poverty Reduction in Ethiopia and Policy Options under an Agriculture-Led Development Strategy* (2014).
10. A. Handytton, M. F. Rahmadana, M. Y. Harahap, and M. Rinaldi, *Adv. Soc. Sci. Res. J.* **9**, 794 (2022).
11. FAO, *The Future of Food and Agriculture Drivers and Triggers for Transformation. The Future of Food and Agriculture* (Rome, 2022).
12. R. Zhang and X. Zhang, *Sustain.* **14**, 1 (2022).
13. FAO, *The State of Food and Agriculture: Leveraging Food System for Inclusive Rural Transformation* (Rome, 2017).
14. A. B. Berdegúe J T, Rosada, *The Rural Transformation* (Oxford University Press, Oxford, 2014).
15. R. A. Rambe, P. Purmini, A. Armelly, L. Alfansi, and R. E. Febriani, *Economies* **10**, 1 (2022).
16. S. I. Kesuma, Sirojuzilam, E. Erlina, and L. Suwardi, *Budapest Int. Res. Critics Institute-Journal* **4**, 4697 (2021).
17. D. Grace, J. Lindahl, F. Wanyoike, B. Bett, T. Randolph, and K. M. Rich, *Philos. Trans. R. Soc. B Biol. Sci.* **372**, 1 (2017).
18. A. Wismadi, M. Brussel, M. Zuidgeest, and M. van Maarseveen, *Infrastruct. Complex.* **2**, 1 (2015).
19. IFPRI (The International Food Policy Research Institute (IFPRI), *Global Food Policy Report* (Washington, DC, 2019).