

Balancing the scales: achieving food security and environmental sustainability in Malaysia through integrated approaches and collaborative governance

Siti Nur Syahira Abdullah Kasim^{1*}, *Muhamad Azahar* Abas^{1,2}, and *Sulaiman* Chindo^{1,2}

¹Faculty of Earth Science, Universiti Malaysia Kelantan, 17600 Jeli, Kelantan, Malaysia

²Environment and Sustainable Development Research Group, Universiti Malaysia Kelantan, 17600 Jeli, Kelantan, Malaysia

Abstract. Food security and environmental sustainability are significant challenges in Malaysia. Malaysia intends to improve food security by expanding domestic food production and increasing access to nutritious food. However, the country also acknowledges the importance of environmental sustainability in protecting its various ecosystems and natural resources. The imbalance between food security and environmental sustainability faced environmental deterioration, water scarcity and pollution, biodiversity loss, greenhouse gas emissions, land use disputes, and food waste. This study explores the issues and challenges of balancing the need for food security and environmental sustainability. An in-depth interview was conducted with saturated data collection, comprising insights from five (5) respondents who are government officers related to food security and environmental sustainability. This study found that Malaysia has implemented several policies, integrated techniques, and collaborative solutions to promote sustainable agricultural systems and environmental preservation. These findings are crucial to balance the scales between food security and environmental sustainability.

1 Introduction

The world's population is expanding at an alarming rate. According to the 2017 World Population Prospects published by the United Nations, the world's current population of approximately 7.4 billion will grow further, reaching 8.5 billion in 2030, 9.7 billion in 2050, and more than 11 billion by 2100 [1]. By 2030, the world population will reach 8.3 billion, with an additional 2 billion people to be fed. Approximately 90% will reside in developing nations, needing 70-100% more food [2]. Thus, it is essential to ensure that enough food can be produced consistently to feed this growing population and that it is available and sustainable for everybody. Sustainable food production is critical to addressing the world's pressing concerns about food security and environmental sustainability, with a beneficial impact on social and economic well-being. Food security is defined as everyone having

* Corresponding author: nursyahira1811@gmail.com

access to safe, nutritious, and sufficient food to meet their dietary requirements. According to the Food and Agriculture Organisation of the United Nations (FAO), the world population will hit 9.7 billion by 2050 [3]. Thus, every nation must produce more food to feed this rising population while minimizing environmental impacts. Sustainable practices such as efficient resource use, biodiversity conservation, and adaptable farming systems can help to meet rising food demand without depleting natural resources.

Malaysia faces significant challenges in balancing food security and environmental sustainability to meet its population's nutritional needs while reducing the negative ecological repercussions of agricultural practices. The fundamental dilemma arises in balancing long-term food security and environmental integrity. Malaysia has embarked on several initiatives to address these concerns. For example, the previous National Agrofood Policy (NAP) has been modified by the Ministry of Agriculture and Food Security (MAFS) into the National Agrofood Policy 2021-2030 (NAP 2.0) [4], which is a comprehensive plan focusing on the modernization and expansion of the agro-food sector. The NAP 2.0 strengthens the national food security with a strong emphasis on technology, research, development, and collaboration among many stakeholders.

2 Methodology

2.1 Purposive sampling

Purposive sampling is a non-probability method in which researchers choose participants based on specified qualities or criteria that correspond to the research objectives. Purposive sampling allowed researchers to target individuals or groups with specialized knowledge or expertise in the research area, which is food security and environmental sustainability in Malaysia. Researchers can gain valuable insights and information by selecting participants knowledgeable about food security and environmental sustainability in Malaysia. This approach helps to capture diverse perspectives and experiences, providing a comprehensive understanding of the topic. In this study, the respondents were selected based on their roles or involvement in food security and environmental sustainability at the ministerial level. Five officers from the Ministry of Agriculture Food Security (R1, R2, and R3) and the Ministry of Natural Resources, Environment and Climate Change (R4 and R5) participated in this study.

2.2 In-depth interview

In-depth interviews are a qualitative method commonly used to collect rich and detailed data directly from participants. In-depth interviews are conducted one-on-one with individuals to investigate the issue of balancing food security and environmental sustainability. Besides that, in-depth interviews allow researchers to obtain detailed and nuanced information from participants. Interviews are also particularly valuable when the researcher seeks to understand a particular situation or phenomenon's complexity and capture the richness of participants' experiences [5]. The questions asked to the respondents are related to 1) the issues of imbalance between food security and environmental sustainability, 2) the impact of imbalance of food security and environmental sustainability, and 3) the integrated approach and collaborative governance practiced in food security and environmental sustainability. Besides, using a small but saturated sample of five respondents ensured that this study reached data saturation, where no new information or themes emerged from further interviews.

2.3 Content analysis

Content analysis has emerged as a robust methodology for extracting meaningful insights from vast textual data. Its widespread applications in various fields demonstrate its significance in modern research. In this study, content analysis was adopted to interpret the interview transcript related to the issues of imbalance of food security and environmental sustainability and the practices of integrated approach and collaborative governance in balancing food security and biodiversity in Malaysia.

3 Results and discussions

3.1 The issues of imbalance between food security and environmental sustainability

All respondents (R1, R2, R3, R4, R5) have highlighted the importance of food security, which must be balanced with the need for environmental sustainability, which includes maintaining ecosystems, protecting biodiversity, and reducing the effects of climate change. An imbalance between food security and environmental sustainability offers substantial difficulties and concerns in Malaysia, as in many other countries.

Environmental deterioration, biodiversity loss, water scarcity and pollution, land use disputes, greenhouse gas emissions, and food waste are all manifestations of this imbalance [6]. Besides, unsustainable agricultural practices, such as the overuse of agrochemicals, deforestation, and habitat destruction, degrade the ecosystem and threaten the long-term sustainability of natural resources [7]. Inadequate water management, ineffective irrigation techniques, and chemical runoff contribute to water scarcity and pollution, which hurts ecosystems and human populations [8]. The challenges of sustaining a robust and sustainable food system are exacerbated by biodiversity loss and environmental instability.

3.1.1 *Poor governance and policy implementation*

Most respondents (R1, R2, R4, R5) have mentioned that poor governance and policy execution can compound the difficulties of achieving food security and environmental sustainability. This is an especially pressing issue in Malaysia, where government and non-government agencies are critical in determining agricultural practices, resource management, and conservation activities [9]. Poor governance can emerge in various ways, hindering efforts to balance food security and environmental sustainability. Ineffective or insufficient regulations governing land usage, agricultural practices, and environmental protection can hinder long-term development. Also, poor governance frameworks may fail to address agricultural activities' environmental implications [10], allowing unsustainable practices to remain. Without defined guidelines and enforcement measures, unrestrained deforestation, pollution, and unsustainable resource extraction can occur [11]. A lack of coordination and integration among various government departments and sectors in Malaysia can obstruct the creation and implementation of comprehensive programs. Besides, disparate methods can result in contradictory policies and fragmented decision-making, resulting in a lack of coherence between food security and environmental sustainability goals [12].

3.1.2 *Ineffective techniques and solutions*

Most respondents (R1, R2, R3, R4) also highlighted that employing inadequate techniques and practices frequently aggravates the gap between food security and environmental

sustainability in Malaysia. Agricultural practices prioritizing short-term benefits [13] in food production over long-term environmental consequences can impede efforts to build a sustainable and resilient food system. Understanding and correcting the flaws of such techniques is critical for striking a delicate balance between food security and environmental sustainability.

In an imbalance between food security and environmental sustainability, ineffective practices can emerge in various ways, including excessive use of agrochemical inputs, such as synthetic fertilizers and pesticides, which can harm the underground [14] and the environment. These chemicals can pollute water, degrade soil, and kill beneficial creatures, altering ecosystems and jeopardizing long-term agricultural output. Furthermore, abuse of agrochemicals might pose health dangers to farmers and consumers [15]. Unsustainable land-clearing practices, mainly deforestation, can contribute significantly to the imbalance between food security and environmental sustainability. The conversion of forests, peatlands, and other natural ecosystems for agriculture destroys habitat, causes biodiversity loss, and contributes to carbon emissions, increasing climate change [16]. Land degradation and deforestation also raise the danger of soil erosion and water scarcity. Like other countries in Asia, Malaysia also faced challenges from inefficient agricultural water management practices, which contribute to water scarcity, providing difficulties to rice production [17] and environmental sustainability.

3.2 The impacts of imbalance between food security and environmental sustainability

The disassociation of food security with environmental sustainability has significant implications for society, the economy, and the environment. Because efforts to establish food security frequently prioritize short-term gains, the long-term environmental effects can be disastrous. Respondents R1, R3, and R5 have highlighted that understanding the consequences of this imbalance is critical for designing effective policies that combine food security with environmental sustainability objectives. These consequences are visible and require attention in Malaysia, where this issue is particularly pressing. Once food security and environmental sustainability are not effectively balanced, the results can be far-reaching and are especially pertinent in Malaysia, where the country is attempting to overcome the issues posed by this imbalance. Food insecurity is the most severe consequence of an imbalance between food security and environmental sustainability, hurting health, well-being, and human development.

Environmental issues such as water scarcity, land degradation, biodiversity loss, and climate change can all lead to lower agricultural productivity, crop failures, and disruptions in food production systems [18]. These factors reduce food availability and accessibility, resulting in inadequate nutrition and hunger, particularly among disadvantaged groups [19]. Besides, achieving a balance between food security and environmental sustainability might worsen societal socioeconomic inequities. These repercussions fall disproportionately on vulnerable and marginalized people, such as small-scale farmers, indigenous groups, and rural populations. Environmental deterioration and unsustainable farming practices can endanger society's health [20]. Agrochemical pollution and inappropriate waste management can contaminate water sources, resulting in waterborne infections and health problems. Pesticides and chemical fertilizers used in agriculture can have adverse effects on humans. Meanwhile, market volatility and price changes can result from an imbalance between food security and environmental sustainability [21]. For example, drought, floods, and crop diseases can interrupt food production, limit supply, and raise food costs. Food price volatility can harm farmers and consumers, hurting income, consumer spending, and general economic stability. The food crisis necessitated quick and preventative measures. Several Asian

countries, for example, have undertaken several two, three, or even four policy actions, plans, and initiatives in trade policy (including local and international trade policies), short-term production strategy, and safety net programs [22]. There are four significant components of food security: accessibility, availability, utilization, and stability. Policy measures, strategies, and initiatives are adopted in response to the food crisis based on the components of food security that demand the most attention or investment [23].

3.3 Integrated approach and collaborative governance in food security and environmental sustainability

Respondents R1, R2, and R3 mentioned that the policy implemented to ensure food security in Malaysia is National Food Security Policy (NFSP). Malaysia's paddy and rice sector has had policy objectives and tools dating back to the 1st Malayan Plan and the present 9th Malaysian Plan, as well as the 1st National Agricultural Plan and the 3rd National Agricultural Plan. However, food security has been the sector's primary priority [23]. This extended approach has led to a significant goal of establishing a reasonable self-sufficiency level (SSL) in rice, which has become an indicator of the country's food security. Malaysia released rice supply (either public or subsidized imports) and enforced wholesale pricing limits [22]. Malaysian authorities made significant efforts to solve the problem through short- and long-term policy actions. Among these was the National Food Security Policy, which intends to enhance rice production in the medium and long term to meet the updated SSL target, notably in Sabah and Sarawak. The policy's goals include increasing domestic food production, promoting sustainable agricultural practices, strengthening food supply chains, and improving farmers' market access. Besides, The National Agro-Food Policy is crucial to making Malaysia's agriculture sector more competitive and sustainable [24]. The strategy aimed to boost productivity, boost market competitiveness, promote sustainable practices, and ensure food safety and quality.

Besides that, most of the respondents (R1, R2, R4, R5) also mentioned that Malaysia had recognized the significance of integrating approaches that guarantee food security and environmental sustainability. Malaysia promotes sustainable agricultural practices that aim to increase productivity while reducing environmental effects. This involves promoting the adoption of organic farming methods, integrated pest control, and precision agriculture techniques to reduce dependency on synthetic inputs and reduce pollution risk. Consumers' preference for organically produced food for health concerns is expected to drive up demand for animal waste. Thus, organic farming has great potential in Malaysia. [25]. Because chemical fertilizers and pesticides are not utilized, work requirements are high in organic farming, resulting in high production costs. Organic products, particularly vegetables, attract a substantially higher premium, frequently triple the price of regular vegetables. Some exceptional enzyme-enriched compost and fermented organic fertilizers are used, and nutrients are recycled by decomposing undesirable plant materials collected on the farm. These approaches show that Malaysia aspires to maintain food security while using sustainable agriculture practices to protect the environment. Besides, respondents R4 and R5 have highlighted that Malaysia recognizes the significance of water resource management in maintaining food security and environmental sustainability. Integrated water resource management (IWRM) entails considering the needs of multiple sectors, such as agriculture, industry, and the environment, while sustainably managing water resources [26, 27]. Malaysia employs efficient irrigation systems, rainwater harvesting, and water recycling to optimize agricultural water usage and reduce the danger of water scarcity.

Respondent R3 has mentioned that Malaysia encourages collaborative governance, such as public-private partnerships, to promote sustainable practices in aquaculture and fisheries for furthering development goals. Examples are partnerships between government agencies,

agricultural research institutions, and commercial firms in knowledge transfer, research and development, and market access [28, 29]. These collaborations strive to pool expertise, resources, and innovation from both sectors to establish sustainable agricultural systems and increase food production and distribution. Besides, Malaysia also encourages the creation of farmer's organizations and associations in order to foster farmer collaboration and increase collective bargaining power [30]. These organizations promote knowledge exchange, give access to training and resources, and enable farmers to jointly handle difficulties linked to sustainable agriculture, land use, and market access. Farmers may adopt sustainable practices, increase output, and strengthen their resilience to environmental and market volatility by working together.

4 Conclusions

Balancing food security and environmental sustainability is an ongoing challenge for Malaysia. As the nation continues to develop and progress, it must prioritize the conservation of its natural resources and biodiversity while ensuring a sufficient food supply for its people. By adopting a comprehensive and collaborative approach, Malaysia can chart a path toward sustainable development, safeguarding its natural heritage for future generations. A collaborative solution like public-private partnerships and farmer cooperatives and associations can help balance Malaysia's goals to maximize food production while sustaining the environment. Achieving the delicate equilibrium between food security and environmental sustainability in Malaysia demands a multi-faceted approach. Collaboration between government institutions, non-governmental organizations (NGOs), the commercial sector, and local communities is essential. Besides that, integrated approaches such as sustainable practices through organic farming and integrated water resource management have massive potential in this nation and require significant government support.

Acknowledgement

Special thanks to Kementerian Pendidikan Tinggi, Fundamental Research Grant Scheme (FRGS), FRGS/1/2022/SS02/UMK/02/1, for adequate financial assistance and Faculty of Earth Science, Universiti Malaysia Kelantan (UMK) for providing technical support and facilities during the study.

References

1. U. Nations, Department of economic and social affairs. population division. World population prospects: The 2017 revision: Key findings and advance tables. Working paper No. ESA/P/WP/248 (2017)
2. S. Abdurazak, *Int. J. Scholarly Res. Sci. Technol.* **1**, 001-8 (2022)
3. H. Nguyen, Sustainable food systems: concept and framework. Food and Agriculture Organization of the United Nations: Rome, Italy (2018)
4. S. Makhtar, I.S.Z. Abidin, R. Islam, *Int. J. Ind. Manag.* **16**, 51-8 (2022)
5. H.J. Rubin, I.S. Rubin, *Qualitative interviewing: the art of hearing data*: sage publications (2012)
6. S.B. Wassie, *Environ. Syst. Res.* **9**, 1-29 (2020)
7. P. Hazell, E. Lutz, Integrating environmental and sustainability concerns into rural development policies. E. Lutz (ed), with H. Binswanger, P. Hazell. 9-21 (1998)
8. I. Zahoor, A. Mushtaq, *Int. J. Chem. Biochem. Sci.* **23**, 164-76 (2023)

9. J. Pretty, D. Smith, *Conserv. Biol.* **18**, 631-8 (2004)
10. A. Kinyondo, C. Huggins, *Environ. Sci. Policy.* **120**, 157-64 (2021)
11. A. Estrada, P.A. Garber, A. Chaudhary, *PeerJ.* **8**, e9816 (2020)
12. M.F. Rabbi, M. Hasan, S. Kovács, *Sustainability* **13**, 12433 (2021)
13. V. Piñeiro, J. Arias, J. Dürr, P. Elverdin, A.M. Ibáñez, A. Kinengyere et al, *Nat. Sustain.* **3**, 809-20 (2020)
14. N. Sharma, R. Singhvi, *Int. J. Agric. Environ. Biotechnol.* **10**, 675-80 (2017)
15. O. Oluwole, R.A. Cheke, *Int. J. Agric. Sustain.* **7**, 153-63 (2009)
16. C. Nellemann, E. Corcoran, *Dead planet, living planet: biodiversity and ecosystem restoration for sustainable development: a rapid response assessment: UNEP/Earthprint* (2010)
17. S.I. Bhuiyan, *Outlook Agric.* **21**, 293-9 (1992)
18. M.A. Hanjra, M.E. Qureshi, **35**, 365-77 (2010)
19. C.B. Barrett, E.C. Lentz, *Food insecurity. Oxford Res. Encycl. Int. Stud.* (2010)
20. M. Donohoe, *Soc. Sci. Med.* **56**, 573-87 (2003)
21. R.L. Naylor, W.P. Falcon, *Food security in an era of economic volatility. population and development review.* **36**(4) 693-723 (2010)
22. M. Demeke, G. Pangrazio, M. Maetz, *Country responses to the food security crisis: nature and preliminary implications of the policies pursued. Rome, APSS, FAO* (2008)
23. Y. Tey, *Int. Food Res. J.* **17**, 501-7 (2010)
24. M.B.B. Zakaria, A.H.M.N.B. Mohd, N.L.M.S.B. Mohamed, M.Y.A.B. Ahmad, J.H. Hasan, *Jurnal Islam dan masyarakat kontemporari UNISZA.* **14**, 28-42 (2017)
25. F. Ahmad, *Editor Sustainable Agriculture System in Malaysia. Regional workshop on integrated plant nutrition system (IPNS), development in rural poverty alleviation, United Nations Conference Complex, Bangkok, Thailand* (2021)
26. R. Elfithri, M.B. Mokhtar, S. Zakaria, *World Water Policy*, **5**, 43-54 (2019)
27. M.S.N. Lee, S. Mohamed, M.A.N. Masrom, M.A. Abas, S.T. Wee, *Risk in green retrofits projects: a preliminary study on energy efficiency* in *IOP Conf. Ser.: Earth Environ. Sci.* **549**, 012084 (2020)
28. F. Weirowski, S. Hall, *Public-private partnerships for fisheries and aquaculture: getting started* (2008)
29. M.A. Abas, M.P. Yusoh, S. Sibly, S. Mohamed, S.T. Wee, *Explore the rural community understanding and practices on sustainable lifestyle in Kelantan, Malaysia* in *IOP Conf. Ser.: Earth Environ. Sci.* **596**(1) 012054 (2020)
30. G. Kalshoven, *SE Asian Irrig. Syst.* **88** (1989)