

Sociology of Sustainable Agriculture to Save Farmer Empowerment in Indonesia: Green-Economy Approach

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Abstract

This study investigates the sociology of sustainable food production and the use of smart green-agricultural. The literature study research method uses content analysis to find answers to the research problem formulation. Various public documents and relevant literature studies were collected. The findings reveal that the government's policy on sustainable food production focuses on a sustainable food system by utilizing the concept of sustainable production, optimizing the use of land and food waters, ensuring fair food prices, and implementing a food waste management hierarchy. Agricultural technology focuses on food knowledge management systems, creation of knowledge management and databases based on local wisdom, implementation of sustainable production and food industry 4.0, development of a national system of barns, development of logistics and distribution systems, development of virtual content, and a national knowledge network. It can be concluded that the novelty of this research on the sociology of sustainable food systems is aware of the importance of a sustainable food system orientation with the concept of 'Fill My Plate'. Sociologically, the community understands that technology is intended as a definite step to support a green economy by encouraging responsible food consumption behavior. The implications of this research are expected to be able to provide recommendations for the development of a sustainable food system using a green economy approach to support the Indonesian sustainable food system (SPBI).

Keywords: sustanailble food, Agricultural Technology, Green Economy

Introduction

Food problems are a major global challenge. Currently, the world is faced with a scarcity of natural resources in the midst of the COVID-19 pandemic. Various efforts have been made to overcome the

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challenges of global change caused by climate change and to increase the rate of consumption of energy and resources. (Roubík et al., 2022). Through a sustainable food system, countries in the world and strive to ensure the availability of three aspects, namely inclusive access, sustainable production and consumption (Dudek & Śpiewak, 2022; Frehner et al., 2022; Di Vaio et al., 2020).

In addition, sustainable food systems minimize food loss and reduce food waste. In 2020, the European Union announced; Europe's Green Deal to be the cornerstone of a green transition. This is achieved by developing the potential of a green, circular, and low-carbon economy in a fair and inclusive manner for all communities (Elkerbout et al., 2020). The European Union and Indonesia are committed to building cooperation in the 2030 Agenda and the Sustainable Development Goals in ensuring sustainable patterns of production and consumption. This program has been launched for quite a long time, to be precise in 2007 (Putri & Salam, 2019).

Unfortunately, Indonesia is one of the countries that has not shown significant progress for a program called 'Local Harvest' (Sustainable Fair Consumption and Local Food Systems). Whereas the EU grant is quite large, namely 2 million euros or around 33.2 billion rupiah. In this case, it seems that the government's program to support a sustainable food system faces major challenges in the supply and distribution of food that does not support it. The pressure of competition in the use of food as a source of energy and the failure of policy implementation has led to the condition of national food performance and has an impact on food poverty in Indonesia (Warren & Steenbergen, 2021; Nuryanti et al., 2018; McCarthy & Obidzinski, 2017; Vel et al., 2016; Tambunan, 2005).

The latest study conducted by Nasrullah & Ovitasari (2022) revealed that it is very important to know the direction of government policies in order to be able to support the transformation of consumption, improve the performance of food management, and food production in a sustainable manner as a solution to achieve food security as mandated by the 1945 Constitution.

Food availability in Indonesia tends to increase along with population growth. Badan Pusat Statistik (2020) recorded that the agricultural production index in 2020 increased by 5.12 points to 167.55 (temporary figure) compared to 2019. The increase occurred in the sub-commodity of horticulture, plantations, and livestock. The contribution of agriculture to Gross Domestic Product in 2020 reached 13.70 percent or 0.99 percent. Such conditions are not followed by an increase in nutritional status which places Indonesia in position 73 of 199 countries internationally based on the Global Hunger index for the period 2007-2017. (Pakpahan, 2018).

The development of the main issues of national food in the formulation of Indonesia's food strategy and roadmap for 2020-2024 is a hard blow for the government. There are at least 45 issues found (Tranggono et al., 2019). In this study, focusing on the issue of a sustainable food system where the study revealed that there are issues of the unavailability of a national food system, a national holistic food plan is not available, an inclusive food policy is not available, and the development of the food industry is not systematic and sustainable.

Explicitly, this study emphasizes the importance of government policies related to the strategy of sustainable food production using smart green agricultural technology with a Green Economy approach. Previous studies conducted by Tranggono et al. (2019) investigate sustainable food systems. His findings reveal that food practices in Indonesia are less sustainable. Food practices are focused on productivity where the system is oriented towards supply rather than demand. In addition, food production facilities and infrastructure tend to be unsustainable and still use conventional methods without paying attention to the surrounding environment.

As a result, food waste is not properly minimized. The dissynchronization of the food sustainability program planning system that occurred in the 2007-2017 period occurred because there was no upstream-downstream sustainability in the planning and application of food practices in Indonesia. The food planning system must start with a plan for consumption patterns, logistics and distribution, and finally a sustainable food cultivation plan. Dahiri & Fitri (2020) explained that evaluating and making adjustments to government policies that focus on the agricultural sector is a vital effort for the government together with the relevant ministries/institutions. Several practitioners and observers of government law explained that government policies were sometimes inconsistent. Moreover, there are investment problems and technical licensing that have not been well coordinated and integrated from upstream to downstream.

Some of the literature focuses on Indonesian government regulations, the impact of technology, and the factors that affect a sustainable food system. Finding Fitri et al. (2019) explained that the adoption of SALIBU technology is an alternative use of agricultural resources in order to achieve sustainable food security. Isharyanto et al. (2022) explained that confidence in production figures would minimize the problem of food availability. Food safety regulations and policies during the COVID-19 pandemic are very important. Ignoring the need for government intervention can result in distrust of the ability of legal imperatives and their application.

For example, a recent study by Ginting et al. (2021) found a positive and significant relationship between food consumption and nutritional status. The research focuses on efforts to improve food access and food consumption by suggesting the importance of employment opportunities policies. Finding of Wijaya et al. (2021) explained that community empowerment through sustainable food programs can improve people's consumption patterns and ensure balanced food consumption and increase livelihood capital. According to Nuryartono et al. (2021) Food policy is needed to prevent inflation by stabilizing food prices, ensuring effective supply lines and market operations. This study is expected to be one of the references in the preparation of food planning in developing countries through multi-stakeholder partnerships.

The novelty of this research reveals that sociologically the community understands that the government needs to accelerate investment in areas that have potential advantages in the agricultural sector by focusing on government policies related to sustainable food production and the use of smart green-agricultural using a green economy approach. This concept is very relevant to the current era of industry 4.0. There have not been many previous studies linking government policies on sustainable food systems, the current food system, and the application of modern environmentally friendly technologies.

Question Research

The agricultural sector has a major role in food security in Indonesia. Therefore, through a sustainable food system policy strategy, the government seeks to support the modern agricultural sector based on a green economy. However, previous studies have shown that there are issues related to the unclear food system policy in Indonesia. Based on these main problems, this research formulates two research problems as follows:

1. Sociologically, what is the strategy for the food system to increase sustainable food production in Indonesia?
2. How is sustainable food production using smart green agricultural technology with a Green Economy approach?

Literature Review

Sociology of Sustainable Food Systems

The sustainable food system according to the community's understanding is a green thematic program area that aims to provide

access to adequate, affordable, and healthy food for the community as well as create substantial economic opportunities and bring a positive impact on the community's economy (Tranggono et al., 2019). Garnett (2014) explained that achieving food system sustainability is a global priority that is oriented towards efficiency, limiting demand, and transforming food systems. The food system according to people's understanding includes production, processing and distribution, consumption, and management of food waste.

A healthy and sustainable food system focuses on three aspects, namely: local and seasonal food, food health, and community building. Food chain management for the development of sustainable food systems is needed to face the priority challenges for managerial improvement towards food sector sustainability. The dependence of stakeholders in the supply chain requires new managerial activities (van den Heuvel et al., 2011). The study explains that technological trends towards global integration and environmental degradation lead people to initiate more sustainable alternative food systems and agricultural sectors. The focus of its development is public participation, new partnerships, and commitment to the principles of social, economic, and environmental justice. A sustainable food system is a vital condition for increasing the role of the agricultural sector in a country (Feenstra, 2002).

Agricultural Technology

Agricultural technology is the application of various mathematical and scientific principles aimed at economic utilization for the welfare of society. Agricultural technology studies consist of four fields, including: (1) agricultural process technology systems related to planning, installation, and improvement of integrated systems (materials, resources, equipment, and energy); (2) industrial management related to the planning, operation, and improvement of agro-industrial business systems; (3) agro-industry technoeconomics, related to planning, analysis, and policy formulation in an integrated system; (4) quality management, relating to the application of management principles, processes, products and the environment for the purpose of improving quality. Study finds two agricultural technology innovations (Stone, 1988).

First, agricultural automation technology which involves computer programs for agricultural tools. Second, sensor technology developed by utilizing drones to obtain data on the growth of pests, diseases, and other problems that occur in agricultural crops. Literature review found a positive and significant effect of increasing agricultural technology on economic growth (Bhalla, 2008). Agricultural technology can help reduce poverty through direct and indirect effects. The direct effect that is felt is in the form of adoption gains,

while the indirect effect is leading to lower food prices, job creation, and linkages with the growth of the agricultural sector and the community's economy. (De Janvry & Sadoulet, 2002).

Green Economy

Green economy is an economic idea that aims to improve the welfare and social equality of the community. The benefit is that it can significantly reduce the risk of environmental damage. Previous studies have explained that the concept of a green economy involves an assessment of natural resources, in the form of statistical reports, financial reports, and policies regarding the maintenance of the earth. (Loiseau et al., 2016). The green economy is also an effort to deal with social and economic inequality with justice. The steps towards a green economy include efforts to build sustainable communities, lower carbon emissions, use of wind and solar power, greener light bulbs, safe livestock production, forest certification, and green employment (Georgeson et al., 2017).

Green economy is seen as a complementary goal to government policies. A green economy cannot guarantee sustainable economic development during the degradation and loss of global ecosystems. The problem of worsening ecological scarcity, overexploitation of resources, market and policy failures are important factors affecting the green economy. funding challenges are another problem that occurs. Implementing innovative financing mechanisms such as ecosystem services, international financing facilities, and financial transaction taxes can help reduce funding challenges (Barbier, 2011).

Methodology

Research Design

This research refers to government policies and previous studies that explain the real condition of food in Indonesia. Literature study research design is a theoretical study related to the culture, values, and norms that developed in the particular situation being studied (Sugiyono, 2009). The literature study research procedure consists of six stages, namely selecting topics, conducting information exploration, determining the focus of the research, collecting data from various sources of literature data, preparing data presentation, and making research reports. The research focuses on two topics, namely food system policy and the concept of smart green-agricultural technology with a Green Economy approach.

Data and Data Sources

The data source is the subject from which the data was obtained by the researcher. In literature study research, documents and relevant literature are the main data sources. The data in this study are in the form of reports and the latest food exposure materials, documentation from the Ministry of RI, Food Roap 2020-2024, and relevant literature studies.

Data collection technique

The data collection technique used by the researcher is literature study by reading relevant books and articles and other data sources. The data collected is related to food issues which are identified into three main components, namely: sustainable food systems, Agricultural Technology, Green Economy. The main identified food issues are grouped into each stage and described as relevant. The literature research steps consist of five stages. First, search keywords for research. The research keywords are sustainable food, Agricultural Technology, Green Economy. Second, the search for research subjects. The research subjects are food system policies and the concept of smart green-agricultural technology with a Green Economy approach in Indonesia. third, looking for relevant and current literature material. Some of the literature material is research for the last three years starting from 2018-2022. Fourth, search for citations in scientific sources. Fifth, search for published bibliographies. The researcher uses the google scholar search engine and several publishing houses such as elsevier and emerald to find good references.

Data Analysis

This study uses content analysis techniques. Content analysis is a data analysis technique to make valid inferences and can be re-examined based on the context (Krippendorff, 2018). Referring to theory Krippendorff (2018), content analysis consists of three stages. First, doing data reduction, namely the process of making abbreviations, coding, and centralizing the theme as well as delimiting the research problem so that it does not expand and remains focused on the research objectives to be achieved. Second, the presentation of the data, namely the assembly of information organizations that allows research conclusions to be made by looking at the presentation of the data. Third, drawing conclusions that answer the research problem briefly. Conclusions are made by compiling the main ideas and important information so as to obtain conclusions that can be understood by the reader.

Result and Discussion

Sociology of Food System Strategy to Increase Sustainable Food Production in Indonesia

Based on the data that has been collected on food strategies to increase sustainable food production according to public understanding, it is found that the Indonesian government needs to make a National Medium-Term Development Plan (RPJMN) and Government Work Plan (RKP). This food system strategy requires multi-stakeholder roles and partnerships as mandated in Presidential Regulation (Pepres) Number 59 of 2017 concerning the Implementation of Achieving Sustainable Development Goals (TPB/SDGs).

The results of the interview with the East Java Agriculture Service stated as follows. Data1.

“The government's attention to food is very urgent, because food is a major need that cannot be delayed. The need is like the need for water or air, which must be present at all times. Therefore, the government must be present in managing food production, supply chain, and supervision, so that people can access it easily, at low prices, with high quality.”

In the Strategy paper on Indonesia's Sustainable Food System compiled by the Ministries and agencies of the Government of Indonesia it was found that the food system strategy focuses on identifying the food life cycle, challenges and obstacles in improving the performance of food system management. Biranchi Upadhyaya, Regional Director of Hivos Hub Southeast Asia and Anang Noegroho, Director of Food and Agriculture in the paper explained as follows. Data 2.

“The food sector is a top priority for national development. Therefore, the food system strategy is very important, especially the principles of sustainability. Sustainable food is an area of Hivos' thematic program that aims to provide access to adequate, affordable and healthy food for low-income consumers, and can create substantial economic opportunities and have a positive impact on the environment. There are three strategic steps taken, namely collaborating with pioneers, creating solutions through stakeholder involvement, and lobbying & advocating/influencing policy. The hope is that the strategy implemented can become a medium for best practice, increase cooperation in obtaining solutions, and the effectiveness of activities to achieve the targets of the Sustainable Development Goals (TPB). (Tranggono et al., 2019).”

From the identification of the food system strategy proposed in the study Tranggono et al. (2019), There are nine sustainable food recommendations made for the purpose of improving the performance of food systems and practices in Indonesia. Data 3.

“Nine recommendations for sustainable food, namely: (1) mainstreaming the sustainable food system (SPBI) into formal policies; (2) optimizing the use of local food germplasm and ensuring the availability of food land and waters; (3) ensure inclusive access to food land and waters, including forests and the sea as sources of food; (4) utilize the concept of sustainable production in cultivation, processing and processing, storage and reserving, as well as food logistics and distribution; (5) ensure the diversity of types of production of staple food cultivation, and guarantee quality and health; (6) development of a network of granaries based on local wisdom; (7) ensure the realization of fair food prices in each value chain; (8) make responsible food consumption a top-of-mind and local community's lifestyle; (9) the application of the hierarchical management of food loss and waste in a consistent manner to prevent food waste.”

It is understood that the nine recommendations for a sustainable food strategy must be carried out consistently and stated in government policies and regulations. The diversity of natural resources owned is optimized to ensure that local food, land and water sources are well available. This is done so that there is no community conflict. Responsible and quality production as well as safe for consumption is an absolute requirement for the concept of sustainable production (Munoz et al., 2005).

The results of interviews with officials at the East Java Agriculture Service stated that, Data 4

"To provide sufficient food sources, the government can do this with careful planning, then carried out with full consistency while maintaining environmental sustainability. Excessive use of drugs is also avoided so that the green economy approach is still considered. Every village or region should have a food barn that is useful in times of food crisis, and for controlling food prices.”

In this case, every region in Indonesia under local government policies must have a target of 'basic needs', development of a network of food granaries, and stability of food prices. Badan Pusat Statistik (2020) released agricultural indicators that are used to make it easier for data consumers to understand developments in the agricultural sector. Six commodity sub-sectors are considered by the government for sustainability, namely food crops, horticulture crops, plantation crops, livestock, fisheries and forestry. These six commodity sub-sectors will

later become directions for the use of smart technology with the concept of a green economy.

In addition, consumption patterns also need to be considered, especially related to people's perceptions and lifestyles. The goal is to promote massively and make a healthy lifestyle a lifestyle for the Indonesian people. A healthy lifestyle is very important in reducing the risk of various diseases (Djermani et al., 2020). According to Cockerham (2005), individual paradigms can influence the concept of a healthy lifestyle. Therefore, it is likely that the objectives can be applied in Indonesia. On the other hand, a good food system is able to form a closed cycle so that it is hoped that its application can minimize food waste and maximize utilization that is beneficial to the welfare of the community. (Tranggono et al., 2019).

The National Development Planning Agency (Bappenas) and the SWITCH Asia Local Indonesia Project Consortium are building a major project for a sustainable food system. The area of the Local Harvest project is very wide, covering 14 districts in 8 provinces in Indonesia, namely North Sumatra, Riau, West Java, Central Java, North Kalimantan, Southeast Sulawesi, and South Sulawesi. This project contributes to economic prosperity and poverty reduction through the capacity of MSMEs and producers as well as promoting responsible consumption behavior and food production of international standards.

The results of interviews with officials from the Ministry of Agriculture via WhatsApp obtained the following information. Data 5.

"Food needs must be prepared with the concept of a green economy, so that it is healthy for consumption, making people's life expectancy increase. The development of the food sector with the approach of local wisdom needs to be continuously encouraged so that the preservation of nature is maintained, so that the land borrowed from future generations is not damaged. Sociologically, in order to create food justice for both current and future generations."

More deeply, the food system has a high complexity, is counter-intuitive, and uses a quantitative model with a system dynamics approach. The government builds a sustainable food vision, namely the Nusantara Wisdom Food Vision which focuses on four dimensions (sovereignty, justice, local wisdom, and sustainability) (Tranggono et al., 2019). Data 6

"Current food system practice focuses on five aspects. First, production-oriented. Second, food and promotional products are pushed to the market. Third, the diversity of staple foods is oriented towards rice, corn, and soybeans. Fourth, food sources as priority commodities. Fifth, separate food policies between sectors and

coordination. Meanwhile, a sustainable food system has a high orientation towards fulfilling community nutrition and is based on economic, social and environmental aspects. In addition, staple foods are oriented towards potential products from resources according to the regions of each region. Subsidies for facilities and infrastructure are oriented towards superior seeds and organic farming. What is clear is that sustainable food must be well integrated and coordinated.”

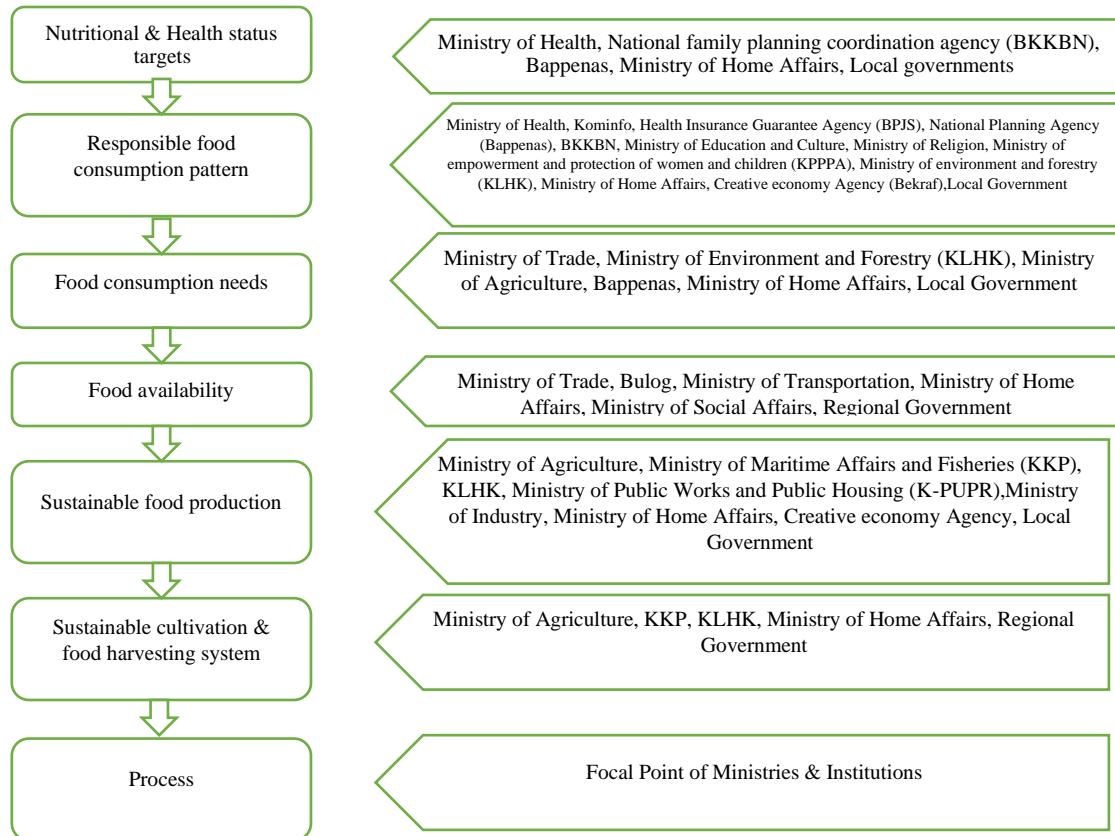
If examined carefully, the five aspects of the food system that were previously and are currently being promoted have fundamental differences in the orientation that is carried out. Conventional ways are starting to be abandoned and focus on caring for the environment through responsible consumption behavior and healthy food products (Nilsson et al., 2016). Concern for nutrition through the 'Fill My Plate' program has become a major movement involving stakeholders in Indonesia. Religious consumption patterns are a big challenge as well as a potential aspect in developing a sustainable food system. This is because, later on, each region will have a variety of food depending on the food product following the consumption pattern in the region. The following is the planning process for a sustainable food system, which can be seen in Figure 1.

Based on Figure 1, it can be explained that ministries and government agencies have responsibilities at every stage of the process carried out from the national, provincial to district/city levels. The role of these stakeholders is very important for successful implementation, because without good integration from upstream to downstream, there will be a food system failure that has a negative impact on food security.

The results of interviews with officials from the Ministry of Agriculture explained as follows. Data 7.

“Government policies in the field of good food must be formulated together with the community, so that people feel included in food policy making. With good policies and supported by the community, it is hoped that the government's goals in preparing high-quality food and being able to improve the level of public health can be achieved. Food distribution must be even, especially for food insecure areas. Thus, there is no stunting in food insecure areas, because food prices are cheap, easy to obtain and there are various types of food that can be consumed by the community.”

Figure 1. The Planning Process for a Sustainable Food System



Source: (Tranggono et al., 2019)

Feenstra (2002) explained that good integration will support alternative agricultural sectors to be more sustainable. The role of government policy is to ensure the availability and stability of food prices so that the practice of a sustainable food system can run well. Data 8.

“The government's policy intervention on a sustainable food system focuses on eight aspects. First, aspects of germplasm and food land & waters. The government ensures the realization of food genetic resources as common property rights, ensures inclusive access to food sources, and ensures the availability of land and water. Second, extraction and conservation to carry out a comprehensive evaluation of the value of ecosystem services, accelerate forest mapping, and ensure the status of customary forests as local food sources. Third, the cultivation aspect is oriented to the diversity of local food and increasing consumption and cultivation of local food sources. Fourth, quality and integrated food processing and processing. Fifth, storage

and backup through massive revitalization and dissemination so as to form virtual and real networks throughout the region. Sixth, logistics and national food distribution involving all stakeholders. Seventh, responsible food consumption, especially rice consumption. Eighth, post-consumption and food loss through the formulation of a system for preventing, reducing, and utilizing food loss and food waste by involving cross-sectors.”

The focus of its development is public participation, new partnerships, and commitment to the principles of social, economic, and environmental justice. A sustainable food system is a vital condition for increasing the role of the agricultural sector in a country Tranggono et al. (2019) explained that sustainable food systems and practices are based on six progressive principles, namely: the principle of common goals, inclusiveness, interdependence, holistic principles, local, environmental systems and natural resources. Data 9.

“The principle of the food system must be holistic and sustainable. This is because food is a unifying stakeholder in the planning process. Stakeholders need to participate in food practices so that later they will form food independence and sovereignty. Stakeholders have an interdependence relationship because they have certain specifications that other stakeholders do not have. In addition, environmental systems and resources are at a controlled level of support and capacity, including anticipation of climate change. So that food management can produce optimal benefits.”

Based on data 9, it is known that an important aspect in these principles is the principle of kinship, where each stakeholder is required to fulfill their respective roles responsibly. What is clear is that every stakeholder needs managerial activities (van den Heuvel et al., 2011). Dahiri & Fitri (2020) explained that government policies together with ministries/agencies are important efforts to make a good food system. Inconsistency and failure of upstream to downstream synchronization makes the food system ineffective.

Based on the findings, the novelty of this research appears that, sociologically, food system policies in Indonesia for sustainable development require improved planning that involves the community, managerial implementation and procurement of food ingredients are entirely community-based, while still applying the main principles that are standardized, and focused on vital aspects, where all stakeholders must understand their respective responsibilities so that the food system can run well, while still paying attention to environmental friendliness and sustainability.

Government Policy on Sustainable Food Production with a Green Economy Approach

The second finding reveals that the government's policy on sustainable food production uses technology that is not yet 100 percent supportive of smart green-agricultural technology. It should be noted that the concept of smart green-agricultural technology means contributing to protecting the natural resource environment and implementing responsible consumer behavior. However, if viewed from the statistical data on agricultural facilities for the period 2017-2021, it is known that there is still the use of pesticides and chemical fertilizers. Excessive use of pesticides and chemical fertilizers can damage soil fertility. However, the allocation and realization of organic fertilizer distribution is also carried out. The realization of the distribution of urea fertilizer for the 2017-2021 period reached 2,799,883 tons, SP-36 fertilizer 297,777 tons, ZA fertilizer 545,189 tons, NPK fertilizer 2,190,200. while the fertilizers that are safe for the environment are 165,153 liquid organic fertilizers and 406,175 tons of organic fertilizers. Thus it is clear that the use of organic fertilizers is smaller than the use of chemicals. Agricultural tools and machines have not implemented modern 4.0 technologies such as blockchain, big data, and IoT. Commonly used agricultural tools and machines include: 2-wheel tractors, 4-wheel tractors, rice planting machines, and water pumps (Kementarian Pertanian, 2021). This indicates that the sustainable food system with the concept of smart green-agricultural technology in Indonesia is still far from being realized. Government policies still focus on conventional agricultural facilities compared to realizing the green economy concept in the agricultural sector.

The government's policy on sustainable food production to realize a green economy can be seen in the 2020-2024 Indonesia Sustainable Food Roadmap. This map provides a five-year strategic direction for sustainable food systems and practices in terms of policy, planning and investment. This green growth program is in collaboration with the Global Green Growth Institute (GGGI). Data 10.

“The roadmap is intended to complement and help guide the use of existing planning documents and procedures using practical methods based on environmentally friendly, sustainable and equitable inclusion, and healthy and productive ecosystems. There are four sections described, including: (1) Indonesia's economic growth trajectory that is more resource and energy efficient, environmentally friendly, socially equitable, and reduced greenhouse gas emissions in an integrated manner; (2) green growth opportunities based on the main economic sectors; (3) mainstreaming green growth in policies, planning, and investment to measure and monitor green growth performance; (4) realizing green economic growth for the nation in the short, medium and long term until 2050.”

Based on data 10 contained in the roadmap for realizing green economic growth, it is known that green growth requires a large investment. Especially if you use smart technology. These costs involved include big data development, use of blockchain, and ICT. So it's not only focusing on green economic growth but also technology development that supports the program significantly. Fitri et al. (2019) explained that the adoption of technology in the agricultural sector supports achieving sustainable food security. It is further revealed that the costs due to an economic approach that ignores quality have negative impacts on the environment such as poor air quality, groundwater abstraction and subsidence, water quality and availability, impacts of coal mining and burning, and social impacts of carbon. The concept of smart green-agricultural technology can minimize these negative impacts, although on the other hand it requires a large investment as a form of compensation. In other words, there is a price to be paid for the opportunity for green growth for a prosperous society and a well-maintained environment. 11. Data.

“The cost of an economic approach that ignores quality consists of five kinds of impacts. First, the use of gaseous emissions and toxic particulate matter from forest and peatland fires reduces water quality and can even lead to death. Second, the impact of groundwater abstraction and subsidence which causes the groundwater level to decrease significantly. In the long term, these conditions can cause other water levels to rise due to extreme climate change. Third, the impact of poor water quality and availability, especially in the city center. This is because, the majority of rivers have been severely polluted. Fourth, the impact of coal mining and burning that endangers public health. Crude emissions reveal the huge costs the government has to bear from the practice. Fifth, the social impact of carbon which reaches 1 billion tons per year.”

From data 7, as stated by GGGI (2015) explained that green growth efforts are very important for the Indonesian government. The negative impact on the environment and society makes the concept of smart green-agricultural technology an alternative for a sustainable food system. The desired technology is the development of clean technology based on biodiversity and waste recycling. The development of this technology can be carried out in collaboration with the Agency for the Assessment and Application of Technology (BPPT) and the Indonesian Consumers Foundation and other stakeholders.

The use of urban farming technology is carried out on the basis of local knowledge for food management throughout the cycle. In the 10 recommendations of the Indonesian Biodiversity Foundation (KEHATI) in 2019, the application of adaptive technology is the fifth key factor

for sustainable food policy through an agroecological approach. The basic stages of food management throughout the life cycle utilize the technological and innovative aspects of SPBI, consisting of eight sub-discussions, namely: nuthaf plasma, land, and waters; retrieval & conservation; cultivation; processing & processing; storage & backup; logistics & distribution; consumption; Post consumption & food loss. (See table 1)

Table 1. Intervention and Innovation from the Technology and Innovation Aspect

No	Sub-discussion	Interventions and Innovations carried out
1	Germplasm, Land & Water	<ul style="list-style-type: none"> • An online based knowledge management system for local germplasm & local food fields including the database system
2	Collection & conservation	<ul style="list-style-type: none"> • Creating knowledge management and databases based on local wisdom of food
3	Cultivation	<ul style="list-style-type: none"> • Create knowledge management and local food cycle database
4	Processing & processing	<ul style="list-style-type: none"> • Implementation of sustainable production for food, especially for land conservation, increasing productivity & reducing food cultivation costs
5	Storage & Backup	<ul style="list-style-type: none"> • Implementation of urban farming in a systematic and sustainable manner
6	Logistics & distribution	<ul style="list-style-type: none"> • Implementation of sustainable production & food industry in food processing & processing
7	Consumption	<ul style="list-style-type: none"> • Research and development of new foods
8	Post consumption & food loss	<ul style="list-style-type: none"> • Development of a national system of various era 4.0 granary panfans based on IT, big data, blockchain, and modern virtual technology

Source: Tranggono et al. (2019). Data processed, 2022

Based on Table 2, it can be understood that the absorption of technology focuses on the basis of local wisdom. Thus, it is clear that the Sustainable Food Production system using Smart Green Agricultural Technology using a green economy approach seeks to maximize the absorption of adaptive technologies in the form of ICT, blockchain, and big data on resources. Technology absorption is carried out without damaging the environment and must be socio-culturally acceptable to the local community. This goal is stated in the recommendations for biodiversity-based food sovereignty put forward by the Indonesian Biodiversity Foundation (KEHATI). Previous studies have explained that smart green-agricultural technology must be developed systematically, sustainably, and apply upstream-downstream concepts. All stakeholders need to be involved and cooperate well with each other in the program. More deeply, barns

must use modern sustainable technology to support decision-making, development of national dashboards and sustainable food systems.

In the European Union, the concept of smart green-agricultural technology was introduced long before Indonesia. the country announced the 'European Green Deal' to become the cornerstone of a green transition by developing the potential of a green, circular and low-carbon economy. Thus, it can be an example of how government policies can support the green economy concept given that the environment and limited resources are very important to maintain global food security. This is what ultimately means that a sustainable food system must be inclusive and equitable in every value chain. The pressure factor for competition in the use of food, failure to implement policies exacerbate the condition of national food performance in Indonesia (Warren & Steenbergen, 2021; Nuryanti et al., 2018; McCarthy & Obidzinski, 2017; Vel et al., 2016; Tambunan, 2005). Previous studies conducted by Dahiri & Fitri (2020) has explained that the agricultural sector has a major role in the economy. Evaluation and adjustment of policies towards a sustainable food system is very important. So that the government can realize green economic growth to achieve sovereign and prosperous food security efforts.

Conclusion

Research has found novelty that, sociologically, government policies related to sustainable food production must involve and be community based. The use of smart green-agricultural can work well when it all relies on community participation, while still prioritizing the use of a green economy approach.

The next novelty is that sociologically, government policies on the food system must always side with the community to ensure fair food prices and including the prices of seeds, fertilizers, pesticides, tools, and agricultural machinery are entirely in favor of farmers.

The novelty of this research also shows that agricultural technology is environmentally friendly and must remain focused on food knowledge management systems. Sociologically, knowledge management and food databases must be based on local wisdom, the application of sustainable production and food industry 4.0. To meet the needs of the community, it is necessary to develop a national system of barns, development of logistics and distribution systems, development of virtual content, and a national network of farmer-based knowledge. Sociologically, government policies related to food should aim to improve the welfare of the community while still paying attention to a sustainable food system based on a green economy. In practice, the

concept of smart green-agricultural technology cannot be fully implemented at this time. However, the government needs to develop a sustainable food system using a green economy approach to support the Indonesian sustainable food system (SPBI) while still involving farmers as the main basis.

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