

BUILDING FOOD INDEPENDENCE: IMPLEMENTATION CHRONICLES OF SUSTAINABLE FOOD HOUSE AREAS

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BUILDING FOOD INDEPENDENCE: IMPLEMENTATION CHRONICLES OF SUSTAINABLE FOOD HOUSE AREAS

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Foreword

With great appreciation, we are pleased to welcome the publication of **BUILDING FOOD INDEPENDENCE: IMPLEMENTATION CHRONICLES OF SUSTAINABLE FOOD HOUSE AREAS**. This book serves as a significant contribution to advancing family-based food security through the innovative concept of Sustainable Food House Areas (SFHA). Its publication is both timely and relevant, addressing pressing global challenges in food security, including climate change, land degradation, and growing reliance on external food sources. Amidst these complexities, the SFHA concept emerges as a strategic and forward-looking solution to promote self-reliant food systems at the household level. This book highlights the implementation of the SFHA program, particularly in South Sumatra Province, showcasing how intensive and sustainable yard management can enhance food security, support environmental preservation, and improve family economic welfare. By maximizing the utilization of limited spaces such as home yards, the program enables the cultivation of diverse food commodities—including vegetables, fruits, and medicinal plants—not only to meet household nutritional needs but also to generate additional income streams. Moreover, this book delves into the integration of information technology into SFHA management, a step that facilitates more efficient monitoring and oversight. The use of digital tools empowers communities to access vital information for increasing food production, managing natural resources sustainably, and adopting innovative agricultural practices. This synergy between modern technology and local wisdom exemplifies how integrated solutions can address the food security challenges faced by families across Indonesia.

Beyond its practical guidance, this book seeks to foster a deeper awareness of the critical importance of sustainability in natural resource management. Sustainability is not merely an ecological necessity but also the cornerstone of robust and resilient food systems. By tapping into the potential resources within our reach, we can reduce dependency on external food supplies, which are often vulnerable to price volatility and climatic uncertainties. We also envision this book as a valuable reference for a wide audience, including academics, practitioners, and policymakers,

in their efforts to promote effective household resource management. By aligning the SFHA concept with local policies, this approach has the potential to strengthen national food security and contribute to achieving the Sustainable Development Goals (SDGs), particularly those concerning poverty eradication, food security, and environmental conservation. We extend our heartfelt gratitude to the author and all collaborators whose efforts have made this publication possible. Without their dedication, this book would not have come to fruition. It is our sincere hope that this work will inspire readers to innovate, collaborate, and remain steadfast in their commitment to building a more resilient and sustainable food system.

Happy reading! May this book bring valuable insights and practical benefits in our shared journey toward achieving greater food independence and sustainability.

Sincerely,

Ir. Taufik Syamsuddin, M.Si

Dean of the Faculty of Agriculture, Taman Siswa University of Palembang,
South Sumatra Province, Indonesia



Preface

With profound gratitude to God Almighty, we celebrate the completion of this book, titled BUILDING FOOD INDEPENDENCE: IMPLEMENTATION CHRONICLES OF SUSTAINABLE FOOD HOUSE AREAS. This publication is a vital response to the pressing challenges of our time—ensuring food security amidst dynamic social, economic, and environmental changes. The book aims to offer guidance and inspiration for the development of Sustainable Food House Areas (SFHA) as an innovative solution that can be effectively applied at the household level, particularly in South Sumatra Province, and adapted to other regions with similar contexts.

Food security represents a multifaceted issue requiring an integrated approach. In this regard, the SFHA concept is crafted to optimize the use of yard spaces through a sustainability-driven framework. Beyond its role in enhancing food production, SFHA also seeks to empower communities socially and economically, fortify households against potential food crises, and foster independence and resilience within society. The objectives of this book are both ambitious and clear. First, it provides a comprehensive exploration of the foundational concepts and operational framework of SFHA programs. Second, it elucidates the diverse benefits attainable at individual, familial, and communal levels through the program's implementation. Third, it identifies the challenges encountered during program execution and offers practical recommendations based on real-world experiences. Lastly, this book investigates the social, economic, and environmental impacts of SFHA initiatives, illustrating their alignment with broader sustainable development goals.

The content of this book is underpinned by rigorous research, field experiences, and in-depth interviews with a diverse range of stakeholders, including implementers, beneficiaries, and observers of the SFHA program. These insights are complemented by a comprehensive review of contemporary literature on food security, information technology, and participatory approaches, all of which are integral to SFHA's successful application. A key feature of this book is its emphasis on the synergy between information technology and participatory methodologies. Information technology facilitates the efficient dissemination of knowledge and resources, while participatory approaches ensure that programs are tailored to the specific needs, potentials, and contexts of local communities. Additionally, the book includes case

studies from regions in South Sumatra that have successfully implemented SFHA programs. These examples highlight best practices, innovative strategies, and field-level challenges, offering practical lessons for readers interested in replicating or adapting the concept in other regions.

We recognize that this book is not without its limitations, both in terms of scope and depth of discussion. We warmly invite constructive feedback and suggestions from readers to enhance the quality of future editions. Our hope is that this book serves as a valuable resource for a wide range of stakeholders—academics, practitioners, policymakers, and the general public—seeking to deepen their understanding of and expand the application of the SFHA concept. This book is also a call to action. Food security is not the sole responsibility of governments or specific institutions; it is a shared commitment that requires collaboration across all sectors of society. Through this work, we aspire to inspire readers to actively support and contribute to the creation of sustainable food systems. Finally, we hope that this book provides not only insight but also the motivation to innovate and collaborate in realizing a brighter future through sustainability-focused initiatives. May the knowledge and experiences shared within these pages deliver lasting benefits and positively impact community development, particularly in advancing food security and family welfare.

Sincerely,



About the Editors



Amodu, Salisu Ameh PhD is a distinguished scholar in African Philosophy, with a Ph.D. in African Philosophy from the University of Nigeria, Nsukka, and advanced degrees from Prince Abubakar Audu University and Kogi State University, Anyigba. His academic expertise spans African metaphysics, epistemology, ethics, humanism, gender studies, and peace and conflict resolution, reflecting his multidisciplinary approach to critical issues within African studies. Amodu, Salisu Ameh PhD is currently serving as a lecturer in the Department of Philosophy and is a member of the board at the Center for Diploma and Pre-degree Studies at Prince Abubakar Audu University. His dedication to education is further demonstrated through his leadership in initiatives such as the Educate 500 Students on Quality Research program, which underscores his commitment to advancing intellectual development among students. An accomplished author and editor, Amodu, Salisu Ameh PhD has made significant contributions to African philosophical scholarship. His publications include *Land in African Ontology* and *Rational Proof of the Existence of God in Igala Ontology*, as well as co-edited works on African philosophy, ethics, and sociocultural studies. His impactful research and writings have earned him numerous honors, including an Award of Excellence for his contributions to African studies. As an active member of several academic organizations, including the Association for the Promotion of African Studies (APAS) and the Association of Philosophy Professionals of Nigeria (APPON), Amodu, Salisu Ameh PhD also serves as an editorial board member and manuscript reviewer for leading journals. His influence extends beyond academia, contributing to contemporary discourse in philosophy and fostering deeper engagement with Africa's intellectual heritage. Through his scholarly work and commitment to community-focused initiatives, Amodu, Salisu Ameh PhD continues to promote African philosophical thought and inspire future generations.



Engr. Imran Arshad is a result-oriented, multi-disciplinary, and Gulf-experienced engineering professional with 14 years of professional experience in the field of agricultural engineering. He holds a Ph.D. in Irrigation and Drainage Engineering from Sindh Agriculture University, Pakistan, and has completed his M.E. in Irrigation and Hydraulics Engineering from Institute of Water Resources Engineering and Management, Pakistan.

He has received numerous awards and recognition for his outstanding research and contributions to the field of agricultural engineering, including the Best Scientist Award, Excellence in Research Award, Best Researcher Award, Outstanding Researcher Award, and Best Ph.D. Scholar Award, among others. As a registered engineer from Pakistan Engineering Council (PEC), he is a permanent member of Pakistan Engineers Foundation (PEF), Pakistan Society of Horticultural Sciences (PSHS), and Institute for Engineering Research and Publication (IFERP). He is serving as an Associate Section Editor for Scientific Forefront Journal in Agricultural Research (SFJAR) and an editorial board member for European Journal of Agriculture and Food Sciences (EJFOOD). He is also a permanent member of the review committee for 5 various international journals.

Engr. Imran Arshad is a distinguished authority in the agricultural domain, boasting an impressive publication record of 58 scientific research papers in national and international peer-reviewed journals, as well as 18 technical articles. His expertise extends to reviewing 134 scientific research papers for various multidisciplinary national and international peer-reviewed journals, including Vigyan Varta, Journal of Experimental Agriculture International, International Journal of Applied Agricultural Sciences, and many others.

With a broad range of research interests in agriculture and water resources management, Engr. Imran Arshad has a special focus on Irrigation and Drainage, Agricultural Engineering, Agronomy, Agriculture Extension, Finite Element Modeling, and agricultural pest control in the Asian region. As the Editor of the Agricultural Sciences section, he provides a platform for researchers, scientists, and engineers to share their knowledge and expertise in the field of agricultural engineering. His goal is to promote sustainable agricultural practices and innovative solutions for agricultural development.



About the Contributors



Yanter Hutapea

Ir. Yanter Hutapea, M.Si is a Principal Researcher at the Research Center for Social Welfare, Village, and Connectivity, part of the Research Organization for Governance, Economic Affairs, and Community Welfare under National Research and Innovation Agency. With a solid academic foundation in Agricultural Development (Bachelor's degree, UNSRI, 1986) and Agribusiness (Master's degree, UNSRI, 2002), he has dedicated his career to advancing innovation in agriculture and rural development. Over the last five years, Yanter has led impactful research projects, including: Farmer and SME Partnerships to Improve the Quality and Value-Added of Semendo Coffee Products (2023); Farmer Responses to Digital-Based Fertilizer Recommendations for Site-Specific Rice Production (2022); Post-Harvest Innovation Assistance for Rubber Farming in South Sumatra (2021). Yanter's research contributions have been featured in reputable journals, books, and conferences. Selected publications include: "Synergy between Partnership and Auction Marketing Methods: Improving Income Certainty and Competitiveness for Rubber Farmers" – Transactions of the Chinese Society of Agricultural Machinery (2023). "Assessing the Challenges and Opportunities of Agricultural Information Systems to Enhance Farmers' Capacity and Target Rice Production in Indonesia" – Sustainability (2023). "Environmental, Social, and Economic Challenges in Lowland Rice Production" – Published in Closing Rice Yield Gaps in Asia, Springer Nature Switzerland (2023). "The Effects of Coagulant Types on the Quality and Added Value of Raw Rubber Materials" – E3S Web Conference (2022). Yanter's work focuses on enhancing agricultural innovation, improving the value chain in coffee and rubber production, and addressing challenges in rice and corn farming systems. His efforts contribute to sustainable development, increased farmer income, and the integration of innovative technologies in agribusiness. Yanter's dedication to agricultural development and rural transformation exemplifies his pivotal role in fostering sustainable practices and empowering farming communities in Indonesia.



Achmad Tarmizi is a distinguished academic and professional with an unparalleled array of qualifications, holding 11 academic degrees and recognized for his extensive contributions to education, research, and governance. He achieved a MURI Record in 2021 as "Secretary of Region with the Most Academic and Non-Academic Degrees." His expertise spans diverse fields, including Mechanical Engineering, Educational Management, Law, and Agribusiness. Dr. Tarmizi has earned degrees from leading institutions, such as a Master's in Mechanical Engineering from Universitas Gadjah Mada (2003), a Doctorate in Agribusiness from Universitas Sriwijaya (2012), and a Professional Engineering Certification from Universitas Lampung (2019). His academic journey is complemented by achievements in law and education management, with degrees from institutions like Universitas Muhammadiyah Palembang and Universitas PGRI Palembang. Recognized internationally, Dr. Tarmizi has received accolades such as the Family Role Model Award and Indonesia Development Award (2019) from the IHRDP International Foundation. Beyond his accolades, he actively participates in international seminars and has contributed to global scientific publications, underscoring his commitment to advancing knowledge and fostering collaboration across disciplines. As a multifaceted professional, Dr. Tarmizi exemplifies lifelong learning and innovation, inspiring both his community and the academic world. His record-breaking achievements and dedication to education and governance make him a prominent figure in Indonesia's intellectual and professional landscape.



Eko Bhakti Susetyo, Ir., MT is a seasoned Associate Expert Engineer at the Center for Agroindustry Technology, National Research and Innovation Agency (BRIN), Indonesia. With a strong academic background in Mechanical Engineering from Diponegoro University (Bachelor's degree) and Industrial Engineering from the University of Indonesia (Master's degree), he combines technical expertise with innovative problem-solving to address complex challenges in agroindustry. Eko Susetyo is the author of impactful works such as "Synergies to Address Stunting in Papua: A Multisectoral Approach" and "Improving People's Quality of Life". He has also contributed to industrial innovation through patents, including: Formula for Sago-Based Instant Noodles (2022); Oven-Method Sago Instant Noodles (2023). An active researcher, Eko Susetyo frequently publishes in scientific journals and maintains profiles on Scopus (ID: 55649045700) and ORCID (ID: 0009-0008-8235-8749), showcasing his dedication to advancing knowledge in agroindustry and improving community well-being. His work exemplifies the application of engineering principles to develop sustainable, impactful solutions in food technology and beyond.



Sahlan was born in 1956 in Cepu, Blora, Central Java, Indonesia. He graduated from the Oil and Gas Mechanical Engineering School in Cepu in 1975 and earned his bachelor's degree from the Nuclear Technology College in Jakarta in 1983. He completed his Master's program in Materials Science at the Faculty of Mathematics and Natural Sciences, Universitas Indonesia, in 1990. From 1980 to 2020, Sahlan worked at the Agency for the Assessment and Application of Technology (BPPT), where he served as Project Leader for the Defense System Study (1985–1997) and as a Senior Principal Researcher (Grade IVe) from 2006 to 2020. Since 2020, he has continued his career at the National Research and Innovation Agency (BRIN). Sahlan is an active author of scientific articles published in international journals, reflecting his dedication to research and advancements in science and technology.



Slamet Rahmat Topo Susilo, is a Senior Researcher specializing in Community Development and Local Economic Empowerment at the Research Center for Social Welfare, Village, and Connectivity, part of BRIN's (National Research and Innovation Agency) Organization for Social, Humanities, and Cultural Research (OR TKEKM). With a deep commitment to advancing social welfare, Slam's work focuses on developing collaborative strategies for improving rural economies and community resilience. Slamet Rahmat Topo Susilo earned his Bachelor's degree in History from Gadjah Mada University (UGM) in 1996 and a Master's degree in Social Welfare from the University of Indonesia (UI) in 2013. Since 2005, he has actively contributed as a researcher in community development, providing innovative insights into empowering marginalized groups and enhancing village economies. Recent research highlights include contributions to combating terrorism through collaborative strategies (Migration Letter, 2023), enhancing income certainty for rubber farmers (Transactions of the Chinese Society of Agricultural Machinery, 2023), and governance of funeral policies and regional income potentials (Russian Law Journal, 2023). Other works explore topics such as healthcare sector capacity during COVID-19 and the development of agrotourism in Indonesia. In addition to journal articles, Slamet Rahmat Topo Susilo has authored several books, including "Kolaborasi Program Pembangunan Desa Mandiri (PPDM) dan Distrik Membangun" (2020) and "Strategi Intervensi Penguatan Badan Usaha Milik Desa (BUM-Desa)" (2019). His books and studies address critical aspects of rural development, including village planning, women empowerment, and optimizing the benefits of village funds to support local economies. Through his extensive publications and research, Slamet Rahmat Topo Susilo continues to contribute significantly to Indonesia's rural development initiatives, combining academic rigor with practical solutions for community welfare and sustainability.



Drs. Suharyon is a Principal Researcher specializing in Farming Systems, with extensive experience in sustainable agricultural innovation, policy development, and rural empowerment. Over the past five years, he has contributed significantly to academic research, publishing in reputable journals such as Plos One (Q1) and Open Agriculture (Q2). His recent studies include “Transformation of Financial Institutions Grants to Inclusive Financial Institutions in Indonesia” (2023) and “The Sustainability of Swamp Buffalo Farming as a Protein Source and Germplasm” (2023). Additionally, his research on intercropping systems, rice biomass utilization, and healthy broiler meat consumption underscores his dedication to advancing practical solutions for agriculture and food systems. Drs. Suharyon has also actively shared his insights at national and international conferences. Notable presentations include his work on “Intercropping Farming of Red Chili and Celery in Jambi City” at the 1st ICADAI (2021) and strategies for cinnamon seed development in Kerinci District (2022). He is also the author of the book “Prospects of Rice Agribusiness: Potential, Constraints, and Development Strategies” (IAARD Press, 2018), which highlights his expertise in agribusiness and rural development strategies. Recognized for his dedication, Drs. Suharyon received the Satya Lancana Karya XXX award in 2023 from the President of the Republic of Indonesia, celebrating his three decades of contributions to agricultural research and development. His work continues to enhance sustainable farming practices and empower rural communities, making him a vital figure in Indonesia’s agricultural landscape.



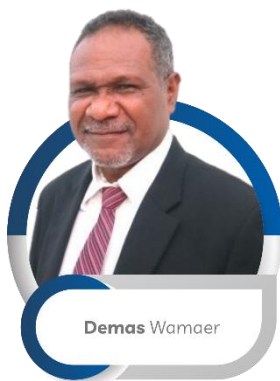
Dr. Agustinus Hartopo, born in Sleman, Yogyakarta, in 1970, is a Senior Researcher and Head of the Research and Innovation Division at the Regional Planning, Research, and Innovation Agency of Papua Province, Indonesia. His educational journey began in Yogyakarta, culminating in a Bachelor’s degree from Universitas Cenderawasih, Jayapura, Papua. Dr. Hartopo has made significant contributions to research, with his findings published in books addressing key topics such as income analysis of sago farmers, the economic impact of development based on customary regions in La Pago, and strategies for cocoa development in Papua Province. His work is deeply focused on understanding and addressing regional economic challenges, particularly in Papua, reflecting a commitment to sustainable development and economic growth. Actively engaged in international scholarly activities, Dr. Hartopo contributes to global academic discourse through the publication of academic articles. His dedication to regional development and his scholarly achievements highlight his pivotal role in advancing research and innovation in Papua and Indonesia.



Andjar Prasetyo is a prominent regional economic expert researcher based in Magelang City, Central Java Province, Indonesia. With a specialization in regional economics, A.P. actively authors international scientific articles and books published by both domestic and international publishers. These works address diverse economic and regional issues, providing valuable insights into multidisciplinary challenges and solutions. Andjar Prasetyo's research contributions are regularly featured in high-impact journals indexed in Scopus Q1 and Q2, reflecting the global relevance and academic rigor of their work. In addition to publishing, Andjar Prasetyo engages in collaborative research projects across multiple disciplines, fostering innovation and advancing knowledge at the intersection of economics and other fields. Through their dedication to research and publication, Andjar Prasetyo continues to play a significant role in addressing regional economic issues, influencing both policy and academic discourse on a global scale.

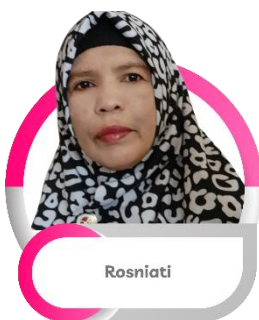


Ir. Nur Imdah Minsyah is a Senior Researcher at the Research Center for Macroeconomics and Finance, part of the Research Organization for Governance, Economics, and Community Welfare under National Research and Innovation Agency, Indonesia. With expertise in agricultural economics and policy, he focuses on integrating innovation and technology to enhance agricultural competitiveness and sustainability. Over the past five years, he has led key research projects such as the Support for Innovation and Technology to Enhance Agricultural Competitiveness (2022), Price Dynamics in Agricultural Inputs/Outputs, Inflation, and Controls (2022), and Policy on Seed Development for Export Commodities in Jambi Province (2020). Nur Imdah is an active contributor to scientific publications, with notable works in international journals and books, including "Synergy between Partnership and Auction Marketing Methods: Improving Income Certainty and Competitiveness for Rubber Farmers" published in Transactions of the Chinese Society of Agricultural Machinery (2023) and "The Integrated Pest Management Implementation of the Cocoa Pod Borer in Indonesia" featured in the book Shifting Frontiers of Theobroma cacao (2023). He has also published extensively on rice and coffee farming systems, including evaluations of new rice varieties and swamp lowland optimization for rice production. His research bridges economic policy and practical innovation, focusing on sustainable solutions for agricultural and regional development. Nur Imdah's work significantly contributes to Indonesia's goals in economic resilience and agricultural advancement.



Ir. Demas Wamaer, M.P. is a Senior Researcher (Peneliti Ahli Madya) at the National Research and Innovation Agency (BRIN), affiliated with the Research Center for Macroeconomics and Finance (PR-EMK) under the Research Organization for Governance, Economics, and Community Welfare (OR-TKPEKM). His expertise lies in agricultural economics and socio-economic development, with a focus on macroeconomic policies and financial systems. Demas earned his Bachelor's degree in Agricultural Cultivation (Socio-Economics) from Cenderawasih University (1984–1991) and a Master's degree in Agricultural

Sciences (Agricultural Economics) from Gadjah Mada University (2001–2003). His academic training and professional experience have positioned him as a vital contributor to research on economic strategies, rural development, and agricultural policies in Indonesia. Committed to advancing socio-economic growth, Demas plays a crucial role in bridging agricultural practices with macroeconomic perspectives, fostering sustainable development across sectors. His work reflects a blend of academic excellence and practical insights into Indonesia's economic and agricultural systems.



Rosniati, is a dedicated researcher with extensive experience in industrial and agricultural research, particularly in product development and functional applications of agricultural commodities. She began her professional career as a Junior Researcher at the Ambon Industrial Center (1991–2000) and currently serves as a Senior Researcher at the Center for Agricultural Product Industries, where she has been active since 2000. She has participated in various national training programs

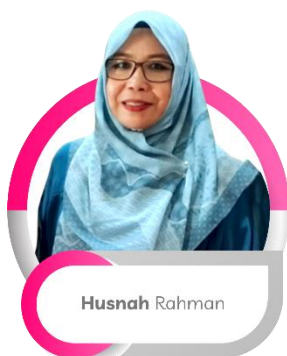
to enhance her professional competencies. Notably, she attended the Technical Guidance for Patent Document Preparation in Makassar (2012) and participated in the Functional Position Communication Forum organized by the Ministry of Industry in Bogor (2012). Her academic contributions are evidenced by numerous publications in reputable journals, with a focus on food technology and cosmetics. Her research includes exploring cocoa pod husk extracts for antibacterial applications, developing functional beverages, and innovating in cosmetic formulations with natural ingredients like cocoa butter and olive oil. Her publications, such as "In vitro antibacterial activity of mouthwashes supplemented with cocoa pod husk extract" (2013) and "Formulation of instant chocolate drinks as an immunomodulator beverage" (2017), highlight her dedication to advancing both scientific understanding and practical applications in these fields. This blend of academic rigor and applied research underscores her commitment to fostering innovation in agricultural and industrial products for enhanced societal impact.



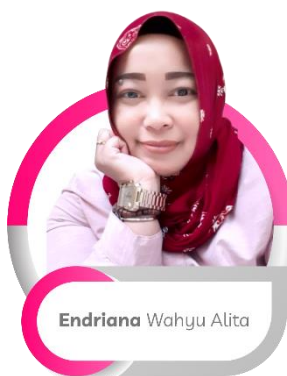
Yardha is a seasoned agricultural researcher with extensive expertise in crop cultivation and agribusiness-focused technologies, particularly in soybean and oil palm development. He earned his Bachelor's degree in Cultivation Science from UMMY Solok (1986–1990) and has dedicated his career to advancing sustainable agricultural practices and innovative solutions for rural farming systems in Indonesia. Over the past five years, Yardha has led impactful research projects, such as optimizing soybean seed production on tidal lands (2022), developing new superior soybean varieties in Jambi Province (2018), and analyzing strategic commodity downstream policies in agriculture (2021). As an active contributor to scientific literature, Yardha has authored numerous journal articles, including “Impact of Globalization on Sustainable Land Use and Farming Systems in Rural Development” (Root Vegetables, Intech Open Book Series, 2023), “The Integrated Pest Management Implementation of the Cocoa Pod Borer in Indonesia” (IntechOpen Limited, 2023), and “The Performance of Growth, Yield, and Quality of Soybean Varieties in Tidal Lands” (Journal of Top Agriculture, 2023). In addition to his research, Yardha has authored pivotal books, such as “Agribusiness-Based Oil Palm Cultivation Technology” (2019) and “Soybean: Seed Multiplication Technology” (2017). He also holds intellectual property rights for his book on oil palm cultivation (2020, No. 000175729). Yardha frequently shares his insights at national and international conferences, including presenting “The Performance of Growth, Yield, and Yield Quality of New High-Yielding Rice Varieties on Tidal Lands” at ICAFES 2023 in Pekanbaru, Riau, and “Analysis on Factors Affecting the Risk of Rice Farming in West Tanjung Jabung Regency” at the 2020 International Conference on Agriculture and Rural Development in Serang, Banten. His dedication to advancing soybean technology, sustainable farming practices, and agribusiness-driven approaches continues to shape agricultural innovation and productivity in Indonesia, ensuring long-term benefits for farmers and the environment.



Asriani, S.Psi., M.A. is a seasoned professional in regional development planning and human resource development, with a strong academic background in psychology. She earned his Master's degree in Psychology from Gadjah Mada University in 2017, following a Bachelor's degree in Psychology from Makassar State University in 2007. Currently, Asriani serves as a researcher at the Wajo Regency Regional Development Planning, Research, and Development Agency, where he contributes to advancing innovation and regional strategies. She previously held the role of Head of the Innovation and Technology Utilization Subdivision, focusing on optimizing the integration of technology in regional development. Earlier in her career, Asriani worked at the Wajo Regency Civil Service Agency, where she managed planning and reporting and conducted integrity analysis to enforce discipline among civil service apparatus. Her multifaceted expertise combines psychological insights with administrative acumen, driving impactful development initiatives in Wajo Regency.



Husnah Rahman is a Young Expert Researcher at the Regional Development Planning, Research, and Development Agency (Bappelitbangda) of Wajo Regency, a position he has held since 2021. With a solid background in research and development, Husna has previously served as the Head of Subdivision in various strategic fields at Balitbangda Wajo Regency. His roles included overseeing the Dissemination of Research and Development and Assessment of Rules and Natural Resources (2017–2018), Regional, Physical, and Infrastructure Development (2018–2019), and Social and Government Development (2020–2021). Husna graduated in 2023 from Puangrimaggalatung Sengkang University in Wajo Regency. His experience and academic credentials reflect his commitment to advancing regional development through research and strategic initiatives, contributing significantly to the progress of Wajo Regency.



Endriana Wahyu Alita, M.A.P is a dedicated researcher with a strong academic and professional background in regional planning and development. She earned her Bachelor's degree from STISIP Muhammadiyah Madiun in 2000 and later pursued advanced studies, completing her Master's degree at Universitas Sebelas Maret Surakarta, Central Java Province, Indonesia in 2020. Since 2015, Endriana has been contributing as a researcher at the Regional Planning, Research, and Development Agency of Pacitan Regency, East Java Province, Indonesia. Endriana's commitment to professional growth is evident through her participation in various non-formal education and training programs. In 2013, she completed the First Level I Researcher Training at LIPI, a comprehensive 30-day program designed to strengthen research competencies. Her dedication to scientific writing led her to join the National Scientific Paper Writing Program in 2019, a 7-day workshop aimed at enhancing skills in academic publication. That same year, she also participated in the Open Journal System Training, equipping herself with tools to navigate digital platforms for publishing and managing scholarly work. As a researcher, Endriana is actively engaged in publishing scientific articles at both national and international levels. Her research covers various aspects of regional planning and development, focusing on evidence-based strategies to address local challenges and promote sustainable growth in Pacitan Regency. Endriana's contributions not only enrich academic discourse but also provide practical insights for policymaking and regional innovation. Her combination of academic achievements, practical expertise, and continuous professional development reflects her dedication to advancing research and its application for the benefit of the community. Endriana remains a vital contributor to the development of Pacitan Regency and a committed advocate for integrating research into regional planning and governance.



Andi Tenri Awaru is a State Civil Apparatus (ASN) serving as a Young Expert Researcher at the Regional Development Planning, Research, and Development Agency (Bappelitbangda) of Wajo Regency since 2021. Born in Soppeng on December 12, 1982, Awaru holds a Master's degree in Public Administration from the Puangrimaggalatung College of Administration, Sengkang. Awaru's career reflects a wealth of experience in public administration and regional development. He previously held key roles, including Head of Innovation and Technology Development Sub-Division at Balitbangda Wajo Regency (2017–2018), Head of Chemical Industry at the Wajo Regency Industry Office (2018–2020), and Head of Economy and Development Sub-Division at Bappelitbangda Wajo Regency (2020–2021). With a strong commitment to innovation and regional economic advancement, Awaru plays a vital role in fostering sustainable development initiatives in Wajo Regency.



Lisa Yuniarti, Magister Sains, is a Senior Researcher (Peneliti Ahli Madya) at the Research Center for Social Welfare, Village, and Connectivity (KSDK) under the National Research and Innovation Agency (BRIN). Born in Balikpapan on June 15, 1962, she holds a Bachelor's degree in Agriculture from Mercu Buana University (1999) and a Master of Science in Administration and Public Policy from Universitas Muhammadiyah Jakarta (2008). Lisa focuses her research on village development, transmigration, and empowerment of underdeveloped regions, contributing significantly to initiatives aimed at improving rural livelihoods. Her notable works include studies such as A Study of Village Development Planning in East Belitung Regency, Collaboration in Independent Village Development Programs (PPDM) and District Development for Community Empowerment, and Developing Superior Commodities in Transmigration Areas through the One Village One Product (OVOP) Approach. She has also explored innovative models like Customary and Natural Resource-Based Village Clusters in Papua and Minimum Infrastructure and Facility Standards in Transmigration Areas: A Case Study of Settlements and Key Villages. In addition, Lisa has contributed to community empowerment through culturally grounded and technology-driven interventions, such as Empowering Communities Through Customary Approaches and Agricultural Technology Interventions in Laindeha Village, East Sumba and Effectiveness of Village Development and Empowerment Programs in Jayapura Regency, Papua Province. She has also studied women's empowerment, exemplified by her work on cashew processing in East Nusa Tenggara Province. Lisa's research demonstrates a deep commitment to empowering rural communities, addressing underdevelopment, and providing sustainable solutions tailored to local contexts. Her contributions significantly influence policy-making and program implementation in Indonesia's rural and transmigration areas.



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Sincerely,

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Abbreviations

ACM	Adaptive Co-Management
BMI	Body mass index
CBNRM	Community-based natural resource management
CBPR	Community-Based Participatory Research
CDI	Cultural Development Index
CEC	Cationic Exchange Capacity
CGE	Computable General Equilibrium
CIMI	Calculator of Inadequate Micronutrient Intake
CNG	Collaborative Network Governance
CRP	Culturally Responsive Pedagogy
CSA	Community Supported Agriculture
EC	Electrical conductivity
FEO	Field Extension Officer
FFG	Females Farmers Group
HDI	Human Development Index
HFP	Hope Food Pattern
INM	Integrated nutrition management
IoT	Internet of Things
KWT	Kelompok Wanita Tani
MCM	Million cubic meters
MLG	Multi-Level Governance
OKU	Ogan Komering Ulu
PBE	Place-Based Education
PGPR	Plant Growth-Promoting Rhizobacteria
PSO	Particle Swarm Optimization
R&D	Research and development
RF	Random Forest
RIS	Regional Innovation Systems
SFH	Sustainable Food House
SFHA	Sustainable Food House Area

SFSC	Short food supply chains
SOM	Soil organic matter
SONG	Sustainability-Oriented Network Governance
SPI	Strategic Policy Integration
VN	Village Nursery
VRK	Values-rules-knowledge
WSN	Wireless Sensor Networks



Part 1

Introduction

Yanter Hutapea, Rosniati

1.1. Introduction

In an effort to address sustainable food requirements, the concept of Sustainable Food Houses (SFH) has become prominent as an approach that combines the intensification of yard utilization with sustainability principles. SFH not only covers food production at the household level, but also fosters a philosophy of wise and sustainable management of natural resources. Basically, SFH emphasizes optimizing land use to achieve food Stock by considering aspects of plant diversity, value, and quality. The basic principles of SFH, which include natural resource management, inventory sustainability, and improving crop quality and value. In this environment, SFH is considered not only as a model of agriculture, but also as a philosophical foundation for sustenance and ecosystem balance at the household level.

The SFH area has a very important role in the context of food Stock, environmental sustainability, and community welfare. The SFH concept allows families to achieve food Stock by making intensive use of yard land. By diversifying food production, including food crops, vegetables, fruits, and medicinal plants, SFH supports a balanced diet and creates access to a variety of nutrient sources. In addition, the SFH area carries sustainable agricultural practices, such as the use of organic fertilizers and natural pest control, maintaining ecosystem sustainability and contributing to biodiversity conservation. Wise management of natural resources in SFH not only supports food Stock, but also has the potential to improve family economic welfare. By reducing dependence on external food supplies, families can save money and even earn more income through the Purchase of small farm produce. In addition, SFH serves as a source of environmental education and awareness, helping the community understand the importance of environmental conservation and sustainable agricultural practices. The SFH area not only creates food Stock, but also supports sustainable development and improving the quality of life of the community.

SFH carries a number of strategic key concepts in an effort to achieve food Stock and sustainability. Intensive use of yards is the main foundation,

where every part of the land is maximized for sustainable food production. Diversifying production is a key strategy by involving food crops, vegetables, fruits, and medicinal plants, creating holistic food Stock. Sustainable management of natural resources, such as the use of organic fertilizers and natural pest control, is the focus to ensure the sustainability of the ecosystem. In addition, SFH emphasizes on improving the quality and value of crops, with the selection of high-quality varieties to support family health. Family economic empowerment through the production and utilization of yard agricultural products is a strategy to improve welfare. Environmental education and awareness become integral in SFH, creating an understanding of sustainable practices and environmental conservation. SFH-based community development, adaptation to urban and rural contexts, and development of supporting infrastructure are also strategies implemented. By integrating these concepts, SFH is not only a model of food Stock, but also a manifestation of a sustainable approach at the household and community level.

In real conditions, the Sustainable Food House Area (SFHA) program in South Sumatra Province, Indonesia is an initiative that aims to integrate the concept of Sustainable Food Houses on a wider scale, especially through the use of information and communication technology. South Sumatra Province is the stage for the implementation of this program, covering a number of villages and sub-districts in 10 districts/cities in the region. In the context of the SFHA program, the intensification approach to yard management is the main focus. Information and communication technology is used to facilitate and monitor the implementation of the concept of Sustainable Food Houses at the household level. The SFHA system includes monitoring the status of yard assessment, the implementation of upgrading activities, as well as problems and obstacles that may be faced in the management of the guardian nursery. The use of this technology allows for efficient delivery of information, training, and help with technology. Data related to increased food production, spending savings, and increased family income were recorded and analyzed to evaluate the effectiveness of the program. The SFHA system is also a forum for farmer group meetings, training, and counseling for the communities involved. In addition, the SFHA program in South Sumatra Province emphasizes the participatory aspect by actively involving the community in the development of the Sustainable Food House concept. Community empowerment is realized through the dissemination of information, education, and strengthening the capacity of local communities. This aims to create a sustainable agricultural culture and increase community independence in achieving food Stock. Through the integration of information technology and active community

participation, the SFHA program in South Sumatra Province is expected to achieve more optimal results in increasing food production, reducing family costs and expenses, and encouraging behaviour change toward sustainable agricultural practices.

1.2. The Urgency of Sustainable Food Policy

Food Stock includes an understanding of global challenges related to the production, distribution, and access to quality food. Factors such as population growth, climate change, land degradation, and changing consumption patterns give rise to an urgent need to create a food system that is sustainable and capable of facing future challenges. Increasing population growth puts pressure on food production. High population density requires increased production to meet the growing Demand Letter for food. Along with that, climate change is causing uncertainty in agricultural production due to extreme weather, irregular rainfall patterns, and rising temperatures that can affect crop productivity. In addition, land degradation is a serious threat to agricultural productivity. Unsustainable land use, deforestation, and agricultural practices that destroy the soil can reduce land fertility and make it difficult to produce sustainable food. This requires an approach that focuses on the conservation of natural resources to achieve long-term food Stock.

In this context, the SFHA program entered the stage as an initiative that combines information technology and sustainable agriculture principles to improve food Stock at the household level. SFHA presents an innovative solution by utilizing the potential for optimal management of the yard to produce part of the family's food needs. This program brings the concept of Sustainable Food Houses into the digital era by utilizing mobile technology (SFHA). Through an application or platform based on information technology, this program can monitor, document, and improve the efficiency of yard management, create an information network between farmers, and provide technology help in a more structured manner.

The data in Table 1.1, which shows the percentage of households with a share of food expenditure of more than 65% from 2018 to 2022 in various provinces in Indonesia, reflects significant vulnerabilities in food Stock at the household level. This data shows that in some provinces, such as Aceh and West Nusa Tenggara, the proportion of households that allocate most of their expenditure on food remains high, even experiencing significant fluctuations from year to year. This indicates that households in these regions are highly dependent on limited food sources and vulnerable to changes in food prices, which are often exacerbated by economic instability and climate change.

Table 1.1. Percentage of Households with a Share of Food Expenditure >65% in 2018–2022

Province	2018	2019	2020	2021	2022
Aceh	40.89	41.27	36.06	38.9	34.23
North Sumatera	35.47	34.8	28.49	29.56	31.76
West Sumatera	32.05	30.56	28.63	25.77	29.28
Riau	22.95	22.25	18.56	18.81	20.85
Jambi	30.81	32.12	27.14	23.23	26.67
South Sumatera	25.91	26.65	27.2	26.27	28.85
Bengkulu	28.42	26.42	27.54	24.55	24.94
Lampung	29.11	28.5	26.3	25.23	24.99
Bangka Belitung Islands	15.4	16.22	15.11	15.18	19.48
Riau Islands	10.97	7.44	8.39	7.13	7.44
Jakarta	15.32	16.6	16.51	11.38	8.42
West Java	34.85	36.65	31.3	30.73	27.97
Central Java	28.7	26.49	22.55	23.12	24.55
Yogyakarta	18.92	20.24	21.45	19.2	16.48
East Java	33.94	30.68	28.21	29.42	31.23
Banten	26.74	31.33	26.02	22.61	24.96
Bali	15.32	13.15	17.43	10.87	8.69
West Nusa Tenggara	49.63	27.88	24.99	26.52	50.76
Eastern South-East Nusa	46.93	54.91	46.12	41.54	33.26
West Kalimantan	27.27	27.39	21.55	19.95	25.24
Central Kalimantan	23.7	23	20.48	19.55	22.67
South Kalimantan	25.62	25.11	23.54	20.16	21.29
East Kalimantan	9.82	9.51	7.8	7.39	6.86
North Kalimantan	11.09	15.04	11.76	9.17	9.95
North Sulawesi	24.91	25.32	21.14	27.69	37.31
Central Sulawesi	24.68	27.45	23.01	16.55	19.41
South Sulawesi	19.99	18.25	27.24	22.45	20.41
Southeast Sulawesi	15.06	13.84	27.59	24.04	19.27
Gorontalo	14.72	12.35	12.19	10.66	26.77
West Sulawesi	32.38	39.31	29.32	24.87	25.19
Maluku	19.36	23.26	13.77	11.26	15.47
North Maluku	17.4	18.97	12.26	10.58	15.41
West Papua	25.61	19.17	19.94	15.67	16.95
Papua	34.76	34.74	31.24	37.17	45.65
Indonesian	29.69	29.09	26.04	25.32	26.19

Source: Ministry of Agriculture, 2024

Global food and agriculture issues, such as dependence on external food sources, climate change, food access gaps, and land degradation, are complex challenges affecting food sustainability and Stock. In this context, the concept of SFH has become very relevant. This program presents an innovative approach by emphasizing the optimal management of the yard for local food production. SFH provides an alternative that can increase food independence at the household level, reduce dependence on external markets, and help households overcome the fluctuations in food prices seen in the data. In addition, SFH seeks to respond to environmental challenges such as land

degradation and the use of chemical fertilizers by promoting sustainable agricultural practices, crop diversification, and the wise use of natural resources. Through this approach, SFH is expected to create a productive micro-ecosystem in the yard of the house, which not only addresses the problem of unequal access to food, but also responds to changes in consumption patterns toward food sustainability. This data on food expenditure in Indonesia underscores the urgency to implement local solutions such as Rumah Pangan Lestari, which can be adapted and applied in various communities to address complex food and agricultural challenges, as well as improve food Stock at the household level.

Food and agriculture issues globally encompass complex challenges that affect food sustainability and Stock at different levels of society. Dependence on external food sources, climate change, gaps in access to food, land degradation, and increased food Demand Letter are the main highlights. In this context, the concept of Sustainable Food Houses becomes relevant as a solution that presents an innovative approach. By emphasizing the optimal management of the yard, this program provides an alternative to local food production to increase food independence and Stock at the household level. In addition, Rumah Pangan Lestari seeks to respond to environmental challenges such as land degradation and the use of chemical fertilizers by promoting sustainable agricultural practices, plant diversification, and wise use of natural resources. An introduction to this concept views that by making optimal use of home yards, people can create a productive micro-ecosystem, overcome the problem of unequal access to food, and respond to changes in consumption patterns toward food sustainability. Rumah Pangan Lestari, through this approach, is expected to be a local solution that can be adapted to address complex food and agricultural issues in various communities.

The urgency of sustainable food policies is very important considering a number of challenges and issues faced by the current global food system. Here are some reasons why sustainable food policies are urgent:

1. Global Food Stock: Sustainable food policies help create a more resilient food system that is resilient to external shocks, such as climate change, natural disasters, and global market instability. By focusing on local production and food diversification, food Stock can be improved.

Global food Stock is greatly influenced by various policies that can strengthen the food system against external shocks such as climate change, natural disasters, and global market instability. One effective approach is to promote sustainable food policies that focus on local production and food diversification. Several literatures have shown that diversification of production and markets can increase resilience to external

shocks, as well as policies that support local farmers can improve their market access and competitiveness (Remans et al., 2019; van Berkum, 2021). The use of biodiversity in agricultural systems can improve productivity and nutrient quality, as well as reduce the need for synthetic fertilizers and pesticides. It can also increase farmers' resilience to climate change and pest damage (Remans et al., 2019). Territorial approaches to RD have also been shown to promote more autonomous and sustainable food systems, as shown in studies in Latin America (Kato et al., 2022). In addition, studies in India show that diversifying crop production by including coarse cereals such as millet and sorghum can make the food supply more nutritious, reduce resource Demand Letter, and increase climate resilience without reducing calorie production (Davis et al., 2019). The lessons from the COVID-19 pandemic also highlight the importance of resilient and sustainable food systems, which can be achieved by supporting small and medium-sized enterprises, technological innovation, and shorter and more diverse food value chains (Njora & Yilmaz, 2023).

Food policy analysis shows that flexibility in responding to market instability and climate change is essential to maintain food Stock. This policy includes the implementation of climate-smart agriculture that can reduce the negative impact of climate change on food production (Timmer, 2013). Crop diversification also plays an important role in reducing the vulnerability of global food systems to climate change and market instability (McCouch & Rieseberg, 2023). Research shows that the development and promotion of sustainable agricultural systems is essential to face global challenges related to climate change and resource scarcity. This approach includes the transformation of production methods from industrial to sustainable and the geographical diversification of food systems (Welsh, 2010). The application of new technologies and increased collaboration between research institutions and governments are also important to develop an effective response to these challenges (OJOGIWA & MUBANGIZI, 2023). Food policies that focus on diversifying local production, using biodiversity, and territorial approaches can increase global food Stock against external shocks. The application of new technologies and increased collaboration between various parties are also important to achieve sustainable and resilient food Stock in the future.

2. Conservation of natural resources, sustainable food policies encourage wise management of natural resources. In this context, sustainable agriculture, the use of organic fertilizers, and the preservation of biodiversity are integral to maintaining the sustainability of ecosystems and agricultural land.

The maintenance of natural resources through sustainable food policies is very important to maintain the sustainability of ecosystems and agricultural land. Sustainable agriculture that uses organic fertilizers and conserves biodiversity is an integral part of this effort. Organic farming is one of the most effective approaches to achieving sustainable agriculture goals. Techniques such as intercropping, mulching, and livestock integration have long been used in traditional farming practices, but are now increasingly being developed within the framework of organic farming that emphasizes soil health (Roychowdhury, 2013). Innovative soil and crop management strategies are also needed to ensure higher crop productivity in a sustainable environment. These include site-specific nutrient management, integrated soil fertility management, and back-lip mulching systems (F. Shah & Wu, 2019).

Organic farming compared to conventional farming has better environmental performance, including reduced soil Casualty, increased soil organic matter, and higher water holding capacity (Gomiero et al., 2011). Organic farming not only improves soil fertility but also contributes to biodiversity conservation. Organic production systems are particularly suitable for smallholders because they rely on the sustainable use of local resources and the traditional knowledge of farmers (Dubey, 2011). Agricultural practices that maintain plant biodiversity are also important for food Stock and nutrient Stock (Thrupp, 2000). In addition, the integration of new technologies in sustainable agriculture such as geographic information systems for the proper application of fertilizers also helps to reduce the use of chemicals, protect the agricultural environment, and improve economic outcomes (Wagner, 1999). Conservation of genetic resources and biodiversity is essential for agricultural sustainability, as it provides an irreplaceable natural resource for food, medicine, and building materials (Karaca & Ince, 2019). Furthermore, the intensification of sustainable agriculture through integrated pest management and agroecological systems can minimize costs, maximize yields, restore ecosystem services, and ensure environmental improvement (Pretty, 2018). The use of organic fertilizers and the implementation of integrated pest management practices are important ways to achieve sustainable crop production without damaging the environment (Imadi et al., 2016). Sustainable food policies that encourage the use of organic fertilizers and biodiversity conservation are essential to maintain the sustainability of ecosystems and agricultural land. These sustainable farming practices not only improve soil fertility but also contribute to overall environmental conservation.

3. Community Welfare By empowering people to manage their natural resources sustainably, sustainable food policies can improve people's welfare. More independent food production can reduce dependence on imports, create jobs, and increase household incomes.

Sustainable food policies that empower communities to manage natural resources sustainably can improve people's welfare. More independent food production can reduce dependence on imports, create jobs, and increase household incomes. Various studies show that local resource-based community empowerment can increase community independence and welfare through increasing knowledge, attitudes, skills, abilities, awareness, and resource utilization (Suryana et al., 2023). Asset-based community development approaches have proven effective in increasing the income of smallholders who have obtained RSPO certification, increasing the number of certified farmers, and building the commitment and independence of farmer groups (Fikri Latief Adrian et al., 2023). The four fundamental aspects of sustainable development are food Stock, job and income creation, conservation of natural resources, and community participation and empowerment (van Mansvelt & Mulder, 1993). The success of community empowerment models in responding to climate change and improving livelihood strategies for food, energy, and water Stock, as well as economic well-being, is achieved through the concept of low resource use and high yield (Sunkar & Santosa, 2017). Food Stock programs that empower rural communities show a positive impact in increasing the productivity and income of local farmers, as well as human capacity to utilize natural products sustainably (Amboisa et al., 2023).

Sustainable local food production systems also provide significant social, environmental, and economic benefits for producers and consumers, by increasing farmer autonomy and providing education on sustainability (Matzembacher & Meira, 2019). Community-based natural resource management (CBNRM) approaches in Zimbabwe show that resource management by local communities can make a significant contribution to sustainable RD through capacity building, empowerment, institutional development, and self-reliance (Emmaculate Tsitsi Ngwerume, 2011). Sustainable local food systems can increase the vitality and sustainability of communities in a logical and appropriate way (Feenstra, 1997). Agricultural certification programs that aim to make agricultural production socio-economically sustainable and agricultural trade fairer for producers and workers have shown positive effects on prices and income from the Purchase of agricultural products (Oya et al., 2018). A sustainable livelihood approach to exploring smallholder farming programs targeted at

females in South Africa has also shown promising results in improving sustainable livelihoods (Lemke et al., 2012). Sustainable food policies that empower communities to manage their natural resources sustainably can create jobs, increase household incomes, and reduce dependence on imports, thereby improving the overall well-being of the community.

4. Health and Nutrition, sustainable food tends to include healthier and more nutritious foods because it focuses on the local production of plants, vegetables, and fruits. This can improve public health and reduce the impact of malnutrition-related diseases.

Sustainable food policies that focus on local production of plants, vegetables, and fruits can improve public health and reduce the impact of malnutrition-related diseases. Sustainable food production not only reduces dependence on imports but also provides healthier and more nutritious food. Local and organic foods are associated with higher dietary quality among young adults. Those who place a high priority on these alternative food production practices consume more fruits and vegetables, dietary fiber, and fewer added sugars and sugary drinks (Pelletier et al., 2013). In addition, food management strategies that reduce fruit and vegetable waste can improve the sustainability of healthy diets by converting lost horticultural products into value-added and nutritious food ingredients (Augustin et al., 2020).

The link between public health and sustainable agriculture is becoming clearer. Public health dietary guidelines cannot be achieved without a simultaneous focus on sustainable agriculture and food production (Hamm, 2008). Food safety in local production of fruits and vegetables is essential to avoid outbreaks of foodborne diseases and ensure that healthy food products are also environmentally friendly (Macieira et al., 2021). Nutrition science-based dietary guidelines urge changes that may have a major impact on agricultural systems. The 2016 Dietary Guidelines for Americans recommend a major increase in fruit and vegetable consumption, which necessitates changes in already depressed food and agricultural systems (Finley et al., 2017). Research shows that improving fruit and vegetable value chain policies can improve the accessibility and affordability of these products, especially in low-income countries and low-socioeconomic groups in all countries (Mattioni et al., 2021). Neglected plants can often be a source of micronutrients, vitamins, as well as health-promoting plant metabolites. Research shows that promoting biodiversity in the diet can provide access to nutritious foods and increase the resilience of food systems (Baldermann et al., 2016). Programs such as Food for Life that integrate actions on nutrition and food sustainability can increase fruit and

vegetable consumption among primary school children (Jones et al., 2017). Studies on household production of fruits and vegetables show that home production can provide more than half of vegetables and potatoes as well as 20% of the fruit consumed each year. This suggests that household production can play an important role in providing access to fresh fruits and vegetables and improving public health (Gulyas & Edmondson, 2024). Positive perceptions of traditional African vegetables can encourage sustainable household production decisions and improve nutritional status (Afari-Sefa et al., 2016). Sustainable food that focuses on the local production of plants, vegetables, and fruits can play an important role in improving public health and reducing malnutrition-related diseases through increased consumption of healthy and nutritious foods.

5. Adaptation to Climate Change, sustainable food policies help communities to adapt to climate change by promoting sustainable agriculture that can address the challenges of extreme weather and unstable climate patterns. Sustainable food policies play an important role in helping communities adapt to climate change through the promotion of sustainable agriculture that can address the challenges of extreme weather and unstable climate patterns. Various studies have shown that adaptation to climate change is essential to maintain food security and agricultural productivity. The adaptation strategies currently used by farmers show a close relationship with sustainable agriculture practices, and government support for sustainable agriculture policies and programs is indispensable (Wall & Smit, 2005). The process of agricultural adaptation must be socially equitable and environmentally sustainable if the goal is more inclusive development. Climate-smart agriculture that promotes resilience, sustainable productivity, reduces inequality, and promotes shared prosperity is essential in the face of climate change (Luo et al., 2017). The increasing frequency of extreme weather and changing rainfall patterns make crop adaptation important to ensure food security (KHAN et al., 2023). In China, climate change has increased agricultural instability and vulnerability. Appropriate agricultural technologies and favorable policies are essential to mitigate the impacts of climate change (Duan, 2024). Future projections suggest that rising temperatures will reduce crop yields, so adaptation measures are needed to reduce climate vulnerability (Ahmed et al., 2019). Conservation farming practices are one of the best solutions for sustainable agricultural production under climate change conditions. Conservation agriculture can adapt and reduce the impact of climate change by managing soil, crops, and climate in an integrated manner (Jug et al., 2018). Climate resilience strategies that manage water resources and

agriculture are also important to mitigate the negative effects of climate change (Srivastav et al., 2021). Climate-smart agriculture with food sovereignty combines climate-smart agriculture with the restoration of local food culture, environmental diversity, and healthy food intake (Spring, 2019). Ecological agriculture can increase agricultural resilience to climate change by selecting the right varieties of crops and livestock and implementing better management practices (Borsari, 2014). Sustainable food policies that support adaptation to climate change through sustainable agricultural practices are essential to ensure food Stock, reduce the negative impacts of climate change, and improve people's welfare.

6. Support for local farmers through sustainable food policies, the government can provide support to local farmers, especially those involved in smallholder and subsistence farming. This includes technical help, access to markets, as well as financial incentives to increase agricultural capacity and yields.

Through sustainable food policies, the government can provide significant support to local farmers, especially those involved in smallholder and subsistence farming. This support includes technical help, access to markets, as well as financial incentives to increase agricultural capacity and yields. This policy is very important to improve the welfare of farmers and ensure the sustainability of the food system. Agroecology, or the application of ecological principles in agricultural management, can improve the performance of local farms. The integration of technology and crop diversification in agroecology has proven to be effective in supporting smallholders and improving food Stock and poverty reduction (Nelson & Coe, 2014). In Ghana, oil palm production by smallholders has significant benefits in household income and drought resilience, despite challenges in access to financing, markets, and technical support (Khatun et al., 2020). Research in Cameroon shows that targeted research and extension support can increase smallholder productivity and profitability. Increased market access is essential to ensure long-term sustainability without extension subsidies (Brummett et al., 2011). In South Africa, the government is seeking to expand the smallholder sector as part of its job creation strategy, despite challenges in the distribution and use of resources (Aliber & Hall, 2012).

The adoption and adaptation of natural resource management innovations is essential for smallholders in vulnerable areas. Good market access, credit, and favorable conservation options are critical factors in driving investments that improve livelihoods and sustainability (Shiferaw et al., 2009). Financial technology also plays an important role in supporting sustainable agriculture by providing innovative financial services and

ensuring market certainty (Muhamad Robbi Qawi & Mahawan Karuniasa, 2020). Technical help and credit proved to be important in connecting smallholders with modern market value chains, which increased their incomes (Digal, 2011). Research in Vhembe district, South Africa, shows that government support to smallholders needs to be directed toward improving their access to credit, extension services, and market information (Phineas et al., 2013). The "Agriculture Supported Communities" program in Pennsylvania shows how smallholders can connect with low-income communities through direct marketing strategies (Winkels et al., 2019). Collective action is essential for smallholder access to inputs, financing, markets, and extension, as found in a study in Eswatini (Simelane et al., 2019). Appropriate economic incentives are also needed to encourage sustainable development patterns that maintain natural resource productivity (Repetto, 1987). Sustainable food policies that provide technical support, access to markets, and financial incentives to local farmers can increase their agricultural capacity and yields, as well as ensure the sustainability of the food system.

7. Carbon Footprint Reduction, small-scale local food production tends to have a lower carbon footprint than long-distance food imports. Sustainable food policies help reduce carbon emissions associated with the global food supply chain.

Sustainable food policies that encourage small-scale local food production tend to have a lower carbon footprint compared to long-distance food imports. Local food production can help reduce carbon emissions associated with global food supply chains, thus making a positive contribution to climate change mitigation. Studies show that local food supply chains, particularly those that use organic methods, have a lower carbon footprint. Research on organic beef shows that the maintenance and fattening phases are the main sources of CO₂ emissions, but local supply chains can significantly reduce emissions compared to global supply chains (Vitali et al., 2018). Food management in the context of tourism has also shown that carbon footprint reduction can be achieved by selecting foods with lower emission intensity and better managing the supply chain (Ghosh et al., 2020). Supplier relationship management in the supermarket supply chain in the United Kingdom shows that supplier engagement can reduce greenhouse gas emissions, especially through good supplier engagement programs (Tidy et al., 2016). Reducing food waste also plays an important role in reducing the carbon footprint. Studies show that interventions to reduce food waste can reduce overall greenhouse gas emissions (Broeze et al., 2023).

An evaluation of the carbon footprint of the food supply chain reveals that most emissions occur before the product reaches the consumer. By reducing food waste and improving supply chain efficiency, carbon footprints can be minimized (Ghosh et al., 2020). Transparency in global supply chains is essential to identify and reduce emissions related to materials, fuels, and food (Cabernard et al., 2022). Case studies in Australia show that local production of lettuce in peri-urban areas has lower CO₂ emissions compared to long-distance production, demonstrating the environmental benefits of local food systems (Rothwell et al., 2016). Carbon emission reduction in sustainable supply chain management shows that carbon regulation policies can be effective in reducing emissions through smart production systems and sustainable supply chains (Singh et al., 2023). Food waste reduction in the retail sector such as Walmart shows great potential to reduce carbon footprint with effective waste management strategies (Carpio-Aguilar et al., 2019). Urban agriculture in the United States shows that although the reduction in carbon footprint of local food production is small, other benefits such as supplemental income and community education are significant (Goldstein et al., 2017). An analysis of China's food system shows that improvements in agricultural technology and shifting dietary patterns can significantly reduce the carbon footprint of the national food system (Li et al., 2016). Sustainable food policies that support local food production can reduce the carbon footprint associated with the global food supply chain, as well as provide more benefits to the environment and society.

8. Community empowerment, sustainable food policies provide encouragement for the active participation of communities in the management of their own natural resources. This creates a sense of responsibility and independence at the community level.

Sustainable food policies that encourage community empowerment are very important in sustainable management of natural resources. The active participation of the community in this management creates a sense of responsibility and independence at the community level, which can improve environmental sustainability and social welfare. Studies show that community participation in natural resource management can increase management capacity and sustainability. The use of prospective structural analysis to support decision-making in CBNRM shows positive results in increasing community knowledge about their socio-ecological systems and improving participation skills (del Mar Delgado-Serrano et al., 2016). Participatory methods that are locally relevant and replicatable can also

increase community engagement in sustainable resource utilization in challenging urban environments (Kenton & Singha, 2018).

CBNRM in South Africa shows that two-way communication and charismatic leadership are essential for successful community engagement (Dyer et al., 2014). Participatory policies that involve communities in decision-making and sustainable skills training increase intrinsic motivation for natural resource conservation (Palmer et al., 2020). In disaster risk management, community empowerment by internalizing disaster risk reduction tools and methods has proven effective in increasing people's capacity to face future risks (Rajeev. M.M, 2014). Participatory fisheries management programs in the European Union have also shown that interactive partnerships are more conducive to local participation in fisheries management (Leite & Pita, 2016). An asset-based approach in environmental conservation and human well-being in the Peru Amazon shows that the validation of social and ecological assets can contribute to the creation and long-term management of protected areas (Wali et al., 2017). The community park movement in the United Kingdom shows that community participation and involvement can be a model for the implementation of social, economic, and environmental policies at the local level (Holland, 2004). A participatory approach is also important in the management of land and natural resources in national park areas such as in Ethiopia, where community participation in tourism development can encourage sustainable land use practices (Wondirad & Ewnetu, 2019). A comparative study of CBNRM in Eritrea and Ethiopia emphasizes the importance of communal rights to pastoral, agricultural, and forest resources for sustainable development (Ogbaharya & Tecele, 2010). Community participation in wetland conservation in Nepal also shows that local involvement is an effective tool for the ecologically balanced use of land and water resources (Shrestha, 2013). Sustainable food policies that support community empowerment and active participation in natural resource management can improve community sustainability and well-being through increased sense of responsibility and independence.

Challenges in the food sector involve a number of complex issues that require innovation and creative solutions. Some of the key challenges in food and the need for innovation are identified as follows:

1. Population growth

Rapid global population growth poses significant challenges to food production, requiring innovation and sustained production increases. Various studies have highlighted these challenges and offered innovative solutions. A literature review on remote sensing applications in agriculture

highlights how satellite data is being used to assess and manage agriculture, which is important for future food Stock, especially in the face of climate change and limited resources (Karthikeyan et al., 2020). Urban agriculture has also been identified as a potential solution to increase global food production by exploiting new locations for cultivation, despite challenges related to land prices and urban pollution (Eigenbrod & Gruda, 2015).

Technological innovation in agricultural systems is also important to overcome food production challenges. Research in Africa shows that institutional innovation in research and development has strengthened the technical changes needed for increased productivity (Temple et al., 2011). In addition, a study on global food challenges concluded that the expansion of agricultural land is less feasible and that the intensification of sustainable agriculture is more effective to increase food production in the future (Wu et al., 2014). Alternative agricultural techniques are also important to ensure sustainable food production. An analysis of alternative agricultural techniques shows that environmentally friendly and economically efficient agricultural systems are superior to conventional chemical agriculture (Padmavathy & Poyyamoli, 2011). In addition, hyper-satellite sensing has great potential to guide sustainable agricultural practices in China (Onojeghuo et al., 2018). Innovations in vertical and urban agriculture can contribute to the second green revolution, which aims to meet current and future food demand better (Armanda et al., 2019). Internet of Things (IoT) technology has been applied in agriculture to increase the productivity of smallholders by utilizing digital tools and services, which can improve livelihoods and food stock (Antony et al., 2020). In addition, green biotechnology through genetic engineering is recognized to have a major role in climate change adaptation and mitigation as well as food Stock (Seid & Andualem, 2021).

Overall, the literature shows that technological innovations in agriculture, remote sensing, urban agriculture, and green biotechnology have an important role to play in confronting the challenges posed by global population growth to food production and sustainability. As several studies have concluded, strategies that include sustainable agricultural intensification, the use of sensing technologies, and the development of biotechnology will be critical to meeting future food needs while maintaining environmental and resource quality (Antony et al., 2020; Eigenbrod & Gruda, 2015; Karthikeyan et al., 2020; Onojeghuo et al., 2018; Padmavathy & Poyyamoli, 2011; Seid & Andualem, 2021; Temple et al., 2011; Wu et al., 2014).

2. Climate change

Climate change is causing major challenges to agricultural resilience and productivity, including extreme weather, irregular rainfall patterns, and rising temperatures. Innovations such as the development of climate-resilient crops, climate change adaptation technologies, and sustainable agriculture approaches are needed to address these challenges. Research shows that climate change is having a significant impact on protected agricultural systems, with the need for sustainable adaptation strategies to reduce greenhouse gas emissions and improve energy efficiency (Gruda et al., 2019). New technologies and strategies such as semi-enclosed greenhouses and passive ventilation systems are recommended to deal with extreme climatic conditions. Another study highlights the importance of climate-smart agriculture to reduce the negative impacts of climate change on crop production by utilizing modern breeding techniques and biotechnology to develop crops that are resistant to environmental stress (Raza et al., 2019). Adaptation at the agricultural level involves the introduction of new crop varieties, changes in operating hours, and better land management to offset the decline in productivity due to climate change (Easterling, 1996). The research also highlights the importance of developing planned adaptation strategies at the agricultural level, including information dissemination, research and development of agricultural technologies, policy formulation, and strengthening partnerships between stakeholders (Anwar et al., 2013). In addition, adaptation in the agricultural sector requires increased cooperation between governments, research institutions, and farmers to overcome the challenges of climate change (Mendelsohn, 2008). Other studies suggest that climate change will have a major impact on agricultural productivity in developing countries, with rising temperatures affecting crop yields and crop water needs (Wang et al., 2014). Adaptation involves the development of new technologies and policy reforms to increase agricultural and irrigation productivity (Karimi et al., 2018).

Technological innovations in climate-smart agriculture such as conservation agriculture, rainwater harvesting, and drought resistant seed varieties were identified as potential solutions to climate challenges in South Africa (Senyolo et al., 2018). Other research shows that agricultural adaptation requires innovations in crop management to increase resilience to climate change in the post-pandemic era (Awopegba T. M. et al., 2022; Smithers & Blay-Palmer, 2001). Overall, the literature suggests that adaptation strategies that include the development of stress-resistant crops, technological innovation, and sustainable agriculture approaches

are essential to meet the challenges of climate change and ensure future food Stock.

3. Inequality of access to food

Inequality of access to food is a serious challenge in achieving global food Stock. The difference in food access between countries and within the country exacerbates this situation. To overcome this problem, innovations are needed in inclusive food distribution models, strengthening logistics infrastructure, and community empowerment programs. A study in South Africa shows that innovations in food production and food consumption entrepreneurship can drive economic and community growth among vulnerable and marginalized communities. The conceptual model developed in this study aims to bridge the gap between fortunate and marginalized communities through innovative and digital entrepreneurial approaches (Samkange et al., 2021). Research in the United Kingdom underscores the importance of transforming food systems involving underprivileged communities. The community food researcher model is used to put communities at the center of change, strengthen social justice, and challenge traditional, more positivist approaches in nutrition and food studies (Pettinger et al., 2024). Environmental justice is also a concern in access to healthy food. Research shows that low-income neighborhoods tend to have greater access to food sources that encourage unhealthy diets, reinforcing inequalities in food access (Hilmers et al., 2012). Equitable food distribution within households is also an important issue, especially in the context of ethnicity and socioeconomic characteristics. Research shows that there is a gender bias in food distribution in households in India, which often harms females, especially young females (Basu et al., 1986). Other research highlights the importance of logistics in short food supply chains (SFSCs) to improve the performance and sustainability of SFSCs. A sustainable and collaborative logistics approach is needed to improve the effectiveness of food distribution in the SFSC (Paciarotti & Torregiani, 2021). Food and development politics also play an important role in food access justice. Research shows that sustainable and inclusive food systems rely heavily on political and power analysis, which includes various approaches such as food regimes, food innovation systems, and food social movements (Leach et al., 2020).

Strengthening the food distribution network is crucial in ensuring food quality, safety, and sustainability. Research shows the importance of a quantitative operations management approach in food distribution networks to face industry challenges (Akkerman et al., 2010). Improving access to finance is also important in inclusive development. Studies show

that financial innovation can contribute to providing human development opportunities for low-income groups through various mechanisms such as mobile banking and microfinance (Asongu & De Moor, 2015). Disequities in the food environment in the U.S. suggest that greater access to healthy foods is associated with better dietary outcomes. This study highlights the importance of multidimensional measurements of the food environment for future interventions (Black et al., 2014). Research in Mississippi reveals the challenges of spatial justice in access to affordable food and housing. A spatial justice approach is needed to address inequities in access to resources in vulnerable communities (Silvina Lopez Barrera, 2018).

4. Use of fertilizers and pesticides

The overuse of fertilizers and pesticides in the agricultural sector brings a significant negative impact on the environment, creates resistance, and increases production costs. Innovations in organic farming technology, sustainable farming approaches, and the development of environmentally friendly organic fertilizers are important solutions to overcome this challenge. Research on Kunapajala, a traditional organic formulation, shows that the use of this formulation can improve soil health and protect plants from pests and diseases, ultimately increasing agricultural productivity (Biswas & Das, 2023). The application of organic farming with organic inputs such as Kunapajala is a more environmentally friendly approach compared to the use of synthetic chemicals. Research on Panchagavya and Kunapajala shows that the use of these liquid organic fertilizers can improve the physical, chemical, and biological properties of the soil, leading to increased soil fertility and plant productivity (M Sharath Chandra et al., 2019).

Soil management for plant disease control can also be done through sustainable agricultural practices. Increased soil microbial activity through the application of organic matter can increase the general suppression of pathogens (Ghorbani et al., 2008). Nanotechnology in agriculture, such as the use of nano-fertilizers and smart delivery systems, offers great potential to improve the efficiency of agrochemicals and reduce environmental impact (Xin et al., 2020). Bacteria-based biostimulants such as Plant Growth-Promoting Rhizobacteria (PGPR) are an environmentally friendly solution to increase plant productivity, reducing the need for synthetic fertilizers and pesticides (Singh et al., 2024). Long-term use of organic fertilizers has been shown to improve soil fertility and agronomic performance, as well as play a role in mitigating climate change through soil carbon segregation (Diacono & Montemurro, 2010). Blatticomposting, an innovative method of using cockroaches as a bio-converter in organic

waste management, is also an efficient eco-friendly strategy for nutrient recycling and decomposition of organic waste (Gowrisankar et al., 2023). Sustainable farming practices such as crop rotation, organic farming, and agroforestry can improve soil fertility, reduce the use of synthetic pesticides, and promote biodiversity (Saikanth et al., 2023).

5. Food Casualty and waste

Food Casualty and waste during production, distribution, and consumption is a major challenge that negatively impacts global food sustainability. Innovations in smart supply chain technology, the use of sensors and data for inventory management, and innovative approaches in packaging and storage design are key to addressing these issues. Smart packaging systems play an important role in the food supply chain by improving food quality, safety, and sustainability through the integration of electronic technology and cloud data solutions. These innovations can improve product traceability and reduce food losses (Chen et al., 2020). On the other hand, various innovations in the food supply chain sector, including smartphone applications for the Purchase of products approaching the expiration date, have succeeded in reducing food waste in the retail sector in Europe (Aramyan et al., 2021). An analysis of the challenges that hinder the reduction of food waste in the food supply chain shows that food characteristics, supply chain uncertainty, and market infrastructure are the main factors that need maximum attention (Gokarn & Kuthambalayan, 2017). The research also highlights the importance of an effective food supply chain management system, including processing and distribution center design, as well as cold chain management, in reducing food losses (N. Shah, 2023).

In the context of achieving the Sustainable Development Goals (SDGs), research shows that managing food Casualty and waste requires awareness, redesigning business processes, and an integrated supply chain model (Lemaire & Limbourg, 2019). In addition, reducing food Casualty and waste throughout the supply chain requires a systemic and collaborative approach between all parties involved (Ocicka & Raźniewska, 2018). Research also shows that the application of digital technologies, such as the IoT and blockchain, can improve traceability and reduce food losses by improving supply chain management (Vanderroost et al., 2017).

Innovative approaches in packaging design also play an important role in reducing food waste. The use of agricultural waste and its by-products to produce environmentally friendly packaging is an interesting solution to overcome the problem of food waste (Cristofoli et al., 2023). Research shows that the use of food waste and by-products in the manufacture of

active and smart packaging can reduce food waste and improve the sustainability of the food supply chain (Zainal Arifin et al., 2023). Meanwhile, studies on food waste management in Turkey show that food waste can be a valuable resource if managed properly (Salihoglu et al., 2018).

6. Food safety and health

Food Stock and food-related health issues, such as zoonotic diseases and antibiotic resistance, are increasingly pressing global concerns. The unwise use of antibiotics in agriculture and livestock increases antibiotic resistance, threatening the health of humans and animals. Therefore, innovations in food safety monitoring systems, safe food processing technology, and sustainable animal health management approaches are urgently needed. Research shows that the use of antibiotics in agriculture increases antibiotic resistance which is potentially harmful to human health. Antibiotics used in animal products often create resistant bacteria, which can then be transmitted to humans through the food chain (Manyi-Loh et al., 2018). Another study showed that food products of animal origin illegally imported into the European Union are often contaminated by zoonotic pathogens and antibiotic-resistant bacteria, adding to the public health risks (Jansen et al., 2019). Antimicrobial resistance monitoring programs in Europe have compared the monitoring methods conducted by EFSA and EASSA, demonstrating the importance of standardization in data collection and testing to effectively monitor antimicrobial resistance (Moyaert et al., 2014).

A global study of antimicrobial resistance in animals indicates a geographic and temporal shift in research, emphasizing the need for increased sampling and testing endeavors in under-monitored regions (Torres et al., 2021). In this case, genomic technology is used to characterize antimicrobial resistance in *Salmonella* species associated with food chains and livestock (Done et al., 2016). The use of antibiotics in aquaculture also poses a threat of antimicrobial resistance similar to that found in terrestrial animal production, reinforcing the need for transparency in the reporting and management of antibiotic use (Done et al., 2015). In addition, studies of major zoonotic bacterial pathogens transmitted through food underscore the importance of hygienic practices and good food processing systems to reduce health risks (Abebe et al., 2020). A One Health approach that integrates human, animal, and environmental health is critical in addressing these challenges. Cooperation between various disciplines is needed to keep an eye on changing disease trends and detect new pathogens (Boqvist et al., 2018). Another study highlights the importance

of the use of probiotics as a safe alternative to antibiotics in improving animal health and reducing the use of antibiotics (Bhogoju & Nahashon, 2022).

7. Globalization and market instability

The globalization of food markets increases vulnerability to cost fluctuations and global economic instability. To address these challenges, diversification of local food sources, the use of digital technology to manage market risks, and the development of strong local markets are needed. Research shows that the global food system is greatly affected by international cost instability and financial volatility affecting the agricultural sector. For illustration, the international financial crisis of the late 1990s showed how financial instability can impact agricultural commodity trade and the overall performance of the sector (Langley et al., 2000). In addition, globalization has created new opportunities and threats to local and regional development, which requires an integrative approach to understanding the changing dynamics of local production in the context of global value and production networks (Parrilli et al., 2013). Diversification approaches in international food markets, such as those undertaken by international construction companies to manage risks, are also relevant for the food sector. Geographic and sectoral diversification can help reduce the impact of global market volatility (Ye et al., 2018). Research on niche markets for local food products shows that supporting and promoting local products can create significant added value and strengthen global competitiveness. Consumers are increasingly interested in the origin of their food, which is not only important for health reasons but also for personal satisfaction of traditional flavors (Goulas, 2022).

In this context, local and regional markets become important. Studies of farmer markets and Community Supported Agriculture (CSA) in the United States show that consumers are willing to pay more for locally grown products, which increases farmers' profits and supports local economies (Brown & Miller, 2008). To manage market risks, the use of digital technologies such as the IoT and blockchain is helpful in improving traceability and reducing food losses. This technology allows for more efficient and transparent supply chain management, which is important in dealing with cost fluctuations and market uncertainty (Vanderroost et al., 2017).

Other innovative approaches include the development of local food hubs that connect small producers with large consumers and buyers, helping to address structural gaps in agri-food markets (Berti & Mulligan, 2016). Overall, the literature shows that a diversification approach, the use of

digital technology, and the strengthening of local markets are essential for managing food market volatility and global economic instability. These endeavors must be supported by policies that promote sustainability and food safety.

8. Humanitarian crisis and conflict

Humanitarian crises and conflicts often result in starvation and destruction of agricultural infrastructure, so innovations in the provision of food aid, agricultural technology in conflict areas, and post-conflict reconstruction strategies are urgently needed. Research shows that humanitarian food aid has a significant impact on improving the nutritional status of conflict-affected households, as seen in Mali, Myanmar, Kenya, and South Sudan (Ecega Guli et al., 2023). In addition, the international financial crisis of the late 1990s demonstrated the impact of financial instability on the agricultural sector, highlighting the importance of robust risk mitigation strategies (Langley et al., 2000).

In the context of humanitarian crises, the use of technologies such as smart supply chain management systems and blockchain can improve the traceability and transparency of food aid distribution (Vanderroost et al., 2017). Another innovative approach involves the use of digital technologies to support agriculture in conflict areas, which can help increase local food production and reduce dependence on external aid (Azman et al., 2023). Post-conflict agricultural reconstruction requires a comprehensive and systematic approach. For illustration, innovations in agricultural technology, such as the use of disease and drought resistant crop varieties, are also important to restore agricultural productivity in conflict-affected areas (Wigboldus et al., 2016).

A study on development help in the agricultural sector shows that long-term investment in agricultural innovation can improve food Stock and reduce poverty, especially in sub-Saharan African countries (Husmann et al., 2015). Additionally, research shows that sustainable animal health support programs, such as the use of probiotics as an alternative to antibiotics, can help improve animal health and agricultural productivity (Bhogoju & Nahashon, 2022). The use of home gardens as a strategy to increase household food Stock in developing countries has also shown positive results. Home gardens can increase access to fresh and nutritious food, as well as provide an more source of income for poor families (Galhena et al., 2013). Innovative approaches in the provision of food aid, the use of digital technology, and post-conflict agricultural reconstruction strategies are essential to address the challenges posed by humanitarian crises and conflicts.

The need for innovation in the food sector is crucial to overcome major challenges and achieve sustainability goals in ensuring global food Stock, improving access to food, and maintaining environmental sustainability and human health. Several relevant literatures underlining the importance of innovation in various aspects of the food sector impacts of natural disasters on smallholder farmers–This study highlights the importance of effective emergency agricultural help for smallholders after natural disasters, with recommendations for inexpensive and easily distributed agricultural products to aid in agricultural recovery (Chapagain & Raizada, 2017). Tapping Potentials of Innovation for Food Stock and Sustainable Agricultural Growth: An Africa-Wide Perspective–This study highlights the importance of innovation in the agricultural sector to improve productivity and food Stock in Africa through investment in research and development (Husmann et al., 2015). Humanitarian Food Help and Nutrition Outcomes among Refugees–This study shows how humanitarian food help can improve nutritional status among conflict-affected refugee populations (Ecega Guli et al., 2023). Development Aid and Agriculture–This study discusses the effectiveness of development help in accelerating agricultural and economic development through the evaluation of various related projects and programs (Herdt, 2010). Food Stock and innovative solutions in crop production–This study evaluates problems and innovations in crop production to improve global food Stock through new technologies and more efficient land use (Kalenska, 2022). Technology adoption, impact, and extension in developing countries' agriculture–This study reviews the adoption of new agricultural technologies and their impact on productivity in developing countries, as well as effective extension methods (Takahashi et al., 2020). Effects of New Agri Techniques on World Hunger–This study evaluates the impact of new agricultural techniques such as GMOs and precision agriculture in reducing global hunger (Mukasa, 2023). Organizational determinant of technological innovation in food agriculture–This study highlights how institutional innovation can accelerate technical change and increase agricultural productivity in sub-Saharan Africa (Temple et al., 2011) Technological Innovations in Agriculture as A Way to Increase Food Stock–This study identifies technological innovations in the agricultural sector that can improve food Stock (Dimitrova, 2022). The adoption of agricultural innovations: A review–This study reviews the literature on the adoption of agricultural innovations and their impact on farmers' welfare and productivity in the food sector (Feder & Umali, 1993). Can food technology innovation change the status of a food stock crop? this study evaluates the transformation of cassava into bread in Africa as an Illustration of how food technology innovations can

improve food safety and reduce imports (Abass et al., 2018). The Political Economy of Agricultural and Food Policies–This study discusses innovations in agricultural and food policies and their impact on the economy and food Stock (Swinnen, 2010). The Impact of Food Help on Pastoralist Livelihoods in Humanitarian Crises–This study evaluates the impact of food help on farmers' livelihoods during humanitarian crises (Czuba & O'Niell, 2016). Systemic perspectives on scaling agricultural innovations–This study highlights a systemic approach to scaling agricultural innovation, with examples from Nicaragua, Cameroon, and China (Wigboldus et al., 2016). Home gardens: a promising approach to enhance household food Stock and well-being–This study highlights the importance of home gardens in improving household food Stock and providing more benefits such as income and ecosystem services (Galhena et al., 2013). New challenges to food Stock: from climate change to fragile states - This book discusses new challenges to food Stock from climate change to fragile countries and offers new approaches to address these challenges (Ian Christoplos & Adam Pain, 2021). Through continuous innovation in agricultural technology, food distribution systems, and food policy, we can ensure better global food Stock and face future challenges more effectively.

1.3. Purpose and Systematics of the Book

The main purpose of the entire literature presented is to highlight the importance of innovation in the food sector to overcome various challenges and achieve sustainability in global food Stock. The following are the main objectives identified:

1. Improving food Stock through innovations in agricultural technology, such as the use of disease and drought resistant crop varieties, digital technology, and more efficient supply chain management systems, aims to increase agricultural productivity and ensure the availability of sufficient and quality food for everyone.
2. Reducing inequalities in access to food by innovating in inclusive food distribution models and strengthening logistics infrastructure aims to ensure that food is accessible to all levels of society, including vulnerable and marginalized groups.
3. Maintaining environmental sustainability through the development of sustainable agricultural techniques and the use of environmentally friendly fertilizers and pesticides aims to reduce negative impacts on the environment and maintain the health of agricultural ecosystems.
4. Overcoming the impact of humanitarian crises and conflicts in innovations in the provision of food aid and agricultural support technology in conflict

areas aims to help communities affected by crises and conflicts in maintaining and restoring their food Stock.

5. Improving food health and safety through the development of more effective food safety monitoring systems and safe food processing technologies aims to prevent zoonotic diseases and antibiotic resistance, as well as ensure that the food consumed is safe and healthy.
6. Managing market risk and economic instability in diversifying local food sources and using digital technology to manage market risk aims to reduce vulnerability to cost fluctuations and global economic instability.

This book emphasizes that through continuous innovation in various aspects of the food sector, we can achieve sustainability goals, improve access to food, maintain environmental sustainability, and ensure human health. This book is compiled with a systematics consisting of 11 parts, which are described as follows: Part 1 is an Introduction with a description in an effort to overcome food Stock challenges and achieve sustainability goals, South Sumatra Province implements the SFHA program. This book aims to present the implementation of the program, analyze the challenges and solutions faced, and consider the social, economic, and cultural impacts of the SFHA program. The urgency of sustainable food policies is increasing amid global challenges such as climate change, economic instability, and humanitarian crises. Global food Stock requires continuous innovation in agricultural technology, food distribution systems, and food policies to ensure access to sufficient and quality food for all, while maintaining environmental sustainability and human health. This book also aims to present the implementation of the SFHA program in South Sumatra Province, analyze the challenges faced in the implementation of the program, and identify solutions that have been implemented. In addition, the book considers the social, economic, and cultural impacts of the program. Part 2 Implementation of SFHA, the SFHA program focuses on improving sustainable food house areas through various activities, including support for concept replication and strengthening of nursery gardens. The goal is to increase the utilization of the yard for food production, reduce daily costs and expenses, and increase family income. The main activities of the SFHA program include the optimal use of the yard for food production, which is expected to reduce the family's daily costs and expenses and increase income. The program also aims to strengthen local food Stock and reduce dependence on external food sources. The SFHA program was implemented in 20 villages for improvement and 14 villages for replication, involving 10 districts in South Sumatra Province. This program involves training, technology support, and dissemination of information to the community. Part 3, Potential and Benefits of Optimal Management of the Home Yard, the use

of the home yard has great potential to increase nutrition and family income. The SFHA program shows that with good management, the yard can become a sustainable source of food. Initial evaluations showed challenges in program implementation, such as a lack of significant improvements in some locations. However, reflection on the potential and impact that has been achieved shows that this program has significant benefits for food Stock and family welfare. Part 4, Concept and Scope of the Sustainable Food House Area, optimal management of the yard ensures food and economic benefits for families. The SFHA program emphasizes the importance of a participatory and sustainable approach to household resource management. The benefits of optimal management of the yard include increasing food Stock, environmental cleanliness, and family food independence. This program also contributes to improving the social and economic welfare of the community. Part 5, Implementation and Evaluation Methodology, the implementation of the SFHA program uses a participatory approach involving local communities. Details of the location, time frame, and stages of implementation are described, as well as data collection methods through field observation and descriptive analysis. Part 6, Challenges in Improving the Status of SFHA, some locations show a "yellow" status in the implementation of the program, which is caused by various factors such as lack of awareness and community participation. Community awareness and participation are key factors in the sustainability of the program. Challenges include low awareness of the importance of programs and limited resources for participation. Challenges related to the management of nursery gardens and sustainable food house areas include coordination between related parties, maintenance of nursery gardens, and provision of sufficient resources. Part 7, Benefits of Optimal Management of Home Gardens, optimal management of home gardens contributes to increasing nutrition and household income. The SFHA program shows that with good management, home gardens can be a significant source of food and more income. Section 8, Hope Food Pattern (PPH) is a concept that measures the quality and diversity of nutritional consumption of the community. The diet score and its calculation parameters are introduced as an evaluation tool. The evaluation of the quality and diversity of nutrition for community consumption shows that PPH plays an important role in improving the nutritional welfare of the population. PPH also reflects people's food preferences and cultural values. Section 9, Policy Network for SFHA Sustainability, policy support is needed for the sustainability of SFHA programs. Policy-related challenges and solutions are discussed to ensure that the program can run sustainably. Program adaptation taking into account regional conditions and the role of local governments in the success of the

program is discussed. Supportive regional policies are critical to the success of the program. The integration of local wisdom in the SFHA program is important to ensure the sustainability and success of the program. The Hope Food Pattern also reflects cultural values that need to be maintained. Section 10 Sustainable Growth: Economic Dynamics and Social Transformation through SFHA, The SFHA program has a significant impact on the local economy, including increasing income and reducing family spending. The economic challenges faced and the dependence on seeds and local economic support are discussed. Community participation in the SFHA program contributes to positive social dynamics. The role of education in increasing awareness and participation was also discussed. Section 11 Conclusion, this section summarizes the key points of the implementation of the SFHA program, including learnings and suggestions for future improvements. This section also discusses the potential for future program development and hopes for positive change in food sustainability. Through this approach, this book is expected to provide comprehensive guidance on the implementation, challenges, and solutions related to the SFHA program, as well as provide insight into the social, economic, and cultural impacts of the program.

Part 1 discusses global challenges in food security, such as rapid population growth, climate change, land degradation, dependence on external food sources, and changing consumption patterns. These challenges are stressing food production and increasing the vulnerability of households to price fluctuations and food supply. To overcome this, the concept of SFH was introduced as an innovative solution that aims to increase family food security through intensive use of yards. This concept integrates the diversification of food crops, such as vegetables, fruits, and medicinal plants, as well as utilizing information technology to monitor and improve program efficiency. In addition, sustainable agricultural practices, such as the use of organic fertilizers and natural pest control, are an integral part of this approach. Going forward, it is important to integrate more advanced technologies, such as digital applications for yard management, expand the SFHA program to more communities, and develop policies that encourage widespread adoption of SFH. Collaboration between the government, the private sector, and the community is also key to supporting the sustainability of this program. With these steps, SFH is expected to become an adaptive local solution to answer the challenges of global food security while supporting family economic welfare and environmental conservation.

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Part 2

Implementation of Sustainable Food House Areas

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2.1. Potential and Focus of Activities

Yard land in Indonesia has a huge potential to be used as a source of nutritious food. With the increasing population and the narrowing of yard land is a big challenge that must be faced, so the increase in yard use needs to be managed optimally. The area of yard land nationally is around 10.3 million ha or 14% of the total agricultural land area and is one of the potential sources of food providers with nutritional value and high economic value. Most of the yard land is still not used as a planting area for various agricultural commodities, especially food commodities. Likewise, yard lands in Banyuasin Regency both in rural and urban areas. Based on information from farmers, knowledge about yard land management is still limited. Most of the yard land is classified as medium strata (120-400 m²) and large (>400 m²). Farmers' attention to the limited use of yard land can be overcome with various innovations related to productive crops, such as horticultural crops, spices, medicines, and spices. Research shows that the use of yards for these plants can provide various benefits, both in economy, health, and the environment. In Tamil Nadu, India, for illustration, research shows that yards can serve as a conservation of various medicinal plants used to treat various diseases (Shanmugam et al., 2020). In Mizoram, India, the use of medicinal plants in the yard shows that these plants can be used effectively for traditional medicine (Lalramnghinglova & Rai, 2010). Research also shows that yards can serve as biodiversity and cultural hotspots, where different varieties of plants can grow and provide nutritional and economic benefits (Galluzzi et al., 2010). In Bangladesh, traditional yards are used as a source of medicinal plants that are important for daily medicine (Rahman, 2013). Research in South Africa shows that peri-urban yards have an important role in household livelihood strategies, where medicinal plants and food play an important role (Mosina et al., 2014). In Nigeria, yards have great potential to increase food production, health, and household income, despite constraints such as lack of space and water (Koyenikan, 2007). In addition, urban horticulture in sub-Saharan Africa has been shown to improve food stock and nutrition, a healthy environment, and sustainable livelihoods (Amao, 2020). In

Ethiopia, medicinal plants in the yard play an important role in traditional health care and the local economy (Yebirzaf et al., 2019).

Yards can also provide ecosystem and health functions, such as improving indoor air quality and mental well-being, especially during the COVID-19 pandemic (Rattanachaikunsopon, 2022). In addition, traditional knowledge of medicinal plants in the Ecuador Amazon shows that yards play an important role in biodiversity conservation and traditional knowledge (Caballero-Serrano et al., 2019). In the United States, urban home yards also contribute to food stock and agrobiodiversity conservation (Taylor & Lovell, 2014). Overall, research shows that the use of yards with productive plants can provide dual benefits in economy, health, and the environment, and play an important role in the conservation of biodiversity and traditional knowledge.

The use of yard land for medicinal plants, food crops, horticultural crops, livestock, and fish can not only meet family needs, but also have the potential to increase household income. Various studies show that planting vegetable crops in the yard can provide multiple benefits, including fulfilling family nutrition, maintaining health, more sources of income, and environmental beauty. Research shows that home yards can improve food stock and family well-being. For illustration, a study in San Jose, California, found that yard gardens can improve vegetable consumption and household food safety by providing access to fresh vegetables (Algert et al., 2016). Additionally, research in the United Kingdom shows that home gardening activities can provide physical and psychological health benefits, by reducing stress and improving well-being (Chalmin-Pui et al., 2021). In Bangladesh, females-run yards show a great contribution to food supply and increased nutritional knowledge (A. U. Khan, 2021).

Research in India shows that horticultural interventions in home yards can increase the availability of vitamin A rich foods and reduce vitamin A shortfall in preschool children (K. Vijayaraghavan et al., 1997). In addition, in Thailand, the practice of mixed yards that produce fish, small animals, and vegetables shows an improvement in the nutritional status of children (Schipani et al., 2002). In the Philippines, research shows that children from households with yards have a higher food diversification and eat vegetables more often (Cabalda et al., 2011). In South Africa, a home yard program integrated with growth monitoring activities showed a significant increase in children's serum retinol levels (Faber et al., 2002). Research in Bangladesh shows that home yard interventions integrated with nutrition training can increase vegetable production and consumption as well as household food diversification in the long term (Baliki et al., 2019). In Sri Lanka, well-managed home yards show increased plant diversification and household nutrient intake

(Thamilini et al., 2019). Overall, this study shows that the use of home yards can provide significant benefits in improving food safety, nutritional status, health, and family economic well-being. The use of yard land for household food development is one of the effective strategies to increase national food stock and independence. Various studies show that yard land optimization can improve food stock, diversify food, and provide economic and health benefits for households. Studies in India show that the ownership of cookware such as pressure cookers can help improve household food safety by reducing fuel costs (Van Elsland et al., 2012). Meanwhile, global research on home yards reveals that home yards play an important role in improving food and nutrition stock, especially in developing countries (Galhena et al., 2013).

Research in San Jose, California, shows that home yards can increase vegetable consumption and household food stock, especially for low-income families (Algert et al., 2016). In addition, a study in Toronto, Canada, found that growing food in the yard of a home can improve community food safety and general well-being (Kortright & Wakefield, 2011). In Myanmar, yard ownership has been shown to be associated with increased food stock and household food diversification (Rammohan et al., 2019). In South Africa, research shows that home yards play a role in improving the quality of life by providing vegetables throughout the year (Walsh & van Rooyen, 2015). In Lesotho, the yard contributes to the nutritional status of preschoolers by providing access to vegetables throughout the year (Makhotla & Hendriks, 2004). Research in Sumatera shows that home yards can help address malnutrition in children by increasing plant diversification and nutritional intake (Bushamuka et al., 2005). In Indonesia, the home yard program has been proven to increase food availability and access as well as household food diversification (Saediman et al., 2021). Research in Bedouin, Lebanon, shows that home food production can protect households from food insecurity and increase food diversification (Ghattas et al., 2013). In Ethiopia, the practice of home yards has been shown to reduce the level of household food insecurity (Motbainor et al., 2022). Research in Lesotho also shows that home yards can contribute to food stock and nutritional status of children by providing vegetables throughout the year (Makhotla & Hendriks, 2004). In India, home yard nutrition intervention programs have been shown to improve household nutritional status and provide direct access to essential nutrients (Rani et al., 2015). Research in Morogoro, Tanzania, shows that nutrient-sensitive farming practices such as home yards can improve food stock and diversify household nutrition (Sanga & Msuya, 2022). In Bundi, Rajasthan, research shows that home yards can improve household nutrition stock by providing direct access to vegetables and fruits (K. Chayal et al., 2013). Research shows that the use of home yards can

improve food stock, diversify food, and provide economic and health benefits for households. Yard land optimization can also be an educational medium for children to recognize the procedures for farming and raising livestock, as well as foster a sense of love for nature.

The Ministry of Agriculture has developed a concept called the Sustainable Food House Area, which is built from a collection of Sustainable Food Houses (SFH). Each SFH is expected to fulfill the principle of environmentally friendly yard use to meet the family's food and nutrition needs, save costs and expenses, and increase income, and ultimately improve welfare through community participation. The results of the report in 2011 showed that Sustainable Food House Area in Talang Keramat Village had developed in Neighborhood 19, 22, 5, 15 and 23 thanks to the support from the provincial/district governments through their respective governments, the food stock Agency and the South Sumatra Regional Development and Innovation Research Agency that initially 20 heads of families implemented the SFHA concept and have developed or replicated this concept with an average of 80 heads of families. The production of various commodities planted in the yard is prioritized for their own needs, if it is excessive, it can be sold. In strata I with a vertical cultivation model (rack) and polybag pots, vegetable production provides an income of 105,000 IDR in one planting, while in strata II and strata III it is 354,000 IDR and 1,852,000 IDR in one planting, respectively. The use of yards with the SFHA concept in addition to providing more income, is also able to reduce the cost of buying household needs for vegetables by 50% of the cost they have been spending on vegetables. Furthermore, in 2012 it was reported that the production of various commodities planted in the yard land is prioritized for their own needs, if it is excessive, it can be sold. In strata I with the vertical cultivation model (racks) and polybag pots, vegetable production is only for self-consumption, while in strata II and strata III it receives revenues of 182,500 IDR and 715,000 IDR respectively in one planting. Family spending savings for vegetables are 5000 IDR / head of family / day, when combined with fish rearing can reach 20,000 IDR / head of family / day.

The objectives of the activity are directed at endeavors to improve the skills of families and communities in the use of yard land; meet the food and nutrition needs of families and communities in a sustainable manner in an area; and develop productive economic activities of families and create a clean and healthy green environment independently. Based on the objectives, the expected output is an increase in family and community skills in the use of yard land; meet the food and nutrition needs of families and communities in a sustainable manner in an area; and the development of productive economic activities of families and creating a clean and healthy green environment

independently. Then for the estimated results of the activity is to save shopping costs and expenses of 5,000-10,000 IDR per day; increasing household income as a by-product greater than 200,000 IDR per month; and an increase in family food diversification as shown by an increase in FPS 90 scores. Meanwhile, the estimated benefits of this activity are to improve family nutrition; improving family health; increasing family income; reducing household spending; and food diversification. Then for the estimated impact of this activity is to increase the ability of families and communities economically; increasing the use of yards and environmental cleanliness; and family food independence.

The implementation of the sustainable food house area that focuses on increasing the capacity and capabilities of sustainable food houses can be carried out through various activities. One way is to choose suitable plants, namely plants that can grow well in the local environment and have high nutritional value. Examples of plants that can be chosen include vegetables such as spinach, kale, and tomatoes, as well as fruits such as papaya and bananas. Eco-friendly cultivation methods, such as using compost, natural pest control techniques, and crop rotation, are also essential to achieving sustainability. Research shows that the selection of plants with high nutritional value and by local conditions is very important for the success of sustainable food houses. In India, diversified homestead gardens have been shown to improve dietary diversification and nutritional outcomes (Pandey et al., 2016). In addition, the use of drip irrigation as a simple technology has been shown to improve water use efficiency and crop yields in various vegetable crops (Seema Dahiya et al., 2022). Organic cultivation has also shown positive results in improving soil quality and crop yields. Research in Canada shows that organic vegetable production not only improves environmental health but also the nutritional quality of products (Dorais, 2007). In addition, cultivation techniques such as the use of compost fertilizers and natural pest control have been shown to be effective in controlling plant diseases and improving overall plant health (Dordas, 2008).

The implementation of simple technologies such as drip irrigation and fertigation (fertilization through irrigation) are also very important. Research shows that this technique can improve crop yields, water use efficiency, and nutrient use efficiency (Kapoor et al., 2022). Other studies show that drip irrigation can also significantly improve citrus crop productivity and water use efficiency (Sravani et al., 2020). Research in Tanzania shows that vegetable production in home yards can improve household food safety and provide significant economic benefits (Mlalama et al., 2022). In addition, a study in Australia shows that home food gardens can provide high resource efficiency and financial savings for households (Csortan et al., 2020). In China, the

practice of growing vegetables in greenhouses shows that the use of proper irrigation and fertilization techniques can reduce environmental pollution and increase crop yields (Yang et al., 2016). In addition, the use of climate-smart agriculture technologies in West Africa has shown increased productivity of vegetable crops and adaptation to climate change (Esaie & Padonou G., 2020). Research shows that the implementation of sustainable food housing areas through the selection of suitable plants, environmentally friendly cultivation methods, and the use of simple technologies can improve food stock, environmental health, and household economic welfare.

Support for concept replication, pursued through education and training, provides training to the community on how to establish and maintain sustainable food house areas. This includes practical training on cultivation techniques and garden management. Then with mentoring and monitoring, conducting regular mentoring to ensure that the garden runs well and provides the expected results. Monitoring is carried out to identify problems that may arise and find solutions together. Furthermore, collaboration with related parties, working with the government, NGOs, and educational institutions to support this program. This collaboration can include the provision of seeds, agricultural tools, and other resources. Strengthening the nursery can be implemented by establishing a nursery and establishing a local nursery that can provide quality plant seeds for the community. This garden functions as a seed distribution center and a training place for the community. In addition, there is also the maintenance and management of the nursery in ensuring that the nursery is managed properly and sustainably. This includes resource management, plant care, and seedling rotation to ensure seedling availability throughout the year.

2.2. Benefits of Sustainable Food House Yard

A yard is a piece of land located around a residential house and can be used for various productive activities such as growing vegetables, fruits, medicinal plants, and raising livestock or fish. Optimally managed yard land can provide significant benefits for households, both in improving nutrition, income, and environmental beauty. Research shows that yards can improve food safety and dietary diversification. For illustration, research in Bangladesh shows that home yard interventions can increase vegetable production and consumption and provide long term benefits on the supply of essential micronutrients (Baliki et al., 2019). Research in San Jose, California, shows that yards can provide cost savings and increase vegetable intake in low-income families (Algert et al., 2016). Research in Indonesia also shows that home yard

programs can increase food availability and access as well as diversify household diets (Saediman et al., 2021).

Yards also have great potential in biodiversity and cultural conservation. Research shows that yards can be biodiversity hotspots, where different varieties of plants can grow and provide nutritional and economic benefits (Galluzzi et al., 2010). Research in Lesotho shows that yards can improve the nutritional status of preschoolers by providing access to vegetables throughout the year (Makhotla & Hendriks, 2004). In Myanmar, yard use shows increased food stock and dietary diversification in vulnerable households (Rammohan et al., 2019). Additionally, research in Santa Clara County, California, shows that urban gardening programs can improve participants' health and well-being through improved food access, vegetable consumption, and mental health (Palar et al., 2019). In Nigeria, research shows that yards can increase food production, health, and household income, despite constraints such as lack of space and water (Koyenikan, 2007). Research shows that the use of yards with productive plants and the right cultivation methods can provide dual benefits in economy, health, and the environment, and play an important role in the conservation of biodiversity and traditional knowledge.

The Ministry of Agriculture in early 2011 has developed the concept of SFHA and the development of the Model-SFHA (M-SFHA) mandated to all Agricultural Technology Assessment Centers (BPTP) in 32 provinces. SFHA is manifested in a Neighborhood Cluster or Neighborhood Circle/hamlet (village) that has applied the principle of using yard land, living fences, village roads and other public facilities (schools, houses of worship, offices, etc.) as well as green open land for intensive cultivation of food crops through wise management of local resources so that it is sustainable while maintaining and improving quality, value and diversity, as well as developing the processing and marketing of results. An area must determine selected commodities that can be developed commercially, to ensure the sustainability of yard use businesses. The area must also be equipped with a seedbed/seedling garden that is managed by the community in a participatory manner.

The implementation of SFHA in South Sumatra in 2012 generally showed a positive response from each member of the farmer group who received the activity in eleven districts/cities. This is also supported by similar activities carried out by local governments such as food Independent Villages or regency (Agriculture Office) or related agencies such as the P2KP Program from Regional Research and Development Agency. In 2013, support from related agencies was by further expanding the fostered area/location. Based on a survey of the average daily household expenditure per household in Talang Jambe village, Sukarami district, Palembang City reached 42,000

IDR/day. The results of the calculation of daily food consumption expenditure per household show that several types of food can be fulfilled from the results of yard land use such as vegetables (mustard greens, lettuce, spinach, kale, eggplant, chili, cing, tomato), catfish, sweet potatoes (sweet potatoes and cassava) and fruits (bananas). The contribution of these types of food in daily food consumption reaches 5,000 IDR/day. So that the contribution from the first seedbed has reached 11.90% (Hutapea and Suprihatin, 2012). The implementation of the SFHA program in Talang Jambe village also succeeded in increasing the community's FPS score by 38.7%, with the achievement of a FPS score of 78.5 after the implementation of the activity. The FPS score still has the potential to be increased to an ideal FPS score of 100 by improving daily food consumption patterns. As an illustration, the daily food consumption per person per day is consuming rice = 1.6 ounces, cassava = 0.4 ounces, potatoes = 1 ounce, catfish = 2 ounces, snapper = 1.6 ounces, vegetable lodeh (eggplant, carrots, tofu and tempeh) = 3 bowls, papaya = 2 ounces, drinking tea = 1 glass, macaroni = 0.6 ounces, sweet cake = 1 piece and crackers = 0.2 ounces, so that with daily food diversification and balanced nutrition with a healthy four plus five perfect menu is expected to achieve a score income tax is ideal.

The methodology is used with a participatory approach to the community and in coordination with the Agriculture Office, IAAFFE, AFFEC and Field Extension Officer (FEO), as well as other related agencies. The activity was carried out in fifteen districts, South Sumatra provinces, namely Musi Banyuasin, Banyuasin, Palembang City, Ogan Ilir, Ogan Komering Ilir, Prabumulih, Muara enim, Ogan Komering Ulu, Ogan Komering Ulu (OKU) Timur, OKU Selatan, Musi Rawas, Lubuk Linggau, Pagar Alam, Lahat and Empat Lawang, each province of two villages starting from January to December 2013. The location was selected based on coordination with the provincial/district food stock Agency, the provincial/district agriculture office, and IAAFFE as well as farmer groups that are active and responsive to technological innovations. The stages of the activity include 1) Preparation, including the collection of initial information about potential resources and target groups; 2) Coordination, with the food stock agency and the agricultural service as well as agencies related to the implementation of SFHA development; 3) Socialization, to convey the objectives of the activity and make an initial contract for the follow-up plan to be carried out; 4) Implementation of activities, the implementation of this activity is carried out by involving target groups and technological help by researchers, extension workers and related agencies. The activities carried out include: Determination of CPCL, making village nursery gardens, vegetable demonstration plots, farmer group

meetings, training, technology help; 5) Reporting, is a form of accountability for activities that have been carried out and the use of activity budgets.

The implementation is designed with a dissemination model that uses yard land divided into three parts, namely a narrow land of < 120 m² (strata 1), medium land of 120-400 m² (strata 2) and an area of > 400 m² (strata 3), involving 25 families of cooperating farmers, the activities of each stage can be seen in table 2.1.

Table 2.1. Commodity base and food house cultivation model based on yard area.

Stage	Land	Commodity base	Cultivation model
I	Narrow (< 120 m ²)	Vegetable crops: kale, spinach, mustard greens, lettuce, chili, celery	Vericulture (hanging and racking) and polybag pots
		TOGA : kunyit, cool, temulawak	
II	Medium (120-400 m ²)	Vegetable crops: kale, spinach, mustard greens, lettuce, chili, celery, long beans, and cucumbers	Vericulture (hanging and shelving) and polybag pots and beds
		Food crops: sweet corn, tubers	
		Family medicine garden: turmeric, ginger	Tarpaulin/hanging pool
III	Size (> 400 m ²)	Catfish	
		Vegetable crops: kale, spinach, mustard greens, eggplant, chili, celery, long beans, cucumber	Vericulture (hanging and shelving) and polybag pots and beds
		Food crops: sweet corn, tubers	
		TOGA : kunyit, cool, temulawak	At home
		Free-range chicken farming	
		Catfish	Tarpaulin/hanging pool

Source: Author's Analysis, 2024

The data and information collected includes data on the results of each commodity, the results of commodities sold, consumed by themselves, FPS scores and farmers' income. The collected data is arranged in a tabulation, then analyzed descriptively by displaying the average value.

2.3. Implementation of Sustainable Food Houses

One of the activities in implementing this M-SFHA is coordination and socialization with the Provincial/District food stock Agency, the Provincial/District food Crops and Horticulture Agriculture Office, the Extension Coordinating Board, IAAFFE and village. The Provincial/Regency food stock Agency coordinates in determining prospective locations and prospective farmers who are qualified as M-SFHA villages/sub-districts where each district has two villages/sub-districts as an illustration of M-SFHA and farmer female

groups who are active and willing to respond to the M-SFHA program (table 2.2.).

Table 2.2. Distribution of locations and development of SFH in M-SFHA in South Sumatra in 2013

No.	Region	Location		Number of Heads of Families Initially Involved	Developments in the number of SFHs	The dominant type of commodity developed
		Administrative Village	Location coordinates (GPS)			
1	Banyuasin	Tanah Mas	LS 02° 55' 186" E 104° 40' 362"	25	40	Vegetable commodities: Tomato trough (Cung), spinach, kale, red chili, cayenne pepper, caisin, lettuce.
		Sterio	LS 02° 52' 219" BT 104° 22' 931"	25	45	
2	Musi Banyuasin	Teluk Kijing 3	LS 02° 51' 129" BT 104° 082' 911"	25	31	Food commodity: sweet corn
		Babat Supat	LS 02° 39' 396" BT 104° 04' 572"	25	25	
3	Palembang City	Sri Mulya	LS 02° 56' 719" BT 104° 48' 035"	25	25	Medicinal plant commodities: turmeric, ginger
		Sukodadi	LS 02° 54' 165" BT 104° 41' 068"	25	33	
4	Ogan Ilir	Suka Mulia	LS 03° 13' 065" BT 104° 33' 355"	25	40	Tuber commodity: cassava
		Payakabung	LS 03° 12' 035" BT 104° 36' 178"	25	30	
5	OKI	Suka Pulih	LS 03° 32' 033" BT 104° 49' 037"	25	30	Farm : free-range chickens
		Mulia Guna		25	30	
6	OKU Timur	Ringin Sari	LS 04° 05' 943" BT 104° 41' 389"	25	40	
		Karang Sari	LS 04° 05' 678" BT 104° 40' 846"	25	35	
7	OKU Selatan	Sidodadi	LS 04° 46' 601" BT 103° 59' 176"	25	30	
		Serakat Jaya	LS 04° 34' 275" BT 104° 97' 426"	25	30	
8	OKU	Tungku Jaya	LS 04° 08' 945" BT 104° 04' 735"	25	30	
		Mekar Jaya	LS 04° 09' 391" BT 104° 05' 227"	25	30	
9	Prabumulih	Gunung Ibul	LS 03° 40' 685" BT 104° 27' 525"	25	30	
		Gunung Ibul Barat	LS 03° 40' 445" BT 104° 25' 437"	25	30	
10	Muara Enim	Karang Endah Utara	LS 03° 16' 815" BT 104° 24' 708"	25	35	

		Karang Endah Selatan	LS 03° 19' 656" BT 104° 23' 355"	25	35	
11	Lahat	Perigi	LS 03° 52' 345" BT 103° 34' 674"	25	40	
		Senabing	LS 03° 43' 834" BT 103° 34' 674"	25	30	
12	Empat Lawang	Rantau Tenang		25	35	
		Terusan Baru		25	35	
13	Musi Rawas	L.Sidoarjo		25	30	
		Q1. Tambak Asri		25	25	
14	Lubuk Linggau	Eka Marga		25	25	
		Megang		25	30	
15	Pagaralam	Muara Siban	LS 04° 04' 503" BT 103° 12' 227"	25	35	
		Pagar Wangi	LS 04° 02' 449" BT 103° 11' 754"	25	25	

Source: Author's Analysis, 2024

The Department of Agriculture, food Crops and Horticulture and related agencies are requested for their support in the development of this program. Furthermore, the Extension Coordinating Board, IAAFFE and AFFEC are asked for their help in providing extension workers as companions for activities in the field as well as mobilizing farmer females groups where each village/sub-district has one extension worker. Coordination with the village head/village head is very necessary in coordinating village officials and community leaders in mobilizing their citizens in the development of M-SFHA. Furthermore, M-SFHA's support in agricultural development includes empowering farmer female groups by providing debriefing in improving knowledge and skills through training and field practice. Training and field practice in the form of plant cultivation technology starting from how to prepare seedling media, seeding, transplanting seedlings, cultivating land and making beds, using plastic mulch, planting and maintaining plants. Environmentally friendly technology by controlling pests and plant diseases using plant-based pesticides with materials such as the use of gadung bulbs, papaya leaves, tobacco leaves and so on. In addition, the technology for utilizing household waste or other organic materials that are used as compost fertilizer with the addition of EM4 decomposer. For narrow yard land, a vertical cultivation model was introduced using shelves made of bamboo, wood, polybags, used cans or other materials. On the large yard land, it is integrated with fish model tarpaulin ponds and hanging ponds. Furthermore, the preservation of local germplasm tubers such as ewi, ganyong, taro, and gemili. The fifteen locations that are the implementation of M-SFHA are described in full in the following table 2.1.

The development of M-SFHA in South Sumatra has reached fifteen city districts with 30 villages/sub-districts (table 2.3), has coordinated and socialized M-SFHA activities with the provincial/district food stock Agency, the Provincial/Regency Agriculture, Crops and Horticulture Office, the Extension Coordinating Board, IAAFFE of each district and AFFEC in the sub-district. Each M-SFHA location has also made 30 units of Village Seedling Gardens (VSG), after the VSG is formed, training is held 1) Plant cultivation and field practice consisting of preparation of seedling media, plant seeding, transfer of seedlings to the soil, tillage in the field, planting, maintenance and harvesting, 2) Plant-based pesticides using papaya leaves, gadung tubers, sisrsak leaves, mindi and others, 3) Fish cultivation in tarpaulin ponds or hanging ponds including the manufacture of feed and 4) Compost making. Help is carried out on the preparation of seedling media, seeding, transfer of seedlings to the mound and preparation of planting media in polybags, shelves or other used cans, planting, mulching etc. Then help was also carried out to six districts of Musi Banyuasin, Banyuasin, Ogan Ilir, Empat Lawang and OKU and Lahat each one village supported by production facilities in the form of vegetable seeds, fertilizers, mulch and meetings with farmer groups (table 2.3).

Table 2.3. Stages of Implementation of M-SFHA Implementation in 30 villages

Location	Implementation Stages		
	Socialization	Implementation	Help
Tanah Mas	X	X	X
Sterio	X	X	X
Teluk Kijing 3	X	X	X
Babat Supat	X	X	X
Sri Mulia	X	X	X
Sukodadi	X	X	X
Suka Mulia	X	X	X
Payakabung	X	X	X
Suka Pulih	X	X	X
Sri Guna	X	X	X
Ringin Sari	X	X	X
Karang Sari	X	X	X
Sidodadi	X	X	X
Serakat Jaya	X	X	X
Tungku Jaya	X	X	X
Mekar Jaya	X	x	X
Gunung Ibul	X	X	X
Gunung Ibul Barat	X	X	X
Karang Endah Utara	X	X	X
Karang Endah Selatan	X	X	X
Perigi	X	X	X
Senabing	X	X	X
Rantau Tenang	X	X	X
Terusan Baru	X	X	X

L.Sidoarjo	X	X	X
Q1. Tambak Asri	X	X	X
Eka Marga	X	X	X
Megang	X	X	X
Muara Siban	X	X	X
Pagar Wangi	X	x	X

Remarks: (x) = has been implemented

In 2013, SFHA socialization was held for farmer female groups in 30 villages in fifteen districts/cities. The socialization was opened by the head of the village/village head which was attended by the Chair of the neighborhood association, Field Extension Officer, Chair of Kelompok Wanita Tani (KWT) and 25 members. At the meeting, it was directed that 25 farmers in each village/sub-district as cooperators will mobilize other farmers/residents, in utilizing their yards with various vegetable plants and food that aims to meet the food needs of families. In addition, material on how to nursery and grow crops with vertical culture and bed cultivation models was also presented. The commodities to be planted are vegetables and family medicinal plants. The material presented was in the form of a power point and a video broadcast of the SFHA Talang Keramat Village. This is intended to provide knowledge and an overview of M-SFHA activities so that it is easy to emulate. After the meeting, the technical team conducted a land survey for the VSG and demonstration plot.

2.3.1. Creation of Village Nursery and Cultivation Training

Village Nursery (VN) is made in 30 villages/sub-districts with a size of 6 x 4 m with a height of 2 m at the back and a height of around 2.25 m at the front. The inner VSG is made of a circular rack with a width of two boards, the height is around 0.5 m and the circumference of the VSG is also installed with waring and a roof made of corrugated plastic. The craftspeople in making VN are given sample drawings so that it is easy to implement. In making VN, they were also accompanied by the local PPL and the head of the village neighborhood association (figure 2.1). Training and field practice of vegetable cultivation to improve farmers' knowledge and skills. The training was attended by the head of the Sub-district AFFEC, field officers, RT Heads, Farmer Group Leaders, farmer group members and others. The material provided by seedling techniques by making planting media, how and when to transfer seedlings to the plant, how to make and fill the soil into the seedbed made from banana leaves and the use of used goods such as aqua plastic cups and planting on shelves, polybags or beds.

Training in making plant-based pesticides needs to be given to farmer females groups to get healthy and environmentally friendly vegetables. The materials used are materials found at the location such as papaya leaves, soursop leaves, gadung tubers and others. For illustration, there are many papaya leaves on site, the way to make them is that 1 kg of papaya leaves are sliced, put in 10 liters of water, mixed with 50 grams of detergent soap and two tablespoons of kerosene, stirred and then soaked overnight, after which it is filtered and then sprayed on the plant using a sprayer for caterpillar pest control.



Figure 2.1. Village Nursery (doc.: author, 2024)

The training on making ponds was held by a group of female farmers, the head of the neighbor hood and extension workers. The fish pond that will be made is a hanging pond made of plastic tarpaulin with a width of 4 m and a length of 6 m, then the pond that will be formed is 2 m wide, 4 m long and 0.75 m deep where around it is installed boards and wooden sento and as the base of the earthen tarpaulin is dug a little to a depth of 20 cm. A water discharge channel is made from the paralon pipe for the disposal of excess water. The tarpaulin is soaked first for a week to remove the smell of plastic. Water quality needs to be measured for acidity (pH) which is 6-7 using a pH measuring device. Fish that are raised such as catfish, tilapia and carp should be catfish.



Figure 2.2. Tarpaulin/hanging pool (doc.: author, 2024)

VN is a vital community-based initiative to promote sustainable farming practices and improve local food stock (figure 2.2). The preparation and management of VSG involves the development of nursery gardens and providing important training to farmers. (Scoggins, 2010) explores the unique relationships between stakeholders in university gardens, emphasizing the educational and community benefits derived from such projects. (Valle, 2021) examined the resurgence of home gardens during the COVID-19 pandemic, highlighting its historical significance in marginalized communities. (Mumaw & Bekessy, 2017) studied how wildlife garden programs in Melbourne support biodiversity and involve local people in conservation endeavours. (Wulandari et al., 2021) discussed community participation in urban agriculture in Yogyakarta, focusing on the establishment of nursery and other urban agriculture initiatives. (Buckwell et al., 2020) provided a cost-benefit analysis of ecosystem-based adaptation in Vanuatu, including interventions aimed at improving garden productivity. (Qiang et al., 2023) identified ectomycorrhizal fungi in urban parks and their role in supporting plant health in nursery gardens. (Avolio et al., 2020) investigated plant diversity in urban landscapes, emphasizing the role of cultivated plants in enhancing urban biodiversity. (Ge et al., 2012) assessed the macrofauna diversity of soil in various urban green spaces, highlighting the ecological benefits of nursery gardens. These articles provide insights into the various benefits of community gardens and urban farming initiatives, which are in line with the village nursery gardens' goal of encouraging sustainable agriculture and community engagement.

2.3.2. Help for Village Nursery and Plant and Fish Cultivation

Help in the preparation of planting media and seeding. With the existence of a village nursery garden, vegetable seeds must be available on a rotational basis for its management so that these seeds will later be distributed to cooperator farmers and then to surrounding residents. Therefore, the VSG management group needs to be accompanied in the preparation of seedling media and how to sow vegetable seeds. The necessary materials are already prepared by the group such as seeds, manure, soil, trays, sprayer, sand sieves etc. The planting medium consists of soil and manure that is sifted first. The seeds to be sown are chilies, tomatoes, mustard greens and eggplants except spinach and

kale seeds. The seeds are first soaked with warm water for one hour and then sown.

Help in the preparation of planting and seeding media is very important for the success of the VN. With the existence of VSG, it is necessary to have the availability of vegetable seeds in rotation which will later be distributed to cooperator farmers and local residents. Therefore, the VSG management group needs to be accompanied in the preparation of seedling media and how to sow vegetable seeds. (Purwasih, 2019) showed that the use of yard land for vegetable cultivation with a hydroponic system improves the understanding of cultivation techniques starting from the preparation of seedling media to harvest. Research by (Ajibola & Amao, 2019) discusses the influence of bed type and weed control methods on vegetative parameters of long chili, demonstrating the importance of proper media preparation for optimal growth. (Sharma et al., 2021) revealed that increased knowledge about quality seed selection and bed preparation significantly improved healthy seedling yields in Nutrismart village. (Kacheyo et al., 2024) discuss the agronomic consequences of planting hybrid potato seedlings in the field, which shows the importance of quality seed production in nurseries. (Rosliani et al., 2024) researched accurate seed-based shallot seeding techniques and found that the use of young seedlings increases bulb production. (Purwanti & Heruwati, 2020) showed that chicken egg shell waste can be used as an effective vegetable seedling medium. (Han et al., 2022) examined the effect of adding horticultural media on local nursery substrates, showing that the addition of sphagnum peat improves seedling quality and root strength. The Ukiraku cultivation method, introduced by (Nishihama et al., 2019), emphasizes the need for appropriate management policies and intensive preparation for the success of green vegetable cultivation.

Help in transplanting seedlings and cultivating land and making beds. After sowing vegetable seeds in VSG, in time the vegetable seeds that have grown according to their age are immediately transferred to bekongan made from banana leaves or used plastic cups that were previously filled with soil media consisting of soil and manure and supplemented with NPK fertilizer solution. The transfer of seedlings was carried out by mutual cooperation of 25 cooperator members in each village/sub-district. Furthermore, the preparation of a pilot plot land on the land of one of the KWT members. Land cultivation by hoeing is then made beds with a width of 1 m and a length of 5 m and fencing with waring. After being hoed and made beds, the soil is given for several

days. (Jin et al., 2022) developed a selective method for transplanting vegetable seedlings based on the ResNet eighteen network, which improved the identification accuracy of healthy seedlings by up to 97.44%. (Ishizaki et al., 2024) developed a low-cost and efficient vegetable transplanter based on a rice transplanter, capable of growing up to 250 cabbage plants per minute per row. (Miah et al., 2023) designed and evaluated a semi-automated vegetable seed transplanter, which increases field productivity by reducing the labor vital. (Shao et al., 2019) developed a multifunctional transplanting machine that can perform various procedures such as irrigation, fertilization, and soil cover at one time. (Jellani et al., 2015) compared pumpkin production with seedlings grown in polybags versus direct planting, finding that the seedlings produced higher yields and profitability. (Melissas et al., 2022) evaluated the effect of light spectrum during healing of grafted tomato seedlings on their adaptation to transplantation.

(Sharma & Khar, 2024) developed a prototype of a semi-automated transplanter for small plots that improves planting efficiency and spacing between plants. (Sun et al., 2024) explored an efficient recognition algorithm for cabbage seedling transplant conditions using the YOLOv5-GFD model, improving the recognition accuracy and speed. Help in transferring vegetable seedlings was carried out at VSG by female farmer groups, especially farmers as cooperators and accompanied by local PPL. Before transplanting the seedlings, planting media consisting of sifted soil and manure were first prepared in a bag of used leaves and plastic cups, for maintenance, especially watering in the morning and evening which was carried out by KWT females in turn according to the picket schedule made by the KWT Chair. Then help on a 10 m x 10 m plant demonstration plot with land clearing and land cultivation and making beds with a width of 1 m, was carried out by the gentlemen. Then the soil is applied first before being given manure and NPK.

Before mulching, the beds are watered first after which they are covered with mulch. Mulching is carried out during the day. The benefits of plastic mulch are: 1) Maintaining soil moisture, 2) Reducing weed growth, 3) Reducing mulching during the rainy season and 4) White plastic surfaces can control pests. Mulch drilling uses used cans that are heated first or filled with coals and then attached to the mulch according to the planting distance of each commodity. Pruning is carried out 1-2 days before planting according to the planting distance

of each commodity. Before planting, the land should be watered first. Seedlings that have been prepared in the village nursery are directly planted into beds. Seedlings with leaf mulch can be planted directly while seedlings with plastic mulch must be removed first. Planting is carried out in the afternoon. Some of the maintenance activities include watering, embroidery, weeding, and follow-up fertilization as well as pest and disease control, pruning shoots, installing stilts and others. Embroidery is carried out when there are dead or damaged plants. The time for embroidery should not be too long, try not to exceed 1 week.

Weeding is carried out by cleaning the planting medium from weeds, aiming to prevent competition in the absorption of nutrients from the soil, in addition to cleanliness and beauty. Plant and grass residues should be buried in the soil because they can increase soil fertility. Weed weeding is carried out 3 or 4 times or according to the weed conditions in the field. Watering by continuous watering is very important, especially in young and newly growing plants, for the next watering activities can be adjusted to the environmental conditions of the yard whether dry or wet (moist). Watering is done with clean water in the morning and evening, if it rains, watering is also done to remove dirt attached to the plant.

Follow-up fertilization of plants in beds that are mulched with plastic, fertilizer is diluted first, both NPK fertilizer and manure or compost. The dosage of NPK fertilizer is 1-2 tablespoons diluted with 5 liters of water given once a week on each plant. In addition, liquid fertilizer or foliar fertilizer can also be given at the recommended dose. Fertilizers are applied once every 7-10 days. In beds without plastic mulch, fertilizers that are given a single fertilizer such as urea, SP-36, KCL or compound fertilizers such as NPK are adjusted to each plant with the recommended dose. Pruning is carried out on unproductive branches or on old leaves. Installation of the vines is carried out on vines such as long beans, chickpeas, winged. Ajir is also used to support plants so that they do not collapse.



Figure 2.3. Plant-based pesticide papaya leaf (doc: author,2024)

Pest/disease control can be carried out in an integrated manner with the following components: superior, healthy and pest/disease-free varieties, manually with human labor, plant rotation, intercropping, tegetes flowers, and natural pesticides (figure 2.3). (Rajeswari et al., 2021) discussed farmers' knowledge of Integrated Pest Control (IPR) practices in vegetable cultivation in Udaipur, showing that farmers have high knowledge of chemical pesticides but low in mechanical and bio-pesticide pest control. (F. Z. A. Khan et al., 2021) examined the factors influencing the intention of Pakistani farmers to adopt PHT in vegetable production, finding that knowledge about the negative effects of pesticides increases the intention for adoption of PHT. A book by (Muniappan & Heinrichs, 2016) emphasizes the importance of reducing the use of chemical pesticides by introducing alternative technologies that include physical, cultural, and biological methods in PHT for tropical vegetable crops. (Dittmar et al., 2018) in a handbook suggest various PHT strategies for vegetable production, including the use of pest-resistant varieties and crop rotation.

(Anjelina et al., 2023) researched the sustainability and business strategy of PHT-based vegetable crops in Mekarsaluyu Village, finding that PHT can help control pests sustainably by using pesticides as a last resort. (Piñero & Keay, 2018) in a survey in Missouri found that pests are the biggest challenge for fruit and vegetable farmers, and suggested the need to increase PHT knowledge among farmers. (Gautam et al., 2017) showed that the training of vegetable farmers in Bangladesh in PHT improved their knowledge of pests and pesticide use, as well as reduced the frequency of spraying. (Jayasooriya & Aheeyar, 2016) identified the adoption rate of PHT and the factors influencing adoption among vegetable farmers in Sri Lanka, finding that knowledge about PHT and access to information are key factor. This literature provides insight into the various components and strategies that can be used in integrated pest control for vegetable crops, supporting sustainable and environmentally friendly agricultural endeavors.

2.3.3. Location and Cooperator Characteristics

Table 2.4 provides information on the administrative structure at the district/city, sub-district, and village/sub-district levels in South Sumatra. Each village or sub-district has different characteristics and potentials, be it in economic, social, cultural, or natural resources in the region. Table 2.4 shows a rich and diverse picture of natural resources

and human resources in various locations in South Sumatra Province, Indonesia. Each location has its own unique characteristics, ranging from the type of land, the height of the sea level, the dominant agricultural commodities, to the diversity of the livelihoods of the population. The number of residents varies by location, with the majority in the productive age group between 19-40 years old. The education of the population also varies, with most having an education between primary school and high school.

Table 2.4. SFHA locations in fifteen districts in South Sumatra Province

Regency/City	District	Village/sub-district
Banyuasin	Talang Kelapa	Tanah Mas
	Banyuasin 3	Sterio
Musi Banyuasin	Lais	Teluk Kijing 3
	Babat Supat	Sukamaju
Palembang City	Sematang Borang	Sri Mulya
	Sukarami	Sukodadi
Ogan Ilir	Indralaya Utara	Suka Mulia
	Indralaya Utara	Payakabung
OKI	Pedamaran	Suka Pulih
	Teluk Gelam	Mulia Guna
OKU Timur	Belitang BK 11	Ringin Sari
	Belitang BK 11	Karang Sari
OKU Selatan	Banding Agung	Sidodadi
	Buay Pemaca	Serakat Jaya
OKU	Sosoh Buay Rayap	Tungku Jaya
	Sosoh Buay Rayap	Mekar Jaya
Prabumulih	Prabumulih	Gunung Ibul
	Prabumulih	Gunung Ibul Barat
Muara Enim	Gelumbang	Karang Endah Utara
	Gelumbang	Karang Endah Selatan
Lahat	Pulau Pinang	Perigi
	Lahat	Senabing
Empat Lawang	Tebing Tinggi	Rantau Tenang
	Tebing Tinggi	Terusan Baru
Musi Rawas	Tugu Mulyo	LSidoarjo
	Tugu Mulyo	Q1. Tambak Asri
Lubuk Linggau	Lubuk Linggau Utara	Eka Marga
	Lubuk Linggau Utara	Megang
Pagaralam	Dempo Utara	Muara Siban
	Dempo Utara	Pagar Wangi

Source: Author's Analysis, 2024

In several locations (table 2.5.), such as Tanah Mas and Sterio in Banyuasin Regency, rubber plantations and oil palm plantations are the main commodities. Meanwhile, in Teluk Kijing 3, Musi Banyuasin Regency, almost 95% of the land is used for oil palm and rubber

plantations. In Babat Supat, Musi Banyuasin Regency, lands with different potentials such as tides, dry, swamps, ponds, and yards are spread over a large area. Sri Mulya in Kodya Palembang has abundant rainfall and humus type soil, which supports various types of agricultural businesses. Meanwhile, in Sukodadi, Palembang City, dry land and yards are used for housing and simple farming. In areas such as Suka Mulia and Payakabung in Ogan Ilir Regency, as well as Suka Pulih and Sri Guna in Ogan Komering Ilir Regency, rubber is the dominant commodity managed by farmers with Javanese and local ethnic backgrounds.

Table 2.5. Resource Characteristics with Number of (SFH 25 location)

Location	Resource Characteristics	
	Nature	Human
Tanah Mas, Banyuasin Regency Number of cooperators family heads (SFH) 25	The land area of 3894 ha consists of 98.6% dry land and 1.4% swamp, 10-20 m above sea level. Rubber and oil palm plantations 10 ha, yards 157 ha	The population is 13,500 people. The age group of 19-40 years is the most 36%. The most livelihood is entrepreneurship/trade 40%, after services 22%. elementary and higher education. The work of the farmer is a dominant cooperators, housewives, the number of family members is 3-5 people, elementary and high school education and the age of 25-45 years
Sterio, Banyuasin Regency	The area of 6400 ha consists of 5800 ha of dry land and 600 ha of lebak swamps. Height from sea level 12 m. Rubber plantations 1840 ha and oil palm 250 ha.	The population is 4628 people. The most common age group is 21-30 years old 21%. The dominant livelihood is farming 957 families and outside agriculture 404 families. Elementary-Higher Education. The work of the farmer is the dominant cooperators of rubber tapping, the number of family members is 3-5 people, elementary and high school education and the age of 25-45 years.
Teluk Kijing 3, Musi Banyuasin Regency	The area is 1,226 ha. The land use is almost 95% for oil palm and rubber plantations owned by PTP Nusantara 7 Betung. The location of this SFHA is located in the PTP Nusantara 7 contractor housing complex.	The population of 5222 people consists of 2353 males and 2869 females. The largest age group is 6-12 years old of school age. Livelihood as entrepreneurs 225 people, trade 483 people, services 126 people. The age of SFHA cooperators is 25-55 years old, cooperators education from elementary school to high school graduation.
Babat Supat, Musi Banyuasin Regency	The area of 3850 ha consists of tidal land 500 ha is utilized 40%, dry land 58 ha is utilized 39.7%, swamp land 2166 ha has not been utilized, pond land 100 ha has not been utilized, yard 60 ha is 100% utilized, public plantation 700 ha is utilized 85%, (500 ha) private plantation 580 ha is utilized 65% (352 ha) Height above sea level 4-7 m	The population is 3676 people. Male 1940 people, female 1736, the most common age group is 31-40 years old: 9.4%, 51-60: 9.3%. Livelihood: 412 (55.8%) farmers, 120 (16.3%), 129 farm workers (17.5%), 35 civil servants (4.79), 17 fishermen (2.30%), and 25 (3.39%) farmers. Education from Early Childhood to High School. The average cooperators farmer's job as a housewife and education from elementary to high school

Location	Resource Characteristics	
	Nature	Human
Sri Mulya, Palembang City	The area is 5000, the average rainfall is 3,200 mm, the humus type soil structure with a pH range of 4-6.5. The height of the place is 4 – 11 m above sea level. Land use: Lebak rice paddy 5 ha, palawija 25.5 ha, vegetables 35.5 ha, ornamental plants and horticulture 11.02 ha, toga 1.03 ha, coconut plantation 1 ha, fisheries 9 pond 2 ha. For housing 60%	The population is 6,227 people, the number of farmer families is 1,117 families. Agricultural livelihood 176 people, services and others 595 people, civil servants 87 Orang. The age of SFHA cooperators range from 25-60 years. Education from elementary to high school
Sukodadi, Palembang City	The area is 505.9 ha, dry land is 10 ha, yard is 30 ha, for housing 60%, food crop farming is about 2%, brick business is 1%, the height of the crock is 10-20 mtr from sea level	The number of male populations is 8957 people, female 8816 people, the largest age group is students, livelihood: Trade 582 people, service 159, civil servant 794. The livelihood of cooperator farmers as housewives, education between elementary and junior high schools
Suka Mulia, Ogan Ilir Regency	The area is 860.67 ha, the dominant commodity is rubber	The population is 1476 people. The cooperating farmers are mostly ethnic Javanese. Age ranges from 25-40 years old
Payakabung, Ogan Ilir Regency	The area is 35.75 km ² . The dominant commodity is rubber plants	The population is 2385 people. Mixed Javanese and local cooperator farmers, aged 25-45 years
Suka Pulih, OKI Regency	The area of Pedamaran sub-district is 1,059 km ² , the height of the place is 10 m above sea level, and the average rainfall is 249 mm. Rubber and vegetables dominant commodities	The population is 41,409 people. The age group of cooperator farmers is 25-40 years old. Elementary-Junior High School Education
Sri Guna, OKI Regency	The area of Teluk Gelam sub-district is 168.29 km ² , the height of the place is 15 m above sea level. Rubber is the dominant commodity	The population is 21,896 people. The age group of cooperator farmers is 25-45 years old. Elementary-Junior High School Education
Ringin Sari, East OKU Regency	Area = 7.20 Km ² . The climate in East OKU Regency is tropical wet with rainfall variations between 2.54 – 3,329 mm/year, with daily temperatures between 15°C – 38°C. The topography in the OKUT Regency area is from flat to hilly, with an altitude of < 70 m above sea level. The land is mostly used for farming, plantations and rice fields.	The population is 1,714 people and most of their livelihood is farming, ethnic Javanese.
Karang Sari, OKU Timur Regency	Area = 2.58 Km ² . The climate in East OKU Regency is tropical wet with rainfall variations between 2.54 – 3,329 mm/year, with daily temperatures between 15° C – 38° C. The topography in the OKUT Regency area is from flat to hilly, with an altitude of < 70 m above sea level. The land is mostly used for farming, plantations and rice fields.	The population is 2,425 people and most of their livelihood is farming, ethnic Javanese.

Location	Resource Characteristics	
	Nature	Human
Sidodadi, OKUS Regency	Medium Plains area–Height 500-700 m above sea level, plain-hilly topography, Village Area ±1,000 ha with details: 695 ha of community gardens (coffee, pepper, cocoa, palm etc.), semi-technical irrigation paddy fields 23 ha, rainfed rice paddies 7 ha, secondary forests 12 ha, settlements 23 ha, others 72 ha. Cold climate, Rainfall 2000 – 3000 mm, Temperature 20 – 23 C. Sandy clay soil, yard area 100 m ² – 2500 m ²	The population is 588 people (316 males, 272 females), the average age is 35-55 years old, 154 heads of families, In general, the work of farmers
Serakat Jaya, OKU Selatan Regency	Medium Plains area 250 m above sea level, plain-hilly topography, Village Area ± 4,831 ha with details: 576 ha of community gardens (coffee, pepper, cocoa, palm etc.), semi-technical irrigation paddy fields 77 ha, rainfed rice paddies 20 ha, settlements 21 ha, others 167 ha. Cold climate, Rainfall 2000 – 2,500 mm, Temperature 24 – 25 C. Sandy clay soil, yard area 100 m ² – 500 m ²	The population is 1,030 people (527 males, 503 females), the average age is 40-55 years old, 291 heads of families, In general, the work of farmers
Tungku Jaya, OKU Regency	Tungku Jaya Village is an area with a dryland agroecosystem. The village has a limited water source, so it experiences water difficulties when the dry season arrives. Agricultural commodities in Tungku Jaya village are dominated by rubber plantations	Most of the people work as rubber farmers. Dominated by Javanese tribes. The nature of family and mutual cooperation is still quite high
Mekar Jaya, OKU Regency	Mekar Jaya Village is next to Tungku Jaya village. It has similar characteristic; it is an area with a dryland agroecosystem. The village has a limited water source, so it experiences water difficulties when the dry season arrives. Agricultural commodities in Tungku Jaya village are dominated by rubber plantations	Most of the people work as rubber farmers. Dominated by Javanese tribes. The nature of family and mutual cooperation is still quite high
Gunung Ibul, Prabumulih City	Lowland topography. Rubber is the dominant commodity. Rainfall is 3108 mm/year.	Cooperator farmers are mostly housewives. Junior and Senior High School Education. The age ranges from 25–45 years.
Gunung Ibul Barat, Prabumulih City	Lowland and undulating topography. Rubber is the dominant commodity. Rainfall is 3108 mm/year.	Cooperative farmers are mostly vegetable farmers and farm laborers. Elementary and high school education. The age ranges from 25-45 years.
Karang Endah Utara, Muara Enim Regency	Area: 5.7m ² , Located at an altitude of 10-25 above sea level. The type of soil is in the form of red-yellow and alluvial podzolic soil	The population is 5096 (2432 males, 1544 females)
Endah Karang Selatan, Muara Enim Regency	Area: 8.2 Km ² , Located at an altitude of 10-25 above sea level. The type of soil is in the form of red-yellow and alluvial podzolic soil	Population 3090 (1546 males, 1544 females)

Location	Resource Characteristics	
	Nature	Human
Perigi, Lahat Regency	The land area, rice fields and bumps, are on the edge of the Lematang River. The altitude is 510 above sea level, the lowlands are 39 Ha, the medium plateau is 78 Ha, the plateau is 183 Ha. The type of podsollic soil is red and yellow, with sandy soil of 14 Ha, rocky soil of 73 Ha, red of 68 Ha. The average rainfall/year is 457 mm, the area prone to drought is 27 Ha, the area is prone to floods and landslides is 3 Ha. Rainfed rice fields are cultivated 18 Ha, Lebak 5 Ha. Cultivated fields are 121 Ha, Gardens 3.5 Ha, Yards 1.5 Ha, Fields 42 Ha, Pasting 41 Ha, Empang 0.5 Ha, Plantations 181 Ha, forests 18 Ha, Non-agricultural land 0.5 Ha	The population is 320 people, the majority of the education level is not graduating from elementary school, the main occupation is farmers (151 people), private employees (4 people) and farm laborers (10 people), with a daily wage level of 25,000 IDR
Rantau Empat Tenang, Lawang Regency	The highlands dry land has a wet tropical climate with varying rainfall, and every year dry months are rarely found. The total land area in Tebing Tinggi sub-district is 59,093 hectares consisting of 2,230 hectares of rice fields, 31,559 hectares of non-rice fields and 25,304 hectares of non-agricultural land.	Having a job mostly as a simple farmer/planter who easily receives information from outside which is constructive, likes to work together, likes to try something new.
Terusan Baru, Empat Lawang Regency	The drylands of the highlands have a wet tropical climate with varying rainfall and every year dry months are rarely found. The total land area in Tebing Tinggi sub-district is 59,093 hectares consisting of 2,230 hectares of rice fields, 31,559 hectares of non-rice fields and 25,304 hectares of non-agricultural land.	Having a job mostly as a simple farmer/planter who easily receives information from outside which is constructive, likes to work together, likes to try something new.
L.Sidoarjo, Musi Rawas Regency	L Sidoarjo Village has a tropical and wet climate with varying rainfall, where every year it is rare to find a dry month. L Sidoarjo Village consists of 66.5% of the fertile lowlands with a clay structure and its natural state is divided into yards, rice fields, fields, rubber plantations and other gardens	Simple, easy to receive information from outside that is constructive, upholding upload-ungguh, straightforward, likes mutual cooperation, and religius
Q1. Tambak Asri, Musi Rawas Regency	Q Village Tambak is beautiful next to L Sidoharjo village which also has a tropical and wet climate with varying rainfall, where every year it is rare to find a dry month. The village consists of 66.5% fertile lowlands with clay structures and its natural state is divided into yards, rice fields, fields, rubber plantations and other gardens.	Simple, easy to receive information from outside that is constructive, upholding upload-ungguh, straightforward, likes mutual cooperation.
Megang, Lubuk Linggau Regency	Megang Village has a strategic area with roads that can be easily accessed to other sub-districts, to the heart of Lubuk Linggau and passed by the central Sumatra crossroads toward Jambi. Most of the Megang sub-districts are urban housing reaching 90% of the sub-district area	Easy to receive information from outside that is constructive, upholding upload-ungguh, straightforward, likes to work together, open, family

Location	Resource Characteristics	
	Nature	Human
Muara Siban, Pagar Alam City	The classification of soil classes in this area generally consists of class 1 (one) soils that contain high fertility. The topography of the Pagaralam City area with a slope of up to 40%, the land height from sea level varies between 100 m to $\pm$ 1000 m with a dominance of altitude of more than 1000 m above sea level. The climatic elements in Pagaralam City are very supportive for agricultural businesses. The average rainfall is 1,462-5,199 mm per year. With the number of wet months relatively high. The air temperature ranges from 20-28 ^o C and the intensity of sunlight is between 6-10 hours per day. The area of Muara Siban is 1280 ha and the area of Pagar Wangi village is 1755 ha	The population is 2846 people. In general, vegetable farmers, aged about 30-45 years, local residents
Pagar Wangi, Pagar Alam Regency		The population is 1755 ha. In general, they work as tea plantation workers, around 30-45 years old, Javanese ethnicity.

Source: Author's Analysis, 2024

In the Ogan Komering Regency area of East Ulu, such as Ringin Sari and Karang Sari, land is used for farming, plantations, and rice fields, with the majority of the population farming and ethnic Javanese. Meanwhile, in Sidodadi and Serakat Jaya in Ogan Komering Ulu Regency Selatan, the topography of the moderate-high plains and cold climate support the cultivation of crops such as coffee, pepper, cocoa, and palm oil. Villages such as Tungku Jaya and Mekar Jaya in North Ogan Komering Regency face challenges in water availability, but still have strong communities with high kinship and mutual cooperation. In Gunung Ibul and Gunung Ibul Barat in Prabumulih City, the cooperators farmers are mostly housewives between the ages of 25-45 years old, who work as vegetable farmers and farm laborers.

In Karang Endah Utara and Karang Endah Selatan in Muara Enim Regency, red-yellow and alluvial podzolic soil types support various types of agricultural businesses. Meanwhile, in Perigi, Lahat Regency, the undulating land on the banks of the Lematang River offers opportunities for farmers to manage various types of land and crops. Rantau Tenang and Terusan Baru in Empat Lawang Regency, as well as L.Sidoarjo and Tambak Asri in Musi Rawas Regency, have a wet tropical climate that supports agricultural and plantation businesses, with a simple community, easy to accept new information, and upholding values such as mutual cooperation and religiosity. In Megang, Lubuk Linggau Regency, there is a large urban housing area, which indicates a transition from rural to urban communities. While in Muara Siban and Pagar Wangi in Kodya Pagar Alam, the varied soil elevation and

favorable climate create ideal conditions for the cultivation of vegetables and tea.

Table 2.6. Savings in household costs and expenses, more range of income and income tax

Village/sub-district	More Revenue Range (IDR /KK/month)	Expenditure Savings neighborhood association (IDR /month/KK)		Hope food Pattern (FPS)	
		Hose	Flattenin g	before SFHA	after SFHA
Tanah Mas	230.000	150000-300000	225,000	83.18	89.0
Sterio	225.000	240000-300000	270,000	80.53	88.64
Teluk Kijing 3	250.000	150000-300000	225.000		
Babat Supat	200.000	150000-300000	225.000		
Sri Mulia	200.000	150000-300000	225.000		
Sukodadi	250.000	150000-300000	225.000		
Suka Mulia	300.000	180,000 – 120.000	150.000	72.98	77.98
Payakabung	300.000	180,000 – 120.000	150.000	71.30	75.00
Suka Pulih	225.000	150.000-250.000	150.000		
Mulia Guna	225.000	150,000 – 240,000	190.000		
Ringin Sari	150.000	120,000 – 180,000	150.000	65.21	70.3
Karang Sari	300.000	150,000 – 330,000	240.000	64.84	71.34
Sidodadi	150.000	150,000 – 300.000	225.000		
Serakat Jaya	150.000	120,000 – 180,000	150.000		
Tungku Jaya	Not yet harvested	Not yet harvested		74.5	N/A
Mekar Jaya	Not yet harvested	Not yet harvested		72.5	N/A
Gunung Ibul	150.000	150.000-250.000	200,000	55.65	61.8
Gunung Ibul Barat	300.000	250.000–300.000	270,000	50.75	
Karang Endah Utara	250.000	150.000–300.000	225,000	67.5	71.4
Karang Endah Selatan	250.000	150.000–300.000	225,000	68.3	72.7
Perigi	72.000 – 153.500	150.000-250.000	200,000	68	77
Senabing	50.000 – 120.000	150.000-300.000	225,000	70	79
Rantau Tenang	300.000	250.000–300.000	270,000	61	72
Terusan Baru	300.000	300.000–350.000	325,000	62	71
LSidoarjo	350.000	250.000–300.000	270.000	75.5	77.5
Q1. Tambak Asri	250.000	200.000–300.000	250.000	65.5	68.6
Eka Marga	150.000	250.000–300.000	270.000	63.5	65
Megang	400.000	200.000–300.000	250,000	74.55	76.6
Muara Siban	300.000	150.000-250.000	200.000	77.45	86.75
Pagar Wangi	250.000	150.000-250.000	200.000	78.27	80.31

Source: Author's Analysis, 2024

Table 2.6. shows various indicators of economic and community welfare in various villages and sub-districts in South Sumatra Province, Indonesia. Variation in more income per family (KK) per month among different villages. The value of this more income ranges from IDR 72,000 in Perigi to IDR 400,000 in Megang. This shows that there is a difference in the level of economic welfare between regions. Savings in costs and

expenses per month per family also vary. Some villages such as Tanah Mas and Sterio showed significant savings after interventions such as the SFHA, which is indicated by higher savings rates after SFHA. The food expectation pattern measured in percentage also showed improvement in several villages after the SFHA. For illustration, in Tanah Mas, FPS increased from 83.18% before SFHA to 89% after SFHA. This shows that there is an increase in public access to better and more diverse food. Some villages such as Tungku Jaya and Mekar Jaya still do not have data on harvest due to the status of "Not yet harvested", which shows that evaluation of economic conditions and welfare in these areas still needs to be carried out.

This data shows that endeavors are being made to improve community welfare through interventions such as SFHA. However, there are still significant differences between regions that indicate that there are gaps that need to be addressed more fairly and equitably. In addition, the variation in economic indicators also shows that there are different potentials and challenges in each region that need to be considered in the development and development of the region in South Sumatra. (D'Haese et al., 2013) examined the impact of food stock improvement programs in KwaZulu-Natal, South Africa, which showed increased food access and dietary diversity despite high levels of food insecurity. (Mendola & Simtowe, 2014) analyzed land redistribution projects in Malawi that showed increased agricultural yields, incomes, and food stock for legatee households. (Stewart et al., 2015) conducted a systematic review of training interventions and new technologies for smallholders in Africa, finding that these interventions improve household incomes and food stock. (Ntihinyurwa & de Vries, 2021) explore the relationship between land fragmentation, land consolidation, and food stock, showing that policies that support land consolidation can improve food production and food stock. (Lawry et al., 2014) reviewed the impact of land tenure interventions on agricultural investment and productivity, showing that land tenure stock contributes to increased productivity and income. (Rosenstock et al., 2013) highlight the importance of understanding the impact of smallholder farming systems on greenhouse gas emissions and mitigation options available. (Tripathi & Tripathi, 2018) discuss the latest developments in microfinance in India and how it helps improve the economic conditions of the poor through a group approach. (Bahru & Zeller, 2022) evaluated the impact of the Ethiopian Productive Safety Net Program on agricultural yields, finding that it increased access to credit and non-

agricultural income. This practice provides insight into various interventions and programs that can improve community welfare through increased income and food stock, supporting endeavor such as SFHA to improve community welfare in various regions.

2.4. Development of Cooperation Networks Between SFHA and Stakeholders

The SFHA program is very helpful to the community, especially to increase knowledge and skills in good plant cultivation methods through training and practice in the field. The training is very useful in the management of village nursery gardens that provide various kinds of vegetable seeds, fruits and medicinal plants. For illustration, the village nursery in M-SFHA Talang Keramat Village, Banyuasin Regency where farmer female groups have carried out sales and even orders for vegetable, fruit and medicinal plant seeds from farmer female groups from other villages and sub-districts even outside Banyuasin district. There are no difficulties in marketing crop products because there is already a network of cooperation with traders in the village, there are even traders from outside the village. In addition, the main market in Palembang City and other traditional markets are not far from the SFHA location. This is relevant to several studies, (Noviani et al., 2023) highlight the importance of digital mapping to optimize village potential, which can support the development of nursery gardens and agricultural training at the village level. (Hasriyanty et al., 2024) implemented zero waste agricultural system technology in Central Sulawesi, increasing participants' knowledge of environmentally friendly agriculture by 80%. (KC et al., 2020) highlight the economic transformation in Nepal that is largely dependent on the agricultural sector, with training in new skills that are essential to support sustainable agriculture. (Egeru et al., 2016) found that innovative field internship programs enhance graduate skills in agricultural science, which are vital to serving smallholder farmers in Africa. (Lukuyu et al., 2012) examined the effectiveness of volunteer farmer trainers in spreading better agricultural practices in Kenya, finding that volunteer trainers play an important role in farmer mobilization and training. (Amri et al., 2024) showed that the development of entrepreneurial skills through training and mentoring can improve the welfare of the community in Bengkayang Regency. (Fanzo et al., 2015) integrate nutrition into extension and advisory services, which has the potential to improve the quality of food produced by farmers through improving agricultural skills. (Ukpong et al., 2019) highlighted socioeconomic disparities in oil-producing rural areas of Nigeria, demonstrating the importance of government support for agriculture and local skills development. The SFHA program provides insight into various interventions and programs that can

improve community welfare through increasing knowledge and skills in plant cultivation, supporting endeavors such as SFHA to improve community welfare in various regions.

The use of yard land with various kinds of plants aims to include family food independence known as the concept of a SFHA which was first launched by the President in 2011 and then in 2012 was replicated by the province of South Sumatra in Banyuasin Regency in Talang Keramat Village launched by the Minister of Agriculture. At first, the community responded very much to this national program and the SFH increased rapidly due to help from the State Budget and Regional Budget. The help is actually capital for farmer female groups so that in the future yard optimization activities can be sustainable or surprising, but in fact after there is no more help, the number of residents who implement SFH has decreased. This is due to: 1) Difficulty in obtaining water when the dry season arrives to water crops, 2) Basic work is not farmers, 3) Household busyness factors, 4) Not having a hobby of farming, 5) Lack of help from field officers (PPL), 6) Lack of support from community leaders and village officials. This condition is in line with previous research, (Honculada-Genove, 2020) examined food safety and nutrition training programs through food production in home yards in the Philippines, showing that home gardens play an important role in increasing access to quality food. (Sia et al., 2023) highlighted the importance of urban horticulture in improving food stock and quality of life in Singapore, which can provide valuable lessons for other cities. (Blakstad et al., 2022) examined a home garden program in Tanzania that improves dietary diversity and household food stock through agricultural training and health education. (Alemu et al., 2019) examined the impact of permagarden interventions in Ethiopia, finding an increase in fruit and vegetable consumption among vulnerable families. (Martin & Vold, 2018) evaluated an "askîy" urban farming project in Saskatoon, Canada, that empowers youth and increases their capacity to grow crops in the city. (Bhutta et al., 2013) discuss challenges and strategies to address micromalnutrition in developing countries through food-based interventions and education. (Tessema et al., 2023) researched the SURE program in Ethiopia that improves the quality of children's diets through community-based nutrition services. (Alemu et al., 2019) in another study found that permagarden interventions increased the frequency and diversity of vegetable and fruit consumption in Ethiopia. This condition provides insight into the importance of yard farming programs and community-based interventions in improving food stock and quality of life, supporting the sustainability of SFHA programs in various regions.

Therefore, the solution for the sustainability of SFHA needs to be: 1) Support from the local government from related agencies, 2) Support from community leaders and village/sub-district officials, 3) VSG management continues, 4) Help continues to be carried out 5) Village competitions to stimulate SFH motivation and 6) There is a market as a container for plant products.

2.5. Policy Conclusions and Recommendations

The Sustainable Food House Area (SFHA) model is a yard optimization program that is very helpful for people in rural and urban areas because even with a narrow land can carry out plant cultivation in the yard which aims for family food independence, but for its sustainability it requires awareness from the community itself, in addition to support from the local government including village officials/community leaders, field assistants, the availability of seeds in VSG and markets as a shelter for plant products.

Plants cultivated in narrow yards are mostly to meet the needs of their own families, while in large yards in addition to meeting the needs of their own families, they can be sold so that they will get more results. Then with the use of the yard, you will get shopping savings of 7500 IDR –10000 IDR/family/day for vegetable consumption.

Family food diversification as shown by the Hope Food Pattern Score (FPS) has increased $\pm 15\%$ after farmers/communities use yard land and also the development of SFH increases by 60%. The support of the local government through Regional Work Unit (RWU) is highly expected so that the sustainable food house area program can continue.

Part 2 discusses the implementation of the concept of Sustainable Food Houses (SFH) which is focused on the use of yards to support family food security. The main problem raised is the limited use of yards as productive land, even though it has great potential. Factors such as lack of public knowledge and limited infrastructure are significant obstacles. In fact, the yard can be used to grow various types of food crops, horticulture, and small farms that not only support family needs but also have the potential to increase household income. The purpose of this implementation is to improve community skills in sustainable yard management, meet food and nutrition needs, and create environmentally friendly productive economic activities. Suggested strategies include training in green cultivation techniques, distribution of organic seeds and fertilizers, and the use of simple technologies such as drip irrigation and vertical gardens to maximize narrow plots. In addition, the establishment of farmer groups, community mentoring, and the development of local nurseries are proposed to improve the success of the implementation of this program. In

the future, it is necessary to strengthen collaboration between the government, NGOs, and the community to support the implementation of SFH in a sustainable manner. Technologies such as water-efficient irrigation systems and community-based yard management should also be expanded. Ongoing education programs and policy support from the government will be an important element to increase the adoption of SFH programs in various regions. With the right approach, the implementation of SFH can support national food security, improve family economic welfare, and support environmental sustainability.

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Part 3

Potential and Benefits of Optimal Home Page Management

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3.1. Emphasis on the Potential of the Home Page

Optimal management of the yard has great potential in increasing nutrition and family income. Several literatures reveal significant benefits of yard gardening activities in improving food security and nutritional status of households and providing more sources of income. A study by (Galhena et al., 2013) highlights that home gardens contribute positively to household food security by providing a direct source of nutritious food and generating more income through the purchase of garden products. (Pandey et al., 2016) emphasized that home gardens are able to improve dietary diversity and nutritional status through the production of nutrient-rich crops. (Berti & Mulligan, 2016) found that agricultural interventions that included home gardening improved nutritional status in many households, mainly through increased food production and investment in various forms of capital such as nutrition education and gender awareness. (Galluzzi et al., 2010) showed that home gardens help in improving nutritional status and family income, especially during retirement.

In addition, (Saediman et al., 2021) reviewed home garden programs in Indonesia that improve food accessibility and utilization, although the sustainability of the program is still a challenge. (Galluzzi et al., 2010) add that home gardens also play an important role in biodiversity conservation and the transmission of cultural knowledge. (Muurinen et al., 2010) stated that community gardens, including home gardens, improve the nutritional and social health of communities. (Rani et al., 2015) found that home gardens with ecological healing functions can reduce mental stress during the COVID-19 pandemic and improve mental health and biodiversity. Overall, the literature suggests that optimal management of the yard can improve nutrition and family income through the production of nutritious food, food cost savings, and income from the purchase of garden produce, while also providing significant social and environmental benefits.

The concept of sustainable food houses offers various benefits and potential for optimal management of the yard. The following are some relevant literatures explaining these concepts and benefits:

- a. Community Empowerment: (Sanga & Msuya, 2022) explained that home gardens as edible landscapes based on community empowerment can increase the consumption of nutritious food, support conservation, improve the microclimate, and provide recreational and aesthetic functions. It can also improve social status and family income (table 3.1.).

Table 3. 1. The concept of sustainable gardens empowers communities

Concept	Description	Implementation
Consume Nutritious Food	Planting nutrient-rich crops to increase the family's nutritional intake.	- training and Education: Conducting gardening training and nutrition education; - land Utilization: Utilize every available space to grow nutritious crops.
Conservation Support	Reduce the use of harmful chemicals and support biodiversity.	- Use of Organic Fertilizer: Use compost and organic fertilizer; - Biodiversity: Planting different types of crops to support local ecosystems.
Microclimate Improvement	The plant helps to improve the temperature and humidity around the house.	- tree and Shrub Planting: Planting trees and shrubs to provide shade; - landscape Design: Design the garden to create a cozy and cool environment.
Recreational and Aesthetic Function	Gardens as a place of recreation and aesthetics to improve the quality of life.	- Recreation Area: Creating a recreation area such as a garden bench or gazebo. - Aesthetic Design: Arrange the garden with aesthetic elements such as flowers and garden decorations.
Improvement of Social Status and Family Income	More sources of income and social status improvement through community interaction.	- community Market: Forming a community market for the purchase of garden products; - gardening Groups: Forming gardening groups to share knowledge and crops.

Source: Author's Analysis, 2024.

- b. Food Security: (Saediman et al., 2021) reviewed the home food garden program in Indonesia which aims to utilize home yards to increase food availability and consumption as well as household food security. (Table 3.2.).

Table 3.2. Home gardens support sustainable food security

Concept	Description	Implementation
Food Security	Utilizing the yard of the house to increase the availability and consumption of food as well as household food security.	- Training and Education: Conducting gardening training and education on the importance of food security. - Distribution of Seeds and Seeds: Providing quality seeds and plant seedlings to the community.
Utilization of House Yard	The use of available land around the house to grow food crops such as vegetables, fruits, and medicinal plants.	- Effective Garden Design : Create an optimal garden design according to the land conditions, such as vertical gardens or hanging pots for narrow plots. - Simple Irrigation System: Implement a simple irrigation system such as the use of drip irrigation or rainwater utilization.
Food Availability	Ensuring that households have adequate access to nutritious food throughout the year.	- Planting Calendar: Drafting a planting calendar to ensure continuity of food production throughout the year. - Storage and Processing: Teaching techniques for storing and processing crops to extend shelf life and utilize surplus production.
Food Consumption	Encourage the consumption of healthier and more nutritious food from home garden products.	- Nutrition Education: Provides education about the nutritional benefits of planted plants and how to cook them properly. - Females's Empowerment: Involve females in the management of home gardens to ensure the well-being of families.
Sustainability and Sustainability	Ensuring environmentally friendly and sustainable gardening practices.	- Organic Fertilizer Use: Using compost and organic fertilizer from kitchen and garden waste. - Water Conservation: Teaches water conservation techniques such as mulching to reduce evaporation and maximize water absorption by plants.

Source: Author's Analysis, 2024

Examples of Implementation in the Field:

- 1) Gardening Training: Conducting gardening training for communities in villages to improve gardening skills and teaching organic and eco-friendly gardening techniques.
- 2) Distribution of Seeds and Seeds: Providing seeds of vegetables, fruits, and medicinal plants to families to plant in their yards and providing superior seeds that have high resistance to diseases and pests.

- 3) Effective Garden Design: Help families design their gardens according to the conditions of the available land and use vertical gardening methods or hanging pots for narrow plots.
- 4) Simple Irrigation System: Teaches how to create a simple irrigation system such as drip irrigation or rainwater utilization and encourages the use of mulching techniques to maintain soil moisture.
- 5) Planting Calendar: Compile a planting calendar tailored to the season and crop type to ensure production continuity.
- 6) Storage and Processing: Provides training on how to store and process crops to extend shelf life and utilize production surpluses.
- 7) Nutrition Education: Holding nutrition education sessions for families about the benefits of planted plants and how to cook them.
- 8) Females's Empowerment: Involve females in the management of home gardens to ensure the well-being of families.

With the right approach, the home food garden program can be an effective solution to increase household food security, improve nutritional intake, and support environmental sustainability.

- c. Food security and nutrition: (Galhena et al., 2013) emphasized the importance of home gardens in improving food security and household nutrition, especially in developing countries facing food scarcity and malnutrition (table 3.4.).

Table 3.3. The concept of home gardens ensures food security and nutrition

Concept	Description	Implementation
Food Safety and Nutrition	Planting food crops in home yards to increase availability and access to nutritious food, especially in developing countries.	- training and Education: Provides training on gardening techniques and nutrition education; - distribution of Seeds and Seeds: Providing quality seeds and plant seedlings.
Increasing Food Production	Encouraging the planting of various types of highly nutritious food crops to meet the nutritional needs of families.	- Plant Rotation: Implement plant rotation to maintain soil fertility. - Utilization of Technology: Using simple technologies such as hydroponics and aquaponics to increase production.
Access to nutritious food	Ensure families have easy access to nutritious food sources from their own gardens.	- Vertical Gardens and Hanging Pots: Use this method to maximize space on limited land. - Efficient Irrigation System: Uses drip irrigation to ensure the plants get enough water.

Concept	Description	Implementation
Crop Processing	Processing crops to extend shelf life and increase the nutritional value of food.	- Food Processing Training: Provides training on how to process and preserve food. - Storage Techniques: Teaches good storage techniques such as canning and drying.
Plant Diversification	Planting different types of crops to ensure nutritional diversity and prevent dependence on one type of food.	- multicultural Cultivation: Combining the cultivation of vegetables, fruits, and medicinal plants; - home Agroforestry: Integrating fruit trees and shade plants with food crops.
Awareness and Education	Increasing public awareness of the importance of food safety and good nutrition through education and campaigns.	- Nutrition Education Program: Holding a nutrition education program in the community. - Awareness Campaign: Using local media to campaign on the importance of home gardens for food security and nutrition.

Source: Author's Analysis, 2024

Examples of Implementation in the Field:

- 1) Training and Education: conducting gardening training and nutrition education in villages or communities and providing knowledge on efficient and environmentally friendly gardening techniques.
- 2) Distribution of Seeds and Seedlings: Providing high-quality seeds and seedlings to the community to plant in their yards and holding a regular seed distribution program.
- 3) Plant Rotation: Teaches plant rotation practices to prevent soil fatigue and pests and encourages the planting of ground cover plants that improve soil fertility.
- 4) Utilization of Technology: Teaching simple hydroponic and aquaponic techniques to increase food production in narrow plots of land and providing facilities and materials for these technologies in the community.
- 5) Vertical Gardens and Hanging Pots: Helping people build vertical gardens and using hanging pots to maximize the use of space and provide design examples and guidelines for making vertical gardens.
- 6) Efficient Irrigation System: Teaching how to make and use drip irrigation systems to save water and holding irrigation equipment help programs for families in need.
- 7) Food Processing Training: Provides training on how to process crops into value-added products such as jams, pickles, and dry foods and teaches food preservation techniques such as canning and drying.

- 8) Nutrition Education Program: Holding nutrition education sessions involving nutritionists to provide knowledge about healthy eating and distributing educational materials such as brochures and nutrition guides to the community.

With the right approach, sustainable food home gardens can play an important role in improving food security and household nutrition, especially in developing countries facing food scarcity and malnutrition.

- d. Agricultural Sustainability: (Finley et al., 2017) show that integrated nutrient management can improve crop yield quality and soil environment, which is critical for the sustainability of household food production (table 3.4.).

Table 3.4. The concept of Agroforestry fertilization for sustainability

Concept	Description	Implementation
Use of Fertilizer in Agroforestry	Integrating the use of fertilizers in agroforestry systems to increase production without damaging the natural resource base.	- Organic Fertilizer: Use compost, manure, and green manure to fertilize the soil. - Inorganic Fertilizers: Use the right and controlled amounts of inorganic fertilizers.
Plant Diversification	Planting different types of food crops, trees, and shade plants to create a balanced and productive ecosystem.	- Multicultural Planting: Combining food crops, fruit trees, and shade plants; - Legum Plant Usage: Planting legum plants to increase soil fertility.
Soil Fertility and Health	Improving soil fertility and health through sustainable agroforestry practices.	- plant Rotation and Agroforestry: Rotate plants with agroforestry plants to maintain soil fertility; - planting Cover Crops: Using ground cover plants.
Water Management	Optimizing the use of water for irrigation with efficient methods in agroforestry systems.	- drip Irrigation System: Uses a drip irrigation system to conserve water; - rainwater Collection: Collects and uses rainwater for irrigation.
Integrated Pest Control	Using environmentally friendly pest control methods to maintain plant health in agroforestry systems.	- Biological Control: Using natural predators and biopesticides to control pests. - Pest Repellent Plants: Plant plants that can repel pests naturally such as marigolds.
Training and Education	Improving farmers' knowledge and skills through ongoing training and education on agroforestry management.	- workshops and Training: Conducting workshops and training on sustainable agroforestry practices; - agricultural Extension: Provides periodic counseling by agricultural experts.

Source: Author's Analysis, 2024

Examples of Implementation in the Field:

- 1) Organic Fertilizer: teaches how to make compost from plant residues and kitchen waste; and use manure from local chattel to fertilize the soil.
- 2) Inorganic Fertilizers: use inorganic fertilizers only, when necessary, based on soil analysis and encourage the use of environmentally friendly and dose-appropriate inorganic fertilizers.
- 3) Multicultural Planting: combining food crops such as vegetables and fruits with fruit trees and shade plants and planting mutually supportive crops such as legumes that can add nitrogen to the soil.
- 4) Uses of legum plants: growing legume crops such as peanuts and mung beans to increase soil fertility through nitrogen fixation and teaching the benefits and techniques of growing legumes to farmers.
- 5) Crop Rotation and Agroforestry: Rotate crops every growing season to prevent the accumulation of pests and diseases and prepare a crop rotation schedule that is suitable for local conditions and types of agroforestry crops.
- 6) Cover Plant Planting: planting cover crops such as legumes to add nitrogen in the soil and prevent erosion and teach the benefits and techniques of cover crop planting to farmers.
- 7) Drip Irrigation System: implement a drip irrigation system to optimize water use and provide drip irrigation equipment help to farmers in need.
- 8) Rainwater Collection: create a rainwater collection system for use during the dry season and teach techniques for making and maintaining a rainwater collection system.
- 9) Biological Control: using natural predators such as ladybugs and spiders to control pests and using biopesticides made from natural materials to reduce the use of chemical pesticides.
- 10) Pest Repellent Plants: plant plants such as marigolds, basil, and rosemary around the garden to repel pests naturally and teach farmers the benefits and ways to grow pest repellent plants.
- 11) Workshops and Trainings: hold workshops and trainings on sustainable agroforestry management and invite agricultural experts to provide counseling and consultation to farmers.
- 12) Agricultural Extension: provide periodic agricultural extension services to monitor and help farmers in implementing agroforestry practices and establish agricultural information center in the community to provide easy access to knowledge for farmers.

With the right approach, agroforestry management can help achieve agricultural sustainability at the household level, increase food production, and maintain soil health and fertility.

- e. Agroforestry Management: (Lalramnghinglova & Rai, 2010) reviewed the use of fertilizers in agroforestry systems, including home gardens, and found that the use of fertilizers can increase production without damaging the natural resource base (table 3.5).

Table 3.5. The concept of Agroforestry fertilization for sustainable food

Concept	Description	Implementation
Use of Fertilizer in Agroforestry	Integrate the use of organic and inorganic fertilizers in agroforestry systems to increase production without damaging the natural resource base.	- Organic Fertilizer: Use compost, manure, and green manure. - Inorganic Fertilizers: Use inorganic fertilizers in the right amount and according to the needs of the plants.
Plant Diversification	Planting different types of food crops, fruit trees, and shade plants to create a balanced and productive ecosystem.	- Multiculture Planting: Combining food crops, fruit trees, and shade plants. - Legum Plants: Grow legum plants to increase soil fertility through nitrogen fixation.
Soil Fertility and Health	Improving soil fertility and health through sustainable agroforestry practices.	- Plant Rotation: Rotate plants to maintain soil fertility. - Ground cover plants: Planting ground cover plants to prevent erosion and increase soil organic matter.
Water Management	Optimizing the use of water for irrigation with efficient methods in agroforestry systems.	- drip Irrigation: Using a drip irrigation system to conserve water; - rainwater Collection: Collects and uses rainwater for irrigation.
Integrated Pest Control	Using environmentally friendly pest control methods to maintain plant health in agroforestry systems.	- biological Control: Using natural predators and biopesticides; - pest Repellent Plants: Grow pest repellent plants such as marigolds and basil.
Training and Education	Improving farmers' knowledge and skills through ongoing training and education on agroforestry management.	- workshops and Training: Conducting workshops and training on sustainable agroforestry practices; - agricultural Extension: Provides periodic counseling by agricultural experts.

Source: Author's Analysis, 2024

- f. Social and economic contributions: (Jatib et al., 2015) reviewed the socio-economic contributions of home garden agroforestry in Ethiopia and found that this practice can improve socio-economic well-being and environmental sustainability (table 3.6).

Table 3.6. The concept of home garden agroforestry's social-economic sustainability

Concept	Description	Implementation
Social and Economic Contribution	The practice of home garden agroforestry can improve socio-economic welfare and environmental sustainability.	- Income Increase: Selling garden produce to supplement the family's income. - Community Empowerment: Involving all family members and communities in agroforestry activities.
Improving Social Welfare	Improving the quality of life through social interaction and community collaboration in agroforestry activities.	- Community Cooperation: Forming farmer groups or gardening communities to help each other and share knowledge. - Training and Education: Conduct regular training on gardening techniques and agroforestry benefits.
Environmental Sustainability	Agroforestry helps maintain the balance of the ecosystem and reduce negative impacts on the environment.	- Eco-Friendly Practices: Using organic fertilizers and natural pest control methods. - Natural Resources Conservation: Implementing soil and water conservation techniques.
Food Safety	Improve food security by producing food in-house and reducing dependence on external markets.	- plant Diversification: Planting various types of food crops to meet the nutritional needs of families; - crop Storage: Teaching techniques for storing and preserving crops.
Females's Empowerment	Involve females in agroforestry activities to enhance their role and contribution in the family economy.	- Skills Training: Conducted specialized training for females on gardening techniques and crop management. - Access to Resources: Providing females with access to resources such as seeds and agricultural tools.
Education and Awareness	Raising public awareness about the importance of agroforestry through education and campaigns.	- awareness Campaign: Conducting an awareness campaign on the benefits of agroforestry; - educational Programs: Integrating agroforestry in local education curricula.

Source: Author's Analysis, 2024

Examples of Implementation in the Field:

- 1) Income Increase: helping families sell garden produce in local markets or through community marketing programs and encouraging the processing of garden produce into value-added products such as jams, pickles, and juices.
- 2) Community Cooperation: forming farmer groups or gardening communities to share resources and knowledge and holding regular

meetings to discuss developments and challenges in agroforestry activities.

- 3) Eco-Friendly Practices: use compost and organic fertilizers to reduce the negative impact of chemical fertilizers and use natural predators and biopesticides for pest control.
- 4) Plant Diversification: planting different types of food crops such as vegetables, fruits, and medicinal plants and teaching plant rotation techniques to maintain soil fertility.
- 5) Females's Empowerment: conduct special training for females in gardening techniques and crop management and provide access to females to obtain gardening seeds, tools, and materials.
- 6) Awareness Campaign: conduct awareness campaigns on the importance of agroforestry for environmental sustainability and economic well-being and use local media to disseminate information about the benefits of agroforestry.
- 7) Education Programs: integrate agroforestry in local education curricula to raise awareness of the younger generation and hold educational programs in schools on the importance of sustainable agriculture.

With the right approach, the social and economic contributions of home garden agroforestry can help improve the welfare of families and communities, as well as support environmental sustainability.

- g. Ecological Impact: (Taylor & Lovell, 2014) emphasize the importance of home gardens in agro-biodiversity conservation and support for urban biodiversity (table 3.7.).

Examples of Implementation in the Field:

- 1) Multicultural Planting: combining the cultivation of vegetables, fruits, flowers, and medicinal plants in one garden to increase plant diversity and provide training on the benefits and techniques of multicultural planting to the community.
- 2) Endemic and Rare Plants: planting endemic and rare plants that are suitable for local conditions to maintain genetic diversity and conserve species and work closely with conservation agencies to obtain endemic and rare plant seedlings.
- 3) Wildlife Habitats: create habitats such as bird's nests, insect shelters, and small ponds to support wildlife life and use plants that are attractive to pollinators and birds.
- 4) Compost and Manure: teaches how to compost from plant scraps and kitchen waste and uses manure from local livestock to fertilize the soil.

- 5) Green Fertilizer: planting green manure crops such as legumes to improve soil fertility through nitrogen fixation and integrating green manure plants in crop rotation.
- 6) Drip Irrigation: implements drip irrigation systems to optimize water use and maintain soil moisture and provides drip irrigation equipment help to farmers in need.

Table 3.7. The concept of ecological impact of home gardens in the context of sustainable food houses in real and implementable

Concept	Description	Implementation
Agro-Biodiversity Conservation	Home gardens can improve agro-biodiversity conservation by planting different types of plants and creating habitats for different species.	- Multicultural Planting: Planting different types of food crops, flowers, and medicinal plants. - Endemic and Rare Plants: Growing endemic and rare plants to maintain genetic diversity.
Support for Urban Biodiversity	Home gardens help to increase urban biodiversity by providing habitat for local flora and fauna.	- Wildlife Habitat: Creating habitats for birds, insects, and small animals. - Shade and Ground cover plants: Planting shade trees and ground cover plants to support local ecosystems.
Use of Organic Fertilizer	Using organic fertilizers to increase soil fertility and maintain the balance of soil ecosystems.	- Compost and Compost: Use compost and manure to fertilize the soil. - Green Fertilizer: Plant green manure plants such as legumes to improve soil fertility.
Sustainable Water Management	Manage water efficiently for irrigation to maintain the balance of water resources.	- drip Irrigation: Using a drip irrigation system to conserve water; - rainwater Collection: Collects and uses rainwater for irrigation.
Integrated Pest Control	Using environmentally friendly pest control methods to maintain the health of plants and ecosystems.	- biological Control: Using natural predators and biopesticides; - pest Repellent Plants: Grow pest repellent plants such as marigolds and basil.
Training and Education	Increase public awareness and knowledge about the importance of agro-biodiversity conservation and urban biodiversity.	- Workshops and Training: Conducting workshops and training on eco-friendly gardening techniques. - Awareness Campaign: Conducting a campaign on the importance of biodiversity conservation.

Source: Author's Analysis, 2024

- 7) Rainwater Collection: create a rainwater collection system for use during the dry season and teach techniques for making and maintaining a rainwater collection system.
 - 8) Biological Control: using natural predators such as ladybugs and spiders to control pests and using biopesticides made from natural materials to reduce the use of chemical pesticides.
 - 9) Pest Repellent Plants: plant plants such as marigolds, basil, and rosemary around the garden to repel pests naturally and teach farmers the benefits and ways to grow pest repellent plants.
 - 10) Workshops and Trainings: hold workshops and training on eco-friendly gardening techniques and agro-biodiversity conservation and invite ecologists and agriculture experts to provide counseling and consultation to farmers.
 - 11) Awareness Campaign: held an awareness campaign on the importance of agro-biodiversity conservation and urban biodiversity and used local media to disseminate information about the benefits of home gardens for local ecosystems.
 - 12) With the right approach, home gardens can play an important role in agro-biodiversity conservation and support for urban biodiversity, as well as improving ecosystem balance and environmental sustainability.
- h. Plant disease control: (Dordas, 2008) showed that nutrients can affect plant resistance to disease, which is important in sustainable agriculture (table 3.8.).

Examples of Implementation in the Field:

- 1) Balanced Fertilization: provide fertilizer that suits the specific needs of the plant based on its growth phase and use organic fertilizers such as compost and manure to improve soil health.
- 2) Periodic soil testing: conduct regular soil testing to monitor fertility levels and nutrient requirements and develop a fertilization program based on the results of soil analysis to ensure proper nutrient delivery.
- 3) Plant rotation schedule: compile an effective crop rotation schedule to prevent the accumulation of pathogens and maintain soil fertility and integrate ground cover plants such as legumes to improve soil health and add nitrogen.
- 4) Legum Plants: grow legumes such as peanuts and mung beans to add nitrogen in the soil and increase fertility and use legumes as ground cover crops to maintain soil moisture and reduce erosion.

- 5) Biological Control: using natural predators such as ladybugs and spiders to control pests and using biopesticides made from natural materials to reduce the use of chemical pesticides.

Table 3.8. The concept of Nutritional management for plant disease control.

Concept	Description	Implementation
Plant Nutrition Management	Proper management of nutrients can improve plant resistance to disease and support sustainable agriculture.	- balanced Fertilization: Apply fertilizer according to the specific needs of the plant; - organic Fertilizer Use: Using compost and manure to improve soil health.
Soil Analysis	Conducting soil analysis to determine the nutrient content and plant needs.	- Periodic soil testing: Conduct regular soil testing to monitor fertility levels and nutrient needs. - Providing Nutrition According to the Results of the Analysis: Developing a fertilization program based on the results of soil analysis.
Plant Rotation	Rotate plants to prevent the spread of diseases and maintain soil fertility.	- Plant rotation schedule: Develop an effective crop rotation schedule to prevent the accumulation of pathogens. - Ground Cover Plant Integration: Using ground cover plants to reduce erosion and increase soil organic matter.
Use of Ground cover plants	Planting ground cover crops to improve soil health and reduce the risk of disease.	- Legum Plants: Grow legumes to add nitrogen to the soil. - Ground cover plants: Use plants such as alfalfa or clover to maintain soil moisture and reduce erosion.
Integrated Pest Control	Using integrated pest control methods to maintain plant health and reduce the use of chemical pesticides.	- Biological Control: Using natural predators and biopesticides. - Pest Repellent Plants: Plant plants that can repel pests naturally such as marigolds and basil.
Training and Education	Increase farmers' knowledge about the importance of nutrition and plant disease management techniques.	- workshops and Training: Conducting workshops and training on nutrient management and plant disease control; - agricultural Extension: Provides periodic counseling by agricultural experts.

Source: Author's Analysis, 2024

- 6) Pest Repellent Plants: plant plants such as marigolds, basil, and rosemary around the garden to repel pests naturally and teach farmers the benefits and ways to grow pest repellent plants.

- 7) Workshops and Training: hold workshops and training on nutrient management and environmentally friendly plant disease control techniques and invite agricultural experts to provide counseling and consultation to farmers.
 - 8) Agricultural Extension: provide periodic agricultural extension services to monitor and help farmers in implementing sustainable practices and establish agricultural information centers in the community to provide easy access to knowledge for farmers.
 - 9) With the right approach, nutrient management can help increase plant resistance to disease, maintain soil health, and support sustainable agriculture in the context of sustainable food houses.
- i. Sustainable agricultural practices: (Neupane et al., 2023) reviews how alternative farming practices in vegetable growing systems can improve soil health and ecosystem services (table 3.9).

Examples of Implementation in the Field:

- 1) Organic Fertilizer use: teaches how to compost from plant scraps and kitchen waste and uses manure from local livestock to fertilize the soil.
- 2) Green Fertilizer: planting green manure crops such as legumes to improve soil fertility through nitrogen fixation and integrating green manure plants in crop rotation.
- 3) Plant rotation schedule: compile an effective crop rotation schedule to prevent the accumulation of pests and diseases and maintain soil fertility and use legume plants in rotation to add nitrogen to the soil.
- 4) Planting Cover Crops: planting ground cover crops such as clover or alfalfa to reduce erosion, increase soil organic matter, and maintain soil moisture and use organic mulch to maintain soil moisture.
- 5) Drip Irrigation: implements drip irrigation systems to optimize water use and maintain soil moisture and provides drip irrigation equipment help to farmers in need.
- 6) Rainwater Collection: create a rainwater collection system for use during the dry season and teach techniques for making and maintaining a rainwater collection system.
- 7) Biological Control: using natural predators such as ladybugs and spiders to control pests and using biopesticides made from natural materials to reduce the use of chemical pesticides.
- 8) Pest Repellent Plants: plant plants such as marigolds, basil, and rosemary around the garden to repel pests naturally and teach farmers the benefits and ways to grow pest repellent plants.

Table 3.9. The concept of Sustainable vegetable farming for food security

Concept	Description	Implementation
Sustainable Vegetable Cultivation	Implementing sustainable vegetable growing techniques to improve soil health and ecosystem services.	- Use of Organic Fertilizer: Use compost and manure. - Green Fertilizer: Plant green manure plants such as legumes to improve soil fertility.
Plant Rotation	Rotate plants to prevent the accumulation of pests and diseases and maintain soil fertility.	- Plant rotation schedule: Develop an effective crop rotation schedule. - Legum Plant Planting: Uses legume plants in rotation to add nitrogen to the soil.
Planting Cover Crops	Plant ground cover crops to reduce erosion, increase soil organic matter, and maintain soil moisture.	- planting Cover Crops: Using plants such as clover or alfalfa; - organic Mulch: Uses organic mulch to maintain soil moisture.
Sustainable Water Management	Optimizing the use of water for irrigation with efficient and environmentally friendly methods.	- drip Irrigation: Using a drip irrigation system to conserve water; - rainwater Collection: Collects and uses rainwater for irrigation.
Integrated Pest and disease control	Using environmentally friendly pest and disease control methods to maintain the health of plants and ecosystems.	- Biological Control: Using natural predators and biopesticides. - Pest Repellent Plants: Plant plants that can repel pests naturally such as marigolds and basil.
Increased Soil Fertility	Improving soil fertility through practices that support sustainable agriculture.	- compost and Compost: Using compost and manure to improve soil structure; - soil Amendments: Adding amendments such as biochar to improve soil health.
Training and Education	Improving farmers' knowledge and skills through ongoing training and education on sustainable agriculture techniques.	- workshops and Training: Conducting workshops and training on sustainable agricultural practices; - agricultural Extension: Provides periodic counseling by agricultural experts.

Source: Author's Analysis, 2024

- 9) Compost and Manure: use compost and manure to improve soil structure and increase fertility and add amendments such as biochar to improve soil health.
- 10) Workshops and Training: hold workshops and training on sustainable agricultural practices such as crop rotation, organic fertilizer use, and integrated pest control and invite agricultural experts to provide counseling and consultation to farmers.

- 11) Agricultural Extension: provide periodic agricultural extension services to monitor and help farmers in implementing sustainable practices and establish agricultural information centers in the community to provide easy access to knowledge for farmers.
 - 12) With the right approach, sustainable farming practices can help improve soil health, ecosystem services, and the sustainability of food production in the context of sustainable food houses.
- j. Sustainable weed management: (Abdallah et al., 2021) reviews sustainable weed management strategies in conservation agriculture and finds that the integration of various management tools can work efficiently (table 3.10.).
- Examples of Implementation in the Field:
- 1) Mechanical Control: use hoes, sickles, or other mechanical tools to manually pull weeds and hold mutual cooperation in the community to clear the land from weeds on a regular basis.
 - 2) Biological Control: introduce weed-eating insects or microorganisms that can infect weeds in agricultural areas and use biological agents with other control methods for more effective results.
 - 3) Limited Chemical Control: use herbicides only when absolutely necessary and in the right dosage to avoid negative impacts on the environment and conduct training on the wise and safe use of herbicides.
 - 4) Ground cover plants: plant ground cover plants such as clover or alfalfa to suppress weed growth and increase soil fertility and use organic mulches such as straw or dry leaves to cover the soil and reduce weed growth.
 - 5) Plant Rotation: draw up an effective crop rotation schedule to disrupt the life cycle of weeds and maintain soil health and use different types of plants to prevent the accumulation of the same weed species.
 - 6) Directed Fertilization: apply fertilizer in a targeted manner only to the main crop to reduce the competitive advantage of weeds and use legumes that improve the soil and reduce the need for chemical fertilizers.
 - 7) Workshops and Trainings: hold workshops and training on sustainable weed management techniques and invite agricultural experts to provide counselling and consultation to farmers.
 - 8) Agricultural Extension: provide periodic agricultural extension services to monitor and help farmers in implementing sustainable weed management techniques and establish agricultural information centers in the community to provide easy access to knowledge for farmers.

Table 3.10. The concept of sustainable weed management in the context of sustainable food houses in real and implementable

Concept	Description	Implementation
Sustainable weed management	Integration of various efficient and environmentally friendly weed management strategies to maintain the balance of the ecosystem.	- mechanical Control: Uses mechanical tools to remove weeds; - biological Control: Uses natural enemies of weeds; - limited Chemical Control: Limited and prudent use of herbicides.
Land Closure	Use ground cover plants to reduce weed growth and improve soil fertility.	- Ground cover plants: Grow ground cover plants such as clover or alfalfa. - Organic Mulch: Use organic mulch to suppress weed growth and maintain soil moisture.
Plant Rotation	Rotate plants to prevent the accumulation of the same weed species and maintain soil health.	- Plant rotation schedule: Develop an effective crop rotation schedule. - Different Plant Uses: Using different types of plants to disrupt the life cycle of weeds.
Biological Control	Using biological control agents such as insects or microorganisms to reduce weed populations.	- biological Agents: Introduces weed-eating insects or microorganisms that can infect weeds; - integrated Control: Integrating biological control with other methods.
Nutrition Management	Regulates the use of nutrients to support the growth of key crops and reduce the competitive advantage of weeds.	- Targeted Fertilization: Apply fertilizer in a targeted manner to the main crop and avoid areas overgrown with weeds. - Legum Planting: Using legumes that improve the soil and reduce the need for chemical fertilizers.
Training and Education	Improving farmers' knowledge and skills on sustainable weed management techniques.	- workshops and Training: Conducting workshops and training on sustainable weed management; - agricultural Extension: Provides periodic counseling by agricultural experts.

Source: Author's Analysis, 2024

- 9) With the right approach, sustainable weed management can help maintain ecosystem balance, improve soil health, and support the sustainability of food production in the context of sustainable food houses.

- k. Agro-biodiversity diversity: (Galluzzi et al., 2010) highlight the importance of home gardens in biodiversity conservation and cultural knowledge related to agricultural practices (table3.11.).

Table 3.11. The concept of agro-biodiversity diversity in the context of sustainable food houses in real and implementable

Concept	Description	Implementation
Biodiversity Conservation	Home gardens can contribute to biodiversity conservation by planting different types of plants and creating habitats for flora and fauna.	- Multicultural Planting: Planting different types of food crops, flowers, and medicinal plants. - Endemic and Rare Plants: Growing endemic and rare plants to maintain genetic diversity.
Maintenance of Cultural Knowledge	Using home gardens to preserve cultural knowledge related to traditional farming practices and the use of local crops.	- Traditional Plant Cultivation: Planting plants that have cultural and historical value for the community. - Education and Awareness Campaigns: Conducting educational programs on the importance of biodiversity.
Use of Organic Fertilizer	Using organic fertilizers to increase soil fertility and maintain the balance of soil ecosystems.	- Compost and Compost: Use compost and manure to fertilize the soil. - Green Fertilizer: Plant green manure plants such as legumes to improve soil fertility.
Sustainable Water Management	Optimizing the use of water for irrigation with efficient and environmentally friendly methods.	- drip Irrigation: Using a drip irrigation system to conserve water; - rainwater Collection: Collects and uses rainwater for irrigation.
Integrated Pest Control	Using environmentally friendly pest control methods to maintain the health of plants and ecosystems.	- Biological Control: Using natural predators and biopesticides. - Pest Repellent Plants: Plant plants that can repel pests naturally such as marigolds and basil.
Training and Education	Increase public awareness and knowledge about the importance of agro-biodiversity conservation and traditional agricultural practices.	- Workshops and Training: Conducting workshops and training on eco-friendly gardening techniques. - Awareness Campaign: Conducting a campaign on the importance of biodiversity conservation.

Source: Author's Analysis, 2024

Examples of Implementation in the Field:

- 1) Multicultural Planting: combining the cultivation of vegetables, fruits, flowers, and medicinal plants in one garden to increase plant diversity and provide training on the benefits and techniques of multicultural planting to the community.
- 2) Endemic and Rare Plants: planting endemic and rare plants that are suitable for local conditions to maintain genetic diversity and conserve species and work closely with conservation agencies to obtain endemic and rare plant seedlings.
- 3) Traditional Plant Cultivation: planting crops that have cultural and historical value for the community, such as traditional medicine plants or local food crops and holding festivals or community events that highlight the importance of traditional crops and local agricultural practices.
- 4) Education and Awareness Campaigns: hold educational programs in schools and communities about the importance of biodiversity and traditional agricultural practices and use local media to disseminate information about the benefits of home gardens for biodiversity.
- 5) Compost and Manure: teaches how to compost from plant scraps and kitchen waste and uses manure from local livestock to fertilize the soil.
- 6) Green Fertilizer: planting green manure crops such as legumes to improve soil fertility through nitrogen fixation and integrating green manure plants in crop rotation.
- 7) Drip Irrigation: implements drip irrigation systems to optimize water use and maintain soil moisture and provides drip irrigation equipment help to farmers in need.
- 8) Rainwater Collection: create a rainwater collection system for use during the dry season and teach techniques for making and maintaining a rainwater collection system.
- 9) Biological Control: using natural predators such as ladybugs and spiders to control pests and using biopesticides made from natural materials to reduce the use of chemical pesticides.
- 10) Pest Repellent Plants: plant plants such as marigolds, basil, and rosemary around the garden to repel pests naturally and teach farmers the benefits and ways to grow pest repellent plants.
- 11) Workshops and Trainings: hold workshops and training on eco-friendly gardening techniques and agro-biodiversity conservation and invite ecologists and agriculture experts to provide counseling and consultation to farmers.

- 12) Awareness Campaign: held an awareness campaign on the importance of agro-biodiversity conservation and urban biodiversity and used local media to disseminate information about the benefits of home gardens for local ecosystems.
 - 13) With the right approach, home gardens can play an important role in biodiversity conservation and cultural knowledge related to agricultural practices, as well as improve ecosystem balance and environmental sustainability.
- L. Home garden ecosystem management: (Chalmin-Pui et al., 2021) reviews the home garden ecosystem in China and emphasizes the importance of optimizing components and structures to improve ecosystem functions and services (table 3.12.).

Examples of Implementation in the Field:

- 1) Multicultural Planting: combining the cultivation of vegetables, fruits, flowers, and medicinal plants in one garden to increase plant diversity and provide training on the benefits and techniques of multicultural planting to the community.
- 2) Fruit Tree Integration: planting fruit trees such as mangoes, oranges, or guavas in home gardens to provide shade and more food sources and providing fruit tree seedlings to communities to plant in their yards.
- 3) Vertical Garden: uses vertical garden techniques such as plant racks or green walls to maximize the use of vertical space and provides materials and guidelines for creating a vertical garden at home.
- 4) Structuring Plants Based on Light Needs: place plants that need full sunlight in areas that get maximum sunlight and place shade-tolerant plants in shadier areas.
- 5) Household Compost: teaches how to compost from kitchen scraps and garden waste and uses compost to improve soil structure and increase fertility.
- 6) Drip Irrigation: implements drip irrigation systems to optimize water use and maintain soil moisture and provides drip irrigation equipment help to farmers in need.
- 7) Rainwater Collection: create a rainwater collection system for use during the dry season and teach techniques for making and maintaining a rainwater collection system.
- 8) Biological Control: using natural predators such as ladybugs and spiders to control pests and using biopesticides made from natural materials to reduce the use of chemical pesticides.

Table 3.12. The concept of managing the home garden ecosystem in a real and implementable manner in the context of sustainable food houses

Concept	Description	Implementation
Optimization of Garden Components	Optimizing various components of home gardens such as food crops, trees, and cover crops to improve ecosystem function.	- Multicultural Planting: Planting different types of food crops, fruits, and flowers. - Fruit Tree Integration: Planting fruit trees to provide more shade and food sources.
Effective Garden Structure	Design effective garden structures to maximize space use and improve ecosystem services.	- Vertical Garden: Use vertical gardens to maximize vertical space. - Plant Arrangement Based on Light Needs: Placing plants according to sunlight needs.
Utilization of Organic Waste	Using household organic waste to make compost and organic fertilizer.	- household Compost: Teaches how to compost from kitchen scraps and garden waste; - organic Fertilizer: Use compost and manure to improve soil fertility.
Sustainable Water Management	Manage water use efficiently for irrigation and maintain the sustainability of water resources.	- drip Irrigation: Using a drip irrigation system to conserve water; - rainwater Collection: Collects and uses rainwater for irrigation.
Integrated Pest Control	Using environmentally friendly pest control methods to maintain the health of plants and ecosystems.	- Biological Control: Using natural predators and biopesticides. - Pest Repellent Plants: Plant plants that can repel pests naturally such as marigolds and basil.
Improvement of Ecosystem Function	Improve the function of the home garden ecosystem by adding elements that support biodiversity and ecosystem services.	- Wildlife Habitat: Creates habitats for birds, insects, and small animals. - Ground cover plants: Planting ground cover plants to reduce erosion and maintain soil moisture.
Training and Education	Increase public awareness and knowledge about the importance of managing the home garden ecosystem.	- workshops and Training: Conducting workshops and training on garden ecosystem management techniques; - agricultural Extension: Provides periodic counseling by agricultural experts.

Source: Author's Analysis, 2024

- 9) Wildlife Habitats: create habitats such as bird's nests, insect shelters, and small ponds to support wildlife life and use plants that are attractive to pollinators and birds.
- 10) Ground cover plants: plant ground cover crops such as clover or alfalfa to reduce erosion, increase soil organic matter, and maintain soil moisture and use organic mulch such as straw or dry leaves to cover the soil and reduce weed growth.
- 11) Workshops and Trainings: hold workshops and training on home garden ecosystem management techniques and sustainable farming practices and invite ecologists and agriculture experts to provide counselling and consultation to farmers.
- 12) Agricultural Extension: provides periodic agricultural extension services to monitor and help farmers in implementing home garden ecosystem management techniques and establishes agricultural information centers in the community to provide easy access to knowledge for farmers.
- 13) With the right approach, the management of the home garden ecosystem can improve ecosystem functions and services, as well as support the sustainability of food production in the context of sustainable food houses.

Optimal management of sustainable food house-based yards has great potential to improve food security, nutrition, socio-economic welfare, and environmental sustainability. Home gardens are a promising approach to improve food security and family welfare. (Galhena et al., 2013) found that home gardens can address food security and malnutrition and provide more benefits such as income opportunities and ecosystem services. (Sebayang et al., 2020) emphasized that community gardens can be used to reduce food insecurity and help families overcome pandemic-related economic losses by supplementing their diets with nutritious foods. Home garden agroforestry in Ethiopia shows that this practice can improve socio-economic stability and environmental conservation, while providing food, timber, and livestock for rural livelihoods (Mthembu et al., 2021). Integrated nutrient management, as described by (Dordas, 2008), can improve plant resistance to disease and play an important role in sustainable agriculture.

Research also shows that home gardens can make a significant contribution to food security and household nutritional status in Indonesia (Saediman et al., 2021). In Sri Lanka, home gardens have long been part of sustainable food production systems and play an important role in agricultural and environmental sustainability (Savino & Mazza, 2014). Urban home

gardens in developed countries also play an important role in food security, community development, and agro-biodiversity conservation (Taylor & Lovell, 2014). Sustainable weed management in conservation agriculture is also important to maintain ecosystem balance and increase crop productivity.

(Galluzzi et al., 2010) highlighted the importance of home gardens in biodiversity conservation and cultural knowledge related to agricultural practices, while (K. Zhang et al., 2023) emphasized the importance of optimizing the ecosystem components and structures of home gardens to improve ecosystem functions and services. Optimal management of sustainable food house-based yards can provide various significant benefits for food security, nutrition, socio-economic welfare, and environmental sustainability. Proper implementation and supported by scientific research can help realize the full potential of home gardens in a variety of contexts.

3.2. Evaluate Results

Optimal management of sustainable food house-based yards faces a number of challenges and often lacks significant improvement. For illustration, (Piermichele La Sala, 2020) show that one of the main challenges in vegetable garden management is ensuring the efficient use of sufficient water and nutrients in sustainable vegetable production. Farmers need to move from maximizing yields per unit area to maximizing productivity per unit of water and/or nutrients used. In China, Miao et al. (2011) found that inefficient nutrient management and over-reliance on synthetic fertilizers lead to environmental problems such as water pollution and greenhouse gas emissions. They suggest that a combination of organic and chemical fertilizers can address this problem and improve the efficiency of nutrient use. (Liu et al., 2023) emphasized that integrated nutrition management (INM) has the potential to improve crop yields and resource use efficiency, but there are still challenges in its implementation, such as lack of knowledge and technical support to farmers.

In South Africa, (Carstens et al., 2021) identified that the top-down approach in home garden projects often ignores local knowledge and community preferences, which contributes to the failure of the program. (Saediman et al., 2021) found that the home food garden program in Indonesia has a positive impact on food availability, access, and utilization, but faces challenges in maintaining food stability after the program ends. (X. Zhang et al., 2023) emphasized that soil degradation and declining soil fertility are major challenges in tropical agriculture. They found that a combination of organic and inorganic fertilizers can increase crop yields and soil fertility in a sustainable manner.

(Mahala et al., 2018) showed that integrated nutrient management can improve tomato quality and yield and improve the soil environment, but its application is still limited due to lack of knowledge and technical support. (Macieira et al., 2021) emphasized that alternative farming practices in vegetable growing systems can improve soil health and ecosystem services, but the adoption of these practices is still limited due to the lack of technical support and knowledge of farmers. (Carstens et al., 2021) highlight that community gardens can reduce food insecurity and help families cope with pandemic-related economic losses, but challenges such as drought and the collapse of social capital after institutional support is lost still exist. (Pretty, 2018) found that the integration of various weed management tools can work efficiently in conservation agriculture, but its implementation still faces challenges due to differences in weed ecology and control methods in various agricultural systems. Sustainable food house-based yard management faces a variety of challenges, ranging from lack of knowledge and technical support to environmental and social issues. Although many programs have been successful, more research and the implementation of better strategies are still needed to address these challenges and achieve significant improvements in food security, nutrition, socio-economic well-being, and environmental sustainability.

Optimal management of sustainable food house-based yards has great potential in improving food security, nutrition, socio-economic welfare, and environmental sustainability. (Galhena et al., 2013) found that home gardens can address food security and malnutrition and provide more benefits such as income opportunities and ecosystem services. This study shows that home gardens can play an important role in addressing food scarcity and improving family well-being in developing countries. (Saediman et al., 2021) emphasized that the home food garden program in Indonesia has a positive impact on food availability, access, and utilization. However, challenges in maintaining food stability after the program has ended still exist, indicating the need for further research to ensure the sustainability of the program.

(Hammar et al., 2020) highlighted that home gardens in Sri Lanka play a critical role in food security, providing year-round food security at low cost while maintaining a wide range of ecosystem services. However, more research is needed to understand the direct and indirect impacts of home gardens on food security. (Taylor & Lovell, 2014) showed that home gardens in developed countries play an important role in food security, community development, and agro-biodiversity conservation. The study also underscores the importance of support from governments and non-governmental organizations for the success of home gardens. (Carstens et al., 2021) highlight

that home gardens in South Africa can reduce food insecurity and improve economic resilience, especially in underprivileged communities. However, challenges such as drought and the collapse of social capital after institutional support has disappeared still exist.

(Lalramnghinglova & Rai, 2010) showed that tropical agroforestry home gardens have significant sustainability attributes, including the ability to meet the needs of farmers without damaging the resource base, as well as meeting various economic, social, and ecological conditions that contribute to sustainability. (Sapkota et al., 2021) found that integrated nutrient management can improve the quality and yield of tomato plants and improve the soil environment. However, its implementation is still limited due to a lack of knowledge and technical support to farmers. (Macieira et al., 2021) emphasized that alternative farming practices in vegetable growing systems can improve soil health and ecosystem services. However, the adoption of this practice is still limited due to a lack of technical support and knowledge of farmers.

(Scoggins, 2010) highlight that community gardens can reduce food insecurity and help families overcome economic losses related to the pandemic. However, challenges such as drought and the collapse of social capital after institutional support is lost still exist. (Blakstad et al., 2022) highlight challenges in the adoption of home garden agroforestry practices in Ethiopia, such as land limitations and unclear land and tree ownership rights. They suggest the promotion of community services and research to increase the adoption of these practices. (Honculada-Genove, 2020) showed that integrated nutrient management has the potential to improve crop yields and resource use efficiency, but there are still challenges in its implementation. (Nichols et al., 2019) emphasized that urban and peri-urban food production has great potential to contribute to sustainable food production and support biodiversity. However, there are still significant knowledge gaps regarding productivity, economic and employment impacts, pesticide use, and implications for biodiversity. Optimal management of sustainable food house-based yards has great potential to provide significant benefits in food security, nutrition, socio-economic welfare, and environmental sustainability. Proper implementation and supported by scientific research can help realize the full potential of home gardens in a variety of contexts.

Part 3 highlights the great potential of yards in improving food security, economic well-being, and environmental sustainability. The main problems discussed are the low utilization of yards to support food diversification and household welfare, as well as the lack of public awareness about the important role of yards in biodiversity conservation and the absorption of traditional

knowledge. In fact, yards have the potential to provide nutritious food, reduce family expenses, and even generate additional income through the yard products sold. The purpose of Part 3 is to demonstrate the various benefits of optimal yard management, including food diversification, improved nutritional and health status, ecosystem conservation, and increased family income. In addition, the yard can also function as an educational, recreational, and aesthetic space for families. The proposed strategy includes community training on agroforestry techniques, nutrition education, the use of organic fertilizers, and women's empowerment in yard management to support the household economy. For the future, it is important to improve yard management techniques through environmentally friendly technologies such as drip irrigation and simple hydroponic systems. Support from the local community market can also open up wider economic opportunities. In addition, education programs on the benefits of yards and agroforestry need to be integrated into educational curricula and community awareness campaigns. With these steps, sustainable yard management can be a practical solution to support food security, improve quality of life, and maintain environmental balance.

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Part 4

The Concept and Area Scope of Sustainable Food Houses

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The Sustainable Food House Area (SFHA) is a concept developed to optimize household land to meet the food needs of families independently and sustainably. This concept covers various aspects, including effective land management, the application of environmentally friendly technology, and the empowerment of local communities. SFHA aims to increase family food security, reduce dependence on outside food supplies, and maintain ecosystem balance. The related literature shows that the concept of SFHA not only focuses on food production, but also involves social and economic aspects. For example, research on the application of the "Blue Economy" to fisheries in East Lombok shows the importance of business diversification and sustainable use of natural resources to improve the household economy (Achmad Zamroni et al., 2019). In addition, studies on household sustainability through the mublà accounting approach show the importance of long-term financial planning and decision-making that involves all family members to achieve common prosperity (Sholihah et al., 2023).

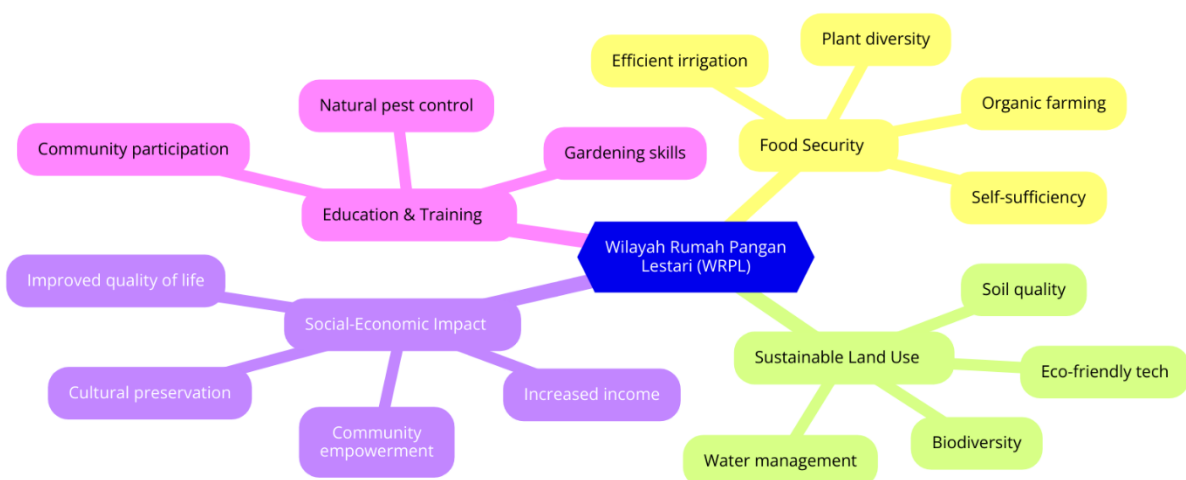


Figure 4.1. Sustainable Food House Area Concept

The relationship between various aspects of this program. The chart focuses on three key aspects: food security, sustainable land use, and socio-economic impact.

1. Food Security, SFHA contributes to food security by increasing plant diversity, organic farming, and self-reliance. This is supported by techniques such as efficient irrigation that help optimize resources.
2. Sustainable Land Use, SFHA also promotes sustainable land use, improves soil quality, and advises environmentally friendly technologies. Water management and biodiversity are also emphasized as an important part of environmental conservation.
3. Socio-Economic Impact, the program increases community participation and provides training and education, such as gardening skills and natural pest control. The result is improved quality of life, cultural preservation, and increased community income, as well as community empowerment.

The implementation of the SFHA has been proven to bring great benefits to food security and the socio-economic impact of the community. A study by (Khuswati et al., 2022; Nailufar et al., 2021) shows that SFHA initiatives have improved food independence at the household level, particularly through crop diversification and increased local knowledge about sustainable land management. In addition, research from (Lepiyanto et al., 2022; Pratama et al., 2022) confirms that improving gardening skills and active community participation in SFHA strengthens social bonds and increases local income through sustainable agricultural products. SFHA is an effective solution that not only improves food security but also contributes to environmental preservation and local economic improvement, especially in rural areas.

Furthermore, the literature on the role of education in developing the critical power of young people, as discussed in the context of the 2013 Curriculum, suggests that problem-based education can help children develop critical thinking skills that are essential for environmental sustainability (Manaf & Hammami, 2020). Other studies show how the implementation of the right concepts and strategies can help communities maintain local cultures and traditions while still adopting modern technology. For example, research on the tradition of Bubur Suran in Surakarta shows that culinary traditions can become a sustainable identity and lifestyle of society (Kartika & Purnasari, 2020). The implementation of SFHA requires a holistic approach that includes social, economic, and environmental aspects to achieve long-term sustainability. Further research is needed to identify the best strategies in various local contexts.

4.1. Optimal Management of the Home Page

Optimal management of the home yard includes various aspects to ensure the sustainability and well-being of the environment and families. Key

indicators of effective yard management include soil quality, plant diversity, water management, and social and economic benefits for residents.

4.1.1. Soil quality

Soil quality is one of the important indicators, where the health of the soil ecosystem plays an important role in the success of urban gardening. These indicators include soil fertility, organic matter content, and soil ability to support plants and mitigate pollution (Schram-Bijkerk et al., 2018). The concept and implementation of soil quality indicators in the context of the SFHA which includes soil fertility, organic matter content, and soil ability to support plants and mitigate pollution.

Table 4.1. Key indicators and practical implementation

Indicator	Description	Implementation
Soil Fertility	The availability of nutrients is important for plant growth, such as nitrogen, phosphorus, and potassium.	Measure the nutrient content of the soil regularly and carry out proper fertilization. (Schram-Bijkerk et al, 2018)
Organic Matter Content	The level of organic matter that contributes to soil structure and water retention.	Adding compost and green manure to increase soil organic matter. (Zornoza et al, 2014)
Soil pH	The level of acidity or alkalinity of the soil that affects the availability of nutrients.	Adjust the pH of the soil with the addition of lime (to increase the pH) or sulfur (to lower the pH). (Bastida et al, 2008)
Cationic Exchange Capacity (CEC)	The ability of soil to store and exchange nutrients is important.	Increases CEC with the addition of organic matter and soil minerals such as zeolites. (Wienhold et al, 2004)
Soil Structure	The regularity and size of soil aggregates that affect aeration and drainage.	Using minimal weeding techniques and adding organic matter to improve soil structure. (Karlen et al, 1992)
Biological Activity	The presence of soil microorganisms and fauna that contribute to soil health.	Reduce the use of chemical pesticides and support microorganism habitats with the addition of compost. (Menta et al, 2018)
Water Absorption Ability	The ability of the soil to absorb and retain water, prevent erosion and retain moisture.	Create an efficient irrigation system and add mulch to reduce water evaporation. (Sharma et al, 2023)
Soil Pollution	The content of harmful chemicals that can damage plants and human health.	Conduct soil contaminant tests periodically and use phytoremediation plants. (Kowalska et al, 2018)

Source: Author Search, 2024

Land management in the SFHA aims to ensure that the soil remains fertile and healthy to support sustainable food production. One of the important steps in this management is the addition of organic matter. By adding compost and manure to the soil every three months, the soil can remain nutrient-rich and well-structured. The addition of this organic matter also helps to increase the levels of humus and soil microorganisms that are essential for plant growth (Cataldo et al., 2021). Additionally, soil pH management is key to ensuring soil conditions are by plant needs. If the pH of the soil is too acidic, dolomite lime can be used to increase it, while if it is too alkaline, sulfur can be added to lower it (Naseri, 2019). Furthermore, an efficient irrigation system such as drip irrigation can help reduce water wastage by directing water directly to the roots of plants. This technique is very important in areas with minimal water supply and helps maintain soil moisture without the need to inundate the land (Hatfield et al., 2001). Plant rotation is also one of the important techniques in maintaining soil health. By rotating perennial crops such as corn and beans, farmers can maintain nutrient balance in the soil, avoid depletion of certain nutrients, and prevent the development of plant-specific pathogens or pests (Techen & Helming, 2017). Another effective practice in managing soil is the use of mulch, which helps to reduce soil erosion and retain moisture by covering the soil surface using straw or grass clippings (Prosdocimi et al., 2016). Cover crops can also be used to add organic matter to the soil, improve soil structure, and prevent erosion when the main crop is not being planted (Lazcano et al., 2020). By combining all of these techniques, the soil in SFHA can remain fertile and healthy. The use of organic matter, soil pH management, efficient irrigation systems, crop rotation, and the use of mulch and cover crops contribute to sustainable food production, ensuring that the soil remains supportive of crops year-round and maintains the balance of the ecosystem.

One way of sustainable soil management is through the AHP fuzzy model which is used to determine the suitability of agricultural land with several parameters such as soil texture, pH, and electrical conductivity (EC). On land in southern Iran, this model is used to determine areas suitable for wheat cultivation. From the modeling results, it was found that 25.65% of the land was classified as very suitable, 38.2% was classified as moderately suitable, and only 8.52% was not suitable for wheat cultivation (Sharma & Malaviya, 2021). In addition, soil organic matter (SOM) prediction using machine learning techniques also offers a fast and accurate approach to measuring soil

organic matter content based on soil color. The Random Forest (RF) model used in this study succeeded in achieving a determination coefficient (R^2) value of 0.984, which shows high accuracy in predicting SOM content. These results help support sustainable soil management quickly and efficiently (Kang et al., 2024). When it comes to managing soils for higher productivity, BODIUM's simulation models map a variety of physical, chemical, and biological interactions within soils. This model is able to predict the influence of soil management methods such as tillage and the addition of organic matter on crop yields, nitrogen cycles, and soil organic carbon. This modeling also makes it possible to analyze scenarios with and without tillage, thus helping farmers choose the best strategy to maintain long-term soil fertility (Blackstock et al., 2007).

4.1.2. Plant diversity

The diversity of plants in the yard is also an important focus because it contributes to family food security and provides various ecosystem benefits. Home gardens not only support food production but also increase biodiversity and provide social benefits such as improved social cohesion and mental health (Galhena et al., 2013). concept and implementation of plant diversity in the context of the SFHA which includes various benefits, such as food security, biodiversity improvement, and social benefits.

Plant diversity in the SFHA not only provides diverse and nutritious food, but also enhances biodiversity, provides social benefits, and supports ecosystem services. By growing various types of plants, such as vegetables, fruits, medicinal plants, and ornamental plants, home gardens can be a sustainable source of food security. Gardening activities can also improve mental health and social cohesion through family and community participation. Additionally, plant diversity helps to maintain local biodiversity and provides habitat for natural pollinators and pest control.

Plant diversity in the SFHA provides real benefits, both in ecosystem and social. In a real-world simulation, a home garden in Indonesia noted that plant diversity plays an important role in supporting food security and household income, as well as providing important ecosystem services such as biodiversity conservation. In home gardens in the Aceh region, Indonesia, 173 species of plants were found that play a role in supporting the ecosystem and the welfare of local communities. These plants consist of fruits and vegetables that not

only provide nutrients but also serve as medicine, animal feed, and a source of firewood (Suwardi et al., 2023).

Table 4.2. Indicators and Implementation of Plant Diversity and Its Benefits in the SFHA

Indicator	Description	Implementation
Plant Diversity	Planting different types of crops to improve food security and ecosystem health.	Grow different types of vegetables, fruits, medicinal plants, and ornamental plants in one garden (Galluzzi et al., 2010)
Food Benefits	Production of diverse and nutritious food for household needs.	Choose plants that have high nutritional value and can be harvested all year round (Galhena et al., 2013)
Social Benefits	Improving social cohesion and mental health through gardening activities.	Involve family members and the community in gardening activities together. (Khan, 2021)
Biodiversity	Conservation of biodiversity through the planting of local and traditional crops.	Planting local plant varieties and maintaining traditional knowledge of agriculture (Mattsson et al., 2018)
Ecosystem Benefits	Provision of ecosystem services such as pollination and natural pest control.	Plant flowers to attract natural pollinators and use eco-friendly pest control techniques (Isbell et al., 2017)
Economic Benefits	Generate more income through the purchase of garden products.	Sell garden products at local markets or through community farming programs (Saediman et al., 2021)
Education and Knowledge	Dissemination of agricultural and conservation knowledge to the younger generation.	Providing gardening education programs for children and teenagers (Taylor & Lovell, 2014)
Environmental Benefits	Reducing the impact of climate change through carbon sequestration and efficient water management.	Planting plants that are able to absorb carbon and using water-saving irrigation techniques (Sant'Anna de Medeiros et al., 2020)

Source: Author Search, 2024

In Senegal, a study found that home gardens have 96 species of beneficial plants, of which 54% are food species and the rest are medicinal plants, ornamental plants, and forage crops. This plant diversity not only provides food security but also plays a role in the conservation of local biological resources. In addition, the more uses a plant species has, the higher the diversity of these species in home gardens, indicating that people prefer multifunctional plants (Naigaga et al., 2022). Another simulation from Mexico showed that plant diversity in home gardens was positively associated with family food

security. Home gardens with higher plant variety have more balanced food consumption, more frequent vegetable consumption, and better levels of food security. This emphasizes the importance of plant diversity in supporting food security and community nutrition, especially in rural areas (Ceccarelli & Grando, 2020). Overall, the plant diversity in the SFHA provides dual benefits: it supports food security, conserves local biodiversity, and provides important ecosystem services, such as habitat for natural pollinators. Through active participation in home gardens, people not only benefit directly from food production but also contribute to environmental sustainability.

Plant diversity in the SFHA not only supports food security but also improves ecosystem services. Mathematical simulations to estimate the impact of plant diversity on ecosystems can be done using the Shannon Diversity Index (H') model which measures species diversity. For example, in a study in Senegal, the value of $H' = 3.9365$ was generated from data collected from home gardens with 96 plant species. The Shannon Index provides an idea that the higher the H' value, the greater the diversity of species in the garden, and the greater the contribution of the garden to biodiversity conservation and ecosystem services such as the provision of habitat for pollinators and natural pest control (Naigaga et al., 2022). As another example of count, the RF model used in research in China to map the distribution of species diversity showed that the RF algorithm resulted in up to 83.3% accuracy in predicting species richness. The use of this model allows for extensive mapping of plant diversity and is particularly relevant for SFHA, where environmental and climatic variations can affect the types of plants that can grow optimally (Cai et al., 2023). With this model, mathematical simulations show that gardens with high plant diversity not only support food security but also provide better ecosystem services such as increased carbon storage and biodiversity protection. These mathematical calculations provide a scientific basis for designing a sustainable SFHA, by utilizing data-driven predictive technologies.

4.1.3. Water management

Efficient water management is necessary to support plant growth in the home environment, especially in water-scarce areas. Water-saving irrigation practices and the use of water stress indicators on plants can help better manage water use (Parkash & Singh, 2020).

Table 4.3. Indicators and Implementation of Efficient Water Management in the SFHA

Indicator	Description	Implementation
Water-Saving Irrigation	Using an efficient irrigation system to reduce water use.	Use drip irrigation or micro-irrigation to optimize water distribution (St. Hilaire et al., 2008)
Land Management	Improve water use efficiency through good soil management.	Use mulch to reduce water evaporation and maintain soil moisture (Hatfield et al., 2001)
Rainwater Management	Utilizing rainwater for crop irrigation.	Build rain gardens or rainwater collection systems to collect and store rainwater (Sharma & Malaviya, 2021)
Soil Moisture Monitoring	Measure and monitor soil moisture to determine water needs.	Using soil moisture sensors to optimize irrigation schedules (Touil et al., 2022)
Use of Smart Technology	Adopt intelligent technology to manage irrigation efficiently.	Using a sensor-based automatic irrigation system to regulate water distribution according to plant needs (Adeyemi et al., 2017)
Use of Drought-Tolerant Crops	Plant plants that are resistant to drought conditions to reduce water requirements.	Choose plant varieties that have the ability to survive in water-scarce environments (Brueck, 2008)
Water Recycling and Reuse	Reuse treated wastewater for irrigation.	Build a domestic wastewater treatment system for reuse in the garden (Majsztrik et al., 2017)

Source: Author Search, 2024

Efficient water management in SFHA can be achieved through a variety of strategies, such as the use of water-efficient irrigation systems, good soil management, and stormwater use. Drip irrigation or micro-irrigation is very effective in optimizing water use by directing water directly to the roots of plants. Additionally, the use of mulch helps to reduce water evaporation and maintain soil moisture for longer. Monitoring soil moisture using sensors can also help in determining the right water needs so as to avoid waste. The adoption of intelligent technology in sensor-based automatic irrigation systems can improve the efficiency of water distribution. Drought-tolerant plants also play an important role in reducing water requirements. In addition, recycling and reusing treated wastewater can be a practical solution to overcome water shortages.

Efficient water management within the SFHA includes a variety of strategies implemented to reduce water use and ensure sustainability. One of the main strategies is the use of water-efficient irrigation systems, such as drip irrigation and soil moisture sensors. A

vivid example of the application of this technology is the use of irrigation-based sensors that have successfully saved up to 34% of water use by utilizing soil moisture and temperature sensor data to regulate the right amount of water at the vital time. This study was conducted in Europe and showed a significant increase in irrigation efficiency with a sensor-based system, so that its use becomes more economical than manual irrigation methods (Ceccarelli & Grando, 2020). In addition to irrigation, the use of rainwater harvesting is also an important opponent of efficient water management. Rainwater harvesting or rainwater harvesting is optimized with Internet of Things (IoT)-based technology, which automatically manages water collection, storage, and distribution. For example, a project in India uses IoT to monitor and control water levels in storage tanks, so that the collected water can be efficiently used for irrigation of gardens and home gardens, reducing rainwater runoff by up to 40.77% and keeping the soil from erosion (Heidari & Kavianpour, 2021). Another simulation in efficient water management is the use of wastewater (greywater). With domestic wastewater recycling accounting for about 43-70% of total wastewater, home garden managers can reduce the pressure on clean water and use it to water plants in home gardens. In countries such as South Africa, greywater has been successfully implemented as a solution to reduce the use of fresh water in household agriculture (Radingoana et al., 2020).

One example of mathematical calculations in efficient water management in the SFHA can be seen through the use of a sensor-based irrigation model. In a study using Wireless Sensor Networks (WSN), where soil moisture and temperature data were used to control irrigation systems, water savings reached up to 34%. To calculate water savings in an irrigation scenario, suppose the total water used in a single growing season is 10,000 liters. With an efficiency of 34%, water savings can be calculated as $\text{water savings} = 34\% \times 10,000 = 3,400$ liters, so the amount of water used after the water-saving irrigation system is implemented into water used $= 10,000 - 3,400 = 6,600$ liters

This reduction of 3,400 liters of water not only saves costs but also supports the sustainability of water resources. This model was applied in a home garden with sensor-based drip irrigation, which proved to be more economical compared to conventional irrigation which tends to over-drain (Ceccarelli & Grando, 2020). Another study in the Miandarband Plain, Iran, used the Particle Swarm Optimization (PSO) method, optimizing the distribution of water from dams with a

total irrigation requirement of 265.8 million cubic meters (MCM) per year. After optimization, the allocation of irrigation water from surface sources only reached 112 MCM, while the deficit of 153.1 MCM was filled by optimal use of groundwater, without drastically reducing groundwater reserves (Isbell et al., 2017). These mathematical models not only provide water-saving solutions, but also help achieve sustainability goals in water resource management, while maintaining agricultural productivity within the SFHA.

4.1.4. Social and economic benefits

The social and economic benefits of optimal yard management include increased food security, more income from the purchase of garden products, as well as stress reduction and improvement of the quality of life of residents (Torquebiau, 1992). Research shows that a well-managed home garden can make a significant contribution to the well-being of the family and the surrounding community (Taylor & Lovell, 2014).

Table 4.4. Indicators and Implementation of Social and Economic Benefits of Home Garden Management in the SFHA

Indicator	Description	Implementation
Improving Food Security	Reduce dependence on external food supplies by growing various types of food crops yourself.	Grow vegetables, fruits, and medicinal plants in the yard (Galhena et al., 2013)
More Income	Generate more income from the purchase of garden products.	Selling the produce at local markets or through community farming programs (Saediman et al., 2021)
Stress Reduction	Gardening activities can reduce stress and improve mental health.	Invite all family members to participate in gardening activities (Schram-Bijkerk et al., 2018)
Improved Quality of Life	Improve family well-being by providing beautiful and productive green spaces.	Designing gardens with various types of plants that also have aesthetic value (Taylor & Lovell, 2014)
Strengthening Social Cohesion	Building stronger social relationships through gardening together.	Holding community gardening programs and joint garden events (Cameron et al., 2012)
Preservation of Traditional Culture and Knowledge	Maintaining traditional knowledge of local agriculture and crops.	Teaching traditional gardening techniques to the younger generation (Galluzzi et al., 2010)
Ecosystem Benefits	Supporting local ecosystems by improving biodiversity and ecosystem function.	Plant different types of plants to attract natural pollinators and reduce soil erosion (Torquebiau, 1992)
Economic Benefits	Reduce household expenditure on food by growing your own.	Make the most of the vacant land in the yard for gardening (Bantihun Mehari & Abera, 2019)

Source: Author Search, 2024

Optimal yard management in the SFHA can provide a variety of social and economic benefits. By growing different types of food crops, families can improve their food security and reduce their dependence on external food supplies. Excess crops can be sold for more income, which greatly helps the household economy. Gardening activities have also been shown to reduce stress and improve mental health, while the beauty of the garden improves the quality of life. Involving family members and communities in joint gardening activities can strengthen social cohesion. Additionally, by maintaining traditional knowledge about agriculture, families can preserve the culture and increase environmental awareness. Economically, gardening in the yard reduces spending on food and provides financial benefits from the purchase of garden products.

Optimal yard management within the SFHA provides significant social and economic benefits. Real simulations of this management can be seen through various examples of implementation in various regions. For example, home gardens in Indonesia have been instrumental in improving family food security, reducing dependence on external supplies, and generating more income from the crops sold. In Yogyakarta, the results of the study show that home gardens contribute 0.81% to household income. Although this contribution is relatively small due to limited land, its ecological and social benefits remain significant, especially in sustainability and reduction of household expenditure (Irham et al., 2021). In addition, the diversity of plants in home gardens, such as those studied in Aceh, supports food security and biodiversity conservation. The study in 180 home gardens in East Aceh recorded 173 plant species, most of which were food crops and fruits. This diversity of plants supports the household economy while preserving genetic resources and protecting the surrounding protected forests (Suwardi et al., 2023). Home gardens also bid health and mental benefits, especially during isolation due to the COVID-19 pandemic. In Italy, research found that home gardening provides important psychological and physical benefits, especially in reducing stress during the pandemic (Sofa & Sofa, 2020). Home gardens also contribute to improving the quality of life by strengthening social cohesion. Research in Tomohon, Denpasar, and Solo, Indonesia, shows that home gardens based on community empowerment help improve family health, education, and social status, as well as support local environmental conservation (Saroinsong et al., 2021).

The management of the yard within the SFHA provides economic benefits that can be measured mathematically. For example, a study in Jhapa District, Nepal, showed that home gardens account for an average of 19.23% of household annual income. Of the total average annual income of NPR 37,697.24, the livestock opponent accounted for 50.92%, while vegetables accounted for 25.02%. If we calculate the contribution of vegetable income:

$$\text{Vegetable income} = 25.02\% \times \text{NPR}37,697.24 = \text{NPR}9,432.56$$

In addition, in a broader scenario, research in Yogyakarta shows that the contribution of home gardens to household income is 0.81%. In this city, home gardens make a small contribution due to the narrow land, but still significant in supporting local food security (Irham et al., 2021; Prasai et al., 2022). Another simulation in Australia shows that in a home garden with a land size of 751-900 m², vegetable production reaches up to 1,443 tons per year in a low-use scenario. This efficient use of land helps in increasing food supply and household income (Ghosh, 2021).

4.2. Benefits and Impact

4.2.1. Improving food security

Improving food security in the SFHA can be achieved through a variety of strategies, including crop diversification, the use of organic farming techniques, and sustainable management of natural resources. By planting different types of crops, households can ensure the availability of diverse and nutritious food throughout the year. The use of vacant land for gardening not only reduces food costs but also improves the nutritional health of families. In addition, involving communities in joint gardening activities can improve social cohesion and economic well-being. Proper management of natural resources such as water and soil is also important to ensure sustainable food production.

Increasing food security in the SFHA can be achieved through various strategies, including crop diversification and sustainable resource management. A real simulation can be seen in a study in Yucatán, Mexico, where the diversity of household crops contributes significantly to food security. Based on regression analysis, it was found that plant diversity was positively associated with an increase in food consumption score and frequency of vegetable consumption. For example, a 10% increase in plant diversity increases the frequency of vegetable consumption by 2-5 times per week (Isbell et al., 2017). In the

economic context, home garden management also has a financial impact. For example, research in Australia found that small-sized home gardens with intensive land use can achieve water use efficiency equivalent to commercial horticulture, as well as provide significant financial savings. Gardens that use efficient irrigation techniques, such as irrigation-based sensors, are able to save water use by up to 34%, with the initial investment cost repaying within 5 years, resulting in financial benefits for households (Csortan et al., 2020). Overall, through crop diversification, water-efficient irrigation techniques, and sustainable resource management, households can improve food security, reduce costs, and increase incomes, thereby supporting social and economic well-being in the SFHA.

Table 4.5. Indicators and Implementation of Improving Family Food Security in the SFHA

Indicator	Description	Implementation
Sustainable Food Production	Increase household food production in a sustainable manner to reduce dependence on external supplies.	Using organic farming techniques and crop rotation to maintain soil fertility and plant health (Galhena et al., 2013)
Plant Diversity	Planting different types of plants to meet diverse nutritional needs.	Growing vegetables, fruits, spices, and medicinal plants in one garden (Galluzzi et al., 2010)
Reduced Food Costs	Reduce household costs and expenses to buy food by growing yourself.	Utilizing vacant land in the yard for gardening(Saediman et al., 2021)
Family Food Security	Providing a stable and sustainable food source for families.	Storing crops for long-term use and managing the garden regularly(Mattsson et al., 2018)
Nutritional Benefits	Increase nutrient intake by consuming fresh and healthy garden produce.	Choose plants that are rich in essential vitamins and minerals(Khan, 2021)
Social and Economic Benefits	Improving social cohesion and family economic well-being through gardening activities.	Engage the community in joint gardening projects and sell the produce at local markets(Sant'Anna de Medeiros et al., 2020)
Natural Resources Management	Managing natural resources sustainably to support long-term food production.	Using compost and organic fertilizers, as well as water-saving irrigation techniques(Isbell et al., 2017)

Source: Author Search, 2024

In the food security index report released by the Ministry of Agriculture, in 2021, there are regional conditions in three categories, which are described in table 4.6.

Table 4.6. Food Security Index per Province in Indonesia in 2021

Province	2021			
	Availability	Affordability	Use	Composite
Aceh	81.05	69.86	68.67	71.63
North Sumatera	82.41	74.5	65.55	72.25
West Sumatera	85.05	83.23	73.45	79.55
Riau	32.55	86.47	71.23	66.84
Jambi	70.68	82.94	69.36	74.18
South Sumatera	84.83	73.77	59.41	69.55
Bengkulu	81.69	73.68	60.35	70.32
Lampung	95.61	78.87	66.04	77.96
Bangka Belitung Islands	41.56	92.08	78.14	73.22
Riau Islands	0	87.35	74.56	63.26
Jakarta	0	81.44	81.77	78.01
West Java	85.53	79.81	73.1	77.79
Central Java	89.74	81.36	79.74	82.73
Yogyakarta	83.22	79.06	82.02	81.43
East Java	91.16	79.54	73.75	79.7
Banten	83.58	83.6	63.88	74.38
Bali	75.32	91.65	82.74	83.82
West Nusa Tenggara	93.09	76.51	65.16	75.67
Eastern South-East Nusa	86.48	58.6	59.91	67.35
West Kalimantan	80.52	84.86	55.71	71.32
Central Kalimantan	62.93	89.99	68.51	73.68
South Kalimantan	91.45	89.26	66.93	80.29
East Kalimantan	53.7	89.68	78.57	77.46
North Kalimantan	51.71	89.77	71.81	73.02
North Sulawesi	75.58	84.06	75.2	78.3
Central Sulawesi	80.08	77.46	71.08	75.73
South Sulawesi	93.88	81.5	71.8	80.82
Southeast Sulawesi	81.09	77.07	73.15	76.64
Gorontalo	96.54	78.66	71.63	80.52
West Sulawesi	87.87	81.96	61.35	75.49
Maluku	42.15	65.02	63.72	58.7
North Maluku	18.79	87.17	61.16	59.58
West Papua	14.83	59.25	56.29	46.05
Papua	8.89	49	43.71	35.48

Source: Food Security Index (Dirjen Tanaman Pangan, 2024), 2024

The 2021 Food Security Index data provides an overview of how provinces in Indonesia differ in availability, affordability, use, and overall composite score.

1. Provinces with High Composite Scores

Some provinces stand out with high composite scores, indicating better food security than others. Bali recorded the highest composite score of 83.82, driven by excellent affordability (91.65) and use (82.74). Central Java also excelled with a composite score of 82.73, supported by very high availability (89.74) and good use (79.74). Other provinces that have strong performance are South

Kalimantan (80.29) and Gorontalo (80.52), both of which recorded high scores in the availability and use of food resources.

2. Provinces with Low Scores

On the other hand, several provinces in eastern Indonesia are experiencing major challenges in food security. Papua has the lowest composite score of 35.48, which is driven by low scores in all aspects, especially use (43.71) and availability (8.89). West Papua also recorded a low composite score of 46.05, with very poor availability (14.83) and low use (56.29). In addition, North Maluku also showed similar challenges with a composite score of 59.58, hampered by low availability (18.79), although affordability was quite good (87.17).

3. Provinces with Imbalances in Indicators

Some provinces show a significant imbalance between the indicators. Riau Islands recorded a zero-availability score, indicating a major problem in food production, although affordability is high (87.35) and use is also quite good (74.56). Jakarta also recorded zero availability, although affordability (81.44) and use (81.77) were excellent, suggesting that the country's capital is more dependent on outside distribution for its food security. Bangka Belitung Islands also experienced an imbalance, with low availability (41.56) but very high affordability (92.08) and good use (78.14).

Provinces in Java and Bali generally show better food security, especially in availability, affordability, and use, compared to provinces in eastern Indonesia, such as Papua and West Papua, which face serious challenges in food security. Provinces such as Riau Islands and DKI Jakarta highlighted the importance of distribution in ensuring food affordability and use in areas with low local availability. This shows that food security management must consider equitable distribution to overcome disparities between regions. Meanwhile, for 2022, there are varied fluctuations between regions with their respective constituent components compared to 2021 which can be seen in table 4.7. The data in the table illustrates the scores of four main indicators in 2022, namely availability, affordability, use, and composite for several provinces in Indonesia.

Table 4.7. Food Security Index per Province in Indonesia in 2022

Province	2022			
	Availability	Affordability	Use	Composite
Aceh	80.17	69.34	66.25	70.16
North Sumatera	80.19	75.02	64.44	71.22
West Sumatera	87.53	84.23	71.84	79.45
Riau	38.78	86.5	69.81	67.59
Jambi	58.48	82	67.04	69,5
South Sumatera	81.57	74.11	61.29	69.64
Bengkulu	69.92	75.18	61.53	67.99
Lampung	94.94	79.62	67.72	78.61
Bangka Belitung Islands	36.38	92.47	77.54	71.71
Riau Islands	5.83	88.9	72.53	63.83
Jakarta	0	83.22	81.12	78.25
West Java	84.59	79.11	73.71	77.55
Central Java	88.88	81.47	80.69	82.95
Yogyakarta	84,2	79.66	79.97	80.88
East Java	90.64	79.42	74.27	79.85
Banten	82.81	83.99	62.79	73.78
Bali	79.08	94	82.08	85.19
West Nusa Tenggara	92.85	76.24	67.81	76.58
Eastern South-East Nusa	86.25	61.62	60.55	68.42
West Kalimantan	76.21	86.33	56.29	70.81
Central Kalimantan	49.87	91.07	67.55	69.96
South Kalimantan	88.69	90.68	69.01	81.05
East Kalimantan	52.33	90.27	79.43	77.65
North Kalimantan	43.5	89.99	72.21	71.04
North Sulawesi	70.37	81.42	71.42	74,3
Central Sulawesi	77.98	80.39	70.88	75.92
South Sulawesi	94.71	83.52	71.22	81.38
Southeast Sulawesi	71,8	78.24	74.38	75.04
Gorontalo	94.25	79.76	71.91	80.35
West Sulawesi	76.11	83.45	65.42	74.04
Maluku	45.87	68.57	62.27	60.2
North Maluku	14.5	88.12	60.61	58.39
West Papua	11.81	62.11	56.17	45.92
Papua	17.68	49.89	42.34	37.8

Source: Food Security Index (Dirjen Tanaman Pangan, 2024),

Here is an analysis and comparison of several regions based on the scores given:

1. Provinces with High Scores

Bali recorded the highest composite score with a score of 85.19. This is driven by a very high affordability score (94) and excellent use (82.08). This shows that Bali has good accessibility and resource use compared to other provinces. Central Java Province also has a high composite score of 82.95, with a high use score (80.69) and excellent availability (88.88). This shows that this province has a good distribution in the availability and use of resources. South

Sulawesi recorded a composite score of 81.38, with high availability (94.71) and good affordability (83.52). This signifies that resources in this province are quite available and easily accessible.

2. Provinces with Low Scores

Papua recorded the lowest composite score of 37.8, with low scores in all aspects, especially use (42.34) and affordability (49.89). This shows major challenges in the availability, accessibility, and use of resources in Papua. West Papua has a low composite score of 45.92, with a very low availability score (11.81) and low use (56.17). The province presents serious problems in distribution and use of resources. North Maluku recorded a composite score of 58.39, with very low availability (14.5) despite relatively high affordability (88.12). This indicates that even though resources are not well available, accessibility for the available ones is quite good.

3. Provinces with Uneven Scores

Riau Province has low availability (38.78), but very high affordability (86.5). This indicates that although resources in Riau are not very available, access to the available ones is quite good, but use can still be increased (69.81). The availability score in DKI Jakarta is zero, but affordability (83.22) and use (81.12) are very high. Jakarta may experience major challenges in local production or availability, but the distribution and use of resources is still very good. Although availability in the province of Bangka Belitung Islands is low (36.38), affordability and use are excellent with scores of 92.47 and 77.54, respectively. This shows that the province has a good distribution system despite limited local availability.

Provinces such as Bali, Central Java, and South Sulawesi had the best performance overall, recording high scores in almost all indicators. Papua, West Papua, and North Maluku are the provinces with the greatest challenges in resource availability, use, and affordability. Some provinces such as Riau and DKI Jakarta show an imbalance between availability and use/affordability, indicating that there are distribution challenges that can be improved.

A comparison between the food security index in Indonesia in 2021 and 2022 shows several important trends related to food availability, affordability, and use in various provinces. Bali, Central Java, and South Sulawesi consistently became the provinces with the highest food security scores in both years, mainly driven by affordability and good food use. In 2021, Bali recorded the highest composite score of

83.82, which increased in 2022 to 85.19, indicating that endeavors to improve food affordability and use are increasingly successful (Sulaeman et al., 2021). Provinces such as Central Java and South Sulawesi also recorded improvements in composite scores, driven by improvements in availability and use. In contrast, provinces in eastern Indonesia, such as Papua and West Papua, continue to experience significant challenges in food security. Papua recorded the lowest composite scores in both years, namely 35.48 in 2021 and 37.8 in 2022. Although there is a slight increase, this score shows that access to food availability and use is still very limited in this region (Fitri et al., 2021). This inequality between the western and eastern regions of Indonesia in food security underscores the need for policy interventions that focus more on food distribution and accessibility in more isolated provinces. Provinces such as Riau Islands and DKI Jakarta show an imbalance between availability and affordability, where availability scores are very low or zero, while affordability and use remain high. This indicates a large dependence on food distribution from outside the region. This has not changed much between 2021 and 2022, underscoring the importance of improving distribution infrastructure to address these inequalities (Junaedi, 2020). Despite progress in several provinces related to food security, particularly in Java and Bali, regional inequality remains a major problem, especially in the eastern region of Indonesia. Policy interventions that focus on the distribution and use of food resources are essential to address this problem.

The implementation of the Family Food Security Improvement program in the SFHA scheme has proven to have a significant impact on the food security index. Based on research, SFHA plays an important role in strengthening food security at the household level. Through the optimization of yard land for food crop cultivation, horticulture, and small farms, this program has succeeded in increasing the availability of local food, especially in providing diverse sources of nutritious food for families. This impact not only includes food availability, but also better access and use of food because the crops from the yard can be directly consumed and reduce dependence on the market (Amboisa et al., 2023). In addition, SFHA also plays a role in increasing family income, especially in rural areas, by selling excess production to the local market. This has an impact on the family's ability to buy other needed foodstuffs, thereby increasing the food access score on the food security index (Ian Christoplos & Adam Pain, 2021). In addition to the aspect of food security, this program also contributes to environmental conservation

through the reduction of organic waste and the use of sustainable agricultural techniques such as compost and organic fertilizers (Amboisa et al., 2023). The implementation of SFHA has proven effective in improving the family food security index by increasing the availability, access, and use of local food in a sustainable manner and providing positive socio-economic impacts for families and communities in the region.

4.2.2. Environmental cleanliness

Environmental hygiene management within the SFHA can be achieved through various strategies, including waste management, the use of rain gardens, and the use of natural methods for pest control. One real example of this implementation can be seen in the application of composting and waste recycling systems. In a study conducted in Tomohon, Denpasar, and Solo, the composting system succeeded in reducing household organic waste and increasing soil fertility. This system helps reduce pollution, while recycling for inorganic waste also supports environmental cleanliness. The use of compost routinely improves crop yields and soil quality (Saroinsong et al., 2021). The use of rain parks also plays an important role in water management and pollution management. Research shows that rain gardens in urban areas are able to effectively absorb rainwater, filter pollutants, and reduce flood risk by up to 40.77%. This rain park also serves as a filter for chemical pollutants such as heavy metals from rainwater runoff, maintaining soil and groundwater health (Sharma & Malaviya, 2021). In addition, the use of plant repellents and natural predators such as insects also reduces dependence on chemical pesticides that damage the environment. Plants such as marigolds and basil, known as natural pest repellents, can be grown in the garden to control pests organically. This reduces the use of pesticides and helps preserve the health of local ecosystems. Other research shows that the use of cover crops such as legumes helps restore soil fertility and improve the health of contaminated soil through phytoremediation, which is important for the environmental sustainability of home gardens (Cataldo et al., 2021). The use of organic fertilizers such as compost has also been proven to maintain soil fertility in the long-term without causing environmental damage. With these strategies, SFHA can support environmental sustainability, improve quality of life, and protect local ecosystems through efficient and environmentally friendly hygiene management.

Table 4.8. Indicators and Implementation of Environmental Hygiene Management in the SFHA

Indicator	Description	Implementation
Waste Management	Household waste management to reduce pollution.	Implement a compost system for organic waste and recycling for inorganic waste. (De Corato, 2020)
Use of Rain Gardens	Managing rainwater to prevent flooding and reduce water pollution.	Build rain gardens to absorb rainwater and filter pollutants. (Sharma & Malaviya, 2021)
Natural Pest Control	Using natural methods to control pests and plant diseases.	Using plants to repel pests and natural predators such as insects. (Darras, 2020)
Soil Remediation	Using techniques to restore soil quality and reduce pollution.	Using phytoremediation and ground cover plants to improve soil health. (Ashraf et al, 2019)
Use of Organic Fertilizer	Reduce the use of chemical fertilizers that damage the environment.	Use compost and manure to fertilize the soil (Hu et al, 2017)
Use of Local Plants	Using local plants to reduce maintenance needs and improve biodiversity.	Plant native plants that are suitable for local environmental conditions. (Zhang et al, 2021)
Efficient Water Management	Managing water use to reduce water waste and pollution.	Using drip irrigation and rainwater collection systems. (Adeyemi et al, 2017)
Biodiversity Conservation	Maintaining and improving biodiversity in the yard.	Planting different types of plants and providing habitat for wildlife. (Galluzzi et al, 2010)

Source: Author Search, 2024

Environmental hygiene management in the SFHA can be achieved through various strategies, such as effective waste management, the use of rain gardens, and the use of natural methods for pest control. By implementing composting systems for organic waste and recycling for inorganic waste, households can reduce pollution and improve soil fertility. The construction of rain gardens helps absorb rainwater and filter pollutants, while the use of natural pest and predator repellent plants can reduce the need for chemical pesticides. Phytoremediation techniques and the use of ground cover plants play an important role in improving the health of contaminated soil. Using organic fertilizers such as compost and manure helps maintain soil fertility without damaging the environment. In addition, planting local plants that match local environmental conditions and managing water use efficiently is also important to support environmental sustainability. By maintaining and enhancing biodiversity in the yard, SFHA not only contributes to environmental sustainability but also improves the quality of life of its residents.

Phytoremediation techniques are methods of treating contaminated soil, water, and air by utilizing the ability of plants to accumulate, transfer, and degrade pollutants. Mathematical modelling in phytoremediation is needed to predict the level of effectiveness of plants in absorbing pollutants. Some mathematical approaches in phytoremediation involve the concept of pollutant uptake kinetics. For example, the calculation of heavy metal uptake follows the Langmuir and Freundlich type absorption kinetics model applied to plants. Langmuir's model can be expressed by the equation:

$$q_e = \frac{q_{max}K_L C_e}{1 + K_L C_e} \dots\dots\dots (1)$$

Where:

Q_E is the amount of pollutants that plants absorb at equilibrium (mg/g),

Q_{max} is the maximum adsorption capacity (mg/g),

K_L is Langmuir's constant related to adsorption affinity (L/mg),

C_e is the concentration of pollutants at equilibrium (mg/L).

In addition, for the temporal analysis of pollutant uptake, the first-order model approach is often used:

$$\frac{DC}{Dt} = -KC \dots\dots\dots (2)$$

Where:

C is the concentration of pollutants at a given time,

k is the reaction rate constant,

t is time.

This model allows the calculation of the degree of decrease in pollutant concentrations in a given time, with the exponential solution C(t)=C₀e^{-kt}, where C₀ is the initial concentration of the pollutant.

A study by (Hou et al., 2012) found that the Langmuir-Freundlich kinetic model is well suited in describing the absorption of heavy metals by hyperaccumulator plants such as *Brassica juncea*. The study also states that environmental factors such as pH, temperature, and the presence of competitor ions affect the value of the K_L constant and the maximum adsorption capacity of q_{max}. Another study by (Abdalhadi Deghles et al., 2018) used a first-order kinetics model to estimate the lead uptake rate by *Phragmites australis*. The results showed that this

plant was able to reduce lead concentrations by up to 85% within 30 days, with a reaction rate constant k of 0.15 days^{-1} . By combining the mathematical calculations of the Langmuir model and the kinetics of first-order absorption, the phytoremediation technique can be predicted quantitatively. Studies show that different hyperaccumulator plants have different capacities in accumulating pollutants depending on environmental conditions and pollutant types, which can be modeled to estimate the effectiveness of phytoremediation.

Example 1: Calculation with the Langmuir Model

Suppose we have a hyperaccumulator plant, *Brassica juncea*, which is used to absorb heavy metals such as lead (Pb) from polluted water. We know from experiments that the Langmuir constant $K_L = 0.5 \text{ L/mg}$, and the maximum adsorption capacity $q^{\max} = 100 \text{ mg/g}$. The concentration of lead in C_e water is 10 mg/L . Using the Langmuir equation:

$$q_e = \frac{q_{\max} K_L C_e}{1 + K_L C_e} \dots\dots\dots (3)$$

$$q_e = \frac{100 \times 0.5 \times 10}{1 + 0.5 \times 10} = 83.33 \text{ mg/g} \dots\dots\dots (4)$$

So, the *Brassica juncea* plant can absorb 83.33 mg of lead per gram of the plant under these conditions.

Example 2: Calculation with First-Order Kinetics

Now we use a first-order kinetics model to estimate a 30-day decrease in lead concentrations from water with *Phragmites australis* plants. Suppose the initial concentration of lead C_0 is 50 mg/L , and the reaction rate constant $k = 0.1 \text{ days}^{-1}$. The first-order kinetics model has the following equations:

$$C(t) = C_0 e^{-kt} \dots\dots\dots (5)$$

To calculate the lead concentration after 30 days ($t=30$):

$$C(30) = 50 e^{-0.1 \times 30}$$

$$C(30) = 50 e^{-3} \approx 50 \times 0.0498 = 2.49 \text{ mg/L}$$

$$C(30) = 50 e^{-3} \approx 50 \times 0.0498 = 2.49 \text{ mg/L}$$

So, after 30 days, the concentration of lead in the water will drop from 50 mg/L to 2.49 mg/L , which means about 95% of the lead has

been removed by *Phragmites australis*. The example above shows how the Langmuir model is used to calculate the adsorption capacity of plants in absorbing pollutants, while first-order kinetics can predict a decrease in pollutant concentrations over a period of time. Both models are very useful in designing and optimizing phytoremediation strategies.

4.2.3. Family food Independence

The management of vacant land around the house to achieve family food independence can be implemented through crop diversification strategies, efficient use of irrigation, as well as pest control techniques and organic fertilizer management. A vivid example of this can be seen in the Eastern Cape region of South Africa, where home gardens contribute to improving food security and the economic well-being of families. In the study, 32 types of food crops, such as vegetables, fruits, and spices, were grown in home gardens, making a significant contribution to the family's daily diet, while reducing dependence on external food supplies. This approach not only provides food diversification, but also improves the nutritional health of families (Ngcaba & Maroyi, 2021). In addition, the use of drip irrigation and rainwater collection has been shown to improve the efficiency of water use in home gardens. A study in Australia showed that with an efficient irrigation system, home gardens can save up to 34% of water use, and this reduction is significant in the long-term, helping to keep water supplies for plants free from waste. This efficiency makes home gardens contribute to water sustainability while reducing household water expenditure costs (Csortan et al., 2020). In addition, the application of natural pest control by using natural pest repellent plants and predators, such as marigolds and basil, can reduce the need for chemical pesticides that are harmful to the environment. This supports a healthier and more natural environment around the home. In addition, the use of organic fertilizers such as compost from household waste not only fertilizes the soil but also aids in waste management and reduces environmental pollution (Cordova Camacho et al., 2022). Through regular gardening education and training, such as those implemented in Ecuador, 85.73% of the families trained managed their gardens well, from fertilization to irrigation, and the harvest contributed to a decrease in household weekly costs and expenses by 85.37% (Cordova Camacho et al., 2022).

Table 4.9. Indicators and Implementation of SFHA Management

Indicator	Description	Implementation
Plant Diversity	Planting various types of crops to increase food security and nutritional value.	Integrating vegetables, fruits, medicinal plants, and spices in one garden(Galhenaa et al., 2013)
Optimal Land Use	Maximizing the use of vacant land around the house for food production.	Building vertical gardens or roof gardens to overcome land limitations(Saediman et al., 2021)
Efficient Irrigation System	Manage water efficiently to ensure plants get enough water.	Using drip irrigation and rainwater collection systems(Taylor & Lovell, 2014)
Natural Pest Control	Using natural methods to control pests and plant diseases.	Using natural pest and predator repellent plants (Galluzzi et al., 2010)
Use of Organic Fertilizers	Use organic fertilizers to fertilize the soil without damaging the environment.	Making compost from household organic waste (Hu et al., 2017)
Education and Training	Improving people's knowledge and skills in gardening.	Holding regular gardening workshops and training (Buabeng & Aduteye, 2022)
Community Participation	Encourage the participation of all family members and communities in gardening.	Forming farmer groups or local gardening communities (Saroinsong et al., 2021)

Source: Author Search, 2024

Family food independence can be achieved by utilizing vacant land around the house for food production. By growing different types of crops such as vegetables, fruits, medicinal plants, and spices, families can improve their food security and nutritional value. The use of efficient irrigation systems such as drip irrigation and rainwater harvesting helps ensure that plants get enough water without waste. Natural pest control using natural pest repellent and predatory plants can reduce the need for harmful chemical pesticides. In addition, the use of organic fertilizers such as compost from household waste can fertilize the soil without damaging the environment. Regular gardening education and training can improve people's knowledge and skills in gardening, while community participation in gardening activities can strengthen social cohesion and expand the positive impact of SFHA.

The SFHA is a concept whose goal is to increase family food security independently and sustainably. This concept includes effective land management, environmentally friendly technology, and empowerment of local communities. SFHA not only focuses on food production, but also involves social and economic aspects. Optimal management of the yard includes aspects of soil quality, plant diversity,

water management, and social and economic benefits for residents. Soil quality is measured based on fertility, organic matter content, soil pH, CEC, and biological activity. Plant diversity in SFHA not only provides diverse and nutritious food, but also enhances biodiversity, provides social benefits, and supports ecosystem services. Efficient water management can be achieved through water-efficient irrigation, the use of mulch, stormwater management, soil moisture monitoring, the use of smart technology, and the cultivation of drought-tolerant crops. Optimal yard management in the SFHA provides social and economic benefits, such as increased food security, more income, stress reduction, improved quality of life, strengthening social cohesion, preservation of traditional culture and knowledge, and ecosystem benefits. The implementation of SFHA in various regions has shown tangible benefits, including increased food security and household income, as well as contributions to the conservation of biological resources and ecosystem services. Family food independence can be achieved by utilizing vacant land around the house for food production, by using crop diversification strategies, efficient use of irrigation, natural pest control, and the use of organic fertilizers. Regular gardening education and training can improve people's knowledge and skills in gardening, while community participation can strengthen social cohesion and expand the positive impact of SFHA.

Plant diversity is key to the success of food houses because they provide a variety of benefits that support food security, biodiversity, and ecosystem services. Here are some reasons why plant diversity is important:

1. Food Security, varied crops ensure the availability of diverse and nutritious food throughout the year, which increases family food security.
2. Biodiversity, plant diversity increases biodiversity, which is important for the sustainability of local ecosystems.
3. Social Benefits, plant diversity can improve social cohesion and mental health through family and community participation in shared gardening activities.
4. Ecosystem Services, varied plants provide essential ecosystem services, such as pollination and natural pest control.
5. More Income, crops from varied crops can be sold for more income, which helps to improve the economic well-being of households.
6. Conservation, the cultivation of local and traditional crops aids in the conservation of biodiversity and traditional agricultural knowledge.

7. Improved Nutrition, plants that have high nutritional value and can be harvested throughout the year help improve the nutritional status of the family.
8. Education, plant diversity also plays a role in the dissemination of agricultural and conservation knowledge to the younger generation.
9. Climate Change impact reduction, plants that are able to absorb carbon and the use of water-efficient irrigation techniques can reduce the impact of climate change.
10. Resource management, the application of organic farming techniques and sustainable management of natural resources ensures sustainable food production.

Plant diversity in the SFHA provides dual benefits, supports food security, conserves local biodiversity, and provides important ecosystem services, such as habitat for natural pollinators. Through active participation in home gardens, people not only benefit directly from food production but also contribute to environmental sustainability.

Plant diversity in the SFHA can increase tolerance to various environmental factors in several ways:

1. Adaptation to drought conditions, by growing plants that are tolerant of drought, home gardens can survive in limited water conditions. This is important in the face of climate change that often results in droughts.
2. Pest and disease control, plant diversity can support natural pest and disease control. Natural pest repellent and predatory plants can reduce pest populations without the use of chemical pesticides that can damage the environment.
3. Ecosystem balance, varied plants provide better habitat for natural pollinators and pest control organisms, thus promoting a healthier ecosystem balance.
4. Soil fertility, the use of organic fertilizers and phytoremediation plants can improve soil fertility and reduce contamination, ensuring that plants get enough nutrients despite sub-optimal soil conditions.
5. Water efficiency, using efficient irrigation systems, such as drip irrigation and rainwater harvesting, ensures that plants get enough water without waste, which is essential in dealing with water shortages.
6. Resistance to disturbances, varied plants tend to be more resilient to environmental disturbances because not all plants are affected by

the same disturbances. This increases the overall resilience of the garden to various threats.

Plant diversity in the SFHA increases resilience to environmental factors that can affect food production, such as drought, pests, disease, and climate change. This ensures that home gardens can continue to produce and support family food security and preserve local ecosystems.

Part 4 discusses problems related to optimizing the use of yards in the SFHA program. The problems faced include degradation of soil quality, lack of adoption of environmentally friendly technology, and limited access to clean water. The main objectives of this part are to improve family food security by utilizing the yard to grow a variety of productive crops, reducing dependence on external food supplies, and maintaining environmental sustainability. This part suggests the application of efficient agricultural techniques, such as water-efficient irrigation, crop rotation, and the use of organic fertilizers. In addition, public education about environmentally friendly agricultural techniques is also an important point. In the future, strengthening synergy between the community, government, and the private sector needs to be carried out to ensure the sustainability of the SFHA program.

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Part 5

Implementation and Evaluation Methodology

Achmad Tarmizi, Endriana Wahyu Alita

The Sustainable Food House Area (SFHA) program is an initiative that aims to increase food security at the household level through optimal use of yard land. This program not only focuses on meeting daily food needs, but also on environmental conservation and empowering local communities. In the context of increasingly limited agricultural land and increasing dependence on imported food, SFHA is an important strategy to develop a sustainable and community-based food system. SFHA is motivated by the need to strengthen food independence at the local level.

The use of yard land, which is often not optimal, is considered a strategic solution to overcome food security problems, especially in rural and urban areas with limited land. This program advises people to plant various types of food crops in their yards, so that they can meet their family's nutritional needs while generating more income from the purchase of crops. On a national scale, the productivity of food crops (rice) for the 2019-2023 period is based on the results of the 2024 agricultural survey by the Ministry of Agriculture.

5.1. National and provincial Food Production Capabilities

The data (table 5.1) shows rice production in Indonesia from 2019 to 2023, with production details in each province. There have been significant fluctuations in rice production in different provinces, reflecting the challenges faced in maintaining food security at the national and provincial levels.

The fluctuating rice production and the challenges faced by various provinces in Indonesia underscore the importance of the SFHA program as a strategy to strengthen local food security. With a comprehensive approach, SFHA can provide sustainable solutions to increase food production, empower communities, and preserve the environment, especially in areas that are vulnerable to declining food production.

Table 5.1. Rice Production in the Last 5 Years (2019-2023)

No	Provinces	2019	2020	2021	2022	2023
	Indonesia	54.604.033	54.649.202	54.415.294	54.748.977	53.980.993
1	Aceh	1.714.438	1.757.313	1.634.640	1.509.456	1.404.235
2	North Sumatera	2.078.902	2.040.500	2.004.143	2.088.584	2.087.474
3	West Sumatera	1.482.996	1.387.269	1.317.209	1.373.532	1.482.469
4	Riau	230.874	243.685	217.459	213.557	205.973
5	Jambi	309.933	386.413	298.149	277.744	275.941
6	South Sumatera	2.603.396	2.743.060	2.552.443	2.775.069	2.832.774
7	Bengkulu	296.472	292.834	271.117	281.610	286.684
8	Lampung	2.164.089	2.650.290	2.485.453	2.688.160	2.757.898
9	Bangka Belitung Islands	48.806	57.324	70.496	61.425	66.469
10	Riau Islands	1.151	853	855	507	324
11	Jakarta	3.359	4.544	3.249	2.338	2.674
12	West Java	9.084.957	9.016.773	9.113.573	9.433.723	9.140.039
13	Central Java	9.655.654	9.489.165	9.618.657	9.356.445	9.084.108
14	Yogyakarta	533.477	523.396	556.531	561.700	534.114
15	East Java	9.580.934	9.944.538	9.789.588	9.526.516	9.710.661
16	Banten	1.470.503	1.655.170	1.603.247	1.788.583	1.686.483
17	Bali	579.321	532.168	618.911	680.602	673.581
18	West Nusa Tenggara	1.402.182	1.317.190	1.419.560	1.452.945	1.538.537
19	Eastern South-East Nusa	811.724	725.024	731.878	756.050	766.810
20	West Kalimantan	847.875	778.170	711.898	731.226	700.291
21	Central Kalimantan	443.561	457.952	381.190	343.919	330.781
22	South Kalimantan	1.342.862	1.150.307	1.016.314	819.419	875.546
23	East Kalimantan	253.818	262.435	244.678	239.425	226.972
24	North Kalimantan	33.357	33.574	29.967	30.534	23.602
25	North Sulawesi	277.776	248.879	232.885	243.730	238.193
26	Central Sulawesi	844.904	792.249	867.013	744.409	821.367
27	South Sulawesi	5.054.167	4.708.465	5.090.637	5.360.169	4.876.386
28	Southeast Sulawesi	519.707	532.773	530.029	478.958	479.407
29	Gorontalo	231.211	227.627	234.393	240.135	251.432
30	West Sulawesi	300.142	345.050	311.072	353.513	291.459
31	Maluku	98.255	110.447	116.804	92.601	79.958
32	North Maluku	37.946	43.383	28.051	24.486	26.663
33	West Papua	29.944	24.378	26.927	23.964	22.567
34	Papua	235.340	166.002	286.280	193.943	3.760

Source: Food Security Index (Dirjen Tanaman Pangan, 2024),

Production Stability: Rice production at the national level is relatively stable, ranging from 53.9 to 54.7 million tons per year during the 2019-2023 period. However, there was a slight decrease in 2023 (53.98 million tons) compared to 2022 (54.74 million tons). This decline may be due to factors such as climate change, natural disasters, or technical problems in agricultural production. The significance of SFHA, given the importance of food security, SFHA has become very relevant. SFHA can play a role in increasing food production in a sustainable manner, especially in areas that have experienced

a decline in rice production, by utilizing yard land and increasing community involvement in local food production.

Central Java, East Java, and West Java continue to be the main contributors to national rice production. For example, Central Java and East Java each contribute around 9 million tons per year, while West Java contributes around 9.1 million tons in 2023. Although their production is relatively stable, there has been a slight decline in some years, such as in Central Java and West Java in 2023. The role of SFHA in these regions, SFHA can help maintain or even increase rice production by encouraging crop diversification and the use of environmentally friendly agricultural technologies. By expanding the implementation of SFHA, people in this area can reduce their dependence on rice as the only source of food.

Aceh and South Kalimantan, showed a significant decline in production during the period. Aceh, for example, has decreased from 1.7 million tons in 2019 to 1.4 million tons in 2023. Similarly, South Kalimantan experienced a decrease from 1.34 million tons in 2019 to 875 thousand tons in 2023. Challenges and Opportunities for SFHA are declines that may be caused by factors such as land degradation, climate change, or lack of access to adequate agricultural technology. The implementation of SFHA in these areas can be a solution to increase production through more efficient and sustainable management of yard land. Papua and Maluku showed large fluctuations in rice production. Production in Papua, for example, decreased drastically from 286 thousand tons in 2021 to only 3.7 thousand tons in 2023. This may indicate the presence of serious problems in agricultural production, such as natural disasters or political instability. The importance of SFHA can be an important tool to improve food security in these vulnerable areas by utilizing yard land and reducing dependence on large-scale rice production. The program can also help diversify local food sources and increase community resilience to external shocks.

Low-production provinces such as Riau Islands, Bangka Belitung, and Jakarta, these provinces consistently show low rice production, which is caused by limited agricultural land. For example, the Riau Islands only produced 324 tons of rice in 2023, while Jakarta produced 2,674 tons. The implementation of SFHA in cities with limited land, SFHA can help increase local food security by maximizing the use of house yards. In big cities like Jakarta, this initiative can also support urban farming, which is an important part of urban food security strategies. In addition, SFHA also aims to support the preservation of local biodiversity through planting local plants and sustainable use of natural resources. Thus, SFHA not only contributes to food security but also to environmental preservation and community welfare. The implementation of

SFHA involves various stages that need to be managed properly to achieve program goals. Some important aspects that need to be considered in the implementation of SFHA include:

1. Location selection and community involvement, the location chosen for the implementation of SFHA must have adequate yard land potential and support from the local community. Community involvement in the planning process is essential to ensure that the program is tailored to local needs and conditions.
2. Socialization and education, the community needs to be given a deep understanding of the purpose and benefits of SFHA through socialization and education activities. Training on cultivation techniques, crop processing, and yard land management is the key to the success of this program.
3. The provision of resources, the provision of seeds, organic fertilizers, and agricultural tools are integral parts of the implementation of the SFHA. In addition, technical support and help from related parties such as the government and NGOs are needed to help the community in carrying out this program.
4. Group organizing, forming local farmer groups can help in the implementation and supervision of the program. This group also serves as a forum for sharing information, experiences, and innovations among community members.

Monitoring and evaluation are carried out to assess the progress of the program, identify the challenges faced, and determine improvement steps. These evaluations must be carried out periodically to ensure that the program runs according to plan and objectives can be achieved. SFHA evaluation, evaluation is an important opponent in the implementation of SFHA, which aims to measure the success of the program and its impact on food security and community welfare. Some aspects that need to be considered in the evaluation of SFHA include:

1. Community empowerment, community empowerment evaluation includes increasing knowledge, skills, and community participation in the SFHA program. The level of independence and community ownership of the program is also an important indicator.
2. Assessment of food availability and access, evaluation must measure the extent to which the SFHA program increases food availability at the household level and community access to nutritious food.
3. Economic impacts, the evaluation also needs to look at the economic impact of SFHA, such as increasing household income from the purchase of yard products, as well as reducing household costs to buy food.

4. Environmental sustainability, aspects of environmental sustainability are evaluated by looking at how this program contributes to the preservation of biodiversity and sustainable management of natural resources.
5. Social welfare, the social impact of SFHA on people's lives, such as increasing social solidarity, participation in community activities, and strengthening relationships between community members must also be evaluated.

The implementation and evaluation of SFHA requires a comprehensive and participatory approach to ensure that the program is not only effective, but also provides long-term benefits to the community and the environment. By engaging various stakeholders and conducting continuous evaluations, SFHA can be a successful model for improving food security, empowering communities, and preserving the environment at the local level.

5.2. Community empowerment

The participatory approach emphasizes the empowerment of local communities by providing them with the tools, knowledge, and skills needed to effectively manage the program (table 5.2.). This is in line with (Freire, 2021) view of education as a tool for empowerment. (Chambers, 1997), discusses participatory methodologies that allow communities to be directly involved in the development process through local needs and capacity assessments. (J. N. Pretty, 1995). explain how participatory learning can increase community capacity to manage resources sustainably.

(Reed, 2008), emphasized the importance of stakeholder participation in sustainable environmental management. (Thomas C. Beierle, 2002) explored how public participation can improve decision-making in environmental contexts. (Arnstein, 2020), introduced a model of the participation ladder that describes the level of community involvement in development projects. (Stringer et al., 2006), highlights the importance of adaptation and flexibility in a participatory approach to the management of socio-ecological systems. (Khotari, 2001) discusses the dynamics of power in participatory development. (Cornwall, 2008), explores various models of participation and their implications in community building. (Kapoor, 2001), examines the feasibility of implementing participation-based environmental management. (Fung, 2006), discusses the variation of participation in complex governance and its impact on public policy effectiveness. (Khotari, 2001) criticizes the use of participation in development and the potential for manipulation in the context of power.

Table 5.2. Reference for community empowerment aspects in SFHA

Description	Real Implementation
Aspects of Tools and Technology	
Utilizing simple agricultural technology that can be accessed and used by the community.	The provision of agricultural tools such as planting tools, organic fertilizers, and simple irrigation systems. People are trained to use existing technology to increase productivity.
Knowledge Aspect	
Educating the public about sustainable agricultural techniques and best practices in yard land management.	Conducting workshops and training on plant selection, planting techniques, and crop rotation to maintain soil fertility.
Skill Aspects	
Improve practical skills in farming and management of agricultural products.	The community is involved in the direct practice of planting and processing crops. Training in managerial skills and marketing of agricultural products is also provided.
Aspects of Participation and Engagement	
Encourage active community participation in all stages of the program, from planning to evaluation.	The formation of local farmer groups responsible for the implementation of activities in the field, as well as regular meetings to discuss progress and obstacles faced.
Aspects of Independence	
Creating conditions where communities can manage programs independently and sustainably without relying on external help.	Development of local resources and training on product diversification for the local market. The community is taught how to generate and manage funds from agricultural products for sustainability.
Information Access Aspect	
Provide access to the latest information on agriculture and markets, as well as related policies.	The establishment of a local agricultural information center and the development of communication networks with the government and related institutions.
Aspects of Ecological Awareness	
Raising awareness of the importance of protecting the environment for agricultural sustainability.	Environmental campaigns and green agricultural practices such as reducing the use of pesticides and implementing integrated farming systems.

source; Author's Analysis, 2024

(Checkland, 2000), discusses the soft systems methods that can be used to understand and manage change in the context of participatory development. (Freire, 2021), highlights the role of education in community empowerment and liberation from oppressive structures. (Chambers, 1997), discusses the importance of prioritizing the perspective and needs of local

communities in development. (Rowe & Frewer, 2000), provides an evaluation framework for public participation methods that can be applied in the context of sustainable development. Several literatures in the context of SFHA have slices that encourage the strengthening and improvement of community empowerment which are categorized into several aspects (table 5.1). In the context of SFHA, literature provides valuable insights into how participatory approaches can improve community empowerment, as well as the challenges and opportunities faced in the implementation of programs that actively engage local communities. The effective implementation of the m-SFHA program will depend on how well communities can be empowered and engaged in every stage of the process, from planning to evaluation, taking into account their local needs and contexts

5.3. Active participation

The community is involved in all stages of implementation, from the identification of needs to the evaluation of the program (table 5.3.). According to (J. N. Pretty, 1995), active participation increases community commitment and program success because they feel they have a part in the process. (Chambers, 1994) outlines the importance of participatory assessment in understanding the needs and conditions of local communities to design appropriate interventions. (J. N. Pretty, 1995), emphasizes that participatory learning increases the capacity of communities to contribute effectively to agricultural sustainability. (Reed, 2008) emphasizes stakeholder participation as the key to sustainable environmental management. (Rowe & Frewer, 2000), provides an evaluation framework of public participation methods, relevant to assess the effectiveness of active participation in SFHA programs.

(Fung, 2006), discusses various forms of participation in complex governance and its impact on public policy. (Khotari, 2001), explores how participation can be used in development and the challenges associated with it. (Cornwall, 2008), explores different models of participation and their impact on community building. (Gaventa & Barrett, 2012), reviewed the various results of community involvement in the development process. (Kapoor, 2001), discusses the potential of participation-based environmental management and the challenges faced. (White, 1996), explores how participation can be used and abused in the context of development. (Kannabiran, 2001), explores gender issues in participatory development and the importance of ensuring equitable inclusion. (Arnstein, 2020), introduced a model of the participation ladder that describes the level of community involvement in development.

Table 5.3. Reference Stages of active participation in SFHA

Description	Real Implementation
Stages of Needs Identification	
The community is involved in identifying local needs and potentials through group discussions and community surveys.	The implementation of focused group discussions to collect direct information from the community regarding food needs and agricultural potential in their environment.
Program Planning Stages	
The community participates in designing action plans and strategies for the implementation of programs that are by local conditions.	Preparation of an annual work plan with active participation from community groups, including the selection of plant types and cultivation techniques to be used.
Implementation and Monitoring Stages	
The community is directly involved in the implementation of activities and monitoring the progress of the program.	Community involvement in planting activities, plant care, and collecting crop data for periodic evaluation.
Evaluation and Feedback Stages	
The community participates in the evaluation of the program to provide input and suggestions for improvement.	Provision of regular evaluation forums where the community can provide feedback on the results of the program and discuss the challenges faced and possible solutions.
Decision-Making Stages	
The community has a voice in decision-making related to program adjustments based on the results of the evaluation.	Involvement of community representatives in decision-making committees to decide on corrective or adjustment measures that need to be taken.
Stages of Division of Duties and Responsibilities	
The community is given clear roles and responsibilities in the implementation of the program, according to their respective abilities and expertise.	The establishment of task sub-groups within the community to address certain aspects of the program, such as seed provision, fertilizer management, and crop marketing.
Stages of Capacity Building	
Hold training and workshops that engage the community to improve the knowledge and skills needed in the program.	Regular workshops and training sessions facilitated by agricultural experts to update community skills in land management and sustainable agricultural techniques.

source; Author's Analysis, 2024

(Kumar, 2002), provides a practical guide to effective methods of community participation. (Hickey & Mohan, 2008), explores new approaches to participation in development and how to address existing challenges. (Freire, 2021), highlighted the importance of education as a tool for empowerment and participation in the development process. Some literature in the context of

SFHA has slices that encourage the strengthening and increase of active participation which are categorized into several stages (table 5.2). These literature highlights various aspects of active participation in the context of sustainable development, including how this approach can improve the effectiveness of programs by engaging communities directly. Effective implementation of active participation in the m-SFHA program can ensure the sustainability and relevance of the program to local communities, while increasing a sense of ownership and responsibility for program outcomes. If there are any sections that need to be expanded

5.4. Collaboration and Partnership

A participatory approach promotes cooperation between various stakeholders, including governments, NGOs, and local communities (table 5.4.). This collaboration ensures that different perspectives and resources are combined for the success of the program, as discussed by (Reed, 2008), explained the importance of collaboration between various stakeholders in sustainable environmental management and how it can improve the effectiveness of the program. (J. N. Pretty, 1995), discusses how social capital formed from collaboration and partnership can affect shared resource management and program sustainability. (WARNER, 1997), highlights the importance of collaboration in managing conflicts in community-based natural resource projects. (Berkes, 2009), explained how collaboration between stakeholders can support social learning and joint management in resource management. (Rusmanto et al., 2022), explains the partnership paradigm in sustainable development and how collaboration between the public, private, and community sectors can be achieved. (Ansell & Gash, 2008), discusses the theory and practice of collaborative governance and how partnerships can improve the effectiveness of public policy. (Pahl-Wostl, 2009), discusses how collaborative frameworks can support adaptive capacity and multi-level learning in resource governance. (Brinkerhoff, 2023), explores the effectiveness of international partnerships in development and how collaboration can yield better outcomes. (Emerson et al., 2012), developing an integrative framework for collaborative governance that can be applied in development programs. (Plummer & FitzGibbon, 2004), explain the terms in partnership-based environmental management and their relevance in natural resource management. (Charles & Pinkerton, 1990), discusses community-based fisheries management and how partnerships can support community development and better resource management. (Jane Nelson, n.d.), explores how new social partnerships can be implemented in Europe to achieve better development outcomes.

Table 5.4. Aspects of Collaboration and Partnership in SFHA

Description	Real Implementation
Aspects of Government Partnership Collaboration	
The government acts as a facilitator and policy provider that supports and funds the m-SFHA program.	Establishment of a policy framework that supports the m-SFHA program and budget allocation from local governments to support training, equipment purchase, and local infrastructure development.
Aspects of Collaboration with NGOs	
NGOs help in providing technical training and supporting community organizing to ensure the program runs well	Collaboration with NGOs to provide training on sustainable agricultural techniques and community empowerment, as well as help facilitate dialogue between communities and governments.
Aspects of Academic Collaboration	
Cooperation with universities and research institutes to provide the data and analysis needed for the program.	Collaborative research to evaluate the impact of the m-SFHA program, as well as the development of a training curriculum based on the latest scientific findings in sustainable agricultural practices.
Aspects of Private Sector Participation Collaboration	
The involvement of the private sector in the provision of resources, technology, and market access for community agricultural products.	Partnerships with agribusiness companies to gain access to modern agricultural technologies, as well as distribution networks to market local products to a wider market
Collaborative Aspects of Local Community Engagement	
Local communities play an active role in the implementation, monitoring, and evaluation of programs to ensure their relevance and effectiveness.	Establishment of community working groups that collaborate with the government and NGOs to determine local priorities and oversee the implementation of programs on the ground.
Aspects of Education and Training Collaboration	
Continuing education and training programs that involve various stakeholders to enhance local capacity and ensure the sustainability of the program.	Workshops and training sessions involving academics, field practitioners, and local communities, focused on improving skills and knowledge in sustainable agriculture management.
Aspects of Joint Monitoring and Evaluation Collaboration	
Involve all parties in the evaluation process to identify successes and challenges faced in the program.	Implementation of collaborative evaluations involving governments, NGOs, academics, and local communities to measure impacts and identify areas for further improvement of the program.

source; Author's Analysis, 2024

(Berkes, 2009), discusses how socio-ecological systems can be managed with a collaborative approach to building resilience and adaptation to change. (Fung, 2006), highlights the challenges and opportunities of public

participation in governance, as well as the role of collaboration in strengthening community capacity. (Margerum, 2008), developed a typology of collaborative endeavors in environmental management, focusing on how partnerships can improve program success. Several literatures in the context of SFHA have slices that encourage the strengthening and improvement of Collaboration and Partnership which are categorized with several aspects (table 5.3).

SFHA has a slice that advises the strengthening and improvement of Collaboration and Partnership which is categorized into several aspects (table 5.4). These literature highlights the importance of collaboration and partnerships between various stakeholders in sustainable development programs such as SFHA. Effective collaboration can ensure that different perspectives and resources are combined to support the success and sustainability of the program. The real implementation of collaboration in the context of m-SFHA involves various parties in the process of planning, implementing, and evaluating the program, as well as utilizing the expertise and resources available from each party to achieve better results.

5.5. Collective Problem-Solving

By involving the community in the decision-making process, a participatory approach allows for more effective problem-solving and is relevant to the local context (table 5.5). This allows for more creative and sustainable solutions, as stated by (Chambers, 1994). (Chambers, 1994), emphasizes the importance of participatory assessment in understanding local needs and supporting relevant and effective problem-solving. (J. N. Pretty, 1995), discusses how participatory learning can increase the capacity of communities to contribute to sustainable agricultural problem-solving. (Kenyon, 2003), explores the role of local knowledge in environmental decision-making and how community participation can improve collective problem-solving. (Cornwall, 2008), reviews the concept of participatory research and how these methods can be used for more effective and relevant problem-solving in the local context. (Reed, 2008), emphasized the importance of stakeholder participation in environmental management and solving complex problems. (Gaventa & Barrett, 2012), explores the relationship between participatory approaches in development and democracy, and their impact on inclusive and sustainable problem-solving. (Cornwall, 2008), explores new approaches to development participation and how this can support collective problem-solving. (Conley & Moote, 2003), examines the evaluation of collaborative natural resource management and how this approach can improve the effectiveness of problem-solving.

Table 5.5. Reference for Aspects of collective problem-solving in SFHA

Description	Real Implementation
Troubleshooting Aspects of Local Information Collection	
The community participates in gathering relevant information and data about local conditions, needs, and challenges faced.	Conduct local surveys and group discussions to identify key issues facing communities related to food and yard land use.
Problem-Solving Aspects of Facilitating Open Discussion	
Facilitate discussions and community meetings to discuss problems and potential solutions in an open and inclusive manner.	Hold regular discussion forums involving all stakeholders to share views and experiences in addressing local agricultural challenges.
Aspects of Joint Decision-Making Problem-Solving	
The community is involved in the decision-making process to ensure that the solutions taken are appropriate to the local context and needs.	The formation of a working group or village committee consisting of community representatives to determine priorities and solution steps to be taken.
Aspects of Problem-Solving in the Implementation of Creative Solutions	
Encourage creative solutions sourced from local knowledge and community experience to solve problems effectively and efficiently.	Adopt innovative agricultural practices developed by local farmers, such as the use of organic fertilizers and cultivation techniques that are suitable for local environmental conditions.
Troubleshooting Aspects of Monitoring and Adjustment	
Conduct continuous monitoring and adjust strategies based on feedback from the community and implementation results.	Periodic evaluation of program implementation and strategy adjustments based on the results of observations in the field and input from the community.
Aspects of Learning Problem-Solving and Experience Sharing	
Encourage shared learning and sharing of experiences among community members to strengthen collective capacity in solving problems.	Conducting workshops and study visits between communities to share best practices and successes in addressing local agricultural and food challenges.

source; Author's Analysis, 2024

(Wenger, 1998), explains how communities of practice can support learning and problem-solving collectively through the sharing of knowledge and experience. (Plummer & Armitage, 2007), explores adaptive co-management and how this approach can improve problem-solving in dynamic contexts. (Khotari, 2001), explores the critique of participatory approaches and how problem-solving can become more inclusive and responsive to local needs. (Muro & Jeffrey, 2008), highlights the role of social learning in participatory resource management and problem-solving processes. (Khotari, 2001), highlights the importance of adaptation and flexibility in a participatory

approach to the management of socio-ecological systems. (Friedman et al., 2023), explored how supportive conditions can improve cross-organizational learning and collective problem-solving. (Keen et al., 2012), discusses social learning in environmental management and how it can support sustainable and creative problem-solving. Some literature in the context of SFHA has slices that encourage the strengthening and improvement of collective problem-solving which is categorized with several aspects (table 5.4). These literatures highlight the importance of a participatory approach to collective problem-solving, by involving the community in relevant and contextual decision-making. Real implementation in the m-SFHA program involves open discussions, joint decision-making, and the implementation of creative solutions based on local knowledge, all of which contribute to the sustainability and effectiveness of the program.

5.6. Local capacity building

Local capacity building is at the core of a participatory approach, focusing on improving the ability of communities to manage resources sustainably and improve their own well-being (table 5.6), in line with (Khotari, 2001) view of strengthening local capacity.

Table 5.6. Local Development Capacity

Description	Implementation and Literature
Education and Training Indicators	
Improving community knowledge and skills in farming and garden management.	Hold workshops, trainings, and field demonstrations on a regular basis (Galhena et al., 2013)
Community Participation Indicators	
Invite all community members to be actively involved in gardening and garden management activities.	Forming farmer groups or local gardening communities to share knowledge and resources (Davis et al., 2021)
Technology Use Indicators	
Using modern technology to improve the efficiency and yield of garden production.	Using soil moisture sensors, automated irrigation systems, and garden management applications (Torquebiau, 1992)
Indicators of Funding and Financial Support	
Provide access to funds and financial help to support gardening activities.	Submit proposals to obtain grants and microloans from financial institutions and the government (Sharma & Malaviya, 2021)
Indicators of Collaboration with Other Institutions	

Work closely with governments, NGOs, and universities for technical support and resources.	Forming partnerships with these institutions to support gardening programs (Saroinsong et al., 2021)
Local Plant Use Indicators	
Planting local crops that are suitable for local environmental conditions to improve yields and sustainability.	Choose local plant varieties that are resistant to local weather and soil conditions (Victory et al., 2023)
Natural Resources Management Indicators	
Sustainably manage water, soil, and other natural resources to support gardens.	Using water-saving irrigation techniques, organic fertilization, and crop rotation (Saediman et al., 2021)

source; Author's Analysis, 2024

Local capacity building is an important step in the SFHA to ensure sustainability and improve community welfare. By providing regular education and training, the community can obtain the knowledge and skills needed in farming and garden management. Community participation is also very important, where community members can share knowledge and resources through farmer groups or local gardening communities. The use of modern technology such as soil moisture sensors and automatic irrigation systems can improve the efficiency and yield of garden production.

Additionally, access to funds and financial support can support gardening activities through grants and microloans. Collaboration with other institutions such as governments, NGOs, and universities can provide the necessary technical support and resources. The use of local plants that are suitable for local environmental conditions is also important to improve yields and sustainability. Finally, sustainable management of natural resources, including the use of water-efficient irrigation techniques, organic fertilization, and crop rotation, can support gardens in the long-term.

5.7. Transparency and accountability

A participatory approach increases transparency and accountability in program implementation by ensuring that all parties have access to information and can contribute to program evaluation (tables 5.7.). This increases the trust and legitimacy of the program in the eyes of the public, as discussed by Fung (2006). A participatory approach in SFHA can increase program transparency and accountability by ensuring all parties have access to information and can contribute to program evaluation. By providing open access to information through digital platforms, the public can follow the development of the program in real-time. Accountability can be maintained by involving the community in decision-making and program performance evaluation.

Table 5.7. Transparency and accountability

Description	Implementation and Literature
Information Transparency Indicator	
Provide open access to information to all parties involved.	Using a digital platform to share data, reports, and program developments in real-time (von Bismarck-Osten, 2021)
Management Accountability Indicators	
Guarantee that all parties are responsible for their roles and contributions in the program.	Involve the community in decision-making and periodic evaluation of program performance (Matala, 2022)
Active Participation Indicator	
Encourage active involvement of all community members in program activities and decisions.	Establish a working group or committee consisting of representatives of various parties to design and supervise the implementation of the program (Saroinsong et al., 2021)
Local Capacity Strengthening Indicators	
Improving the ability and skills of the community in managing programs independently.	Holding ongoing training, workshops, and educational programs (Davis et al., 2021)
Participatory Evaluation Indicators	
Involve the community in the evaluation process to ensure that the program runs as planned.	Using participatory evaluation methods such as focus group discussions and community surveys (Kapoor, 2001)
Multi-stakeholder Collaboration Indicators	
Building partnerships with various institutions to support the program.	Work with governments, NGOs, academia, and the private sector to get technical support and resources (Sharma & Malaviya, 2021)
Program Sustainability Indicators	
Develop a long-term plan to ensure the program stays running and growing.	Make strategic planning that involves the community in every stage (Prasetyo & Gartika, 2022)

source; Author's Analysis, 2024

The active involvement of all community members can be encouraged by forming a working group or committee consisting of representatives of various parties. Strengthening local capacity is important to improve the ability and skills of the community to manage programs independently, through continuous training and education programs. Participatory evaluation involves the community in the evaluation process to ensure that the program runs as planned. Collaboration with various institutions can support the program by providing technical support and resources. Finally, the sustainability of the program can be ensured by developing a long-term plan that involves the community at every stage.

5.8. Relationship between concepts and Adaptation to Local Conditions

The relationship between concepts in the implementation and evaluation of SFHA (figure 5.1.), which involves various elements such as community empowerment, local capacity building, collective problem-solving, collaboration and partnership, adaptation to local conditions, active participation, and transparency and accountability. At the core of the SFHA program is the implementation of a participatory approach, where the community is not only the beneficiaries but also active actors in each stage of implementation. Community empowerment through local capacity building ensures that communities have the necessary skills and knowledge to manage and sustain programs independently (Chambers, 1997; Freire, 2021). Thus, the process of solving problems collectively becomes more effective, because the solutions produced are based on collaboration between the community and other stakeholders, so that they are more in line with local needs (Reed, 2008). This collaboration is strengthened by partnerships between governments, NGOs, and local communities, which allow the sharing of resources and expertise, as well as ensuring that programs run as planned and can adapt to changing conditions ((Joniškienė et al., 2020; Nguyen, 2023). Adaptation to local conditions is a key element in the implementation of SFHA, where the program must be flexible and responsive to feedback from the community. This is in line with findings that show that responsive adaptation to local contexts is essential for program sustainability (Mutolib et al., 2022; J. Pretty, 2003). Active participation from the community in every stage of the program, from planning to evaluation, ensures that the program is relevant and supported by the local community (Cornwall, 2008; Gaventa & Barrett, 2012). In addition, transparency and accountability in the decision-making process and reporting of program results increase public trust and commitment, which ultimately strengthens the sustainability of the program (Spring, 2019; Wagner, 1999). Through this literature, participatory approaches in SFHA can be better integrated to achieve optimal sustainability in the use of local food resources, strengthen local capacity, and ensure effective adaptation to local conditions.

Complex relationships between various interrelated factors in the context of the implementation and evaluation of SFHA (figure 5.1.). Each element of the diagram is interconnected and influences each other, forming a dynamic network that ensures the program's successful adaptation to local conditions. Adaptation to local conditions is the main focus, and is shown to be an element that influences and influences almost all other factors. This adaptation is triggered by the active participation of the community, which is a direct cause. Active community participation allows for the adaptation of the program to local specific conditions, making it more relevant and sustainable.

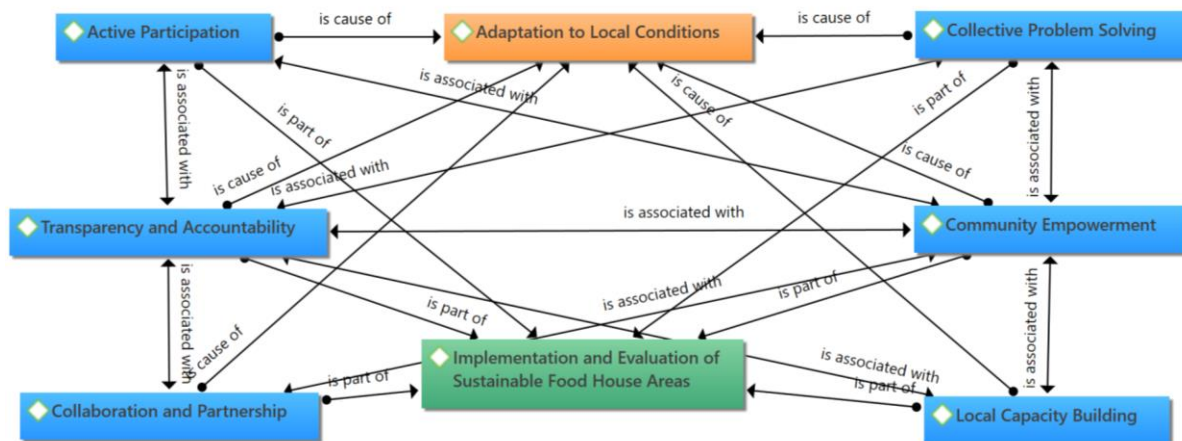


Figure 5.1. Relationship between concepts in the implementation and evaluation of SFHA

Collective problem-solving in these factors is closely linked to adaptation to local conditions. When people come together to find solutions to the problems they face, it facilitates better adaptation. Collective problem-solving also leads to community empowerment, where they feel they have control and responsibility for the solutions produced. Community empowerment is the result of various processes, including collective problem-solving and active participation. Empowered communities are better able to participate in local capacity building, which in turn strengthens their ability to continuously adapt and maintain the SFHA program. Local capacity building with empowered communities, local capacity building is a vital opponent in ensuring long-term sustainability. This is directly connected to adaptation to local conditions, where the capacity built allows the SFHA program to continue to grow and adapt to changing situations. Collaboration and Partnerships between stakeholders improve the effectiveness of adaptation to local conditions by providing more support and needed resources. The collaboration also strengthens accountability and transparency, where parties are accountable to each other and work openly. Transparency and Accountability in program management increase public trust and encourage active participation. When people feel that they can trust the process, they are more likely to participate and support the program. This active participation not only influences adaptation to local conditions, but is also the foundation for all other processes. Without active participation, empowerment, collaboration, and capacity building will not be effective, as the community will not feel like they own the program. The implementation and evaluation of SFHA is the result of the integration of all existing factors. Good implementation and evaluation ensure that the SFHA program remains relevant, sustainable, and can continue to adapt to changing local conditions. Figure 5.1. shows that the success of

SFHA is highly dependent on the integration of all these factors. Each element is interrelated and influences the other, creating a positive cycle that supports the adaptation and sustainability of the program according to local needs.

The SFHA program is designed to increase food security through optimal use of yard land. However, to ensure the success and sustainability of this program, it is very important that the SFHA must be flexible and adaptable to local conditions. Adaptation to local conditions involves not only technical adjustments, but also participatory approaches that allow communities to provide feedback and play an active role in every stage of implementation.

1. The importance of flexibility in SFHA, each region in Indonesia has different ecological, social, and economic characteristics. Therefore, SFHA cannot be applied with a uniform approach in all places. For example, the type of plant suitable for planting in the yard of a house in Java may be different from the optimal one in Sumatra or Papua. Therefore, the program must be designed flexibly to adapt to climatic conditions, soil fertility, as well as local preferences and knowledge about agriculture.
2. The implementation of flexibility through a participatory approach, a participatory approach is key in ensuring that the SFHA program can be adapted to local conditions. Community participation allows them to be involved in the planning and implementation of the program, as well as provide feedback that can be used to make necessary adjustments. For example, the public can provide information about local plants that are resistant to extreme weather conditions or that have high nutritional value and are easy to maintain. Thus, the program can be customized to be more relevant and effective.
3. Examples of adaptation implementation in SFHA, in practice, SFHA adaptation to local conditions can include the following aspects:
 - a. Selection of plant types, selection of plants that are by local climatic and soil conditions, and those that are by the consumption habits of the local community.
 - b. The use of simple technology, the implementation of technology that is by the capabilities of the local community, such as a simple irrigation system or the use of organic fertilizers that can be made from local materials.
 - c. Planting time adjustment, adjusting the planting time that is adjusted to the local seasonal pattern to maximize crop yields.
 - d. Community empowerment, involving the community in decision-making and training to ensure that they have the necessary knowledge and skills to manage the yard sustainably.

4. Participatory monitoring and evaluation, adaptation is not only carried out in the early stages of implementation but also during the program. Participatory monitoring and evaluation the m-SFHA program to continue to be adjusted based on changes in environmental or social conditions, as well as feedback received from the community. In this way, the program can continue to grow and provide long-term benefits to the local community.

Adaptation to local conditions in the implementation of SFHA requires a flexible and participatory approach, where the program is tailored to local needs and characteristics through active community involvement. By leveraging local knowledge and experience, SFHA can be designed to achieve more relevant, effective, and sustainable outcomes.

Part 5 discusses the community approach in the implementation of the SFHA by highlighting the role of community empowerment to overcome food security problems. The main problems raised are low community participation, limitations of environmentally friendly agricultural technology, and lack of integration of SFHA in regional development policies. In addition, other challenges include suboptimal land use, dependence on external food sources, and lack of education related to local resource management. The main objective of Part 5 is to increase community empowerment through a participatory approach in every stage of SFHA implementation. By actively engaging communities, this part aims to create self-sufficient local food systems, increase community capacity, and reduce dependence on external food supplies. This approach is expected to be able to create an ecosystem that supports economic, social, and environmental sustainability at the local level. This part suggests the formation of local farmer groups as a forum for community collaboration in implementing the SFHA program. Training on sustainable agricultural techniques, yard management, and diversification of agricultural products is a top priority to improve community capabilities. In addition, periodic evaluations are needed to identify obstacles and opportunities for SFHA development. Collaboration between the community, the government, and the private sector is also a key suggestion to strengthen support for this program. In the future, the important thing that must be done is to increase the integration of SFHA into regional development strategies, as well as expand public access to modern technology and agricultural resources. The government also needs to provide incentives for people who are actively involved in this program, for example through subsidies or technical support. These steps will ensure the sustainability of the SFHA program while strengthening food security at the local level. Overall, Part 5 emphasizes that

the success of SFHA depends not only on technology and resources, but also on community empowerment. With a participatory approach and appropriate policy support, SFHA can be an effective sustainability model in creating an independent and sustainable food system.

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Part 6

Challenges in Sustainable Food House Status Improvement

Hasim Ashari, Asriani

6.1. The Challenge of Sustainable Food Houses

The concept and scope of challenges in improving Sustainable Food Houses (SFH) is very broad and involves various interrelated aspects. SFH is an approach to create a sustainable food system at the household level through the optimization of yard land to meet daily food needs. The goal is to increase food security, improve community nutrition, and empower the family economy. However, the challenges in its implementation are quite complex, involving technological, policy, economic, and social aspects. One of the main challenges is the limited land and resources available to implement the SFH concept. In many areas, access to fertile land and clean water is very limited, which hampers efforts to develop yards into sustainable food sources (T. M. Basuki et al., 2022). In addition, the limitation of environmentally friendly agricultural knowledge and technology at the household level is also a significant obstacle (Ahmad et al., 2017). In a publication from the Ministry of Agriculture in 2024, access to clean water in 2018-2022 has not been maximized (table 6.1.). The percentage of households without access to clean water in Indonesia in the 2018–2022 period shows significant variation between provinces. This data reflects the challenges faced by various regions in providing adequate access to clean water for their citizens. Although there has been a decline in some provinces, there are also areas that have experienced an increase or stagnation in the percentage of households without access to clean water, which indicates a gap in efforts to improve water infrastructure in various regions. At the national level, the percentage of households without access to clean water decreased from 27.01% in 2018 to 25.05% in 2022. However, there are provinces such as Papua that have actually experienced an increase in percentage, from 61.67% in 2018 to 64.23% in 2022.

This shows that despite improvements in some areas, there are still major challenges in certain areas, especially in the eastern region of Indonesia. Provinces with a high percentage of households without access to clean water, such as Papua, West Papua, and West Kalimantan, show the need for more significant and focused interventions. Meanwhile, provinces such as Jakarta and Riau Islands have managed to reduce this percentage consistently, which can be a model for other regions.

Table 6.1. Percentage of Households Without Access to Clean Water 2018–2022

Province	2018	2019	2020	2021	2022
Aceh	32,47	29,3	28,21	28,52	28,26
North Sumatera	28,38	26,14	27,34	27,73	28,98
West Sumatera	27,4	26,91	22,38	23,05	23,47
Riau	31,57	30,44	28,32	28,44	29,85
Jambi	39,45	37,06	36,33	36,03	32,72
South Sumatera	37,16	36,74	35,33	33,3	34,3
Bengkulu	48,28	50,48	47,74	46,85	44,99
Lampung	41,94	40,35	37,39	34,14	34,5
Bangka Belitung Islands	18,83	15,91	16,81	16,94	16
Riau Islands	10,32	8,47	8,5	8,01	7,33
Jakarta	6,59	11,56	7,2	5,51	9,33
West Java	27,04	27,62	24,56	22,58	24,31
Central Java	22,42	21,14	19,36	19,83	20,67
Yogyakarta	23,37	24,7	20,07	25,48	23,21
East Java	25,39	23,9	21,97	21,38	22,4
Banten	25,1	26,32	27,48	25,37	25,63
Bali	12,36	11,33	11,56	12,93	13,8
West Nusa Tenggara	27,44	25,31	25,64	23,36	27,29
Eastern South-East Nusa	32,67	34,52	34,87	35,25	35,27
West Kalimantan	65,06	62,63	62,78	60,44	60,42
Central Kalimantan	33,16	30,82	28,86	29,93	30,34
South Kalimantan	29,25	27,95	26,25	22,3	23,38
East Kalimantan	9,12	6,23	6,59	7,37	5,58
North Kalimantan	21,7	19,42	18,37	19,96	20,61
North Sulawesi	21,28	18,28	20,18	20,27	19,78
Central Sulawesi	27,81	25,33	24,62	23,19	28,99
South Sulawesi	22,98	20,68	22,92	22,18	21,5
Southeast Sulawesi	20,71	20,68	15,98	15,85	16,58
Gorontalo	20,8	17,67	15,17	15,34	12,14
West Sulawesi	38,92	36,45	36,3	29,67	30,68
Maluku	27,81	26,83	26,41	25,73	26,87
North Maluku	35,27	35,18	33,37	29,24	33,11
West Papua	32,69	29,82	31,63	34,25	38,64
Papua	61,67	60,95	60,9	62,06	64,23
Indonesia	27,01	26,35	24,76	24,02	25,05

source: Ministry of Agriculture in 2024

To address this problem in real terms, an integrated approach is needed that involves improving water infrastructure, policies that support access to clean water, and educating the public about the importance of clean water for health. The implementation of more inclusive and sustainable programs, with support from central and local governments, is urgently needed to ensure that all Indonesians have access to clean water. Papua and West Kalimantan show great challenges with very high percentages, reaching 64.23% and 60.42% respectively in 2022, although Papua has increased the percentage, while West Kalimantan has decreased slightly. DKI Jakarta and Riau Islands showed significant improvements in access to clean water with consistent percentage declines, making it a positive example for other provinces.

(Grossi et al., 2020) describes the effects of increased access to clean water and sanitation on public health. (Blum & Feachem, 1983) examines the relationship between clean water availability, service levels, and health. (Lewin et al., 1997) analysing the impact of fed water and better sanitation on public health. (Tsegai et al., 2013) identifies the main challenges in providing water access in developing countries. (CAIRNCROSS, 1990) reviewing water quality interventions and their impact on health. Disparities in access to clean water indicate the existence of inequalities that require strong policy interventions and investments in infrastructure to ensure that all households, regardless of location, have decent access to clean water. Without concerted and sustained efforts, these inequalities will continue to be an obstacle to achieving broader health and well-being goals across Indonesia.

Increasing SFH faces various challenges related to resource availability, technology implementation, and policy support. One of the main challenges is the limited land and water available to develop the yard into a sustainable food source. Fertile soil and access to clean water are often the main obstacles, which make the implementation of SFH difficult in many areas (A. T. Basuki, 2023). Another challenge is the low participation of the community and the involvement of the government in supporting and supervising the implementation of SFH (Ahmad et al., 2017). Many SFH programs run without good coordination between institutions, resulting in suboptimal and sustainable program implementation (Narendra et al., 2021). Policy aspects also play an important role in supporting or hindering SFH. The lack of clear incentives and policies to support the development of SFHs can reduce public motivation to participate in these programs (Abidin et al., 2013). To overcome this challenge, a comprehensive and collaborative approach is needed that involves all parties, from the community, the government, to the private sector. In addition, technological innovation, human resource capacity building, and supportive policies are needed to realize sustainable SFH.

Important indicators in the SFH model include environmental sustainability, efficient use of resources, and socio-economic impact on society. Environmental sustainability includes the use of environmentally friendly agricultural technology, efficient management of water resources, and efforts to maintain soil fertility in the long term (Mucharam et al., 2019). Resource use efficiency includes the use of organic matter as fertilizer, waste reduction, and wise use of water (Ramos, 2019).

Policy aspects and support from the government also play a crucial role. Without supportive policies, such as incentives for green technologies and infrastructure support, the implementation of SFHs could be hampered. Community involvement through education and empowerment programs is also an important element to ensure the sustainability of this model (Gokarn & Kuthambalayan, 2017). The success of the SFH model relies heavily on the synergy between technology, policy, and community engagement. Efforts to overcome this challenge must be carried out comprehensively by involving various parties, including the government, the community, and the private sector.

Environmental sustainability indicators in the SFH model are essential to ensure that agricultural practices at the household level not only produce enough food, but also protect and improve environmental quality. The concept of environmental sustainability in SFH includes various aspects such as resource use efficiency, soil and water conservation, and emission and waste reduction. In real terms, the implementation of this indicator can be measured through various parameters. For example, water use efficiency can be measured through the ratio of water use to crop yields, while soil conservation can be measured through reducing soil erosion and increasing soil fertility. The use of organic fertilizers compared to chemical fertilizers is also an important indicator that shows efforts to reduce the environmental impact of agriculture. In addition, other indicators such as the amount of organic matter in the soil, biodiversity, and the level of water pollution from agricultural activities are also important measures of environmental sustainability. To give a clearer picture, here is table 6.2. describe environmental sustainability indicators that can be applied in the SFH model.

(Latruffe et al., 2016) examining sustainability indicators in the agricultural sector with a focus on three main pillars: environmental, economic, and social. (Zhen & Routray, 2003) offers operational indicators to measure agricultural sustainability in developing countries. (Carvalho et al., 2021) developed a multidimensional index to measure the sustainability of the food system in Brazil, including environmental aspects. (Bellassen et al., 2019) provides methods and indicators for assessing sustainability performance in

the food value chain. (Feil et al., 2015) developing indicators to measure the sustainability of small industries, including environmental indicators. (Lebacqz et al., 2013) reviewing sustainability indicators for sustainable livestock systems.

Table 6.2. Environmental sustainability indicators in the SFH model

Indicator	Description	Implementation
Water Use Efficiency	Ratio of water use to crop yield	Use of drip irrigation technology and need-based irrigation scheduling
Soil Conservation	Erosion reduction and increased soil fertility	Conservation techniques such as contour farming, terrarium, and the use of compost
Use of Organic Fertilizer	Percentage of use of organic fertilizers vs chemical fertilizers	Promotion and training on composting and organic fertilizer at the home level
Biodiversity	Diversity of plant species in the yard	Ground cover planting, crop rotation, and agroforestry
Waste Management	Reduction of agricultural waste and recycling of organic matter	Household composting systems and livestock waste management
Greenhouse Gas Emissions	Reduction of emissions from agricultural activities	Use of environmentally friendly technology and reduction of land burning
Water Quality	Water pollution levels from agricultural activities	Liquid waste management and the use of buffer zones to protect water bodies

Source: Author's Analysis, 2024

(Dong & Hauschild, 2017) review the indicators applied in the assessment of the life cycle, planetary boundary framework, and SDGs. (Ahmad et al., 2019) review sustainability indicators for the manufacturing sector from a triple bottom line perspective. (Perignon et al., 2017) examining the environmental impact of dietary choices in relation to sustainability. These indicators will help in directing policies and practices that ensure the SFH model can run effectively and sustainably.

The efficiency of resource use in SFH is a very important aspect to ensure that every resource used in small-scale agriculture is utilized optimally without waste. This efficiency includes various elements such as water use, energy, land, and other agricultural inputs such as fertilizers and pesticides. Resource usage efficiency indicators can be applied through a variety of measurement methods. For example, water use efficiency can be measured by comparing the volume of water used with the amount of crop yields produced. For energy efficiency, the indicator that is often used is the ratio of input energy to food production output. Land use can be measured by land productivity, namely crop yield per unit area. In addition, reducing the use of chemical

fertilizers and pesticides through substitution with organic matter is also one of the important efficiency indicators. The following is a table that summarizes some of the key indicators of resource use efficiency in the SFH model (table 6.3)

Table 6.3. Key indicators of resource usage efficiency in SFH models

Indicator	Description	Implementation
Water Use Efficiency	The ratio between the volume of water used and the yield obtained	Implementation of water-saving irrigation systems such as drip irrigation or wastewater treatment
Energy Efficiency	Ratio of input energy to food production output	The use of energy-saving technologies such as solar panels and the optimization of production processes
Land Productivity	Yield per unit area	Use of intensive farming techniques that do not damage the soil, such as crop rotation
Use of Fertilizers and Pesticides	Reduction of the use of chemical inputs with organic substitution	Use of compost and bio-pesticides to reduce dependence on chemical fertilizers
Waste Management	Recycling process and reduction of agricultural waste	Implementation of household composting systems and integrated waste management
Groundwater Quality	Groundwater contamination levels due to agricultural activities	Regular monitoring of groundwater quality and the use of buffer zones to protect water sources

Source: Author's Analysis, 2024

(Zhen & Routray, 2003) offers operational indicators to measure the sustainability of agriculture in developing countries, including resource efficiency. (Zisopoulos et al., 2017) discusses the use of exeregic indicators to assess the efficiency of food chains in the industry. (Demartini et al., 2018) identify best practices and key performance indicators in a sustainable soft drink supply chain. (Klinglmair et al., 2014) review methods and methodological issues in assessing resource depletion in life cycle assessment. (Gharfalkar et al., 2018) developing new indicators to measure the effectiveness of operational resources in the manufacturing industry. (Di Vaio et al., 2018) providing key performance indicators for energy efficiency and environmental sustainability in ports. (Winroth et al., 2016) identifying performance indicators for sustainable production at the factory level. (Efroymsen et al., 2017) reviewing socioeconomic indicators for the design of sustainable algae biofuel systems. (Li & Tao, 2017) presents an energy efficiency evaluation method in industries with high energy consumption. These indicators provide practical guidance for measuring and improving resource use efficiency in SFH models, ensuring long-term sustainability.

The socio-economic impact indicators in the SFH are critical to ensure that the program not only improves food security and nutrition, but also provides significant economic and social benefits to the community. Socio-economic impacts include various aspects such as economic welfare, equitable access to food, improving community skills, and increasing social participation and gender equality. In real terms, the implementation of socio-economic indicators in the SFH model can be seen through several parameters, such as increasing household income from yard agricultural products, reducing inequality in food access between community groups, and increasing knowledge and skills in environmentally friendly agriculture. In addition, indicators such as food price stability, increased consumption of nutritious food, and women's participation in SFH activities are also important measures of socio-economic impact. The following is a table summarizing some of the key indicators of socio-economic impact in the SFH model (table 6.4.).

Table 6.4. Key indicators of socio-economic impact in the SFH model

Indicator	Description	Implementation
Household Income	Increase in income from yard farm products	Diversification of agricultural products and direct marketing of yard products
Equitable Food Access	Reducing inequalities in access to healthy and nutritious food	Development of equitable food distribution systems at the local level
Skill Enhancement	Improvement of knowledge and skills in sustainable agriculture techniques	Training and extension on sustainable agriculture at the community level
Food Price Stability	Food price stability at the local level that is affordable for all levels	Establishment of agricultural cooperatives for price stabilization and food stock management
Social and Gender Participation	Increase the participation of women and marginalized groups in SFH activities	Women's empowerment and social inclusion programs through SFH activities
Food Safety	Improving food security and security in households	Implementation of agricultural practices that improve the quality and quantity of food
Consume Nutritious Food	Increased consumption of healthy and nutritious food	Promotion and education on the importance of local and healthy food consumption

Source: Author's Analysis, 2024

(Carvalho et al., 2021) developing a multidimensional index to measure the sustainability of the food system in Brazil that includes socio-economic, environmental, and nutritional aspects. (Efroymsen et al., 2017) review socio-economic indicators for sustainable energy system design, including impacts on food security and social welfare. (Lebacqz et al., 2013) providing

sustainability indicators for livestock systems that include socio-economic and environmental aspects. (Perignon et al., 2017) examining the socio-economic impact of dietary choices in relation to food sustainability. (Govindan, 2018), developing a conceptual framework for sustainable consumption and production in food supply chains by taking into account socio-economic indicators. (Béné et al., 2019) - Presenting a global map of food system sustainability that includes social, economic, and environmental dimensions. (Zhen & Routray, 2003), offers operational indicators to measure agricultural sustainability in developing countries, including socio-economic aspects. (Berry et al., 2015), examining the relationship between food security and sustainability with a focus on socio-economic aspects. (Karvonen et al., 2017) providing indicators to assess the sustainability impact of natural resource use with a focus on socio-economic dimensions. (van Oel et al., 2019) review relevant indicators for sustainable governance of water systems for food that include socio-economic aspects. These indicators are critical in understanding and evaluating the socio-economic impact of the SFH model, ensuring that the benefits of the program can be felt equally and sustainably by the community.

6.2. Policy aspects and support from the government

Policy aspects and support from the government are key elements in the implementation and sustainability of the SFH model. Without supportive policies, such as incentives for the adoption of green technologies and adequate infrastructure, these programs can be hampered in achieving food sustainability goals. In addition, active community involvement through education and empowerment programs is also essential to ensure that SFH not only serves as a short-term solution, but also provides sustainable long-term benefits to the community. The implementation of policies that support the SFH includes several strategic steps, such as providing incentives for farmers to adopt sustainable agricultural practices, providing adequate infrastructure facilities for the distribution of agricultural products, and implementing education and training programs for communities to increase their awareness and skills in managing natural resources effectively. In addition, it is important to integrate SFH in national and regional development plans in order to access the necessary financial and technical support. The following is a table summarizing some of the policy aspects and government support that are important in the implementation of the SFH (table 6.5).

Policy aspects and government support are crucial in supporting the implementation and sustainability of the Sustainable Food House (SFH) model. Policies that encourage the adoption of green technologies, provide adequate infrastructure, and offer economic incentives are indispensable to ensure the

success of these programs. In addition, active community involvement through education and empowerment is a key element to ensure that SFH programs can operate effectively and sustainably.

Table 6.5. Important policy and government support aspects in the implementation of SFH

Policy Aspects	Description	Implementation
Incentives for Green Technology	Providing incentives for the adoption of green agricultural technologies	Subsidies for the purchase of energy-efficient agricultural tools, and tax incentives
Infrastructure Support	Provision of infrastructure that supports distribution and access to markets	Construction of roads, irrigation and local distribution centers
Education and Empowerment	Educational programs to improve community skills and awareness	Organic farming training, seminars on sustainable resource management
Integrated Development Policy	Integration of SFH into national and regional development policies	Development plan that includes the SFH program as part of the food security strategy
Financial and Technical Support	Access to the necessary financial and technical resources	Microfinance for smallholders, and technical assistance from the government or NGOs
Increased Social Participation	Increase community participation in SFH planning and implementation	Community forums and working groups involving various stakeholders

Source: Author's Analysis, 2024

The implementation of this policy must include providing incentives for farmers, developing food distribution infrastructure, and training and counseling to increase public awareness of sustainable agricultural practices. Policy supports also needs to be integrated into national and regional development plans, in order to access the necessary financial and technical resources. Without this support, the SFH model risks not reaching its potential in improving food security and community welfare. To support this implementation, specific data such as:

1. Data on the adoption of environmentally friendly technologies, including the number of farmers using these technologies, the types of technologies applied, and their impact on production and the environment.

The adoption of environmentally friendly technology in agriculture is an important step to increase productivity while preserving the environment. This concept involves the use of technologies such as integrated nutrition management, precision agriculture, and climate-smart agriculture technologies. This technology not only aims to increase crop yields, but also reduce negative impacts on the environment, such as

reduced greenhouse gas emissions and excessive use of chemical fertilizers.

Table 6.6. Types of eco-friendly technologies

Technology	Number of Users	Impact on Production	Environmental Impact
Integrated Nutrition Management	Widely used in South Asia	Increase yield by up to 150%	Reduce nitrogen emissions, improve soil quality
Precision Agriculture	Limited to developed countries	Improve the efficiency of input use, increase crop yield	Reduce water and fertilizer use, protect biodiversity
Climate Smart Agriculture (CSA)	Beginning to be implemented in Africa and Asia	Improving resilience to climate change, crop stability	Reducing greenhouse gas emissions, water conservation
Vermitechnology	Applied in developing countries	Improves soil productivity and health	Reduce organic waste, increase soil organic matter
IoT Technology in Agriculture	Limited to large-scale farming	Optimization of input use, increased productivity	Reduce water and energy waste, efficiency in resource use

Source: Author's Analysis, 2024

In real terms, the adoption of these technologies in the field varies depending on factors such as cost, farmer awareness, and policy support. An example of an implementation is the application of INM which can increase crop yields by up to 150% compared to conventional practices, while reducing nitrogen emissions and improving soil quality. On the other hand, precision agriculture technologies, such as the use of IoT sensors for water and soil management, help farmers optimize the use of agricultural inputs, but their adoption is still limited due to high costs and the need for technical skills. The following is a table summarizing some of the types of eco-friendly technologies adopted in agriculture as well as their impact on production and the environment (table 6.6).

(Adnan et al., 2019) examining the adoption of green fertilizer technology and the challenges faced in its application. (Wu & Ma, 2015) – discusses integrated nutrient management as an environmentally friendly strategy in increasing plant productivity. (Senyolo et al., 2018) identifying climate-smart agriculture innovations in South Africa and their adoption challenges. (Medici et al., 2019) examining the environmental benefits of the adoption of precision agriculture technology. (Singh, Karmegam, et al., 2020) explaining the use of vermitechnology as an environmentally friendly solution to improve soil fertility. The adoption of this eco-friendly

technology is essential to support sustainable agriculture, but it requires policy support, education, and increased access to these technologies among farmers.

2. Infrastructure data, information on the availability and quality of supporting infrastructure such as irrigation, roads, and local distribution centers.

The availability and quality of supporting infrastructure such as irrigation, roads, and local distribution centers are critical in supporting sustainability and productivity in agriculture, especially in the Sustainable Food House (SFH) model. Good infrastructure ensures that resources such as water can be distributed efficiently, crops can be marketed more easily, and transportation costs and product damage can be minimized. However, the main challenges in the development of this infrastructure include financing, maintenance, and adaptation to climate change. In real life, the implementation of high-quality infrastructure can be seen in various examples. For example, precision irrigation systems equipped with sensor technology allow for more efficient use of water, increasing crop yields by up to 20-30% compared to traditional systems. Good road construction also reduces transportation time and costs, as well as reduces post-harvest losses. In addition, local distribution centers equipped with cold storage facilities help maintain the quality of agricultural products and extend shelf life. The following is a table summarizing some of the types of supporting infrastructure, their availability status, and their impact on production and efficiency (table 6.7.)

Table 6.7. Types of supporting infrastructure, their availability status

Infrastructure	Availability Status	Impact on Production	Impact on Efficiency
Precision Irrigation System	Limited, but thriving in certain areas	Increase yield by 20-30%	More efficient use of water, reducing waste
Roads and Transportation Access	Still limited to rural areas	Reduce product damage during transportation	Reduced transportation costs and time, wider market access
Local Distribution Centers	Limited, with minimal cold storage facilities	Maintaining post-harvest product quality	Extend product shelf life, reduce post-harvest losses
Drainage and Water Management	Less than optimal in many areas	Reduces flood risk, improves soil fertility	Increasing land use, maintaining groundwater balance

Source: Author's Analysis, 2024

(Makropoulos & Butler, 2010) discusses distributed water infrastructure and its impact on community sustainability. (Mishra &

Aithal, 2022) assessing the performance of irrigation systems in Nepal and their impact on planting intensity and crop productivity. (Ward, 2010) reviewing financing and policies related to irrigation management and infrastructure. (Adeyemi et al., 2017) discusses monitoring and management systems to improve sustainability in precision irrigation. These data are important to ensure that the existing infrastructure optimally supports agricultural production and environmental sustainability, as well as identify areas that need further improvement or intervention.

3. Data on economic incentives, the number and types of incentives provided by the government, and their impact on farmers' motivation to be involved in SFH.

Economic incentives play an important role in encouraging farmers' participation in SFH programs and other sustainable agricultural practices. These incentives can be in the form of subsidies, tax relief, access to low-interest credit, and direct cash assistance to adopt environmentally friendly technologies. The impact of these incentives varies depending on the design and implementation of the program. In many cases, well-designed economic incentives can increase farmers' motivation to participate in SFHs, increase their productivity, and at the same time reduce negative impacts on the environment.

Table 6.8. Types of economic incentives, their availability

Types of Incentives	Quantity and Availability	Impact on Farmer Motivation	Impact on Sustainability
Organic Fertilizer Subsidy	Available in some developing countries	Increasing the adoption of green practices	Improve soil health and reduce pollution
Tax Relief for Technology	Limited to areas with policy support	Increasing farmers' investment in smart agriculture technology	Increase efficiency and reduce carbon emissions
Microloans with Low Interest	Available through microfinance programs	Enabling smallholders to access new technologies	Increasing productivity and resilience to climate change
Cash Assistance for Development	Limited to areas that receive special programs	Increasing farmer participation in SFH programs	Increasing farming diversification and income stability
Incentives for CSA Practice	Beginning to be implemented in several countries	Increasing the adoption of climate-smart agriculture	Reducing the negative impact of climate change on food production

Source: Author's Analysis, 2024

In real terms, the implementation of economic incentives in the field can be seen from several examples. For example, in some countries, subsidies for the use of organic fertilizers have been successful in increasing the adoption of environmentally friendly technologies, which in turn improves crop yields and soil health. In addition, access to low-interest microcredit for smallholders allows them to invest in new, more efficient and sustainable technologies. However, the success of these incentives is highly dependent on the program's suitability to local conditions and the specific needs of farmers. The following is a table that summarizes the different types of economic incentives, their availability, and their impact on farmers' motivation and agricultural sustainability (table 6.8.). (van Asseldonk et al., 2023) discusses how policy incentives can support the adoption of climate-smart agriculture by smallholders. (Gneezy et al., 2011) examining the effectiveness of monetary incentives in modifying behavior and their impact on intrinsic motivation. (Michel-Villarreal et al., 2020; Piñero & Keay, 2018) identify producer motivations in short food supply chains and the challenges faced in the context of economic incentives. (With accurate data on the number and type of incentives provided, as well as their impact on farmer motivation and participation, SFH programs can be optimized to achieve better outcomes in terms of sustainability and productivity.

4. Data on community participation, statistics on community participation in education and training programs, as well as changes in their skills and awareness of sustainable agricultural practices.

Community participation in agricultural education and training programs is a key factor in ensuring the successful implementation of sustainable agricultural practices. Community participation statistics include how many individuals participate in the program, as well as the impact on their skill improvement and awareness of environmentally friendly farming practices. Effective education programs not only improve farmers' technical skills, but also their awareness of the importance of sustainable agricultural practices to protect the environment and support their economic sustainability. In real terms, the implementation of this program can be seen from various initiatives, such as farmer field schools, which have shown success in improving farmers' skills and reducing the use of pesticides. However, challenges such as low community participation in some regions and lack of knowledge transfer to non-participants are often obstacles. To address this, a more inclusive and sustainable approach is needed, including active involvement from governments and non-governmental organizations. Table 6.9. which summarizes several aspects

of community participation in agricultural education programs and their impacts.

Table 6.9. Aspects of community participation in agricultural education programs

Participation Aspect	Participation Statistics	Impact on Skills	Impact on Consciousness
Farmer Field School (FFS)	High in some regions, especially in Asia and Africa	Improve technical skills, reduce the use of pesticides	Raising awareness of sustainable farming practices
Sustainable Agriculture Training	Participation varies depending on access and support	Improvement in the application of green technology	Increased awareness of the environmental impact of agriculture
Community Education Program	Moderate participation, needs to be increased in remote areas	Improved skills in water and soil management	Raising awareness about the importance of resource conservation
Mentoring and Consultation	Low participation in some areas	Improving the ability to solve problems independently	Awareness of the importance of agricultural practices that are adaptive to climate change

Source: Author's Analysis, 2024

(Van den Berg & Jiggins, 2007) discusses the impact of farmer field schools on the adoption of more sustainable agricultural practices. (Tripp et al., 2005) – researching the contribution of farmer field schools in improving farmer skills in Sri Lanka. (Kumba, 2003) Examining the level of farmer participation in research and extension programs in Namibia. (Rossing & Heasley, 1987) explains how leadership development through education can increase public participation in public affairs. (Prokopy et al., 2008) reviewing the factors influencing the adoption of best practices in agricultural management in the United States. High community participation in education and training programs is key to increasing skills and awareness of the importance of sustainable agricultural practices. Efforts to increase this participation must be supported by appropriate policies and the provision of wider access to such programs.

5. Socio-economic impact data, data on changes in household income, food price stability, and public access to healthy and nutritious food.

The socio-economic impacts of agricultural programs, such as Rumah Pangan Lestari (SFH), involve analyzing changes in household incomes, food price stability, and people's access to healthy and nutritious food. This analysis is important to evaluate the success of the program in improving community welfare and reducing food insecurity. In a broader

context, these factors influence policy decisions and resource allocation aimed at improving food security and economic well-being. In real terms, the positive impact of SFH implementation can be measured by various indicators. For example, increasing household income through diversification of farming and increasing crop yields from home yards. Food price stability can also be measured through the analysis of fluctuations in the prices of major commodities in the local market, which is influenced by increased local food production. In addition, public access to healthy and nutritious food can be seen from the decrease in the prevalence of malnutrition and the increase in the consumption of local vegetables and fruits. The following is a table summarizing various socio-economic data related to the impact of SFH (table 6.10.).

Table 6.10. Socio-economic aspects related to the impact of SFH

Socio-Economic Aspects	Indicator	Implementation Impact
Household Income	Increased income from farming diversification	Improving the economic well-being of families
Food Price Stability	Fluctuations in the prices of major commodities in the local market	Reduce uncertainty and maintain access to affordable food
Access to Healthy Food	Prevalence of malnutrition and consumption of vegetables/fruits	Increase in local food consumption and decrease in malnutrition rates
Household Food Safety	Food safety and food security index	Improves food stability and reduces the risk of hunger
Reducing Food Inequality	Differences in food access between social and economic groups	Strengthening equal access to food at various levels of society

Source: Author's Analysis, 2024

(Headey & Martin, 2016) analysing the impact of food price fluctuations on poverty and food security. (Rose, 1999) examines the relationship between food insecurity and socio-economic status in the US. (Senauer, 1990) researching household behavior related to food consumption and nutrition in developing countries. (Hirvonen, 2020) reviewing the economic impact of the COVID-19 pandemic on food security in Ethiopia. (RWIGEMA (PhD), 2021) examining the impact of COVID-19 lockdowns on food security in Rwanda. (Darnton-Hill & Coyne, 1998) discusses socio-economic inequalities in global nutrition and its impact on health. (Fekad & Bekalu, 2020) reviewing the impact of climate change on household food security in Ethiopia. (Bitler & Seifoddini, 2019) examining the health impact of food aid programs in the United States. These data provide a comprehensive view of how sustainable agriculture

programs, such as SFHs, can affect the socio-economic conditions of communities, particularly in terms of household income, food price stability, and access to healthy and nutritious food.

6.3. Sustainable Food House Management

Management challenges in nursery and SFH areas involve various aspects related to maintaining seed quality, resource management, and suitability of practices with local conditions. One of the main issues is ensuring that the seedlings produced in the nursery are of consistent quality, which includes resistance to disease, adaptation to the local environment, and high productivity. In addition, nursery gardens also face challenges in terms of soil nutrient management, irrigation, and environmentally friendly pest control. Effective management implementation in nursery and SFH requires an integrated approach that includes modern technology and proven traditional practices. For example, the use of organic fertilizers and precision irrigation techniques can improve resource efficiency while maintaining environmental sustainability. However, other challenges such as lack of access to technology, training for the workforce, and financial constraints must also be addressed through support programs from governments and non-governmental organizations.

1. Seedling quality

The quality of seeds is one of the key factors in the success of the sustainable agriculture program, including in the context of SFH. The main challenge that is often faced is the limitation in producing consistently high-quality seeds. High-quality seedlings must have good adaptability to the local environment, resistance to disease, and optimal yield potential. However, often seed production is disrupted by factors such as genetic degradation, pest and disease attacks, and a lack of adequate technology in the seedling process. To overcome this challenge, one of the implementable solutions that can be applied is the use of tissue culture technology. This technology allows the mass production of seedlings of uniform quality and free from diseases. Tissue culture also provides the ability to maintain the superior traits of the parent plant, so that the resulting seedlings have consistent quality. In addition, routine quality monitoring through laboratory tests and information technology-based monitoring systems is also needed to ensure that the seeds produced meet the set quality standards. The implementation of tissue culture technology in seed production has been proven effective in various countries. For example, in horticultural crop cultivation, tissue culture allows for faster and larger production of seedlings compared to conventional methods. In

addition, seedlings produced through tissue culture have advantages in terms of disease resistance, which is very important for maintaining agricultural productivity in the long term.

(Ronga et al., 2021) examining root zone management to improve seed quality in organic farming systems, which is very relevant to tissue culture technology. (Bajwa, 2014) discusses sustainable crop management strategies, which are included in modern nursery practices. (Mukhopadhyay et al., 2021) researching environmental challenges that can affect seedling quality, including soil salinity, and how technology can help address these issues. (Bhandari & Nayama, 2020) reviewing nursery management to improve seedling quality and income, with a focus on tissue culture techniques. (Fahad et al., 2021) discusses environmentally friendly pest management, which is relevant to the maintenance of high-quality seedlings. The use of tissue culture technology and routine quality monitoring is an effective strategy to overcome the challenges of producing high-quality seeds. This implementation will not only increase agricultural productivity, but also ensure the sustainability of the food system in the long term.

2. Soil nutrient management

Soil nutrient management is a major challenge in sustainable agriculture, especially in the face of soil degradation and nutrient imbalances. Soil degradation often occurs due to the excessive use of chemical fertilizers and a lack of proper soil management practices. This results in a decrease in soil quality, including reduced organic matter, changes in soil pH, and decreased soil capacity to retain water and nutrients. Nutrient imbalances, especially deficiencies or excesses of nitrogen, phosphorus, and potassium, can also inhibit plant growth and lower yields. To overcome this challenge, the implementation of balanced fertilization techniques and the use of organic fertilizers are highly recommended solutions. Balanced fertilization involves using a combination of organic and inorganic fertilizers to ensure that the soil receives all the nutrients needed by the plant without disturbing the natural balance of the soil. Organic fertilizers, such as compost, manure, and plant residues, not only provide nutrients for plants, but also help improve soil structure, increase soil capacity to store water, and support soil microbial activity that is essential for long-term soil health. Studies show that consistent use of organic fertilizers can increase soil organic matter content by up to 90%, which in turn improves crop yields and overall soil quality (Diacono & Montemurro, 2010). In addition, the combination of organic fertilizers with inorganic fertilizers can increase plant productivity

without damaging soil quality, thereby creating a more sustainable and durable agricultural system (Bhatt et al., 2019). (Diacono & Montemurro, 2010) discusses the long-term effects of organic amendments on soil fertility. (Roba, 2018) to examine the effect of a mixture of organic and inorganic fertilizers on soil productivity and fertility. (Singh, Pandey, et al., 2020) review the practice of integrated soil nutrient management and its impact on soil chemistry. (Lather et al., 2021) explain the importance of balanced fertilization to improve and maintain fruit quality and productivity. (Dereje Dobocha Goda, 2019) reviewing the importance of integrated soil fertility management for sustainable crop production.

The implementation of this technique requires careful knowledge and monitoring to ensure that fertilizer applications are carried out in a timely manner and in accordance with the specific needs of the plant and soil conditions. Additionally, it is important to continue to develop and adopt new technologies that can help farmers monitor soil conditions more effectively and manage fertilizer use efficiently. By applying balanced fertilization techniques and the use of organic fertilizers, farmers can increase soil fertility sustainably, increase crop yields, and support a healthier and more productive agricultural ecosystem.

3. Pest and disease control

Pest and disease control in agriculture is a complex challenge, especially when dealing with the unsustainable use of pesticides and the emergence of pest resistance. Excessive and untargeted use of pesticides has resulted in increased pest resistance to the chemicals, which ultimately requires higher doses or stronger types of pesticides to achieve the same effectiveness. This not only increases production costs but also negatively impacts the environment and human health. One effective implementable solution to overcome this challenge is the adoption of Integrated Pest Management (IPM). IPM is a systematic approach that combines various pest control methods, including selective use of pesticides, crop rotation, utilization of natural predators, and the use of bioherbicides. IPM aims to reduce dependence on chemical pesticides by optimizing pest control through a combination of sustainable and environmentally friendly methods. One of the important components in IPM is bioherbicides, which are biologically-based pest control agents that can suppress the growth of weeds or plant pathogens without damaging the environment.

Studies show that the adoption of IPM, combined with the use of bioherbicides, can reduce the use of chemical pesticides by up to 50%, while maintaining or even increasing crop yields. For example, bacteria-based bioherbicides such as *Bacillus thuringiensis* have been used

extensively in the control of various types of pests and have proven to be effective in reducing pest populations without causing a negative impact on natural predators or the surrounding environment (Mnif & Ghribi, 2015). (Alyokhin et al., 2015) Highlighting the importance of HDI in managing highly adaptive pests such as the Colorado potato beetle. Review the application of HDI in rice plants and the role of bioherbicides in pest management. (Raymaekers et al., 2020) Discussing the selection of new biocontrol agents for plant disease management within the framework of IPM. By adopting HDI and utilizing bioherbicides, farmers can reduce the negative impact of using chemical pesticides, inhibit the development of pest resistance, and improve agricultural sustainability in the long term.

4. Irrigation and water management

Irrigation and water management are key components in agriculture, especially in areas that have a high dependence on water-intensive irrigation methods. This dependence can lead to significant water waste, reduce production efficiency, and increase operational costs. Therefore, the adoption of more efficient irrigation systems, such as drip irrigation, as well as the use of soil moisture sensor technology, is a very effective and implementable solution to improve water use efficiency and maintain the sustainability of agricultural production. Drip irrigation is one of the most efficient irrigation methods, in which water is applied directly to the root zone of plants through small pipes at a very low rate. This allows for a reduction in water loss through evaporation and percolation, as well as ensuring that water is optimally available to plants when it is needed. Research shows that drip irrigation can increase water use efficiency by up to 40-70% compared to traditional irrigation methods such as surface flow irrigation (Mushtaq, 2017). In addition, the system also allows for more efficient fertilizer application through fertigation techniques, where fertilizer is applied directly to the root zone along with irrigation water, thus optimizing nutrient use by plants.

Soil moisture sensor technology plays a crucial role in optimizing irrigation by providing real-time data on soil moisture conditions. This sensor can be used to automatically adjust the frequency and duration of irrigation, thus avoiding over-irrigation and under-irrigation. The implementation of this technology has been proven to reduce water use by 20-50% without sacrificing crop yields (Thakur et al., 2018). In addition, humidity sensors also assist farmers in managing irrigation based on the specific needs of crops and soil conditions, ultimately improving productivity and resource efficiency. (Mushtaq, 2017) examining the effectiveness of drip irrigation and fertilizer application through fertigation.

(Touil et al., 2022) review smart irrigation management strategies and their impact on water savings and crop yields. (Thakur et al., 2018) discussing the performance of drip irrigation in tomato cultivation. (Ayars et al., 1999) reviewing subsurface drip irrigation and its benefits on water efficiency. (Bajpai & Kaushal, 2020) review the distribution of soil moisture under drip irrigation and its importance for efficient water management. By adopting drip irrigation and soil moisture sensor technology, farmers can achieve more efficient water use, reduce operational costs, and maintain crop productivity in the long term. This implementation is very important to support sustainable agriculture, especially in areas experiencing water shortages.

5. Training and skill development

Training and skills development for farmers is a key element in increasing productivity and sustainability of agricultural practices, especially in rural areas that often have limited access to modern technology. The main challenge faced is the limited knowledge and skills of farmers in adopting modern agricultural practices, which can hinder production efficiency and reduce competitiveness in the market. To address this problem, the implementation of continuing training programs and community-based counseling is essential. This training program not only aims to improve farmers' technical knowledge of modern agricultural practices, but also to build their capacity in terms of management, marketing, and use of information technology. Community-based extension plays a central role in this approach, where farmers can learn through direct interaction with extension workers who understand the local context and through co-learning with other farmers in the group.

An example of successful implementation is the Farmer Field Schools (FFS) program, which has been used in various countries to teach environmentally friendly farming techniques and improve farmers' managerial skills. The program allows farmers to learn through hands-on practice in the field, which not only improves their understanding of more efficient farming techniques, but also builds confidence and independence in managing their farming ventures (Butt et al., 2015). (Feder et al., 2010) highlighting the challenges and opportunities in community-based extension approaches. (Wellard et al., 2013) examining the impact of community extension approaches on food safety and agricultural technology. (Saleh, 2019) discusses the need for training agricultural extension workers. (Raidimi & Kabiti, 2019) explaining the role of counseling and training in achieving sustainable food security. (Lillard et al., 2013) provide recommendations for extension programs for organic

farmers. Sustainable, community-based training and outreach can have a significant impact in empowering farmers to adopt modern agricultural practices, increase productivity, and drive sustainability in the agricultural sector. The implementation of these programs must continue to be supported by appropriate policies and cooperation between the government, educational institutions, and local communities.

Management challenges in agriculture in the production and management of SFH are interrelated and form an integrated system. Every aspect, from seed quality, soil nutrient management, pest and disease control, to irrigation and workforce training, plays a critical role in achieving sustainable and efficient agricultural yields. Success in one area often depends on effectiveness in another, so coordinated and comprehensive management is essential. Seed Quality is the main foundation in agriculture that determines the yield potential. The main challenge here is to produce consistently high-quality seedlings. Tissue culture technology and routine quality monitoring can be used to address this problem, ensuring that the seedlings produced are of uniform quality and free from disease. This is important because good seedlings will be more responsive to proper nutrient management techniques and more resistant to pest and disease attacks (Ronga et al., 2021). Soil Nutrient Management is a crucial next step, especially given the problems of soil degradation and nutrient imbalance. The implementation of balanced fertilization techniques and the use of organic fertilizers can increase soil fertility in a sustainable manner, allowing plants to grow optimally and achieve maximum yields. The use of a combination of organic and inorganic fertilizers can significantly increase crop yields while maintaining soil health in the long term (AGEGNEHU & AMEDE, 2017). Pest and Disease Control is often a challenge that hinders productivity. Unsustainable use of pesticides has led to the emergence of pest resistance, which can be fatal to crop production. The adoption of Integrated Pest Management (IPM) and the use of bioherbicides can be an effective solution. HDI not only reduces dependence on chemical pesticides but also maintains the balance of agricultural ecosystems, supporting long-term sustainability (Rejesus & Jones, 2020). Irrigation and Water Management are other important factors, especially in areas experiencing water shortages. The dependence on water-intensive irrigation methods can be overcome by the use of drip irrigation systems and soil moisture sensor technology. This system allows for more efficient use of water, ensuring that plants receive the right amount of water at the right time, which is essential for optimal growth and high yields (Touil et al., 2022). Training and Skills of the Workforce are the main pillars in the successful implementation of

all these management techniques. Without adequate knowledge and skills, farmers will not be able to adopt the latest technologies and practices necessary to improve efficiency and productivity. Continuing training programs and community-based extension can provide the support farmers need, helping them overcome challenges and improve their farming yields (Feder et al., 2010). These management challenges in agriculture must be managed in an integrated manner. Success in one area can favor improvement in another, while failure in one area can undermine the overall effectiveness of the strategy. Therefore, a comprehensive and sustainable approach is urgently needed to achieve optimal results and maintain the sustainability of the agricultural system in the long term.

Part 6 discusses the challenges and policy support needed for the implementation of the SFHA. The main problems discussed are limited resources, such as fertile land and clean water, low adoption of environmentally friendly technology, and lack of coordination between institutions in program implementation. In addition, the lack of policy incentives and public education related to sustainable resource management is a significant obstacle. The main objective of Part 6 is to identify strategic policies, sustainability indicators, and the support needed to ensure the sustainability of the SFHA. This part aims to improve the efficiency of resource use, create positive socio-economic impacts, and ensure environmental sustainability through good agricultural management. Policy support is an important element in creating synergy between technology, society, and the government. This part provides several suggestions to address existing challenges, including providing incentives for the adoption of green technologies, the development of supporting infrastructure such as irrigation and food distribution center, and ongoing training for the community. In addition, it is important to integrate SFHA in national and regional development policies in order to obtain adequate technical and financial support. In the future, it is important to strengthen the role of the government in providing supporting policies, such as subsidies for green technology and access to financing for farmers. The development of sustainability indicators, such as water and soil efficiency, organic fertilizer use, and socio-economic impact, also needs to be improved to measure the success of the program. In addition, the active involvement of the community in each stage of program implementation must continue to be expanded.

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Part 7

Benefits of Optimal Management of Home Gardens

Syahrial Abdullah, Yardha

7.1. Home Garden Management

Optimal management of home gardens can provide various significant benefits, both in nutrition, environmental sustainability, and community welfare. The practice of home gardening has been recognized as one of the effective strategies in improving household food security, especially in developing countries where food scarcity and malnutrition are crucial problems. By maximizing the use of residential land, people can not only meet their nutritional needs by growing fresh vegetables and fruits, but also contribute to biodiversity conservation and climate change mitigation. Additionally, a well-managed home garden can improve an individual's psychological and social well-being through increased physical activity, stress reduction, and strengthening social relationships in the community. Some important indicators in the optimal management of a home garden include: Increased access to nutritious food, the ability of households to produce diverse nutritious foods from their gardens. Environmental sustainability, practices that support biodiversity conservation, water use efficiency, and waste reduction. Social and health well-being, positive impact on mental well-being, stress reduction, and increased physical activity through participation in gardening. Economic empowerment, the ability to generate more income through the sale of garden products and the reduction of food costs.

Home gardens, a promising approach to enhance household food security and well-being (Galhena et al., 2013). Building on traditional gardening to improve household food security (R. Marsh, 2018). Exploring the co-benefits (and costs) of home gardening for biodiversity conservation (Raymond et al., 2019). The impact of urban home gardening on plant species conservation and environmental sustainability (Legesse, 2016). Home and community gardens in Southeast Asia, potential and opportunities for

contributing to nutrition-sensitive food systems (Galhena et al., 2013). Improving lifestyles sustainability through community gardening, results and lessons learned from the JArDinS quasi-experimental study (Tharrey et al., 2019). Nutrition and health improvements after participation in an urban home garden program (Palar et al., 2019). Why garden? – Attitudes and the perceived health benefits of home gardening (Chalmin-Pui et al., 2021). Role of traditional home gardens in natural resource management (Mondal, 2009). The development of a model of community garden benefits to well-being (Holland, 2004). Optimal management of home gardens has great potential in providing various multidimensional benefits that contribute to food security, environmental conservation, and community welfare.

7.2. Increasing Access to Nutritious Food

Increasing access to nutritious food through home gardens is one of the effective strategies to improve food security and nutritional quality of households, especially in rural areas and low-income communities. A series of impacts in this condition boils down to stunting conditions, life expectancy. In the publication of the Ministry of Agriculture, stunting is one of the conditions that affect the food security index.

The prevalence of stunting among children under five (table 7.1) in Indonesia from 2018 to 2022 shows a significant downward trend in many provinces, although some regions still face major challenges. Nationally, the prevalence of stunting decreased from 30.8% in 2018 to 21.6% in 2022. This decline reflects the intensive endeavors made by the government and various parties in addressing the problem of stunting, which is an important indicator of malnutrition status in children. North Sumatra: The province showed a significant decline from 32.4% in 2018 to 21.1% in 2022. This decline is one of the fastest in Indonesia, demonstrating effective interventions in health and nutrition programs. Riau recorded a decrease from 27.4% in 2018 to 17% in 2022. This decline shows success in increasing access to nutritious food and health services. Lampung has succeeded in reducing the stunting rate from 27.3% in 2018 to 15.2% in 2022, reflecting consistent improvements in handling the stunting problem.

Eastern South-East Nusa Province recorded the highest stunting prevalence in 2018 with a figure of 42.7% and is still high in 2022 although it has dropped to 35.3%. This shows a major challenge in tackling stunting in the area, which may be related to limited access to adequate food resources and health services. The prevalence in West Sulawesi also remains high, from 41.6% in 2018 and only slightly decreased to 35% in 2022. This indicates the need for more intensive and sustainable interventions. Uniquely, Papua showed an

increase in the prevalence of stunting from 23.4% in 2020 to 34.6% in 2022. This increase can be indicated as an impact of socio-economic changes, conflicts, or other factors that worsen health and nutrition conditions in the area.

Table. 7.1. Prevalence of Stunting of Toddlers by Province in 2018–2022

Province	2018	2019	2020	2021	2022
Aceh	37.1	34.2	33	33.2	31.2
North Sumatera	32.4	30.1	28.7	25.8	21.1
West Sumatera	29.9	27.5	26.7	23.3	25.2
Riau	27.4	24	22.4	22.3	17
Jambi	30.2	21	19.6	22.4	18
South Sumatera	31.6	29	28.7	24.8	18.6
Bengkulu	28	26.9	25.4	22.1	19.8
Lampung	27.3	26.3	24.4	18.5	15.2
Bangka Belitung Islands	23.4	19.9	20.9	18.6	18.5
Riau Islands	23.6	16.8	13.7	17.6	15.4
Jakarta	17.6	20	19.2	16.8	14.8
West Java	31.1	26.2	25.6	24.5	20.2
Central Java	31.3	27.7	26.9	20.9	20.8
Yogyakarta	21.4	21	19.9	17.3	16.4
East Java	32.8	26.9	25.6	23.5	19.2
Banten	26.6	24.1	21.8	24.5	20
Bali	21.9	14.4	13.7	10.9	8
West Nusa Tenggara	33.5	37.9	38.2	31.4	32.7
Eastern South-East Nusa	42.7	43.8	43	37.8	35.3
West Kalimantan	33.3	31.5	30.9	29.8	27.8
Central Kalimantan	34	32.3	30.5	27.4	26.9
South Kalimantan	33.1	31.8	30.9	30	24.6
East Kalimantan	29.2	28.1	27.5	22.8	23.9
North Kalimantan	26.9	26.3	25.8	27.5	22.1
North Sulawesi	25.5	21.2	29.3	21.6	20.5
Central Sulawesi	32.3	31.3	29.7	29.7	28.2
South Sulawesi	35.7	30.6	19.7	27.4	27.2
Southeast Sulawesi	28.7	31.4	29.8	30.2	27.7
Gorontalo	32.5	34.9	32.7	29	23.8
West Sulawesi	41.6	40.4	40.4	33.8	35
Maluku	34	30.4	27.9	28.7	26.1
North Maluku	31.4	29.1	27.2	27.5	26.1
West Papua	27.8	24.6	28.1	26.2	30
Papua	33.1	29.4	23.4	29.5	34.6
Indonesia	30.8	27.6	26.9	24.4	21.6

Source: Ministry of Health of the Republic of Indonesia, 2024

Stunting in children under five is caused by various factors, including chronic malnutrition, recurrent infectious diseases, poor sanitation, and low access to health services and nutrition education. In many regions of Indonesia, economic instability, lack of access to nutritious food, and low knowledge of

good child feeding practices are major contributors to the high prevalence of stunting.

Home gardens, a promising approach to enhance household food security and well-being suggests that interventions such as home gardens can improve household food security and reduce the risk of stunting by providing direct access to nutritious food (Galhena et al., 2013). Sustainability in home garden interventions to improve food security highlights the importance of a sustainable approach in home garden interventions to support food security and nutrition, which is important in endeavors to reduce stunting (Ajibade et al., 2023). The long-term behavioral impact of an integrated home garden intervention in Bangladesh shows the long-term impact of home garden interventions on vegetable production and consumption, which helps to increase nutritional intake and reduce stunting (Baliki et al., 2019). The decrease in the prevalence of stunting in Indonesia from 2018 to 2022 shows the success of most provinces in addressing this problem, although there are still significant challenges in some regions. Factors such as access to nutritious food, effective health interventions, and nutrition education play an important role in reducing stunting rates. However, areas with high prevalence require special attention and more intensive interventions to address underlying problems, such as socio-economic instability and limited access to health services.

Sustainable Food House (SFH) has a very important role in reducing the prevalence of stunting in Indonesia, especially in areas with high stunting rates. Here are some of the ways that SFH contributes to reducing stunting prevalence:

1. Increasing access to nutritious food, SFH advises every household to plant vegetables, fruits, and other food crops in their yards. Thus, households can have direct and sustainable access to fresh, nutritious food. Better access to nutritious food is essential to prevent stunting, especially in children under the age of five, who need adequate nutritional intake for optimal growth and development. Research shows that the existence of home gardens can increase food diversity and nutrient intake, which directly contributes to stunting prevention (Galhena et al., 2013).
2. Food Diversification, by implementing SFH, households are encouraged to grow various types of food crops, including green leafy vegetables, fruits, tubers, and protein source crops such as legumes. This food diversification ensures that children get a variety of nutrients necessary for growth, such as vitamins, minerals, and protein. This is important to prevent nutritional deficiencies that are often the cause of stunting.

3. Reducing dependence on the market, through SFH, households become more independent in meeting their food needs. Lower dependence on the market helps ensure constant food availability despite cost fluctuations or food scarcity in the market. With the availability of guaranteed food at home, the risk of stunting due to malnutrition can be minimized.
4. Nutrition and food Education, SFH also includes an education component, where household members are taught about the importance of balanced nutrition and how to make optimal use of their garden produce to meet the nutritional needs of families. This education is important to ensure that the food produced in the yard is used effectively to prevent stunting.
5. Economic Empowerment, SFH not only provides food for family consumption but also allows households to sell excess production. This more income can be used to increase family access to health services, education, and other needs that support children's growth. Thus, SFH contributes to household economic stability, which is also an important factor in endeavors to reduce stunting (Marek et al., 1990).
6. Sustainability and food security, SFH advises sustainable and environmentally friendly agricultural practices. By making optimal use of yard land, SFH helps maintain the sustainability of natural resources and ensure long-term food security. Good food security will reduce the risk of stunting because children will have constant access to healthy and nutritious food.

SFH has a crucial role in reducing the prevalence of stunting in Indonesia. By increasing access to and availability of nutritious food through yard land use, diversifying food sources, and reducing dependence on markets, SFH helps ensure that children get enough nutrition for optimal growth and development. In addition, with the right economic empowerment and education, SFH also contributes to poverty alleviation and the improvement of family quality of life, which overall supports endeavors to reduce stunting in Indonesia.

Furthermore, in the context of the Life Expectancy Figure, which is a parameter in the food insecurity figure, through the publication of the Ministry of Agriculture in 2018-2022, it is also one of the important conditions that must be considered. Life expectancy is an important indicator that reflects the general health level, quality of life, and socio-economic development of a region. Data on life expectancy per province in Indonesia from 2018 to 2022 shows a steady upward trend in most regions, although there are significant differences between provinces. The Special Region of Yogyakarta consistently has the highest life expectancy in Indonesia, reaching 75.08 years in 2022. This reflects the quality of health services, education, and good socio-economic

conditions in the province. Jakarta and West Java also show high life expectancy, reaching 73.32 years and 73.52 years respectively in 2022. These provinces have better health infrastructure and wider access to quality health services compared to other provinces.

Table 7.2. Life Expectancy Per Province 2018-2022 (years)

Province	2018	2019	2020	2021	2022
Aceh	69.64	69.87	69.93	69.96	70.18
North Sumatera	68.61	68.95	69.1	69.23	69.61
West Sumatera	69.01	69.31	69.47	69.59	69,9
Riau	71.19	71.48	71.6	71.67	71.95
Jambi	70.89	71.06	71.16	71.22	71.5
South Sumatera	69.41	69.65	69.88	69.98	70.32
Bengkulu	68.84	69.21	69.35	69.42	69.69
Lampung	70.18	70.51	70.65	70.73	70.99
Bangka Belitung Islands	70.18	70,5	70.64	70.73	70.98
Riau Islands	69.64	69,8	69.96	70.12	70,5
Jakarta	72.67	72.79	72.91	73.01	73.32
West Java	72.66	72.85	73.04	73.23	73.52
Central Java	74.18	74.23	74.37	74.47	74.57
Yogyakarta	74.82	74.92	74.99	75.04	75.08
East Java	70.97	71.18	71.3	71.38	71.74
Banten	69.64	69.84	69.96	70.02	70.39
Bali	71.68	71.99	72.13	72.24	72,6
West Nusa Tenggara	65.87	66.28	66.51	66.69	67.07
Eastern South-East Nusa	66.38	66.85	67.01	67.15	67.47
West Kalimantan	70.18	70.56	70.69	70.76	71.02
Central Kalimantan	69.64	69.69	69.74	69.79	70.04
South Kalimantan	68.23	68.49	68.66	68.83	69.13
East Kalimantan	73.96	74.22	74.33	74.61	74.62
North Kalimantan	72.5	72.54	72.59	72.65	72.67
North Sulawesi	71.26	71.58	71.69	71.76	72.08
Central Sulawesi	67.78	68.23	68.69	68.83	68.93
South Sulawesi	70.08	70.43	70.57	70.66	70.97
Southeast Sulawesi	70.72	70.97	71.22	71.27	71.37
Gorontalo	67.45	67.93	68.07	68.19	68.51
West Sulawesi	64.58	64.82	65.06	65.25	65.63
Maluku	65.59	65.82	65.98	66.09	66.45
North Maluku	67.8	68.18	68.33	68.45	68.79
West Papua	65.55	65,9	66.02	66.14	66.46
Papua	65.36	65.65	65.79	65.93	66.23
Indonesia	71.25	71.34	71.47	71.57	71.85

Source: Ministry of Health of the Republic of Indonesia, 2024

West Nusa Tenggara and East Nusa Tenggara consistently have lower life expectancy rates compared to other provinces, with figures of 67.07 years and 67.47 years respectively in 2022. This is most likely due to challenges in access to health services, malnutrition, and unfavorable economic conditions. Papua and Maluku also have relatively low life expectancy, although showing a small

increase year-on-year. Papua, for example, reached 66.23 years in 2022, up from 65.36 years in 2018. Low life expectancy in these regions is often linked to geographical challenges and a lack of basic infrastructure. West Nusa Tenggara has experienced a significant increase, from 65.87 years in 2018 to 67.07 years in 2022. This indicates an improvement in health and socio-economic conditions in the region, possibly as a result of government interventions and better health programs. East Kalimantan consistently shows a high life expectancy, reaching 74.62 years in 2022. This increase reflects economic development supported by the mining and gas industries as well as improvements in health services.

The life expectancy rate in an area is influenced by various factors including access to health services, nutritional quality, education, hygiene, and environmental conditions. The increase in life expectancy in most of Indonesia's provinces indicates an improvement in these conditions, although some provinces are still lagging behind. Health services, provinces with high life expectancy rates such as Yogyakarta and West Java generally have better health infrastructure, including hospitals, clinics, and access to trained health workers. This is very important in the treatment of chronic diseases and the prevention of premature demise. Education and health awareness, good education raises public awareness of the importance of health, nutrition, and hygiene, all of which contribute to an increase in life expectancy. Provinces with higher life expectancy usually also have better levels of education. Economic conditions, economic stability allows for better access to basic necessities such as nutritious food, decent housing, and health services. Provinces with more developed economies tend to have higher life expectancy. Geography and infrastructure, provinces in the eastern region of Indonesia such as Papua and Maluku face significant geographical challenges, affecting access to health services and basic infrastructure, which negatively impacts life expectancy.

Explores the dynamic relationship between life expectancy, economic growth, and healthcare expenditures using Bayesian models (Reeve & Kabiawu, 2020), analysis the impact of gross national income, gender inequality, and financial crises on older age life expectancy in Europe (Kimani, 2021), provides global data on changes in healthy life expectancy, disability-adjusted life years, and the influence of socio-demographic factors (Goh et al., 2024) and examines how socioeconomic indicators like unemployment and literacy rates affect life expectancy in Brazilian municipalities (Pho & Truong, 2023). The impact of socio-economic factors on life expectancy in Indonesia examines how economic development, healthcare, and education contribute to variations in life expectancy across Indonesia (Kim et al., 2015). Life expectancy in Indonesia has shown a steady increase, reflecting improvements

in the quality of health services, education, and socio-economic conditions. However, there is a significant disparity between more developed provinces such as Yogyakarta and Jakarta and more backward provinces such as Papua and Eastern South-East Nusa. Further endeavors are needed to reduce these disparities, including increased access to quality health services, improved nutrition, and education in underdeveloped areas.

SFH as an initiative that advises the use of yard land for sustainable food production, has an important role in increasing the Life Expectancy Rate (LER). This program has an impact on various factors that contribute directly and indirectly to the health and well-being of the community, which ultimately increases LER in Indonesia. Some important points related to the contribution of SFH to the Life Expectancy Figure:

1. Increased availability of nutritious food, SFH allows families to grow vegetables, fruits, and other food crops that are rich in nutrients, thus ensuring continuous access to nutritious food. Good nutritional intake is essential to prevent various diseases related to nutritional deficiencies, such as anemia, which can affect quality of life and long-term health. Studies show that home gardens increase food diversification and nutrient intake, which contributes to better health and increased LER (Santos, 2022).
2. Healthy eating habits, facilitated by self-sufficient food production through SFH, can reduce the risk of non-communicable diseases such as diabetes, hypertension, and heart disease. These diseases are the leading cause of demise in many developing countries, including Indonesia. By providing access to healthier and fresher foods, SFH helps to lower the prevalence of non-communicable diseases, which in turn increases Life Expectancy (Fahad Javaid Siddiqui et al., 2021).
3. Stress Reduction and Improved Mental Well-being, Gardening not only provides physical benefits but also has a positive effect on mental health. Gardening activities are associated with reduced stress levels, improved mood, and overall mental well-being. Good mental well-being contributes to longevity, which directly increases Life Expectancy. Studies show that home gardens can reduce stress and anxiety, as well as increase life satisfaction (Chalmin-Pui et al., 2021).
4. Physical Activity and Healthy Aging, SFH also advises regular physical activity through gardening activities. Regular physical activity is essential for maintaining heart health, improving mobility, and preventing various diseases associated with aging. Studies conducted in the Netherlands showed that the elderly who engaged in gardening activities had better physical and mental health compared to those who did not garden, which

contributed to healthier aging and increased Life Expectancy (Van den Berg & Jiggins, 2007).

5. Economic Empowerment and food security, SFH plays a role in improving food security and family economy by reducing dependence on the market to buy food, as well as providing more sources of income through the sale of farm products. Better economic stability allows families to access better health services, which in turn contributes to an increase in Life Expectancy (Tesfay et al., 2023).
6. Environmental Conservation, SFH supports environmental sustainability by promoting organic farming practices and water conservation, which are essential for maintaining the quality of the residential environment. A healthy environment contributes to better public health and longevity, which directly increases Life Expectancy (Legesse, 2016).

SFH play an important role in increasing life expectancy through various mechanisms, including increased access to nutritious food, reduced risk of non-communicable diseases, improved mental health, and healthy aging. By contributing to physical and mental health, as well as economic and environmental well-being, SFH serves as an important tool in national strategies to improve the quality of life and extend the life expectancy of the Indonesian people.

Important indicators used to evaluate the success of home gardens in improving access to nutritious food include:

1. Food diversity, a well-managed home garden typically produces a wide variety of vegetables and fruits that are rich in essential nutrients, including vitamins and minerals. Research shows that home gardens increase the diversity of food consumed, which in turn can increase overall nutrient intake (Blakstad et al., 2022).
2. Household food security, home gardens can significantly reduce food insecurity by providing direct access to affordable fresh food sources. A study in Sumatera found that home garden interventions can improve food security and lower rates of malnutrition among children (Maldonado-Guzmán et al., 2023).
3. Improved nutritional status, a well-managed home garden contributes to improved nutritional status by providing a more diverse and nutrient-rich diet. For example, a home garden program in Vietnam has been shown to increase the intake of vitamin A, iron, and other micronutrients among participating households (Abajobir et al., 2017).
4. Reducing food insecurity, home gardens can play an important role in reducing food insecurity by ensuring sustainable food availability

throughout the year, despite challenges such as climate change and economic hardship (Saediman et al., 2021).

5. Positive economic impact, in addition to providing a source of food, home gardens can also contribute to family income through the sale of crops. Home garden programs in the Philippines show that families who own gardens generate more income and have better access to nutritious food (Cabalda et al., 2011).
6. Increasing nutrition knowledge, home garden programs combined with nutrition education can increase understanding of the importance of balanced nutrition, which ultimately promotes a healthier and more balanced diet at the household level (Keepanasseril et al., 2019).
7. Improved well-being and mental health, participation in home gardens not only provides physical benefits through the consumption of healthy foods but also improves mental health and overall well-being through physical activity and social engagement (Palar et al., 2019).
8. Sustainability of food production, home gardens support sustainability by making optimal use of land and using environmentally friendly agricultural practices to produce food sustainably (R. Marsh, 2018).
9. Resilience to food crises, home gardens can serve as a resilient strategy in dealing with food crises by ensuring sustainable access to healthy food amid economic and environmental uncertainty (Honculada-Genove, 2020).
10. A positive influence on children's growth, home gardens can contribute to healthier children's growth by ensuring the availability of nutrient-rich foods, which are essential for their physical and cognitive development (K. Vijayaraghavan et al., 1997).

Through these indicators, home gardens are proven to play an important role in improving access to nutritious food and supporting food security and overall household welfare. Food security, a vital determinant of public health, is often integrated into health indicators as presented in Ministry of Health publications. It encompasses dimensions such as food availability, affordability, accessibility, utilization, and stability, reflecting its direct impact on nutrition and overall health outcomes. The Global Food Security Index (GFSI), for instance, evaluates food security across countries by examining factors like food affordability, availability, and quality. Studies reveal that food security influences health metrics such as child nutrition, dietary diversity, and disease burden, making it an essential component of health monitoring frameworks (Cartelli et al., 2023). Recent research highlights the bidirectional relationship between food security and health indicators. For example, in Ohio, USA, studies

observed a correlation between food insecurity and higher prevalence rates of conditions such as diabetes and hypertension, underscoring the broader public health implications (Spang & Baker, 2000). Similarly, multidimensional indices have been developed to analyze the interplay between food insecurity and health factors like obesity, hypertension, and depression, emphasizing the integrated approach needed to address these challenges (Loopstra, 2018). To enhance public health policy, frameworks like the Healthy Eating Food Index (HEFI) have been designed to align dietary behaviors with national dietary guidelines, reflecting food security's impact on nutrition. This alignment facilitates better monitoring of population health and dietary trends (Cabalda et al., 2011).

7.3. Environmental Sustainability

Environmental sustainability in home garden practices involves several important aspects, including biodiversity conservation, water use efficiency, and waste reduction. The following indicators are important to evaluate the success of home gardens in supporting environmental sustainability:

1. Biodiversity conservation, home gardens can serve as habitats for various species of plants and animals, both above and below ground. This helps maintain biodiversity in urban environments. Research in Ethiopia shows that home gardens contribute significantly to the conservation of plant species, which in turn supports environmental sustainability (Legesse, 2016).
2. Water use efficiency, eco-friendly home garden practices often involve efficient use of water, such as rainwater harvesting and the use of mulch to reduce evaporation. A study in Mexico emphasizes the importance of using sustainable mulch to improve crop yields while maintaining water conservation (Dorta-Afonso et al., 2021).
3. Waste reduction, the use of compost from household organic waste in the garden can reduce the amount of waste that goes into landfills while increasing soil fertility. Studies involving home gardens in various countries show that this practice not only reduces waste but also improves soil quality and supports sustainable agriculture (Spring, 2019).
4. Reduction in the use of pesticides and chemical fertilizers, excessive use of pesticides and chemical fertilizers can damage the environment. Therefore, another important indicator is the decrease in the use of these chemicals through organic gardening methods. A survey of home gardeners in Tennessee, USA, shows that many gardeners prefer gardening products that reduce the need for fertilizers and pesticides, favoring more environmentally friendly gardening practices (Motbainor et al., 2022).

5. Improving soil quality, soil quality is the basis for the sustainability of home gardens. Research shows that good gardening practices can increase soil microbial biomass and decrease metabolic ratios, which are indicators of healthy and productive soil (Hatfield et al., 2001).
6. The use of local plants and native species, utilizing local or native plant species in home gardens can reduce negative environmental impacts and support local ecosystems. Studies in Europe show that the use of native plants is preferred by environmentally conscious gardeners, ultimately supporting ecological sustainability (Blackstock et al., 2007).
7. Reducing greenhouse gas emissions, a well-managed home garden can help reduce greenhouse gas emissions by minimizing the use of synthetic chemicals and optimizing environmentally friendly soil and plant management practices (Masuda, 2023).
8. Ecosystem resilience and resilience, ecologically diverse home gardens tend to be more resilient to environmental disturbances and climate change. Research shows that gardens that take advantage of plant diversity and sustainable farming practices tend to have greater resilience to challenging environmental conditions (Lebacqz et al., 2013).

These indicators show that sustainable home garden practices not only contribute to environmental preservation but also support the long-term well-being of communities by ensuring that natural resources are used efficiently and sustainably.

7.4. Social Welfare and Health

Gardening, both at home and in the community, has been shown to provide significant benefits to the social well-being and health of individuals. Some important indicators that can be used to evaluate the positive impact of gardening on mental well-being, stress reduction, and increased physical activity include:

1. Improved mental health, regular gardening has been shown to improve mental health, including reduced levels of depression and anxiety and improved quality of life. A meta-analysis found that gardening significantly reduced depression and anxiety and improved life satisfaction and overall quality of life (Rajkumar, 2023).
2. Stress reduction, gardening can serve as an effective stress reduction tool. Research shows that gardening in urban environments can reduce stress and promote relaxation, as evidenced through a reduction in diurnal cortisol profiles in participants after gardening interventions (Chalmin-Pui et al., 2021).

3. Increased physical activity, participation in gardening also promotes increased physical activity, which is important for maintaining physical health and reducing the risk of chronic diseases. Studies have found that regular gardening is associated with increased physical activity and overall fitness (Tevald et al., 2021).
4. Improving social welfare, gardening, especially in community gardens, can improve social welfare by facilitating social interaction and building community cohesion. Research shows that participating in community gardens reduces social isolation and improves social relationships among community members (Oh & Kim, 2019).
5. Reduction in body mass index (BMI), some studies have shown that gardening can help control or lower BMI, although the results vary. For example, a study in Tokyo showed that gardeners tended to have better health in general even though the difference in BMI was not significant (Fakier et al., 2017).
6. Increased life satisfaction, life satisfaction and a sense of connection to nature increased with participation in gardening. Research in Canada shows that gardening, although often a solitary activity, provides many social and psychological benefits for the participants (Raymond et al., 2019).
7. Increasing resilience and adaptability, gardening also supports the development of adaptability and emotional resilience, as well as increasing confidence and self-esteem, especially in vulnerable populations such as the elderly (Scott E. Page, 2008).
8. Engagement with the community, gardening increases involvement and participation in the community, which in turn supports mental health and social well-being. This involvement also serves as a way to increase social cohesion and solidarity within the community (Kortright & Wakefield, 2011).
9. The psychological benefits of being in nature, contact with nature through gardening, both in home gardens and communities, have been shown to provide significant psychological benefits, including improved mood and decreased anxiety levels (Chalmin-Pui et al., 2021).
10. Increased intake of fruits and vegetables, gardening directly increases access to fresh fruits and vegetables, which is essential for a healthy diet. Research shows that community garden participants tend to consume more fruits and vegetables than those who are not involved in gardening (Tharrey et al., 2019).

These indicators confirm that gardening has a broad positive impact on social well-being and health, with significant contributions to mental health, stress reduction, increased physical activity, and social cohesion.

7.5. Economic Empowerment

Economic empowerment through home gardens includes the ability of households to generate more income and reduce food costs, which in turn improves food security and economic well-being. Important indicators used to evaluate the economic impact of home gardens:

1. Saving on food costs, home gardens can reduce costs and expenses on food purchases by providing fresh vegetables and fruits that are grown by themselves. Research in California shows that home gardens can save up to \$339 per household per growing season, depending on the type of crops grown and the gardening practices used (Algert et al., 2016).
2. Increased income, home gardens have the potential to increase income through the sale of crops. A study in Senegal found that a successful home garden project can significantly increase a family's income, although not all of the more income is used to buy food (Abajobir et al., 2017).
3. Reducing market dependence, home gardens also serve as a cheaper alternative to buying products from the market, thereby reducing dependence on food cost fluctuations. Research in Nepal shows that organic vegetable production in home gardens can reduce dependence on the market while improving family food security (Dhakal & Poudel, 2020).
4. The use of local resources, home gardens allow optimal use of land and local resources to increase family income. In Indonesia, agroforestry systems in home gardens have been shown to have a higher net value (NPV) now on larger plots of land, especially those dominated by fruit trees (Park et al., 2023).
5. Increasing economic resilience, by lowering production costs and improving land efficiency, home gardens can increase the economic resilience of families in the face of economic or environmental crises (Gong, 2023).
6. Increased productivity and sustainability, sustainably managed home gardens not only increase food production but also provide environmental benefits such as biodiversity conservation, ultimately supporting economic and family environmental sustainability (Raymond et al., 2019).
7. Improved health and nutrition, home gardens that produce fresh vegetables and fruits not only reduce food costs but also increase the nutritional intake of the family, which is essential for long-term health. Studies in Bangladesh show that home garden training can increase vegetable production and

intake of essential micronutrients such as iron and vitamin A (Bhutta et al., 2013).

These indicators confirm that home gardens play an important role in family economic empowerment, by increasing income, reducing food costs, and supporting economic resilience and long-term sustainability. In addition, these indicators have an interrelated interaction with each other, as shown in figure 7.1. Economic empowerment in SFH is an integrated concept, where various indicators such as food cost savings, increased revenue, production cost efficiency, reduction of market dependence, use of local resources, increased economic resilience, females's empowerment, increased productivity and sustainability, improved health and nutrition, and diversify revenue sources are interrelated and mutually supportive. Each of these indicators does not stand alone, but has a close relationship that results in a collective impact on economic empowerment in the context of SFH.

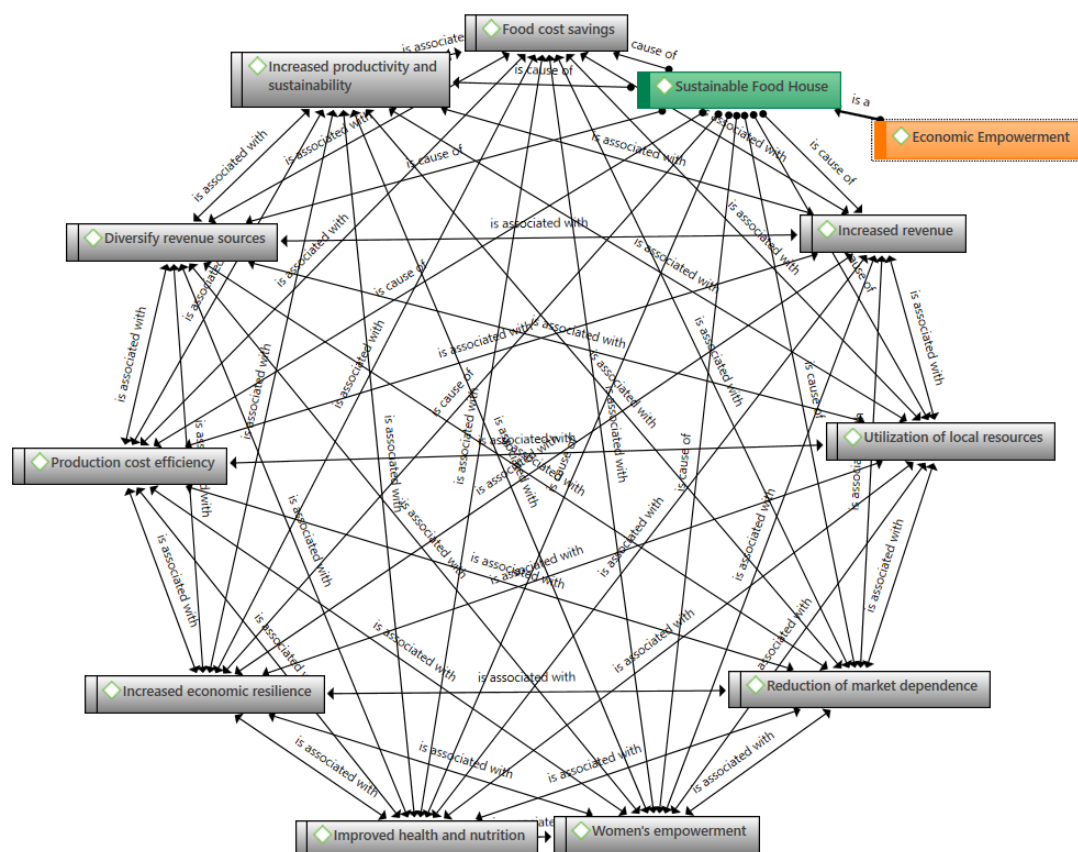


Figure 7.1. The relationship between economic empowerment indicators in SFH

Interaction between Indicators begins with saving food costs through self-production, allowing families to allocate funds that are usually used to buy food to other needs. This not only increases net income (Increased revenue), but also allows investment in other aspects such as education and health. Saving

on food costs also increases the economic resilience of families, which in turn strengthens their economic resilience to market fluctuations (Ward, 2015). The efficiency of production costs resulting from the optimal use of local resources and sustainable agricultural practices allows families to maximize output at minimal cost. This, in turn, allows diversification of income sources by selling products or creating derivative products, which further increases family income and reduces dependence on a single source of income (Boost & Meier, 2017; Tendall et al., 2015). By reducing market dependence through independent food production, families are more protected from market cost volatility and food crises. Increased economic resilience is important in the face of emergencies or economic crises, where access to food and income can be highly uncertain (Ansah et al., 2019; Barthel & Isendahl, 2013).

Use of local resources increases environmental sustainability and agricultural productivity through environmentally friendly and sustainable practices. This reduces transportation costs and increases productivity through a more efficient and localized approach. Increased productivity and sustainability also enable the long-term continuation of the Rumah Pangan Lestari initiative, which supports the sustainability of the family economy (FAOSTAT, 2024). Females's empowerment through SFH gives them an important role in food production and household management, which improves the overall well-being of the family. Improved access to healthy and nutritious food (Improved health and nutrition) as a result of better management by females not only improves family health but also strengthens the role of females in family economic decision-making (Kumar et al., 2023). Better economic resilience also allows females to take a greater role in the household economy, further strengthening their position in society. This creates positive feedback where females's empowerment strengthens economic resilience, which in turn strengthens females's empowerment further (Quisumbing et al., 1996). The integration of various indicators in economic empowerment in the context of SFH creates an ecosystem that supports and strengthens each other. Each indicator contributes to an overall improvement in household economic well-being through interrelated pathways, ensuring that these initiatives are not only sustainable but also have a far-reaching impact on improving the quality of life and economic resilience of families.

To implement the concept of SFH based on figure 7.1., a tiered approach can be designed with strategic steps that involve stages from the individual, community, to national policy levels. At the individual and household level, the main goal is to increase awareness and empowerment of families for food diversification. Education and socialization play an important role by training

families on the importance of a variety of food sources and providing technical training, such as simple gardening methods using hydroponics or verticulture, which allow for the effective use of narrow land. These steps can encourage families to start self-contained food gardens in their yards by growing vegetables, fruits, and spice crops, using cost-effective technologies such as organic fertilizer from kitchen waste. This initiative provides various benefits, including savings in food costs and improved family health and nutrition. Scientific evidence suggests that household-based interventions, such as independent food production, can significantly reduce dependence on commercial food as well as improve access to nutritious food (Mawois et al., 2019).

At the community level, the approach focuses on establishing a sustainability ecosystem through communal gardens and income diversification. The communal garden, which is jointly managed, utilizes local resources and serves as a training center in sustainable food production. Plantation products can also be used to generate more income through sales in local markets or the development of processed food products such as sweet potato chips and herbal products, which supports the diversification of income sources. In addition, female involvement in food management provides more benefits, including economic empowerment and strengthening their social roles. Studies show that this collaborative model supports strengthening food security while increasing female empowerment in the local food sector (Thiele et al., 2023).

At the regional level, the strategy focuses on economic resilience through the optimization of local technologies, the development of market infrastructure, and nutrition campaigns. The use of local technology for food processing, such as sago processing in eastern Indonesia or corn in other regions, increases production cost efficiency while harnessing the potential of local resources. The development of community markets is also a priority to create an efficient food distribution system, which ultimately reduces dependence on large markets and increases people's incomes. Education on nutrition and healthy lifestyles needs to be integrated into regional programs to support balanced diets and prevent stunting. Research supports the importance of local market infrastructure in reducing food insecurity and improving community welfare, especially in rural areas (Hathie et al., 2017).

At the national level, structural support is needed through policies that strengthen local food production. The government can provide subsidies or incentives to encourage food diversification and import reduction. National programs that integrate SFH in food security also need to be prioritized, making it part of poverty and stunting alleviation policies. In addition, monitoring and

evaluation systems must be implemented to ensure the successful implementation of SFH. For example, the measurement of the Hope Food Pattern (HFP) can be used periodically to assess its impact on food security. Research suggests that national policies that focus on sustainable food diversification can help reduce dependence on imported food and increase people's economic resilience (Swaminathan & Swaminathan, 2018).

7.6. The Relatedness of the Optimal Management Aspect of the Home Garden

Home gardening initiatives enhance food security by enabling households to grow diverse, nutrient-dense crops. Studies have shown that homestead gardens increase dietary diversity, improving access to micronutrients that are often lacking in market-dependent diets (Blakstad et al., 2022). Urban gardening in Brazil demonstrated its potential to produce diverse foods, supporting nutrition security while reducing reliance on commercial sources (Sant'Anna de Medeiros et al., 2020). Similarly, a review in Indonesia highlighted home gardens as an essential strategy for mitigating malnutrition and ensuring stable access to vegetables during crises such as the COVID-19 pandemic (Saediman et al., 2021).

Table. 7.3. Optimal management practices for home gardens

Aspects	Expected Conditions	Conditions That Can Be Obtained
Increasing access to nutritious food	- Households produce diverse nutritious foods independently.	- Easier and more affordable access to healthy food.
	- Decreased malnutrition rates at the household level.	- Reduce dependence on market products.
Environmental Sustainability	- Eco-friendly gardening practices support the preservation of biodiversity.	- Reduction in the use of pesticides and chemical fertilizers.
	- The efficiency of water use increases and waste reduction occurs.	- A real contribution to environmental conservation through the reduction of carbon footprint and waste.
Social Welfare and Health	- Improved mental well-being and stress reduction through participation in gardening.	- Quality of life improves through better mental health.
	- Increase physical activity and social cohesion of the community.	- Improvement of social relationships between community members.
Economic Empowerment	- Households earn more income from the sale of garden products.	- Diversification of income sources and increase of purchasing power.
	- Reduction of food costs and improvement of family economic stability.	- Strengthening the local economy through increasing the circulation of money in the local community.

Source: Author's Analysis, 2024

Eco-friendly gardening methods support biodiversity preservation and reduce dependency on chemical fertilizers and pesticides. Sustainable gardening in Cambodia emphasized the strategic management of neglected and underutilized species, promoting sustainable intensification without environmental harm (Pretty, 2018). In Nepal, interventions improved organic gardening practices, significantly reducing harmful agricultural inputs (Shrestha et al., 2022). Participation in gardening improves physical and mental health by reducing stress, fostering a connection with nature, and increasing physical activity. Frequent gardening is linked to better well-being and reduced perceived stress (Chalmin-Pui et al., 2021). Community gardens also promote social cohesion by building relationships and providing opportunities for shared activities (Tharrey et al., 2019). Gardening not only lowers food costs but also generates supplemental income through the sale of surplus produce. In Uganda, households with gardens reported increased income spent primarily on child welfare and savings, highlighting the economic benefits of these interventions (Gerny et al., 2021). A study in Nepal showed home gardens meeting 62% of vegetable needs in intervention households, significantly reducing food expenditures (Sasaki et al., 2005).

Based on four main aspects—increasing access to nutritious food, environmental sustainability, social and health welfare, and economic empowerment—the expected conditions and conditions that can be obtained from optimal management practices of home gardens are as follows (table 7.3). The expected condition of optimal home garden practices is the achievement of a balance between nutritional, environmental, social, and economic benefits, which collectively improve the quality of life of households and communities in a sustainable manner. The conditions that can be obtained reflect the tangible benefits that can be felt directly by the community through the application of these practices.

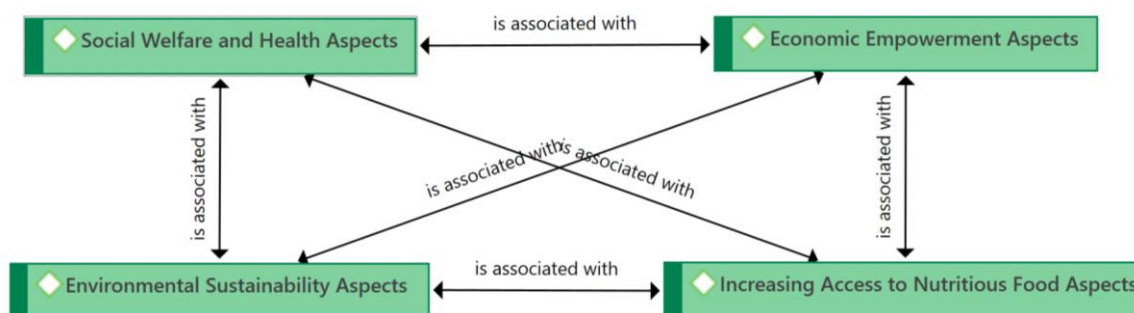


Figure 7.2. The relatedness of the Optimal Management aspect of the Home Garden

Home gardens play an important role in strengthening access to nutritious food, supporting environmental sustainability, improving social welfare and health, and empowering household economies. These four aspects are closely related to each other and have a synergistic impact on the quality of life of the community.

1. Increased access to nutritious food, home gardens allow families to grow different types of nutrient-rich vegetables and fruits, which directly increases access to nutritious food. This is especially important in areas that face food security issues, where home gardens are a reliable and sustainable source of food. Studies in Tanzania show that participation in home garden programs increases food diversity and reduces food insecurity at the household level (Blakstad et al., 2022).
2. Environmental Sustainability, eco-friendly gardening practices help to conserve biodiversity, improve water use efficiency, and reduce waste, all of which contribute to the sustainability of ecosystems. Home gardens also play an important role in the conservation of local plant species that adapt to local environmental conditions, helping to maintain the genetic diversity of plants. Research in Mekelle, Ethiopia, highlights how home gardens contribute to the conservation of plant species and support environmental sustainability in urban areas (Legesse, 2016).
3. Social Welfare and Health, home gardens also provide significant social and health benefits. Participation in gardening can reduce stress, increase physical activity, and strengthen social relationships, especially through interactions in community gardens. In addition, gardening is also associated with improved mental health and a reduction in depressive symptoms. Studies in New Zealand show that students who participate in gardening activities have healthier dietary habits, as well as better levels of physical activity and mental health compared to those who do not garden (van Lier et al., 2017).
4. Economic Empowerment: Home gardens can also empower the family economy by providing more sources of income through the sale of crops and reducing food costs. In many communities, home gardens provide not only food but also an important source of income, especially for families with limited resources. For example, in the Philippines, home gardens have been shown to increase children's dietary diversity and the frequency of vegetable consumption, which in turn also helps families save on spending on food purchases (Cabalda et al., 2011).

These four aspects are interrelated and mutually reinforcing. Increasing access to nutritious food through home gardens directly impacts health and

social well-being, which in turn strengthens household economic resilience. For example, when households have better access to nutritious food, they tend to have better health, which reduces health costs and increases work productivity, thus strengthening the family economy. On the other hand, sustainable home garden practices support environmental conservation, which in turn ensures the long-term sustainability of the household farming system. By preserving biodiversity and using resources efficiently, home gardens become more resilient to climate change and food market fluctuations, which helps protect family food security. Home gardens bid holistic solutions that support food security, environmental sustainability, social welfare, and economic empowerment simultaneously. The integration of these four aspects allows home gardens to be an effective tool in addressing global challenges such as hunger, malnutrition, climate change, and economic inequality.

Part 7 discusses various problems related to optimal home yard management, focusing on challenges in improving household food security, overcoming stunting, and supporting environmental sustainability. The main factors discussed include the high prevalence of stunting in several regions, low access to nutritious food, lack of food diversification, and dependence on markets that limit household food independence. In addition, there are still limitations in nutrition education and the implementation of sustainable practices in the yard. The main objective of Part 7 is to identify ways to maximize the potential of home yards in supporting food security, increasing nutritional intake, reducing the prevalence of stunting, and empowering communities economically. With the right approach, the yard can be a sustainable source of nutritious food while supporting the social and economic welfare of the community. Part 7 provides a number of important suggestions, such as encouraging the diversification of plants in the yard to meet more diverse nutritional needs, reducing dependence on the market through the empowerment of home yards, and increasing public education on the importance of healthy eating. In addition, the implementation of environmentally friendly agricultural practices and efficient use of resources is also an important part of an optimal yard management strategy. For the future, what is important to do is to expand nutrition education programs and yard management in a sustainable manner, including providing technical support to the community to increase yard productivity. In addition, more comprehensive policies are needed to encourage the sustainability of these initiatives, as well as collaboration between the government, the private sector, and local communities to ensure long-term success. Part 7 highlights the strategic role of home yards in addressing various food and nutrition challenges. With good management, yards can be an effective solution to

increase food security, reduce stunting, and create a healthier and more prosperous life for the community. Policy support and consistent educational programs will be the key to realizing the full potential of the yard.

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Part 8

Food Pattern of Hope

Husnah Rahman, Andi Tenri Awaru

8.1. The Context of the Hope Food Pattern

The Hope Food Pattern (HFP) is a concept that describes the quality and diversity of nutrition in people's consumption patterns, which reflects the balance of consumption of various food groups. The Sustainable Food House Area (SFHA) program is designed to support HFP by optimizing the use of home yards as a sustainable food source. This program has been proven to improve HFP scores, especially through healthier and more diverse food diversification in several regions such as Yogyakarta and East Nusa Tenggara (N. Firdaus & Cahyono, 2017). In Yogyakarta, the community has become more cognizant of the importance of food diversification, as evidenced by food consumption that is more varied and balanced than other regions that have not adopted SFHA optimally (N. Firdaus & Cahyono, 2017). The SFHA program also shows a positive impact on household welfare through increased income and food independence (Kurniawan et al., 2018). In some areas such as Pasuruan, SFHA makes a significant contribution to food security through the effective and sustainable use of home yards (Khuswati et al., 2022). The implementation of SFHA has also proven to be effective in improving HFP scores in Aceh, although the results are still below national standards (Mayusa et al., 2018). Factors such as education, family size, and family income greatly influence the achievement of a better HFP score. Families with better nutritional knowledge and higher incomes tend to have higher HFP scores, which indicates healthier and more varied food consumption (Dewi & Utami, 2019). On the other hand, the SFHA program in West Lampung Regency shows that the level of food accessibility and HFP scores are higher in households participating in the program compared to those who do not participate (Oktarina et al., 2023). Overall, the SFHA program has great potential to improve nutritional quality and food security through more balanced and sustainable dietary diversification (Rahayu et al., 2021). However, to achieve optimal results, there needs to be an increase in socialization and nutrition education to the

community, as well as sustainable policy support from the government and related institutions (Juntra Utama et al., 2023).

The concept and scope offered in the HFP and the implementation of the SFHA can be arranged in several main aspects as follows:

1. Nutritional Quality

Optimal nutritional quality is one of the main goals of a balanced diet. Calorie and macronutrient intake such as carbohydrates, proteins, and fats, as well as the adequacy of micronutrients, are key elements that must be considered in assessing the nutritional quality of a population. This concept is increasingly relevant in the context of the HFP, which serves as an indicator to measure how close people's diets are to the expected standards to achieve nutritional balance.

Adequate calorie intake is essential for maintaining daily body function and energy. Studies conducted in West Sumatra show that calorie intake in the elderly population in rural areas is still far below the recommended daily requirement, with most of the population consuming less than 1500 calories per day. This is in contrast with the urban population which has a better calorie intake, although there are still a small percentage that does not reach 2000 calories per day (Nakano et al., 1997). This condition shows that urbanization factors have a significant effect on calorie and macronutrient consumption patterns.

In addition to macronutrients, the adequacy of micronutrients such as vitamins and minerals also plays a crucial role in health. A study in Banten, Indonesia, using the CIMI (Calculator of Inadequate Micronutrient Intake) application, found that most children under the age of five are deficient in micronutrients, including vitamin A, iron, and zinc (Fetriyuna et al., 2022; Hatma et al., 2005). This micronutrient shortfall indicates significant nutritional disparities in several regions in Indonesia, especially in rural areas where food accessibility is limited.

HFP is an index that measures the variation and balance of food consumption based on the energy contribution of various food groups. Higher HFP scores indicate better food variety and consumption closer to the ideal diet. Studies conducted using "ddp package" software in Indonesia show that most of the population has a low HFP score, which means that energy, protein, and carbohydrate consumption is still not optimal (Budiaji et al., 2021; Rahmannia et al., 2019). Other studies show that micronutrient deficiencies such as calcium, iron, vitamin A, and vitamin C are still prevalent among adults in Indonesia. This indicates that despite food fortification endeavors, such as wheat flour enriched with iron and

zinc, more diverse and nutritious food consumption is still needed to meet the needs of micronutrients (Ickowitz et al., 2016; Prasetyo et al., 2018).

The implementation of nutritional quality through the measurement of calorie, macronutrient, micronutrient, and HFP score shows that there are still major challenges in achieving optimal nutritional balance in Indonesia. Endeavors to improve the quality of food consumption, diversify food, and increase access to nutritious food must continue to be carried out to improve the HFP score and achieve the expected nutritional balance.

2. Food Diversity

Food diversity is an important indicator that reflects the quality of a population's diet and nutrition. Food diversification, which includes the consumption of various food groups such as vegetables, fruits, grains, and animal products, plays an important role in ensuring that nutrient intake is properly met. The use of local food is also a crucial aspect in supporting food sustainability and reducing dependence on imports.

Food diversification, or food variety in the daily diet, contributes significantly to nutritional adequacy. Studies show that households in Indonesia are experiencing a decline in food diversity as agricultural specialization increases, focusing on some high-value commodities such as rice, compared to more diverse traditional farming methods. As a result, the consumption of nutritious food groups such as fruits, vegetables, nuts, and fish decreased, although household incomes increased (Mehraban & Ickowitz, 2021). This shows that food diversification is greatly influenced by production patterns and market access.

In the context of children in Indonesia, food diversification has been proven to be directly related to their nutritional status. Research shows that children with more diverse diets tend to have better nutritional status, while a lack of food variety can lead to nutritional problems such as malnutrition and stunting (Colozza & Avendano, 2019). The use of local food in the daily diet not only supports food security, but also supports the sustainability of the environment and local economy. Local food, which is often more suited to local geographical and cultural conditions, can reduce dependence on imported food and strengthen food independence. In some regions of Indonesia, such as Yogyakarta, people have succeeded in diversifying food consumption by using local food, which ultimately increases the HFP score and supports household food security (N. Firdaus & Cahyono, 2017). On the other hand, research also shows that the shift from local food consumption to imported or processed food can have a negative impact on food diversity and health. For example, a change in diet from traditional food consumption to a "Western" diet high in fat, sugar, and

animal products has been identified in several cities in Indonesia, resulting in decreased nutritional quality and an increased risk of non-communicable diseases (Colozza & Avendano, 2019).

Food diversification and local food use play an important role in ensuring good nutritional quality and food security. By encouraging diversified food consumption and supporting local food production, Indonesia can reduce its dependence on imports and improve people's health and well-being. However, to achieve this, there needs to be supportive policies as well as education and awareness that continues to be increased regarding the importance of food diversification and local food use.

3. Food Security

Food security is a concept that includes adequate food availability, accessibility, and food safety for all communities. In Indonesia, endeavors to strengthen food security are closely related to food availability, food security, and reducing dependence on imported food through various programs, including the SFHA.

Food availability in Indonesia, especially at the household level, is highly dependent on local food production and efficient distribution. Research shows that despite the increase in food production, food availability in some regions still faces significant challenges. In Bali, for example, the availability of food, mainly from carbohydrate and protein sources, shows adequate results, but the dependence on imports is still high enough to meet certain needs (Antara & Sri Sumarniasih, 2020).

In more remote areas such as East Nusa Tenggara, food availability problems are often caused by low food production due to unfavorable natural conditions, such as low rainfall. In addition, poor infrastructure also hinders efficient food distribution, which further exacerbates the problem of food availability (Rina Herawati et al., 2023).

Food safety is an important aspect of food security that includes the feasibility of food consumption and the minimum risk of contamination. In Indonesia, food safety issues often arise due to a lack of awareness about the importance of food safety among both producers and consumers. The use of inappropriate food additives, contamination during the production process, and inadequate storage are some of the main challenges in ensuring food safety (Wirakartakusumah & Hariyadi, 2005).

In addition, suboptimal food policies also contribute to this problem. Several studies show that stricter supervision and regulation are needed to ensure that the food available in the market is not only sufficient in quantity but also safe for consumption (Ika et al., 2016).

The SFHA program and similar initiatives aim to reduce dependence on imported food by increasing local food independence. The wider use of local food through these programs not only strengthens food security but also supports local economies and environmental sustainability. In some areas, the implementation of SFHA has shown positive results, where households involved in this program tend to have better food security compared to those who are not involved (Nona et al., 2019). However, despite significant endeavors to promote food independence, dependence on imports is still a challenge, especially for certain commodities such as rice and soybeans. To overcome this, more comprehensive policies and sustained support from the government as well as active participation from local communities are needed (Limenta & Chandra, 2017; McCarthy & Obidzinski, 2017).

To achieve sustainable food security, Indonesia needs to focus on improving food availability and security, as well as reducing dependence on imports through programs such as SFHA. Although challenges remain, the steps taken so far show that with the right policies and active participation from various parties, better food security can be achieved.

4. Nutrition Education and Knowledge

Education and nutritional knowledge are important components in endeavors to improve public health, especially in the context of balanced diets and the use of local resources. The implementation of effective nutrition socialization and education programs can change people's eating habits and increase awareness of the importance of balanced nutrition, which can ultimately improve the nutritional status of the population.

Socialization related to healthy eating and the use of home yards has become the main focus in various programs in Indonesia. One study showed that nutrition education conducted through socialization campaigns significantly increased public understanding of the importance of balanced nutrition during the COVID-19 pandemic. These programs not only include explanations about healthy eating, but also include training on how to read food labels, allowing people to make healthier food choices (Rahmah et al., 2022).

In addition, training for communities in rural areas on balanced diets and food safety shows that community-based education can improve people's understanding of how to choose and process food correctly. This education often includes hands-on practice and question-and-answer sessions, which have proven effective in increasing public knowledge about balanced nutrition (Mauludyani et al., 2023; Weerasekara et al., 2020).

The nutritional knowledge possessed by the community plays an important role in determining daily diet and overall health status. Studies in Indonesia show that maternal education, especially regarding child nutrition, has a great influence on children's nutritional status. Mothers who have good nutrition knowledge tend to provide their children with more varied and healthy foods, which in turn reduces the risk of malnutrition and nutrition-related diseases (Gibson et al., 2021; Sucipta et al., 2019). Furthermore, research shows that nutrition education in schools can form healthy eating habits from an early age. For example, an interactive educational module developed for elementary school teachers in Bogor has succeeded in increasing children's knowledge about balanced nutrition, as well as forming better eating habits through fun and educational activities (Aries et al., 2018; Soon, 2014).

Effective nutrition education and knowledge through socialization and educational programs can have a significant impact on public health. By raising awareness about the importance of a balanced diet and the use of local resources, as well as providing comprehensive nutrition education at various levels, people can better manage their diets and improve their overall nutritional status.

5. Social and Economic Welfare

The SFHA program is one of the Indonesian government's initiatives to improve the social and economic welfare of the community through the use of home yards as an more source of income. The program not only focuses on food security, but also on improving family income and overall quality of life.

The use of home yards through SFHA has been proven to increase family income, especially in rural and small urban areas. Research in Asahan Regency shows that participation in SFHA can significantly increase household income. Before participating in the SFHA program, the average household income was IDR 1,500,000 per month, and after participation, the income increased to an average of IDR 2,240,000 per month (Satria et al., 2023). This increase shows that the SFHA program plays an important role in improving household economic conditions by providing more sources of income through yard crops. In addition, in Banten, SFHA also contributes to dietary diversification and savings in household expenditure on fresh vegetables. Many families who participate in the program report a decrease in monthly spending on vegetables, as they can meet most of their vegetable needs from their own yards. This not only increases net income but also advises a healthier diet (Rastiyanto Amrullah et al., 2017).

The implementation of SFHA also has an impact on improving overall household welfare. Research in Gianyar shows that the SFHA program has a significant economic impact on female farmer families who are members of farmer groups. In addition to increasing income, this program also improves social welfare by strengthening social networks and cohesion between group members (Anindya et al., 2021; Yohana S. Kusuma Dewi, 2019). This increase in social welfare also contributes to a better quality of life, which includes aspects such as health, education, and involvement in social activities. However, despite the increase in welfare, challenges remain, especially related to the scale of activities and market access. In some regions, the economic impact of SFHA is still limited due to limited access to a wider market and small business scale (Simanihuruk & Sitorus, 2018). Therefore, further support from the government and related parties is needed to expand the positive impact of this program, such as through more training, market access development, and increased production capacity. The SFHA program has shown a real impact in increasing household income and welfare in Indonesia. Despite challenges, such as limited market access, this program remains one of the important initiatives in strengthening the household economy through the use of yards as an more source of income. To optimize its benefits, continuous support from various parties is needed, especially in capacity building and market access.

6. Sustainable Environment

Sustainable environment in the context of yard agriculture involves the judicious use of natural resources and efficient waste treatment. Good implementation of these two aspects is important to maintain the balance of the ecosystem while increasing the productivity of household agriculture.

The use of yards to grow food crops must be done in a way that does not damage the ecosystem. Sustainable land management requires strategies that minimize soil degradation, maintain biodiversity, and use water and nutrients efficiently. In North Sumatra, for example, studies show that well-managed agriculture can maintain soil fertility and reduce negative impacts on the environment, such as soil erosion and deterioration of water quality (M. Firdaus et al., 2021). In addition, agroforestry practices in South Sulawesi show that the integration of different types of plants in the yard not only increases land productivity but also contributes to the preservation of biodiversity. This agroforestry system allows for more efficient and sustainable land management, which

ultimately also increases the income of household farmers (Paembonan et al., 2018).

Proper waste treatment is also an important aspect of sustainable yard farming. Effective household waste management can support agriculture by providing nutrient-rich natural compost and fertilizers. In Gianyar, Bali, waste treatment projects have shown that the separation of organic and non-organic waste and composting can produce fertilizers that are useful for improving the fertility of yard soils, while reducing the amount of waste disposed of in landfills (Mardiana et al., 2017; Susmono, 2017). In addition, the circular economy approach to waste management in Surakarta shows that the application of the 3R principles (Reduce, Reuse, Recycle) can provide economic and ecological benefits. The study found that communities that implement the 3Rs can reduce waste management costs, increase income through the purchase of recycled products, and reduce negative environmental impacts (Fatimah et al., 2020; Marwanti et al., 2023). Sustainable management of natural resources and waste treatment is essential in supporting productive and environmentally friendly yard agriculture. Proper implementation can preserve ecosystems, increase land productivity, and provide economic benefits for households. Existing studies show that with good management, yards can become a sustainable resource to meet food needs while maintaining environmental balance.

7. Infrastructure and Policy Support

Strong infrastructure and policy support are key elements in the success of the SFHA and HFP programs. Without this support, the goal of improving food security and household economic welfare through yard use will not be achieved optimally.

Government policies play an important role in the implementation and success of the SFHA program. The Government of Indonesia has shown a significant commitment to sustainable agricultural development, including through SFHA. For example, in Katingan Regency, Central Kalimantan, research shows that supportive policies and adequate resource involvement contribute greatly to the success of this program. However, challenges remain, especially in aspects such as community involvement and the fulfillment of the expected benefits of the program (Br Saragih et al., 2021). Another study in Tanah Bumbu Regency shows that the management and supervision of village infrastructure development, especially those that support agricultural activities, still need to be improved. Better support from village governments and community participation is essential to optimize existing infrastructure (Rastiyanto

Amrullah et al., 2017). Strong policies, focused on community empowerment and optimization of local resources, are also needed to address these constraints.

The availability of adequate infrastructure is essential to support the sustainability and effectiveness of the SFHA program. Infrastructure such as irrigation, agricultural roads, and crop storage facilities play an important role in increasing the productivity and efficiency of agricultural activities. In Malang Regency, for example, although there are many agricultural programs, only a few them effectively support sustainable agriculture due to limited infrastructure and socio-cultural problems of the community (Fitri et al., 2022). In addition, improving agricultural infrastructure has also been proven to improve economic performance and reduce poverty in rural areas. Analysis with the Computable General Equilibrium (CGE) model shows that improving agricultural infrastructure such as irrigation and land transportation significantly increases rural household income and reduces poverty levels (Rahman, 2022).

Strong policy support and infrastructure are critical to the success of the SFHA and HFP programs. The government must continue to strengthen policies that support and improve agricultural infrastructure to ensure that these programs can run effectively and provide maximum benefits to the community. Despite the challenges, research shows that with careful planning and community participation, the goals of these programs can be achieved more effectively.

8.2. Significance of Income Tax

The HFP is an important tool in measuring the quality and diversity of food consumption of a population. This concept provides an overview of the extent to which people's consumption patterns are close to the ideal diet, which can meet nutritional needs in a balanced and varied manner. HFP is used to assess how diet can affect nutritional well-being and overall population health.

1. Evaluation of Quality and Diversity of Community Consumption Nutrition

The evaluation of HFP is carried out by calculating a score that reflects the variation and balance of nutrients in the food consumed by the community. Studies conducted in various regions of Indonesia, such as Yogyakarta and East Nusa Tenggara, show that higher HFP scores correlate with a more varied and healthy diet. In Yogyakarta, a higher HFP score indicates that people have more diverse consumption patterns, which include various food groups such as vegetables, fruits, and animal products. In contrast, in East Nusa Tenggara, lower HFP scores reflect less

varied diets, which can negatively impact the nutritional status of the population (N. Firdaus & Cahyono, 2017). Another study showed that low HFP scores are often found among children aged 2-6 years in Indonesia, indicating a shortfall in the intake of energy, fat, and essential micronutrients such as calcium and vitamin A. This indicates that an unbalanced diet can contribute to nutritional problems, including stunting and malnutrition in children (Prasetyo et al., 2014).

Table 8.1. Reference Strategic aspects in HFP

Strategic Aspects	Description	Intervention Rate
Nutrition Education and Extension	Raising public awareness of the importance of a balanced and varied diet through nutrition education programs, especially among mothers and children.	Individuals and Communities
Strengthening the Food Subsidy Program	Providing better access to nutritious food sources through subsidy programs for poor families, which include vegetables, fruits, and animal products.	Community and Policy
Empowerment of Local Farmers	Increasing the production and distribution of nutritious local food through support to smallholders, including training and access to markets.	Community
Diversification of Agriculture and Food Products	Encourage the diversification of agricultural products to ensure the diversity of available foods, with a focus on nutrient-dense foods such as legumes.	Community and Policy
Improving Food Access and Availability	Build an effective food distribution infrastructure to ensure the availability and access to nutritious food in remote areas.	Policy
Development of Nutrition and Local Food Gardens	Develop nutrition gardens in households and schools to provide fresh vegetables and fruits, which can be directly consumed by the community.	Individuals and Communities
Tax Policy and Nutrition Subsidy	Implement tax policies for unhealthy foods and subsidies for nutritious foods to make them more affordable for the wider community.	Policy
Micronutrient Supplement Program	Give micronutrient supplements to vulnerable groups, such as children and pregnant females, to meet the needs of essential nutrients that may be lacking.	Individuals and Communities
Periodic Monitoring and Evaluation of Nutrition	Conduct periodic monitoring and evaluation of the nutritional status of the community to identify nutritional problems early and make appropriate interventions.	Policy
Development of Nutrition Information System	Building a data-based nutrition information system to support the formulation of more targeted policies and programs.	Policy

Source: Author's Analysis, 2024.

To overcome the problem of quality and nutritional diversity of public consumption, especially as reflected in the low HFP score, here are some

strategic aspects that can be used. These aspects include interventions that can be undertaken at the individual, community, and policy levels to improve people's diets and nutritional status. Table 8.1. covering various strategic aspects that can be used to improve the quality and diversity of nutrition for public consumption in Indonesia. Each strategy has different levels of intervention, ranging from individual levels to national policies. The simultaneous implementation of these strategies is expected to increase HFP scores and reduce nutritional problems such as stunting and malnutrition in the community.

2. Role in Improving Population Nutritional Well-Being

HFP not only serves as an indicator of the quality of food consumption, but also as a tool to identify the need for more specific nutritional interventions. For example, in Banggai Laut Regency, the implementation of HFP shows that there is still a gap in meeting energy and protein needs among the community, which indicates food inadequacy. Using HFP scores as a basis, interventions can be directed to increase access to and availability of more nutritious and balanced food (Damayanti et al., 2022). On the other hand, increasing HFP in an area can directly contribute to improving social and economic welfare. For example, by encouraging diversification of food consumption and the use of local resources, people not only get health benefits but also increase food independence and reduce dependence on imports (Argandi et al., 2018), some of the strategic aspects that can be used are contained in table 8.2. This table includes strategies that can be applied to address disparities in the fulfillment of nutritional needs, as well as ways to improve social and economic well-being through improving HFP scores.

Table 8.2. describe various strategies that can be applied to improve the nutritional welfare of the population through the use of HFP. By focusing on improving access, diversifying local food sources, and developing specific nutrition intervention programs, it is hoped that the social and economic welfare of the community will also improve. The implementation of these strategies requires the involvement of various parties, from the individual level to national policies.

The significance of HFP lies in its ability to measure and evaluate the quality and diversity of people's consumption nutrition, which ultimately has an impact on the nutritional welfare of the population. By increasing the HFP score, both through supportive policies and nutritional interventions, the quality of life of the community can be improved as a whole.

Table 8.2. Role in Improving Population Nutritional Well-Being

Strategic Aspects	Description	Intervention Rate
Increasing Access to Nutritious Food	Increasing public access to nutritious food through more equitable distribution, especially in areas with high nutritional disparities.	Community and Policy
Diversification of Local Food Sources	Encourage diversification of food sources by utilizing local potential such as nutrient-rich plant and animal products to meet energy and protein needs.	Community and Policy
Development of Specific Nutrition Programs	Develop specific nutrition intervention programs based on HFP scores to address energy and protein deficiencies in specific areas.	Community and Policy
Community Empowerment in Food Management	Increasing community independence in food management through training and counseling on healthy and nutritious food production.	Community
Reducing Dependence on Imported Food	Reduce dependence on imported food by strengthening the production of nutrient-rich local food, which will also boost the local economy.	Community and Policy
Strengthening Food and Logistics Infrastructure	Improve infrastructure and logistics to ensure the availability and distribution of nutritious food throughout the region, including remote areas.	Policy
Healthy Food Consumption Campaign	Conduct a healthy food consumption campaign that focuses on increasing HFP to encourage changes in people's eating behavior in a healthier and more balanced direction.	Individuals and Communities
Development of Food Processing Technology	Developing and introducing food processing technology that can increase nutritional value and extend the shelf life of local food products.	Community and Policy
Periodic Monitoring and Evaluation of Income Tax Score	Conduct periodic monitoring and evaluation of HFP scores in various regions to assess the effectiveness of nutrition programs and make policy adjustments if necessary.	Policy
Improving Nutrition Education in Schools	Incorporate education about the importance of HFP and nutritious food consumption into the school curriculum to form healthy eating habits from an early age.	Individuals and Communities

Source: Author's Analysis, 2024.

8.3. SFHA Slice with Food Security and HFP

SFH plays a key role in improving food security in Indonesia. This program focuses on the use of yard land for food production, which is directly related to endeavors to increase food availability, affordability, and use at the household level. By utilizing the yard of the house to grow various types of food crops, this program not only contributes to food diversification but also supports food independence. SFH aims to improve food security through a more decentralized approach, namely by encouraging people to produce their own

food. Research shows that SFH has a positive impact on food availability, especially in households that are actively involved in this program. For example, a study in Banten showed that SFHA was able to reduce household spending on vegetables, which in turn increased household income (Rastiyanto Amrullah et al., 2017). This program also helps the community in dealing with economic uncertainty by providing a stable and affordable source of food.

In addition, SFH also contributes to better food use, where yard produce is not only used for personal consumption but can also be sold, providing more income for families. A study in Gianyar Regency, Bali, showed that the SFH program had a positive impact on the social and economic well-being of the female farmers involved, improving their overall well-being (Suputra et al., 2016). SFH also has a role in supporting food diversification, which is an important element in food security. By planting various types of plants in the yard, households can better meet their nutritional needs, as evidenced by the improvement in food diversification and consumption quality in the Yogyakarta region (Trianingsih et al., 2023). This food diversification is important to ensure that nutritional needs are met and the risk of malnutrition can be reduced.

However, challenges remain in the implementation of SFH, especially related to program sustainability and community engagement. Research in Pasuruan shows that although SFH has the potential to be implemented sustainably, the economic aspects of the program still require further attention to ensure long-term sustainability (Khuswati et al., 2022). This shows the importance of continuous support from the government and community capacity building to ensure the success of SFH. SFH not only supports food security through increasing food availability and affordability, but also contributes to improving the socio-economic welfare of the community. The program offers practical and sustainable solutions to food security issues, especially in regions that are vulnerable to economic and environmental uncertainty.

SFH and HFP are interrelated in an effort to improve food security and the quality of community nutrition. Both contribute to creating healthier and more sustainable food consumption patterns, with a focus on food diversification and the use of local resources. The relationship between SFHA and HFP is shown in several indicators, Food diversification in SFH advises households to plant various types of food crops in their yards. This plant diversification is by the HFP principle which emphasizes the importance of food variety in the diet to meet nutritional needs. With the SFH, it is easier for people to access various types of food, such as vegetables, fruits, and medicinal plants, which can increase their HFP score. The use of local resources, HFP advises food consumption based on local resources, and SFHA provides the means to realize

this. Through SFH, people can reduce their dependence on imported or processed foods, and switch to fresher and more nutritious local foods. This is in line with HFP's goal to achieve a healthier and more sustainable diet.

Improving nutritional quality, SFH contributes directly to improving the quality of household nutrition by providing easy access to fresh and nutritious food. This can increase the HFP score which measures how close people's diets are to the expected nutritional standards. Studies show that households involved in SFH tend to have healthier consumption patterns, with an increase in the consumption of vegetables and fruits (Rastiyanto Amrullah et al., 2017). Household food security, SFH supports the achievement of HFP by strengthening food security at the household level. By utilizing the yard for food production, households can increase the availability and accessibility of nutritious food, which in turn supports the achievement of higher HFP scores. Reducing food dependence, HFP emphasizes the importance of reducing dependence on external food sources, which is in line with SFHA's goal to make the most of yard land. Thus, SFHA helps households to be more independent in meeting their food needs, which is the core of HFP's philosophy. SFH plays an important role in supporting the HFP by providing the means for food diversification, use of local resources, and improvement of household nutrition quality. Thus, SFH not only helps to achieve food security, but also supports a healthier and more sustainable diet, in line with HFP goals.

The HFP is described in several indices, namely the food availability, affordability, use, and security indices in all regions in Indonesia in 2021 and 2022. Some provinces showed a positive trend in improving food security, while others showed challenges that needed to be addressed. In 2021 (table 8.3), the food security index, which includes food availability, affordability, and use, provides an overview of how well provinces in Indonesia are able to ensure food security for their populations. From the data provided, we can identify disparities between regions that reflect differences in infrastructure, policies, and socio-economic conditions. Food availability, which measures how easily food is available in a region, varies widely between provinces. Provinces such as Lampung (95.61), West Nusa Tenggara (93.09), and South Kalimantan (91.45) show very high scores, indicating that food is widely and regularly available in the region. In contrast, provinces such as Papua (8.89), West Papua (14.83), and North Maluku (18.79) have very low availability scores, which indicate major challenges in food distribution that may be caused by poor infrastructure or difficult geographical conditions.

Food affordability, which measures the ability of the population to buy food, also shows significant variation. Provinces such as Bangka Belitung Islands (92.08), Central Kalimantan (89.99), and East Kalimantan (89.68) show

high affordability scores, indicating that while there may be challenges in food availability, people have relatively strong purchasing power. On the other hand, provinces such as Papua (49), West Papua (59.25), and Maluku (65.02) showed lower scores, indicating economic problems that worsened food security in these regions.

Table 8.3. Provincial Food Security Index in Indonesia in 2021

Province	Availability	Affordability	Use	Composite
Aceh	81.05	69.86	68.67	71.63
North Sumatera	82.41	74.5	65.55	72.25
West Sumatera	85.05	83.23	73.45	79.55
Riau	32.55	86.47	71.23	66.84
Jambi	70.68	82.94	69.36	74.18
South Sumatera	84.83	73.77	59.41	69.55
Bengkulu	81.69	73.68	60.35	70.32
Lampung	95.61	78.87	66.04	77.96
Bangka Belitung Islands	41.56	92.08	78.14	73.22
Riau Islands	0	87.35	74.56	63.26
Jakarta	0	81.44	81.77	78.01
West Java	85.53	79.81	73.1	77.79
Central Java	89.74	81.36	79.74	82.73
Yogyakarta	83.22	79.06	82.02	81.43
East Java	91.16	79.54	73.75	79.7
Banten	83.58	83.6	63.88	74.38
Bali	75.32	91.65	82.74	83.82
West Nusa Tenggara	93.09	76.51	65.16	75.67
Eastern South-East Nusa	86.48	58.6	59.91	67.35
West Kalimantan	80.52	84.86	55.71	71.32
Central Kalimantan	62.93	89.99	68.51	73.68
South Kalimantan	91.45	89.26	66.93	80.29
East Kalimantan	53.7	89.68	78.57	77.46
North Kalimantan	51.71	89.77	71.81	73.02
North Sulawesi	75.58	84.06	75.2	78.3
Central Sulawesi	80.08	77.46	71.08	75.73
South Sulawesi	93.88	81.5	71.8	80.82
Southeast Sulawesi	81.09	77.07	73.15	76.64
Gorontalo	96.54	78.66	71.63	80.52
West Sulawesi	87.87	81.96	61.35	75.49
Maluku	42.15	65.02	63.72	58.7
North Maluku	18.79	87.17	61.16	59.58
West Papua	14.83	59.25	56.29	46.05
Papua	8.89	49	43.71	35.48

Food use, which measures how well the available food is used to meet nutritional needs, also shows variation. Provinces such as Yogyakarta (82.02) and Bali (82.74) have excellent use scores, indicating that people not only have access to food but also understand how to utilize it to meet their nutritional needs. In contrast, provinces such as Papua (43.71), West Papua (56.29), and

Eastern South-East Nusa (59.91) showed lower scores, indicating the need for interventions in nutrition education and access to the resources needed to utilize food more effectively.

Provinces on the island of Java such as Central Java (82.73), East Java (79.7), and DI Yogyakarta (81.43) show relatively high levels of food security, supported by good infrastructure, supportive government policies, and higher levels of education. The high composite scores in these regions reflect a good balance between food availability, affordability, and use. In contrast, provinces in eastern Indonesia such as Papua (35.48) and West Papua (46.05) continue to show much lower composite scores, indicating persistent challenges in all aspects of food security. This highlights the need for larger, more focused interventions to address significant gaps in food security between these regions and more developed provinces. Disparities in food security between Indonesia's western and eastern regions reflect deep-seated structural problems, including unequal access to infrastructure, disparities in economic strength, and varying levels of education. To improve food security in underdeveloped provinces, governments need to focus on improving infrastructure, such as transportation networks and food storage facilities, as well as strengthening nutrition education programs and access to markets. This condition refers to the study of (N. Firdaus & Cahyono, 2017)–A study on food consumption patterns and diversification in Indonesia. (Damayanti et al., 2022)–Improving food security through the HFP in Banggai Laut. (Prasetyo et al., 2014)–The relationship between HFP and nutritional problems. (Sekartaji et al., 2021)–Analysis of food diversification and the factors that influence it. (Irawan et al., 2012)–The impact of infrastructure improvement on food security in Indonesia. (Rahayu et al., 2021)–Trends and determinants of food diversification in children in Indonesia. (Budiaji et al., 2021)–The use of software for the analysis of HFPs. (Khusun et al., 2022)–A study on protein sources and socio-demographic differences in Indonesia. (Damayanti et al., 2022)–Improving food security through the HFP in Banggai Laut. (Juber et al., 2024)–The relationship between food consumption patterns and physical strength among adults in Indonesia. This analysis shows that to achieve more equitable food security across Indonesia, there needs to be more focused policies and significant infrastructure improvements, especially in underdeveloped areas.

Data for 2022 (table 8.4) shows the food availability, affordability, use, and composite indices in various provinces of Indonesia. The index provides insights into food security based on three main aspects, food availability (how easily food is available), affordability (people's ability to buy food), and use (how food is used to meet nutritional needs). There is a striking difference in composite scores among the provinces in Indonesia. Provinces in Java such as

Central Java (82.95), East Java (79.85), and DI Yogyakarta (80.88) show high composite scores, reflecting relatively strong food security. Central Java scored high in all aspects, with the highest score in use (80.69), which shows that people in this province not only have good access to food, but are also able to make optimal use of it to meet their nutritional needs. In contrast, provinces in eastern Indonesia such as Papua (37.8) and West Papua (45.92) showed much lower composite scores, with very low scores in food availability and use. Papua, for example, has an availability score of only 17.68 and use of 42.34, which indicates major challenges in food access and use. This low score is most likely due to infrastructure limitations, poor food distribution, and high dependence on imported food or food aid.

Table 8.4. Provincial Food Security Index in Indonesia in 2022

Province	Availability	Affordability	Use	Composite
Aceh	80.17	69.34	66.25	70.16
North Sumatera	80.19	75.02	64.44	71.22
West Sumatera	87.53	84.23	71.84	79.45
Riau	38.78	86.5	69.81	67.59
Jambi	58.48	82	67.04	69,5
South Sumatera	81.57	74.11	61.29	69.64
Bengkulu	69.92	75.18	61.53	67.99
Lampung	94.94	79.62	67.72	78.61
Bangka Belitung Islands	36.38	92.47	77.54	71.71
Riau Islands	5.83	88.9	72.53	63.83
Jakarta	0	83.22	81.12	78.25
West Java	84.59	79.11	73.71	77.55
Central Java	88.88	81.47	80.69	82.95
Yogyakarta	84,2	79.66	79.97	80.88
East Java	90.64	79.42	74.27	79.85
Banten	82.81	83.99	62.79	73.78
Bali	79.08	94	82.08	85.19
West Nusa Tenggara	92.85	76.24	67.81	76.58
Eastern South-East Nusa	86.25	61.62	60.55	68.42
West Kalimantan	76.21	86.33	56.29	70.81
Central Kalimantan	49.87	91.07	67.55	69.96
South Kalimantan	88.69	90.68	69.01	81.05
East Kalimantan	52.33	90.27	79.43	77.65
North Kalimantan	43.5	89.99	72.21	71.04
North Sulawesi	70.37	81.42	71.42	74,3
Central Sulawesi	77.98	80.39	70.88	75.92
South Sulawesi	94.71	83.52	71.22	81.38
Southeast Sulawesi	71,8	78.24	74.38	75.04
Gorontalo	94.25	79.76	71.91	80.35
West Sulawesi	76.11	83.45	65.42	74.04
Maluku	45.87	68.57	62.27	60.2
North Maluku	14.5	88.12	60.61	58.39
West Papua	11.81	62.11	56.17	45.92
Papua	17.68	49.89	42.34	37.8

Source: Ministry of Health of the Republic of Indonesia, 2024

Provinces such as Bali (85.19) and Lampung (78.61) stand out with high scores in affordability and use. Bali, in particular, has the highest scores in affordability (94) and use (82.08), indicating that the province not only has good access to food but also relatively affordable food prices for the community, as well as a good ability to utilize food for nutritional fulfillment. In the Sumatra region, West Sumatra (79.45) and North Sumatra (71.22) showed better food security compared to other provinces such as Riau (67.59) and Jambi (69.5). West Sumatra excels in all aspects, especially in affordability (84.23), which shows that food prices in this province are relatively stable and affordable for the community. In contrast, Riau has a very low availability score (38.78), demonstrating the challenge of ensuring that food is adequately available in the province.

The Kalimantan region shows significant variation in food security. South Kalimantan (81.05) stands out with a high score in affordability (90.68), while West Kalimantan (70.81) shows a lower score, especially in use (56.29), which may reflect challenges in nutrition education or effective food distribution in the province. Relevant ilmiah references include Firdaus & Cahyono, 2017–A study on food consumption patterns and diversification in Indonesia. Damayanti et al., 2022–Improving food security through the HFP. Prasetyo, 2013–The relationship between HFP and nutritional problems. Sekartaji et al., 2020–Analysis of food diversification and the factors that influence it. Irawan et al., 2012–The impact of infrastructure improvement on food security in Indonesia. Paramashanti et al., 2021–Trends and determinants of food diversification in children in Indonesia. Budiyanto et al., 2021–The use of software for the analysis of Hope Food Patterns. Khusun et al., 2022–A study on protein sources and socio-demographic differences in Indonesia. Damayanti et al., 2022–Improving food security through the Hope Food Pattern in Banggai Laut. Juber et al., 2023–The relationship between food consumption patterns and physical strength among adults in Indonesia.

Food security in Indonesia is greatly influenced by regional disparities, which are influenced by factors such as infrastructure, government policies, and economic conditions. The provinces in Java and Bali tend to have better food security compared to the provinces in the eastern part of Indonesia. This disparity points to the need for more focused interventions in disadvantaged areas, especially in improving infrastructure and food access. This analysis shows the need for more focused policies and infrastructure interventions to address inequalities in food security in Indonesia.

The comparison between the food availability, affordability, use, and composite indices for several provinces in Indonesia in 2021 and 2022, in general, saw some significant changes between 2021 and 2022. Provinces

such as Aceh, North Sumatra, and West Sumatra showed a decline in their composite scores, reflecting a small decline in food availability or use. In Aceh, for example, the availability score decreased slightly from 81.05 in 2021 to 80.17 in 2022, and use also decreased from 68.67 to 66.25, which led to a decrease in the composite score from 71.63 to 70.16. Provinces such as West Sumatra and Bali, on the other hand, maintained or even improved their composite scores, with Bali showing improvement in all key indicators. Bali managed to increase availability from 75.32 to 79.08 and affordability from 91.65 to 94, which overall increased the composite score from 83.82 to 85.19. This suggests that Bali may have implemented more effective policies to support food security. In contrast, Papua showed a significant increase in availability from 8.89 in 2021 to 17.68 in 2022, but still recorded the lowest overall score, with the composite score increasing from 35.48 to 37.8. Despite the improvements, the province still faces serious challenges in food security, which can be related to difficult infrastructure, distribution, and food access issues in the region.

When compared between provinces, it can be seen that provinces in Java such as Central Java and East Java have relatively high and stable scores, which indicates good food security. Central Java maintained a composite score of around 82.73 and 82.95 in 2021 and 2022, indicating good food availability, affordability, and use. These provinces are likely to have better infrastructure and effective food support programs. However, provinces in the eastern part of Indonesia such as Papua and West Papua continue to show low scores, especially in food availability and affordability. The availability score in West Papua decreased from 14.83 in 2021 to 11.81 in 2022, with the composite score also showing a slight decline from 46.05 to 45.92. This confirms the food security gap that still exists between the western and eastern regions of Indonesia.

Studies show that food security in Indonesia is greatly influenced by factors such as geographical accessibility, government policies, and infrastructure. Research by (N. Firdaus & Cahyono, 2017) emphasizes the importance of integrated food policies and infrastructure support to strengthen food security, especially in remote areas. Another study by (Damayanti et al., 2022) shows that an increase in HFP scores in several regions can contribute to improving food security through food diversification and increased access to local food. Further research by (Prasetyo et al., 2014) showed a correlation between low HFP scores and nutritional problems such as stunting, which emphasizes the importance of good food use to improve public health. Differences in food security scores between provinces reflect disparities in accessibility, policies, and infrastructure that affect the quality of

food security in Indonesia. While some provinces are showing significant progress, there are still major challenges in the eastern region of Indonesia, which require more focused interventions and infrastructure improvements to achieve more equitable food security across the country.

Part 8 discusses various problems related to the HFP and the implementation of the SFHA. The main problems discussed include the low PPH scores in various regions, especially in rural areas, which reflects the lack of diversity and quality of people's food consumption. In addition, limited access to nutritious food, dependence on imported food, and lack of public knowledge about the importance of food diversification are significant challenges that need to be overcome. The main objective of Part 8 is to improve the quality and diversity of people's nutritional consumption through the SFHA approach. This program aims to encourage food diversification, improve HFP scores, increase food independence, and support environmental sustainability. This part also aims to promote the use of local food as a solution to strengthen food security and reduce dependence on imports. Part 8 suggests several strategic steps, such as expanding the implementation of the SFHA, increasing public education and awareness on the importance of food diversification, and strengthening policy and infrastructure support for food distribution. In addition, technology development and active community involvement in SFHA management are the keys to achieving the desired goals. Increasing support for local farmers and introducing healthy diets based on local food is also recommended. For the future, it is important to make continuous efforts to increase community participation in the SFHA program through counseling, training, and providing access to the resources needed. The government needs to strengthen policies that support local food use and food diversification. On the other hand, education about healthy diets and the importance of consuming nutritious food needs to be continuously improved, especially in areas that are underdeveloped. Overall, Part 8 highlights the importance of food diversification and local food use in achieving sustainable food security. With an integrated SFHA approach and strong policy support, communities can improve nutritional quality, reduce dependence on imported food, and create a more independent and sustainable food system. Collaboration between the government, the community, and the private sector will be key to the long-term success of this initiative.

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Part 9

Policy Network for Sustainable Food House Sustainability

Nur Imdah Minsyah, Demas Wamaer

9.6. Policy Network Concept

The concept of the policy Network for the Sustainability of Sustainable Food Houses (SFHA) covers various aspects related to policy support, regional adaptation, and cultural integration. In its implementation, the sustainability of SFHA is highly dependent on collaboration and policy networks involving various stakeholders from the government, private sector, and society. Policy support is very important to ensure the sustainability of the SFHA program. The government needs to develop policies that support cross-sector collaboration to ensure that these programs are not only sustainable in the short term, but also in the long-term. Effective policies will facilitate collaboration between the government, the private sector, and the community to achieve sustainability goals. However, there are challenges associated with managing complex policy networks, especially in ensuring the active participation of all stakeholders and avoiding dominance by a single party (Camarinha-Matos & Boucher, 2012). The adaptation of the SFHA program needs to take into account the diverse regional conditions in Indonesia. Local governments have a crucial role in adjusting the implementation of this program by local characteristics. Research shows that the success of environmental collaboration at the regional level is often determined by the proactive role of local governments in coordinating and integrating various existing initiatives, as well as in overcoming land use and resource conflicts (Gambert, 2010).

The integration of local wisdom and cultural preferences in the SFHA program is an important aspect to ensure that this program is accepted by the local community. The implementation of Food Pattern of Hope (FPH) that reflects food preferences and local cultural values can increase public participation and support for this program.

Table 9.1. Integration of local wisdom and Cultural Preferences in Sustainable Development Programs.

Article Title	Key findings	Author & Year
<i>Cultural Tourism-Based on local wisdom</i>	Collaboration between the public, private, and community sectors is important to harness the potential of local wisdom in culture-based programs.	(Arfelina Iskandar et al., 2021)
<i>Global Citizen Preparation: Enhancing Early Childhood Education Through Indonesian Local Wisdom</i>	Local wisdom improves collaborative skills and global competence, adapting local cultural values in early childhood education.	(Hidayat et al., 2020)
<i>Local Wisdom-Based School Culture Model Design in Realizing Character Education</i>	Education based on local wisdom in Aceh strengthens students' character to understand the value of pluralism and global contribution.	(Nasrah & Siraj, 2023)
<i>Relevance of local wisdom to Tourism Education for Fisheries Resources Conservation</i>	The collaboration between local cultural values and fisheries conservation education in West Java has succeeded in preserving local resources.	(Nurhayati et al., 2021)
<i>School, University, And Community Collaboration To Promote Equity Through Inclusive Cultural Competence</i>	Cultural-based collaborations between schools, universities, and local communities promote social justice through an inclusive cultural approach.	(Ellis-Robinson & Wayde-Coles, 2021)
<i>Development of Tourism Communication Model Based on local wisdom in Padangsidempuan</i>	Local culture-based communication involves collaboration between governments, communities, and tourism managers, leveraging social capital such as cultural networks and trusts.	(Tanjung et al., 2021)
<i>The Effectiveness of Thematic Textbook Based on local wisdom on Cooperation Character of First Grade Students</i>	Thematic books based on local wisdom improve the character of student cooperation through learning activities that prioritize local cultural values.	(Ulfah & Purwanti, 2020)
<i>Enhancement School Competitiveness Through a Literacy Culture-Based on local wisdom</i>	A literacy culture-based on local wisdom strengthens the competitiveness of schools, especially in rural areas, by increasing students' knowledge of local culture.	(Amalia et al., 2022)
<i>Revitalizing local wisdom in Committing Radicalism in Aceh</i>	Aceh's local wisdom values are effective in fighting radicalism through custom-based education and local religious programs such as <i>meuseumeuraya</i> and <i>hadih madja</i> .	(Saputra et al., 2021)
<i>Social Cohesion of local wisdom for Plural Communities</i>	Local traditions such as <i>nyadran</i> in Central Java strengthen social cohesion between religious groups through solidarity and cooperation in common cultural traditions	(Asikin, 2021)

Source: Author Search, 2024

Studies on collaborative networks show that successful collaborations often involve adaptation to local values and cultural integration in the planning and implementation process (Hallberg et al., 2021; Halme, 2001). The integration of local wisdom and cultural preferences in the Sustainable Food House Area (SFHA) program and the implementation of the FPH can increase community acceptance, participation, and support for the program. Table 9.1. summarize the findings of various relevant studies.

Multi-Sector Collaboration: Studies show that collaboration between governments, local communities, and the private sector contributes significantly to the success of local wisdom-based programs, especially in tourism and education (Arfelina Iskandar et al., 2021; Nurhayati et al., 2021). **Community Capacity Building:** Local wisdom-based education can develop individuals' collaborative skills, ethics, and global abilities from an early age, which enhances social and cultural sustainability (Hidayat et al., 2020; Nasrah & Siraj, 2023). **Conservation of Local Resources:** The integration of local cultural values in the management of natural resources, such as fisheries and forestry, not only supports environmental conservation but also strengthens the community's sense of belonging (Nurhayati et al., 2021). **Value-Based Development of Pluralism:** Cultural-based collaborations that pay attention to pluralism can improve intergroup relationships in society and increase the effectiveness of policy implementation (Ellis-Robinson & Wayde-Coles, 2021). **Improving Education and Character of the Young Generation:** Studies show that local culture-based teaching materials, such as thematic books, significantly improve students' cooperative character and strengthen literacy mastery related to local culture (Amalia et al., 2022; Ulfah & Purwanti, 2020). **The Role of Local Values in Countering Radicalism:** The revitalization of traditional values in Aceh proves that programs based on local wisdom can be an effective tool to fight radicalism and social conflicts (Saputra et al., 2021). **Multistakeholder Collaboration for Tourism Communication:** Communication based on local wisdom requires the active involvement of all stakeholders, including local governments, to build a network of trust and social capital (Tanjung et al., 2021). **Strengthening Social Cohesion:** Local traditions such as nyadran show how cultural rituals can create a sense of solidarity, cross-group cooperation, and social cohesion in plural societies (Asikin, 2021). The integration of local wisdom into sustainability-based programs not only increases program effectiveness, but also strengthens social relationships, character education, and cultural resilience in local communities. This culture-based approach can be adopted in various sectors, such as education, environmental conservation, and community building. The integration of local wisdom and cultural preferences in development programs, such as SFHA and

FPH, significantly supports the sustainability and acceptance of local communities. Adaptive and culture-based collaboration is the main key to increasing the success of the program. The sustainability of SFHA is highly dependent on strong policy support, program adaptation that takes into account regional conditions, and the integration of local wisdom. Cross-sector collaboration and effective policy networks are essential to achieve the long-term success of these initiatives.

9.7. Policy Aspects

Policy support is a key element in the sustainability of the SFHA program. The government has a vital role in designing and implementing policies that not only focus on short term sustainability but also ensure the long-term sustainability of these programs. In this context, cross-sectoral collaboration between the government, the private sector, and the community is very important. Policies that support this kind of collaboration will ensure that all stakeholders have a clear and active role in the implementation of the SFHA program. However, the challenges that arise in managing this cross-sectoral policy network are very complex. One of the main challenges is how to ensure the active participation of all stakeholders without the dominance of one particular party. Domination by a single actor, be it the government or the private sector, can hinder the effectiveness of collaboration and can even lead to program failure in the long run. Research shows that effective policy networks must be able to integrate contributions from various stakeholders in a balanced manner, as well as facilitate open and transparent dialogue to reach common consensus (Camarinha-Matos & Boucher, 2012).

A relevant approach in managing policy networks for SFHA sustainability is to implement Collaborative Network Governance (CNG). This approach emphasizes the importance of cooperation between various actors through the establishment of an inclusive policy network. In the CNG, the government acts as a facilitator who ensures that all parties have an equal opportunity to contribute to the decision-making process. Studies show that the success of programs involving various sectors is greatly influenced by the effectiveness of coordination and collaboration between actors, especially in resource management and policy implementation (Juber et al., 2024). In addition, the Multi-Level Governance (MLG) approach is also relevant in this context, where policies and initiatives are not only carried out at one level of government, but involve coordination across levels (local, regional, national). MLG allows for better policy adaptation to diverse local and regional conditions, which is very important in the context of SFHA programs

implemented in different regions with different characteristics (Angelstam et al., 2019).

Network Management is another important aspect that should be considered in policy network management. Good network management can encourage more effective collaboration by facilitating the flow of information, strengthening trust between actors, and ensuring that sustainability goals are achieved. Without effective network management, cross-sector collaboration can become adirectional, and unproductive (Gambert, 2010; Hallberg et al., 2021). In addition, the integration of Sustainability-Oriented Network Governance (SONG) is also a relevant approach, where the focus is on ensuring that all actors in the network are working toward the same sustainability goals. This approach requires close coordination and strong commitment from all stakeholders to ensure that the implemented policies can be sustainable in the long-term (Halme, 2001). However, these approaches face a variety of challenges, including differences of interest among stakeholders, misalignment of goals, and limited resources. Therefore, it is important to implement Strategic Policy Integration (SPI) that allows for policy alignment across various sectors and levels of government. SPI can help address conflicts of interest and ensure that all policies implemented support broader sustainability goals (Reece & Gough, 2019).

Table 9.2. Policy management approach of the SFHA Model

Approach	Illustration of Implementation	Reference
CNG	The government is a facilitator to integrate the contribution of the private sector and NGOs in the SFHA. For Illustration, collaboration with agricultural organizations for training.	(Angelstam et al., 2019)
MLG	The central government provides policy guidance, while local governments adapt their implementation according to local needs in the food sector.	(Zeigermann, 2021)
Network Management	Establishment of a network management system to ensure communication and coordination between actors involved in the SFHA.	(Juber et al., 2024)
SONG	Setting the same sustainability goals for all actors in the SFHA network, including the community and the private sector.	(Macedo et al., 2020)
SPI	Alignment of food, environmental, and cultural policies to ensure the sustainability of SFHA in the long-term.	(Reece & Gough, 2019)

Source: Author Search, 2024

Managing the policy network for SFHA sustainability requires a holistic and coordinated approach involving various actors and levels of government. The implementation of CNG, MLG, Network Management, SONG, and SPI are some of the approaches that can be used to ensure that these programs are

sustainable and can be implemented effectively in the long-term. Existing challenges must be addressed through open dialogue, transparency and effective coordination between all stakeholders. Table 9.2. summarizes examples of the implementation of various approaches in policy management for the sustainability of the SFHA program.

The approaches (table 9.2.) demonstrate flexibility in the implementation of the SFHA sustainability policy. CNGs promote broad engagement of various actors through inclusive collaboration, while MLGs provide room for adaptation at the local level to ensure policy relevance. Network Management is crucial in coordinating the relationship between the controllers, while SONG strengthens the sustainability orientation through alignment of goals. Finally, SPI ensures all related policies are aligned to avoid conflicts of interest and maximize results. Studies supporting this approach suggest that successful policy implementation often depends on the government's ability to create an environment that supports collaboration, integrates various sectors, and adapts to local needs (Macedo et al., 2020). In addition, this kind of strategy not only increases the effectiveness of the policy but also ensures that all actors feel that they belong to the program. This approach also has its challenges, including differences in interests and power imbalances between the actors. Therefore, continuous evaluation and open dialogue must be carried out to ensure the sustainability of the program in the long-term.

9.8. Regional Aspects

The adaptation of the SFHA program in Indonesia must take into account diverse regional conditions, including geographical, cultural, and socio-economic aspects that are unique to each region. Local governments have an important role to play in ensuring that the implementation of the SFHA program is by local characteristics, which requires a specific approach to achieve sustainable success. Research shows that the success of collaboration at the regional level is highly dependent on the active role of local governments in coordinating and integrating existing initiatives, as well as in addressing conflicts that may arise related to land use and resources.

The MLG approach is very relevant in the context of SFHA program adaptation, where policies and implementation are carried out in an integrated manner at various levels of government, ranging from national to local. In MLG, local governments not only carry out policies set by the central government, but also play an active role in adjusting these policies to suit local conditions. For illustration, in natural resource management, local governments must be able to integrate various local interests, including agriculture, forestry, and

fisheries, to ensure that all sectors can operate sustainably (Hallberg et al., 2021). Collaborative Governance is also an important approach in SFHA adaptation, where local governments work closely with various stakeholders, including local communities, NGOs, and the private sector, to develop solutions that are suitable for local conditions. Research shows that this collaboration involving various actors can improve the effectiveness of program implementation, as each party can make a unique contribution based on their expertise and perspective (Angelstam et al., 2019). Furthermore, the Adaptive Management approach allows local governments to implement flexible and dynamic strategies in the face of changing environmental and socio-economic conditions. In the context of SFHA, this can involve adjusting agricultural methods and land management that are responsive to climate change or shifting needs of local communities. Adaptive management also requires continuous monitoring and evaluation to ensure that the strategies implemented remain relevant and effective (Shah, 2023).

In addition, Place-Based policy is another approach that emphasizes the importance of policies that are especially designed to meet the specific needs and conditions of a region. This place-based policy advises local governments to develop solutions that are relevant to the potential and challenges that exist in their areas. In the action of SFHA, place-based policies can be implemented by adapting agricultural technology, types of crops developed, and marketing strategies according to local preferences and cultures (Sodikov et al., 2021). Regional Innovation Systems (RIS) can also be an effective framework in supporting the adaptation of SFHA programs. RIS involves the establishment of an innovation network consisting of various actors, including universities, research institutes, and the private sector, to develop new technologies and methods that are appropriate to local conditions. Local governments play an important role in facilitating this collaboration and ensuring that the resulting innovations can be effectively applied in the field (Gambert, 2010).

The implementation of the SFHA program must also consider cultural sustainability, where program adaptation is carried out by respecting and integrating local wisdom and cultural values in the community. This approach not only increases the relevance and acceptance of the program by local communities, but also ensures that the practices applied are in harmony with existing traditions and cultures (Halme, 2001). However, the success of this adaptation cannot be separated from challenges, especially in cross-sector coordination and policy integration which often experience fragmentation. Therefore, the implementation of Integrated Regional Planning is urgently needed to unite various existing initiatives and policies, so as to create synergies that support broader sustainability goals. Local governments must

be able to play a key role in this integration, by ensuring that all programs and policies implemented are aligned and supportive of each other (Reece & Gough, 2019). Implementation of the adaptation of the SFHA program with an approach that considers geographical, cultural, and socio-economic variations, table 9.3. Explain various local approaches and initiatives.

Table 9.3. MLG Approach and Location-Based Strategy

Approach	Implementation Description	Examples of Practice	Reference
Multi-Level Governance	Policy integration from the national to local levels with a focus on local policy adaptation.	The local government modifies the SFHA policy to adjust to the potential of local agricultural land.	(Gambert, 2010)
Collaborative Governance	Collaboration between local governments, NGOs, local communities, and the private sector in SFHA planning.	The establishment of community gardens that are jointly managed by the local government and the community, with technical support from NGOs and the private sector for the procurement of agricultural tools.	(Angelstam et al., 2019)
Adaptive Management	Adaptation of climate-based farming methods and the needs of local communities.	Implementation of drip irrigation in dry areas and introduction of climate-resilient plants in areas affected by climate change.	(Juber et al., 2024)
Place-Based policy	Place-based policies that take into account the specific culture and needs of a particular region.	The selection of food crops that are adapted to local culinary traditions and preferences, such as cassava in Eastern Indonesia.	(Hallberg et al., 2021)
Regional Innovation Systems	The development of RIS involves universities and local research institutions.	Development of more productive local plant varieties through collaboration between universities and local farmers.	(Gambert, 2010)
Cultural Sustainability	Integration of local cultural values in SFHA adaptation.	Training for indigenous peoples to increase food production using modern technology without eliminating traditional practices.	(Halme, 2001)

Approach	Implementation Description	Examples of Practice	Reference
Integrated Regional Planning	Unification of various policies related to resource management at the regional level to support SFHA.	Preparation of agroecosystem zoning maps to determine regional superior commodities and integration with regional spatial planning policies.	(Reece & Gough, 2019)
Participatory Planning	Involvement of local communities in the planning and implementation of the SFHA program.	The implementation of village deliberations to determine the location and model of SFHA by the needs of the local community.	(Du et al., 2020)
Technology-Driven Innovation	The use of digital technology to support the management of SFHA in a more efficient and measurable manner.	The use of IoT-based applications to monitor soil moisture and plant health in real-time on SFHA land.	(Hassan et al., 2023)
Capacity Building	Training and capacity building of local communities in sustainable agricultural practices.	Training programs for farmers in making organic fertilizers and efficient irrigation techniques to increase crop yields.	(Shorikov & Butsenko, 2020)
Ecosystem-Based Management	An ecosystem-based approach to maintain environmental sustainability and support SFHA.	Water resource conservation by building small reservoirs in the SFHA area to maintain water availability in the dry season.	(Angelstam et al., 2019)
Social Innovation	Integrate social approaches to increase community participation in SFHA.	The formation of farmer groups that focus on distributing SFHA agricultural products to the local market with a community-based cooperative model.	(Nikolaiev & Cherniavska, 2021)
Resilience Framework	Strengthening the resilience of local communities to climate change through adaptation in the SFHA system.	Planting drought-resistant food crop varieties in areas prone to climate change and the development of durable crop storage systems.	(Zhu et al., 2022)

Source: Author Search, 2024

Table 9.3. highlighting the importance of local flexibility and sensitivity in the adaptation of the SFHA program. Approaches such as MLG and Collaborative Governance ensure that SFHA policies are vertically integrated and involve cross-sector actors. On the other hand, methods such as Place-Based policy and cultural sustainability emphasize the importance of conformity with the local socio-cultural context. Research shows that integrating technology and innovation through RIS can improve efficiency,

while Adaptive Management enables responses to changing environmental dynamics. The main challenges identified are policy fragmentation and the need for cross-sectoral coordination, which can be addressed with integrated regional planning. These approaches highlight the need for a combination of technological innovation, policy integration, and community-based approaches to achieve successful SFHA adaptation. Integrated Regional Planning supports policy harmonization across sectors, while Technology-Driven Innovation and the Resilience Framework add a dimension of sustainability through the application of technology and increased resilience to environmental challenges. The Participatory Planning and Social Innovation approach provides space for local communities to actively participate, which increases ownership and long-term sustainability. This is consistent with findings that show that the success of SFHA is highly dependent on community participation and the ability of local governments to integrate various interests. With this approach, the implementation of SFHA can achieve long-term sustainability while increasing local food security.

9.9. Cultural Aspects

The integration of local wisdom and cultural preferences in the SFHA program is key to ensuring that the program is accepted and supported by the local community. Local wisdom includes traditional knowledge and practices that have stood the test of time, which are usually closely related to the local environment, social, and culture. The implementation of the Hope Food Pattern (FPH) that reflects food preferences and local cultural values can not only improve food security, but also strengthen the cultural identity of the community. This is important because the success of the implementation of the SFHA program is highly dependent on the acceptance and active participation of local communities.

The cultural sustainability approach becomes relevant in this context, where cultural sustainability is seen as an integral part of the overall sustainability of the program. Studies show that programs that integrate local cultural values and practices tend to be more successful because they are more in line with the needs and expectations of the community. For illustration, research on the success of community-based agriculture initiatives in different countries shows that program adaptation to local values and cultural integration in the planning and implementation process can increase community participation and the long-term sustainability of the program (Angelstam et al., 2019). In addition, Community-Based Participatory Research (CBPR) is a relevant approach to be adopted in the implementation of SFHA. This approach involves communities in every stage of program planning and

implementation, ensuring that their voices and needs are well represented. CBPR allows for more appropriate program adaptation to local contexts, as well as advises a sense of community ownership and responsibility for program success. Studies on local food initiatives in Africa show that community participation in planning and decision-making can improve the effectiveness and sustainability of local food programs (Shorikov & Butsenko, 2020).

The ethnographic research approach is also relevant to understand and integrate local cultural values in the SFHA program. Ethnographic research allows program developers to gain in-depth insights into the cultural practices and values that exist in the community, which can then be used to tailor the program to better suit the local context. For illustration, in the context of SFHA, ethnographic research can help identify the most culturally and ritually important food crops in a given society, as well as understand the traditional ways of processing and consuming these foods (Zhu et al., 2022). In addition, Culturally Responsive Pedagogy (CRP), which is commonly applied in the context of education, can also be adapted for SFHA programs. CRP emphasizes the importance of adapting educational approaches and materials to the cultural background of students, which in the context of SFHA can be applied by adjusting training and education related to agriculture and nutrition with the local cultural context. This will ensure that the community not only accepts this program but is also able to integrate it into their daily lives (Du et al., 2020).

Place-Based Education (PBE) can also be applied in the context of SFHA to ensure that the education and training provided to local communities is relevant to their cultural and environmental context. PBE advises the use of the local environment as a context to teach agricultural and sustainability concepts, which not only increases the relevance of learning but also advises the preservation of local wisdom. PBE can help people to see the SFHA program as a continuation of their existing cultural practices, not as something foreign or imposed from the outside (Halme, 2001). However, the integration of local wisdom and cultural values in the SFHA program also faces challenges, including resistance to change and incompatibility between traditional practices and modern techniques. Therefore, the implementation of Adaptive Co-Management (ACM) that combines local and scientific knowledge through continuous collaboration can be an effective solution. ACM allows for ongoing dialogue and adjustment between communities and other parties involved, thereby addressing potential conflicts and ensuring that programs remain relevant and effective in local contexts (Reece & Gough, 2019). Table 9.4. providing a form of implementation of the integration of local wisdom in the

SFHA program, using approaches such as cultural sustainability, CBPR, and others.

Table 9.4. Implementation of Integration of local wisdom in SFHA

Approach	Implementation Description	Examples of Practice	Reference
Cultural Sustainability	Adapting the program to local cultural values and practices.	Integrating traditional food crops such as sorghum and cassava in areas whose cultural value is related to these crops.	(Rivas-Aceves & Schmidt, 2022)
CBPR	Involve the community in every stage of program planning and implementation.	Discussion of community groups to determine the design of SFHA gardens according to local needs and traditions of the community in the agricultural area.	(Mejia et al., 2020)
Ethnographic Research	Ethnographic studies to understand and respect local practices.	Identify cultural rituals involving specific food crops to ensure the integration of those crops in the SFHA program.	(Dahlin & Svensson, 2021)
CRP	Adapting agricultural training to the local cultural context.	Training of farmers on the use of organic fertilizers designed according to traditional practices, such as compost based on local materials.	(Du et al., 2020)
PBE	Using the local environment as a context for agricultural and sustainability education.	Using the school garden as an environment-based learning center for students on farming techniques that are in harmony with the local culture.	(Yang et al., 2021)
ACM	Collaboration between the community and other parties for continuous adjustment.	The establishment of a community forum to evaluate and adapt farming methods in the SFHA program according to climate change or community needs.	(Granco et al., 2022)
Biocultural Heritage	Leveraging cultural and ecosystem relationships for local sustainability.	Reviving the practice of traditional plant-based crop rotation to maintain soil fertility and maintain the balance of agricultural ecosystems.	(Kaulen-Luks et al., 2022)
Community-Driven Agroecology	Involve the community in the application of local-based agroecological methods.	Involving farmers in a project to make organic fertilizer from household waste according to traditional techniques in remote farming villages.	(Espluga-Trenc et al., 2021)
Participatory Tourism-Based SFHA	Combining aspects of local culture and SFHA in community-based tourism.	Utilizing local food crops as part of an educational tour package in the village, combining agricultural training and local cultural exhibitions.	(Djuwendah et al., 2023)

Approach	Implementation Description	Examples of Practice	Reference
Local Knowledge Transfer	Integrating traditional knowledge with modern agricultural techniques.	Training in modern irrigation techniques combined with traditional knowledge in water management, such as locally-based rainwater harvesting systems.	(Petway et al., 2020)
Food Sovereignty and Identity	Emphasizing food sovereignty through practices that reflect cultural identity.	Planting local crops such as black rice as a cultural symbol in customary areas, to increase local identity pride while supporting food security.	(Savarese et al., 2020)
Adaptive Capacity Enhancement	Improving community adaptability through innovations that are by local culture.	Introduction of drought-tolerant plant varieties that are suitable for local ecosystems to deal with the impact of climate change in the SFHA area.	(Granco et al., 2022)
Cultural Co-Design	Involve the community in designing programs based on local wisdom.	Creating a SFHA garden design with the local community to include plants used in traditional rituals, such as traditional medicine plants.	(Yang et al., 2021)

Source: Author Search, 2024

The integration of local wisdom in SFHA strongly supports the success of the program through adaptation that is relevant to the cultural values of the community. Approaches such as cultural sustainability and CBPR ensure active community engagement, increasing a sense of belonging and long-term sustainability. Studies show that the success of SFHA is highly dependent on community acceptance, especially when cultural elements such as local plants or traditional methods are integrated in the program. However, challenges such as the difference in perception between modernization and tradition preservation still need to be addressed through dialogue facilitated by ACM. By placing the community as an active joint venture, the implementation of SFHA can strengthen local food security and preserve cultural heritage. These approaches expand the implementation of the integration of local wisdom by utilizing the relationship between culture and the environment. For illustration, the Biocultural Heritage approach helps preserve traditions while ensuring sustainable practices. Participatory Tourism-Based SFHA connects local agriculture with economic opportunities through culture-based tourism, while Local Knowledge Transfer enables synergy between modern and traditional science. The emphasis on Food Sovereignty and Identity also strengthens the community's sense of ownership toward the program, as they feel that SFHA supports food sustainability while preserving their cultural identity. Challenges such as resource limitations and resistance to new technologies can be

overcome through collaboration-based approaches such as Cultural Co-Design, which increase the active participation of the community. These approaches show that integrating local wisdom not only strengthens the cultural relevance of the SFHA but also enhances the long-term sustainability of the program.

In the context of culture in Indonesia, it is known for the existence of a Cultural Development Index (CDI) that provides enrichment to SFHA. GPA in Indonesia plays an important role in enriching and supporting initiatives such as SFHA. GPA is a measuring tool designed to assess and monitor progress in various aspects of culture in Indonesia. The index covers various dimensions, including local wisdom, cultural expression, social values, and community participation in cultural activities. Some important roles of GPA in the context of enriching the SFHA program:

1. Integrating local wisdom, GPA helps in identifying and measuring local wisdom in each region. In the context of m-SFHA, this local wisdom is very important because this program aims to empower the community through agricultural practices that are by local cultural values. With the GPA, SFHA policies and programs can be adjusted to local wisdom that has stood the test of time, making it easier to accept and support by the local community. This reflects the importance of culture in facilitating the sustainability of the program.
2. Encouraging cultural participation in the program, GPA also measures community participation in cultural activities. In relation to SFHA, this participation can be in the form of community involvement in the implementation of FPH that reflects food preferences and local cultural values. Increased cultural participation, as measured through GPA, will contribute to the acceptance and success of the SFHA program because the community feels that the program not only pays attention to economic and environmental aspects, but also respects and preserves their culture.
3. Assessing social and cultural sustainability, GPA can be used as a tool to assess the social and cultural sustainability of SFHA programs. By measuring how local culture is maintained and developed through this program, the GPA provides insight into the long-term impact of SFHA on local communities. This includes its impact on the preservation of traditions, increased cultural awareness, and social welfare. It is important to ensure that the SFHA program not only focuses on economic and environmental sustainability, but also on cultural sustainability that supports the identity and well-being of the local community.
4. Providing data for policy formulation, data collected through GPA can be used by the government and policymakers to design more targeted policies

in support of the SFHA program. For Illustration, if the GPA shows that an area has a low level of cultural preservation, the policy can be focused on strengthening the cultural aspects of the SFHA program in that area. This ensures that every step taken to support SFHA also takes into account the needs and conditions of local culture.

5. Increasing cultural awareness, with the existence of GPA, awareness of the importance of culture in various aspects of development, including in initiatives such as SFHA, can be increased. This awareness is important to encourage support from various stakeholders, both at the local and national levels. The GPA helps to reinforce the argument that the success of development programs is determined not only by economic and environmental factors, but also by the extent to which they succeed in preserving and promoting local culture.

GPA plays a crucial role in enriching the m-SFHA program by ensuring that cultural aspects are not neglected in program planning and implementation. By integrating local wisdom, encouraging cultural participation, assessing social and cultural sustainability, providing data for policy, and increasing cultural awareness, the GPA helps to make SFHA a more holistic and sustainable program, which not only contributes to food security but also to the preservation and development of local culture. Table 9.5. describes how the Cultural Development Index (GPA) can be used to support and enrich the SFHA program.

Table 9.5. Implementation of GPA in Enrichment of SFHA Program

Role of GPA	Implementation Description	Examples of Practice in the SFHA Program	Reference
Integration of local wisdom	Identify relevant local cultural values and traditions for the SFHA program.	The use of traditional food crops such as local rice or tubers to encourage food diversification based on local culture.	(Rivas-Aceves & Schmidt, 2022)
Encouraging Cultural Participation	Measuring and encouraging community involvement in culture-based activities.	The implementation of farming training with traditional methods involving local communities as resource persons and active participants.	(Mejia et al, 2020)
Assessing Socio-cultural sustainability	Evaluate the cultural preservation and social impact of the SFHA program.	Monitoring the receipt of the SFHA program for the preservation of customary traditions such as the use of rituals in harvesting or watering.	(Singh et al, 2020)

Role of GPA	Implementation Description	Examples of Practice in the SFHA Program	Reference
Provision of policy Data	Provide GPA-based data to develop policies that support SFHA according to the regional cultural context.	Adjustment of local policies to support regional typical crops in the SFHA program based on GPA data on the sustainability of traditional crops.	(Reyes et al., 2020)
Increasing cultural awareness	Using GPA data to encourage public recognition of the importance of culture in sustainable development.	An educational campaign on the importance of using modern technology combined with traditional practices in SFHA.	(Ferrario, 2021)
Increasing Cultural Economic Value	Measuring the potential economic value of cultural products integrated in SFHA.	The production and marketing of traditional foods is based on SFHA products, such as local cassava chips or customary-based organic rice.	(Calizaya et al., 2023)
Strengthening Cultural Identity	Using GPA to encourage the preservation of local cultural identity in the management of SFHA agricultural land.	The preservation of the tradition of farming with cultural rituals, such as traditional ceremonies before planting and harvesting in certain agricultural communities.	(Ferrario, 2021)
Evaluation of Cultural Indicators	Provide GPA indicators to evaluate the success of SFHA in cultural and social aspects.	Assessment of cultural sustainability through an increase in GPA indicators, such as community cultural participation and preservation of traditional knowledge related to agriculture.	(Reyes et al., 2020)
Improving Social Welfare	Measuring the impact of the SFHA program on the welfare of local communities through the cultural and social dimensions of GPA.	The use of SFHA land to support community-based economies such as traditional harvest markets or local cultural exhibitions.	(Polcyn et al., 2023)
SFHA-Based Cultural Education	Integrating GPA results in culture-based education in the community related to SFHA management.	Using the SFHA garden as a learning location to introduce the younger generation to the values of culture and sustainable agriculture.	(Molina-Torres & Ortiz-Urbano, 2020)
Collaboration Between Cultural Communities	Encourage the exchange of best practices between cultural communities through GPA mapping related to SFHA.	Exchange of SFHA management practices between indigenous communities with a focus on the preservation of local crops and relevant traditional agricultural methods.	(Singh et al., 2020)

Role of GPA	Implementation Description	Examples of Practice in the SFHA Program	Reference
Use of GPA Data for policy	Using GPA data to formulate policies that support cultural preservation through SFHA.	The local government has developed incentive policies for farmers who integrate local crops in the SFHA-based on the results of the Human Development Index (HDI) cultural mapping.	(Zhao et al, 2021)

Source: Author Search, 2024

The Cultural Development Index (GPI) strengthens the success of the SFHA program by ensuring that the cultural dimension is an integral part of planning and implementation. The integration of local wisdom through Cultural Development Index (CDI) helps create tradition-based solutions, improving long-term sustainability. In addition, cultural participation monitored by GPA allows people to feel that they own the SFHA program, thereby increasing its effectiveness. The GPA also provides a tool for assessing socio-cultural sustainability, which is important to ensure that the SFHA is not only oriented toward economic and environmental aspects but also preserves cultural identity. In addition, GPA-based data allows the government to design policies that are more responsive to local cultural needs. Key challenges include the need to increase cultural literacy in society and policymakers to make effective use of GPA. Therefore, the combination of GPA data with participatory approaches such as community engagement can be key to achieving holistic success. The role of GPA in supporting SFHA can be expanded through the integration of cultural dimensions in every stage of the program, from planning to evaluation. The increase in cultural economic value shows that traditional products produced from SFHA can have significant economic potential, supporting the local economy as well as cultural preservation. In addition, SFHA-based cultural education has a long-term impact by increasing the awareness of the younger generation about the importance of preserving local culture. With the evaluation of cultural indicators, the GPA provides important data to assess the socio-cultural sustainability of the program, so that evidence-based policies can be designed to support sustainability. Increased collaboration between cultural communities through SFHA also helps to disseminate best practices, strengthen social and cultural networks that support sustainability. This approach ensures that SFHA not only supports food security, but also the sustainability of cultural identity and social well-being of the community.

9.10. Sustainability Indicators and Inter-Aspect Relationships

To ensure the sustainability of the SFHA program in three main aspects, namely policy, Regional, and Cultural, table 9.6. is an indicator that can be used.

Table 9.6. sustainability of the SFHA program in three main aspects

Aspects	Indicator
1. Policy Aspects	Policy Support for Program Sustainability
	1. Inclusive Policies
	2. Long-Term Sustainability
	3. Policy Integration
	Policy-Related Challenges and Solutions
	1. Policy Evaluation and Monitoring
	2. Response to Policy Challenges
	3. Public Participation in Policy Formation
2. Regional Aspects	Program Adaptation by Considering Regional Conditions
	1. Program Adjustment Based on Local Conditions
	2. Ability to Respond to Environmental Changes
	3. Availability of Local Resources
	The Role of Local Governments in Program Success
	1. Local Government Involvement
	2. Coordination Between stakeholders
	3. Empowerment and Training
3. Cultural Aspects	Integration of Local Wisdom in the Program
	1. Application of Cultural Values
	2. Use of Local Knowledge
	3. Local Community Support
	FPH as a Reflection of Food Preferences and Cultural Values
	1. Conformity with Local Food Patterns
	2. Protection of local wisdom
	3. Income Tax Receipt by the Community

Source: Author's Analysis, 2024

Policy support for program sustainability is indicated by an inclusive policy, with the availability of policies that include all stakeholders (government, private sector, civil society) in supporting the sustainability of the SFHA program. Long-Term Sustainability, the existence of policies that support the long-term sustainability of the program, including sustainable budget allocation and periodic regulatory updates. Policy Integration, the level of integration of SFHA policies with other national and regional policies, such as food security, environmental, and economic policies.

Policy-related challenges and solutions have policy evaluation and monitoring indicators that the frequency and quality of SFHA policy evaluation

and monitoring to ensure that the policy is still relevant and effective. Response to Policy Challenges, The government's ability to respond to emerging policy challenges, including policy revisions based on evaluation and feedback from the field. Public Participation in Policy Formation, the level of public participation in the policy-making process, which reflects the government's openness to input from the public and other stakeholders.

Meanwhile, for the regional aspect with program adaptation indicators by considering regional conditions, it is based on program adjustments based on local conditions, that the level of adaptation of the SFHA program to the specific conditions of each region, including climate, natural resources, and socio-economic structure. The ability to respond to environmental changes has the speed and effectiveness of local governments in adjusting the SFHA program to environmental changes, such as climate change or natural disasters. The availability of local resources leads to the level of use of local resources (land, water, labor) in the implementation of the program, which shows the adaptation of the program to the potential and limitations of the region.

Then for the Role of Local Governments in Program Success, there is an indicator of Regional Government Involvement with the level of involvement of local governments in the planning, implementation, and evaluation of the SFHA program. Coordination between stakeholders plays an important role because of the effectiveness of coordination between local governments and the private sector, NGOs, and the community in the implementation of the program. Then on Empowerment and Training that the frequency and quality of training provided by the local government to the community to support the implementation of the program.

In the Cultural Aspect, an important indicator is the Integration of Local Wisdom in the Program, the Implementation of Cultural Values is important because of the level of integration of local cultural values in each stage of the SFHA program, from planning to implementation. Then the Use of Local Knowledge with the frequency and method of using traditional knowledge and local wisdom in agricultural practices and natural resource management. Local Community Support is the level of support and participation of local communities in the SFHA program, which reflects the extent to which the program is by local cultural values and norms. FPH as a Reflection of Food Preferences and Cultural Values, has an indicator of Conformity with Local Food Patterns that the level of conformity of FPH implemented in the SFHA program with food patterns and local food preferences. Protection of local wisdom with endeavors to protect and promote local wisdom through the implementation of FPH by local food traditions. The acceptance of FPH by the

community with the level of public acceptance of FPH as part of the SFHA program, which reflects the success of the integration of cultural values in the food pattern. These indicators can be used to measure the success of the SFHA program in achieving sustainability goals in policy, regional, and cultural aspects. The use of these indicators will also help in making the necessary evaluations and adjustments to ensure the long-term sustainability of the program.

An integrative approach in the implementation of the SFHA program requires a close linkage between policy, regional, and cultural aspects to achieve sustainability. Each aspect supports and influences each other, so it needs to be carried out in harmony by considering the local context and cultural values that exist in the community. The policy aspect is the main foundation in ensuring the sustainability of the SFHA program. Inclusive policies are an important first step, where governments must involve various stakeholders, including local communities, NGOs, and the private sector in policy formulation and implementation. This policy that includes various perspectives allows for the creation of programs that are more adaptive and responsive to local needs (Molina-Torres & Ortiz-Urbano, 2020). The long-term sustainability of the SFHA policy can be realized if the policy is continuously evaluated and monitored to ensure its relevance. In addition, policies must be able to respond to emerging challenges, such as environmental changes or resistance from local communities, through flexible policy adaptation mechanisms (Polcyn et al., 2023). Public participation in the policy-making process is also very important, as it can increase the legitimacy and support from the public for the programs carried out (Reece & Gough, 2019).

The regional aspect of the SFHA program emphasizes the importance of program adaptation to specific conditions in each region. Programs must be adapted to local conditions, including climate, natural resources, and socio-economic dynamics. This approach requires careful and responsive adjustments to environmental changes and wise use of local resources (Zhu et al., 2022). Local governments have a crucial role in the success of this program. They must be actively involved in coordination between stakeholders, including the private sector and NGOs, to ensure that the implementation of the program runs smoothly and is integrated. Community training and empowerment by local governments is also an important indicator, where communities are trained to run programs independently and sustainably (Du et al., 2020). The integration of local wisdom in the SFHA program is no less important. Programs must reflect local cultural values to ensure that they are accepted and supported by the community. The application of cultural values in every stage of the program, from planning to implementation, can increase

local community support and ensure the sustainability of the program in the long-term (Angelstam et al., 2019). The FPH as a reflection of food preferences and local cultural values must also be considered in the SFHA program. FPH that is by local food patterns will be easier for the community to accept, and at the same time, help preserve local wisdom. Programs that are able to protect and promote local wisdom will have a higher chance of sustainability (Halme, 2001). These three aspects, namely policy, regional, and cultural (figure 9.1.), must be carried out in an integrated manner. Inclusive and sustainable policies must be adapted to regional and local cultural conditions to ensure that the SFHA program can run effectively and be accepted by the community.

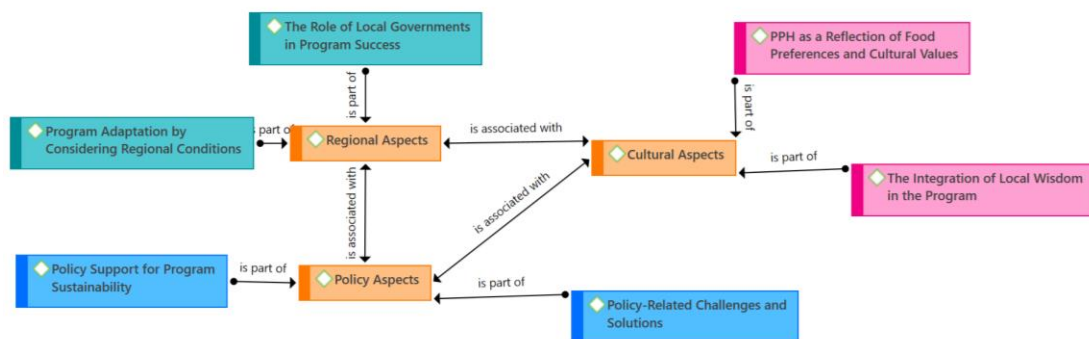


Figure 9.1. Interaction between policy, regional, and cultural aspects

Local governments play a role as a liaison that ensures that national policies can be adapted to local conditions and accepted by the community through the integration of local cultural values. Research shows that this integrative approach will result in a more adaptive and sustainable program, as each aspect supports and reinforces each other (Zhu et al., 2022). This integration also allows governments to manage programs more effectively, address emerging challenges, and ensure the active participation of all stakeholders (Reece & Gough, 2019). Figure 9.1. showing the relationship between various important aspects in the success of community-based programs, such as SFHA and Hope Food Pattern (HFP). Regional, policy, and cultural aspects are the main intertwined foundations to ensure that the program is relevant and accepted by the community. The regional aspect highlights the importance of program adaptation to local conditions, including climate, geography, and socio-cultural dynamics. This is closely related to policy aspects, which include policy support for program sustainability as well as solutions to challenges faced, such as cross-sectoral coordination and regulation. On the other hand, the cultural aspect emphasizes the important role of local wisdom, where food preferences and cultural values must be

integrated to ensure that the program reflects the needs and identities of the local community. These three aspects are coordinated by the role of local governments, which are key actors in management, policy adaptation, and collaboration facilitation at the community level. International studies support the importance of this integration. For illustration, research shows that the application of local wisdom in food systems can improve food security and program sustainability, as found in cases (Bollettino et al., 2020; Harviyaddin et al., 2020; Tetelepta et al., 2023). In addition, collaboration between local governments and communities, such as in Europe and Southeast Asia, has proven effective in supporting sustainable food systems through adaptive and integrated policies (Miqat et al., 2021; Mulyana et al., 2021). Other studies show that programs that prioritize local cultural values and community preferences, such as those implemented in Latin America and Africa, tend to gain greater community participation and support (Harviyaddin et al., 2020; Tetelepta et al., 2023). The success of community-based programs relies heavily on the synergy between local wisdom, cultural values, and relevant policy support. The role of local governments as key facilitators ensures that this integration runs effectively, ultimately increasing the sustainability and relevance of the program at the community level.

Part 9 discusses issues related to the sustainability of the SFHA through policy networks, regional adaptation, and local cultural integration. The main problems identified include the lack of effective cross-sector collaboration, limitations in policy adaptation to diverse local conditions, and the lack of integration of local wisdom values that can increase public acceptance and support for this program. In addition, challenges in policy management, fragmentation between stakeholders, and resource gaps are also significant obstacles. The main objective of Part 9 is to create an effective and adaptive policy network, capable of supporting the implementation and sustainability of the SFHA in the long term. This part aims to ensure that the program can run effectively through cross-sector coordination, policy adjustments to local needs, and the integration of cultural values in the implementation of the program. Thus, SFHA can be more relevant and accepted by the community, while supporting environmental and social sustainability. Part 9 provides a number of strategic suggestions, such as implementing Collaborative Network Governance to increase synergy between the government, the community, and the private sector. The part also recommends a multi-level policy approach to ensure policies that are adaptive to local conditions, as well as integrated network management to encourage effective collaboration. In addition, the integration of local wisdom in the design and implementation of SFHA is one of the important steps to increase community participation. For

the future, it is important to strengthen cross-sector coordination by clarifying the role of each actor in the policy network, as well as ensuring the active involvement of the community in the planning and implementation of SFHA. Program adaptation to local geographical, social, and cultural conditions must be continuously improved to increase relevance and sustainability. The use of technology, such as regional innovation systems, can be a solution to improve the efficiency and effectiveness of programs. Additionally, periodic evaluation and monitoring are required to ensure the program's long-term success. Overall, Part 9 highlights the importance of a collaborative, adaptive, and culture-based approach in achieving SFHA sustainability. By integrating local wisdom values, strengthening cross-sector coordination, and utilizing technological innovations, this program can be more effective in supporting food security, community empowerment, and environmental sustainability. Inclusive and sustainable policy support will be key to addressing existing challenges and ensuring long-term success.

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Part **10**

Sustainable Growth: Economic Dynamics and Social Transformation

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Sustainable growth in an economic and social context has become a major focus in many countries, especially in developing regions. One of the prominent initiatives is the Sustainable Food House Area (SFHA), which focuses on the use of yard land for food production. These initiatives not only contribute to household food security, but also have a far-reaching impact on economic dynamics and social transformation. SFHA or home gardening has an important role in improving food security and household nutrition, especially in developing countries. Global studies show that household gardens are able to provide a stable source of food, increase household incomes, and bid livelihood opportunities for underprivileged families, as well as provide a number of important ecosystem services (Galhena et al., 2013). In addition, urban household gardens have also been identified as an effective strategy in addressing urban problems such as food insecurity, community economic revitalization, and improving social welfare (L. Gray et al., 2014).

Studies in Ethiopia show that household gardens contribute significantly to the household economy by providing food and more income (A. Legesse et al., 2016). In addition, home gardens are also a source of environmental sustainability and conservation of plant species in urban areas (A. , & T. F. Legesse, 2016). SFHA also plays a role in increasing the social capacity of the community, especially for disadvantaged groups. Studies in Nepal show that household gardens can strengthen the social and economic status of rural females, improve food security, and provide access to important resources that may not be economically available (Prasai et al., 2022). In the context of social transformation, home gardens also serve as agents of cultural change and identity preservation, especially among new immigrants who use these spaces to build identities and strive toward collective action and self-determination (Bhandari et al., 2021). Initiatives such as SFHA not only improve food security, but also facilitate economic stability, environmental sustainability, and positive social change in society. This makes household gardens an effective tool for

economic and social transformation, especially amid modern challenges such as climate change and rapid urbanization.

10.5. Implementation of SFHA

The SFHA is a community-based program that aims to optimize the use of yard land to grow food crops, medicines, and raise livestock or fish in a sustainable manner. This program aims to increase family food security, food diversification, and household income by utilizing yards that have been less productive (Rahayu et al., 2021). This program was first initiated by the Indonesian Ministry of Agriculture to support family- and community-based food security. Its implementation involves community groups, such as the Females Farmers Group (KWT), with government help in the form of providing seeds, training, and technical help (Khuswati et al., 2022). SFHA is carried out to overcome various food security challenges, such as the conversion of agricultural land into settlements and industries, which reduces the area of productive agricultural land. In addition, SFHA is designed to empower communities through education and training so that they can use land efficiently to meet their own food needs (Piska et al., 2020). SFHA begins with the formation of community groups involved, identification of needs, technical training, and the provision of plant seeds and supporting facilities. This program continues to manage the yard independently with methods such as verticulture, polyculture systems, and the use of household waste as fertilizer. The government also provides support in the form of periodic monitoring and evaluation (Nailufar et al., 2021). SFHA brings many benefits, including: Food security, increasing food availability and diversification, especially in food-prone areas (Trianingsih et al., 2023). Improving the economy, reducing household expenditure on food purchases and opening up small business opportunities based on yard products (Satria et al., 2023). Community empowerment, increasing community knowledge, skills, and motivation to use the yard productively (Widodo & Purwanto, 2020). Ecological Sustainability, utilizing household waste and improving local ecosystem cycles through organic practices (Khuswati et al., 2022). The program creates a sustainable food security model that supports local communities economically, socially, and ecologically.

The concept of SFHA has been implemented in various countries as part of efforts to improve food security, support local resource management, and empower communities. Each country has a unique approach based on geographical, social, and cultural contexts. Table 10.1. summarizes some examples of implementation in various countries.

Table 10.1. Implementation of Sustainable Food Housing Area Programs in Various Countries

Country	Program	Approach	Benefit	Reference
Indonesia	SFHA	Use of home yards for food crops, livestock, and organic fertilizers	Food diversification, increase household income, and food spending efficiency	Mentioned in (Khuswati et al., 2022)
India	Homestead Garden	Small household garden for vegetables, fruits, and spices	Increased consumption of healthy food and reduction of food costs	Mentioned in (Indow et al., 2021)
Philippines	Urban Agriculture Program	Use of urban space, such as roofs or yards for hydroponic and organic plants	Improving urban food security, improving the local environment	Mentioned in (Rahayu et al., 2021)
Kenya	Sack Farming	Growing vegetables in large bags in urban areas	Overcoming land limitations and increasing family food supply	Mentioned in (Candra et al., 2023)
Australia	Urban Food Security Initiatives	Management of community gardens and greenhouses in urban areas	Provision of fresh local food and promotion of environmental sustainability	Mentioned in (Faqih et al., 2023)
Thailand	Royal Initiatives for Sustainable Agriculture	The use of yards to grow rice, vegetables, and raise livestock by the economic philosophy is sufficient	Improving food self-sufficiency and preserving traditional farming practices	Mentioned in (Trianingsih et al., 2023)
Ethiopia	Urban Agriculture for Food Security	Planting drought-resistant plants in household yards or small town plots	Reducing food insecurity in urban areas	Mentioned in (Piska et al., 2020)
Cuba	Organoponics	Organic urban farming using abandoned land in the city	Providing healthy food in the midst of an economic crisis	Mentioned in (Faqih et al., 2023)
Japan	Community Shared Agriculture	Community collaboration to grow vegetables and raise fish in public spaces	Increasing community togetherness while meeting food needs	Mentioned in (Khuswati et al., 2022)
Canada	Backyard Bee Farming	Small beekeeping in yard to support honey production and plant pollination	Supporting biodiversity and food products through pollination	Mentioned in (Sukma et al., 2021)

Source: Author Search, 2024

Each country adapts this concept according to its local needs. In Indonesia, SFHA stands out in empowering local communities through the Females Farmers Group (FFG), resulting in food diversification and a reduction in household spending. In Kenya, sack farming offers an innovative solution to land constraints in urban areas. Meanwhile, countries like Australia are focusing on environmental sustainability and urbanization. These programs demonstrate the importance of a local approach and government or community support for the success of the initiative. However, challenges such as funding, education, and public awareness still require attention so that the program can be more effective and sustainable. Programs in different countries demonstrate a diversity of local needs-based approaches. Thailand uses a traditional approach by integrating various aspects of agriculture, which are suitable for local conditions and support environmental sustainability. Cuba uses organopónicos as a solution to the economic crisis with high efficiency, creating cheap and healthy food. Canada focuses on biodiversity through beekeeping programs that not only increase pollination but also produce honey as an economically valuable product. These programs emphasize the importance of local innovation that is responsive to global challenges such as climate change, urbanization, and economic crises. For maximum results, the sustainability of the program requires the active involvement of the government, local organizations, and the community itself. The SFHA in Indonesia is based on regulations from the Decree of the Head of the Food Security Agency number 21/KPTS/RC.110/j/02/2019 concerning amendments to the Decree of the Head of the Food Security Agency number 58/KPTS/RC.110/j/12/2018 concerning technical instructions for optimizing the use of yard land through the SFHA. This decision was taken based on several considerations, including the need to adjust the location of SFHA activities by the Regulation of the Minister of Agriculture on the Agriculture-Based Prosperous People's Poverty Surgery Program for the 2019 calendar year. This technical instruction aims to provide a reference for the implementation of SFHA activities at the central, provincial, district/city levels, and beneficiaries. The goal is to improve coordination and access to food, as well as livestock production to increase food consumption and family nutrition. The target of SFHA activities is the development of 2,300 growth groups and 2,300 development groups in 34 provinces.

SFHA activities are carried out through a community empowerment approach and the development of the use of local resources. There are two types of SFHA activities: SFHA Working which supports the Working program, and SFHA Non-working program. Working SFHA activities focus on the use of yard land for plant and livestock cultivation, while Non-Working SFHA is not

included in the working location. The implementation of SFHA activities is carried out in three stages, growth, development, and independence. At the growth stage, government help is given for the development of nursery gardens, demonstration plots, and yard development. At the development stage, government help funds are used to improve and optimize production. The regulation also includes mechanisms for disbursing government help funds, accountability, organization and work procedures, control, monitoring, evaluation, and reporting. These technical instructions are vital to be followed by all stakeholders in carrying out SFHA activities in Indonesia.

The main purpose of the 2019 SFHA activities is to provide a reference for the technical implementation of SFHA activities at the central, provincial, district/city levels, and beneficiaries by the goals and objectives that have been set. This activity aims to improve coordination, synchronization, and harmonization of various parties in the management of SFHA activities, as well as to increase access to food and livestock production to increase food consumption and family nutrition. The strategy for implementing SFHA activities is divided into three main stages:

1. Growth Stage (First Year): At this stage, the optimization of yard land use is carried out with the concept of Non-Working SFHA which receives government help of IDR 50,000,000 and for Working SFHA of IDR 65,000,000.
2. Development Stage (Second Year): This stage is an advanced stage aimed at the SFHA group that has been grown in the first year and is still active and shows the progress of the implementation of activities until the terminate of 2019. At this stage, the SFHA group will receive government help funds of IDR 15,000,000.
3. Independence Stage (Third Year): At this stage, the central government only monitors and assists SFHA activities, while the next maintenance is handed over to the local government.

The terms and criteria that must be met by prospective locations and prospective recipients of SFHA activities are as follows:

1. Candidate location:
 - Working SFHA activities: Villages/sub-districts located in districts/cities where there are SFHA Work activities, based on Ministerial Regulation Number 14 of 2019. For districts/cities that are included in stunting areas, the location of the village must be by the list of priority areas for stunting handling issued by the National Team for the Acceleration of Poverty Alleviation.

- Non-Working SFHA: Villages/sub-districts located in districts/cities that are not included in the location of the Working SFHA, with appropriate provisions for stunting, vulnerable to food insecurity, or border areas.
2. Prospective recipients
- Growth stage: prospective SFHA beneficiaries are community groups with the following criteria:
 - a) Number of members:
 - Non-Working SFHA, minimum 30 households/people in one area or according to the conditions of the area;
 - SFHA Working at least 30 households in which there are Agricultural Poor Households (RTM-P).
 - b) Have a valid institution and organizational/management structure that is authorized by the village head/village head/authorized official.
 - c) Registered on the Agricultural Extension Management Information System (Simluhtan) application.
 - d) They have never received SFHA activities from state budget funds.
 - e) Have a bank account.
 - f) For the Non-Working SFHA group, it can provide land for the nursery and demonstration plot for a minimum of three years as outlined in the contract.
 - g) Willing to sign a pact on the integrity of SFHA activities.
 - Development stage: SFHA Group in 2018 that meets the following criteria:
 - a) Still carrying out activities actively.
 - b) The number of members or households developing the yard is increasing.
 - c) Willing to sign a pact on the integrity of SFHA activities.

SFHA activities also have relevance to economic dynamics, which refer to processes that affect economic growth and change in society. SFHA activities in 2019 have relevance to the concept of social transformation because it aims to change the paradigm and behavior of the community in utilizing yard land more effectively and sustainably. SFHA has been proven to increase food security at the household level, with crops being used for their own consumption or sold in local markets. A study in Asahan Regency showed an increase in average household income from IDR 1,500,000 to IDR 2,240,000 per month after participating in the SFHA program (Satria et al., 2023). In addition, SFHA is also able to reduce household expenditure to buy food,

increase family nutrition consumption patterns, and create yard-based small business opportunities (Rahayu et al., 2021). In the context of food security, SFHA not only provides food needs but also serves as a strategic solution to overcome the conversion of agricultural land into non-productive areas. With community involvement through farmer groups, this program can create an ecosystem that supports economic, social, and environmental sustainability simultaneously (Nailufar et al., 2021). Through a gradual approach and active community participation, SFHA has succeeded in improving community welfare and strengthening food security at the local level. This model can be an illustration of community-based programs to create sustainable food security and improve household economies in other regions. The activity also focuses on empowering community groups, which can increase their capacity to utilize local resources and develop sustainable agricultural enterprises. Thus, the SFHA implementation strategy teaches people to become more independent and reduce dependence on external help, which can ultimately increase food security and household income.

10.6. Economic Dynamics in SFHA

In the approach of economic dynamics theory, SFHA activities can be seen as an effort to increase economic productivity at the community level through increasing food production and family income. Economic dynamics theory is a branch of economics that studies changes and adaptation processes in economic systems over time. This theory includes the analysis of business cycles, economic growth, and the impact of policies on economic structures through market mechanisms and public policies. The main goal is to understand how economic variables such as production, consumption, investment, and policy affect the dynamics of the overall economic system, both at the micro and macro levels (Leonov & Pronin, 2020). The theory has its roots in the contributions of economists such as John Stuart Mill, who introduced the element of time in economic analysis, as well as Keynesian theories and growth models such as Solow and Tobin. This theory emerged in response to the need to understand long-term and short-term changes in the economy, particularly due to external factors such as fiscal policy, technological changes, or global market dynamics (Rivot & Trautwein, 2020). Economic dynamics theory works through mathematical models that predict changes in economic variables based on mechanisms such as: Dynamic Equilibrium, the relationship between supply and demand letter that is constantly changing following external policies or disturbances. Government intervention, the use of fiscal and monetary policies to direct economic growth. Technological Innovation, technological change as a key driver of economic

dynamics in the long-term (Leonov & Pronin, 2020). The benefits of economic dynamics theory include Effective Policy Planning by providing a framework for evaluating the impact of government policies on the economy. Economic Stability by reducing the risk of economic fluctuations through more accurate prediction models. Investment risk management by helping businesses and governments understand risks and opportunities in investment decisions (Yang & Qi, 2022). Global Understanding by demonstrating complex interactions in the global economy, including the impact of international policies on local dynamics (Araujo & Teixeira, 2021). Economic dynamics theory is an important analytical tool in understanding the changes in complex economic systems. By leveraging a dynamic systems approach and modern macroeconomic theory, it helps create more adaptive policies and supports sustainable economic growth.

By promoting the use of yard land for crop and livestock production, SFHA activities have the potential to increase household income through the purchase of excess production. This can encourage local economic growth and reduce dependence on imported food. In addition, these activities can also create new jobs and reduce unemployment, which is an important factor in economic dynamics. Overall, SFHA activities in 2019 have relevance to the concept of social transformation and economic dynamics because it aims to change the paradigm and behavior of the community and improve economic welfare through a participatory approach and the use of local resources.

The home garden development program (SFHA) has a significant economic impact on the community, especially in increasing household income and food security. In many regions, home gardens have been shown to make a substantial contribution to the local economy, but they also face no less important challenges, especially the dependence on seeds and the support of the local economy. Studies in Ethiopia reveal that home gardens can be an important source of income for households, with economic contributions varying based on land size and access to resources such as water and quality seeds (A. Legesse et al., 2016). In addition, the challenges faced in the sustainability of home gardens are often related to limited access to quality local seeds, as well as inadequate financial support from local governments or institutions (Sunwar et al., 2006). In countries such as Hungary, home gardens also play an important role in food security, but better market changes with the entry into the European Union have reduced dependence on home gardens for some communities, except for the most economically and geographically marginalized farmers (Leite & Pita, 2016). This shows that strong local economic support is urgently needed to ensure the sustainability of home gardens in the face of broader economic changes.

In Indonesia, the household food garden program has shown a positive impact in improving food security and household nutrition. However, the economic stability resulting from this program is still limited to the program period, and its sustainability depends on continuous support, both from the government and local communities (Saediman et al., 2021). Limited access to quality seeds is the main challenge often faced by household farmers. In Nepal, for illustration, the infrastructure for good local seed distribution is very lacking, which negatively impacts the long-term sustainability of home gardens (Sunwar et al., 2006). Although home gardens have great potential to improve economic well-being and food security, their success depends heavily on ongoing support in the form of better access to quality seedlings and economic support from local governments. Without this, the long-term sustainability of such programs can be severely compromised, especially in the face of external challenges such as market changes and fluctuating economic conditions.

The economic dynamics theory approach is related to SFHA activities in 2019 because this activity is oriented to community economic empowerment through increasing agricultural productivity at the community level. Economic dynamics refer to the processes that affect economic growth and change in society, and SFHA plays a role in promoting these dynamics through an approach based on local production. SFHA activities can increase household income through increasing food production and diversifying agricultural businesses. In this way, these activities help in driving local economic growth and reducing dependence on imported food, which is an important factor in economic dynamics.

10.7. Social Transformation in SFHA

Social transformation in this context refers to the process of structural change in society that affects the mindset, attitudes, and actions of individuals and groups in the community. Social transformation is a process of profound change in the structure of society, encompassing economic, political, cultural, and social aspects, leading to a new, more inclusive and sustainable order. This process aims to improve people's welfare through systemic changes, such as resource redistribution, mindset changes, and strengthening social institutions. This transformation is relevant in responding to global challenges such as social inequality, climate change, and economic crises (Barrios et al., 2020). Social transformation is born out of an urgent need to respond to social inequality and environmental degradation. Sociologists, philosophers, and economists such as Karl Marx and Émile Durkheim provided the initial theoretical basis. Today, social transformation is also driven by globalization, digital technology, and civil society movements, which aim to create social

justice and ecosystem sustainability (Crane et al., 2021). Social transformation runs through several main mechanisms: Structural change through institutional reforms such as wealth redistribution or improved education and health policies. Social Mobilization by strengthening civil society movements that promote human rights and social justice. Technological Innovation and Digitalization focuses on the use of technology to accelerate social inclusion and resource efficiency (Tana et al., 2023). Education and cultural change by changing people's mindsets to support sustainability and equality (Boik, 2020). Social transformation provides significant benefits: Reduction of Inequality which can narrow socio-economic gaps in society (Pozzebon et al., 2021). Environmental Sustainability by encouraging environmentally friendly practices that help address climate change (Yoo & Yi, 2022). Social Inclusion by increasing the participation of marginalized communities in the development process (Ahmed, 2023). Social stability that reduces conflict through strengthening social cohesion and recognition of cultural diversity (Ross, 2020). Social transformation is an essential step in creating a more just and sustainable society, leveraging the synergy between structural change, innovation, and community collaboration.

Social transformation in the agricultural sector has become an important approach to improve sustainability and productivity. Different countries implement different policies and programs to drive socio-economic change through local resource management, technological innovation, and systems integration. Table 10.2. summarizes the implementation of social transformation in agriculture in various countries.

Table 10.2. Implementation of Social Transformation in the Agricultural Sector

Country	Program/Strategy	Approach	Benefit	Reference
India	Agricultural Digitalization Movement	Use of digital technology for land management and crop yields	Increased efficiency and food security	(Rijswijk et al., 2021)
Tanzania	Integrated Agriculture with a Focus on Diversification	Development of crop diversification by smallholders	Reducing inequality and improving access to irrigation water	(Lala et al., 2023)
Rwanda	Modernization of Priority Crops	Support for priority crops such as sugarcane	Increased productivity and income of large farmers	(Pasgaard et al., 2022)

Country	Program/Strategy	Approach	Benefit	Reference
European Union	Social Agriculture	Combination of social services with agricultural production	Improving social inclusion and sustainability of the agricultural sector	(Elings et al., 2022)
Japan	High-Tech Based Agriculture	Implementation of indoor farming and alternative proteins	Food security and resource efficiency	(Teng & Montesclaros, 2023)
South Africa	Social Protection for Smallholders	Subsidy-based social protection policy	Increase productivity and farmers' income	(Osabohien et al., 2020)
Brazil	Agroforestry System	Combination of plants and forestry to increase productivity	Ecological sustainability and income diversification	(Barrios et al., 2020)
Indonesia	Community-Based Agriculture	Development of farmer groups for the use of environmentally friendly technology	Increase in crop yields and smallholder incomes	(Pretty et al., 2020)
Canada	Diversification of Organic Agricultural Products	Support for farmers to adopt organic farming techniques	Improving food quality and organic markets	(Santini Pigatto & Brunori, 2021)
Nigeria	Irrigation Infrastructure Development	Dam construction to improve access to irrigation water	Increasing crop yields and food security	(Osabohien et al., 2020)
South Korea	Integrated Agriculture 6th Industrialization	Diversification of farming with the development of agritourism	Adding economic value through tourism and the food industry	(Arya, 2022)
New Zealand	Climate Responsive Land Management	Land adaptation system using <i>values-rules-knowledge</i> (VRK) framework	Climate change adaptation and agrarian risk management	(Kirk & Cradock-Henry, 2022)
Philippines	Agroecology Education for Smallholders	Community-based training to improve agroecological techniques	Improve resource efficiency and yield	(Barrios et al., 2020)

Source: Author Search, 2024

These programs demonstrate the diversity of approaches to social transformation in agriculture, with a focus on sustainability and community empowerment. Environmental Sustainability with agroforestry systems in Brazil and VRK in New Zealand shows that sustainable resource management

is critical to meeting climate challenges. Smallholder empowerment through community-based programs in Indonesia and the Philippines strengthens smallholders' role in ensuring food security. Economic diversification in South Korea has successfully integrated tourism and agriculture in an integrated agricultural model, creating new economic opportunities. Food Security through irrigation infrastructure in Nigeria provides direct benefits for local food security by increasing access to water for agriculture. The success of these programs demonstrates the importance of collaboration between governments, local communities, and international institutions to optimize social transformation in the agrarian sector. This provides a model that can be adopted by other countries with similar challenges. In the social transformation theory approach, SFHA activities can be seen as an effort to improve community welfare through a participatory approach that promotes the use of local resources and the development of agricultural businesses at the community level. By teaching good plant and livestock cultivation techniques, as well as optimizing the use of available land around the house, this activity has the potential to change people's food and nutrition consumption patterns to be more balanced and based on local production. In addition, SFHA is also oriented toward empowering the community, especially groups that are vulnerable to poverty, so that it can help reduce social and economic inequality. Thus, this activity advises a more equitable and inclusive social transformation.

Community participation in the household garden program (SFHA) has a significant social impact, especially in strengthening social bonds, increasing community awareness, and encouraging social change. Home gardens are not just a place to grow food, but also serve as a platform for education, mental health improvement, and community building. In Sydney, Australia, studies show that community gardens in social housing provide significant psychosocial benefits, including improved personal well-being, community connections, and awareness of health and well-being. The garden becomes an effective local learning environment, helping to address social inequalities by creating safe and supportive social spaces (T. Gray et al., 2022). In France, community gardens have been identified as a form of environmental management that involves relational values. Participation in these gardens allows communities to meet their social and environmental needs, create new socio-ecological relationships, and address local challenges (Torres et al., 2017).

The role of education in increasing participation and awareness is also very important. In the United States, community gardens have been used as informal pedagogical sites in the food movement, where social learning and

environmental education play an important role in driving social change and strengthening democratic values (Walter, 2013). These community gardens also serve as a platform for continuing education, where gardening activities help to increase public understanding of environmental sustainability and social engagement (Corkery, 2004). In addition, community gardens in Denver, Colorado, show that the social processes that occur in these gardens can increase collective efficacy, which is an important mechanism in strengthening the role of gardens in the promotion of public health (Teig et al., 2009). Participation in a household garden program brings many social benefits, including increased community bonding, a sense of belonging, and a sense of collective awareness. With the right educational support, the program can play an important role in promoting social and environmental sustainability in the community. Integrated education in these programs can also strengthen participation and increase social impact, making home gardens an effective agent of social change.

The activities of the SFHA support social transformation by changing the paradigm and behavior of the community in using yard land more effectively and sustainably. Social transformation in the context of SFHA focuses on empowering communities, especially groups that are vulnerable to poverty, so that it can improve welfare and reduce social inequality. SFHA advises the community to cultivate yards as a sustainable source of food, which can meet nutritional needs and increase family income. With a participatory approach, this activity helps the community to understand the importance of local resource management and develop agricultural businesses at the community level. In addition, SFHA activities also help in raising awareness about the importance of diversifying food consumption and implementing healthier food patterns, which in turn can improve the nutritional status of the community. In this way, SFHA helps in changing people's food and nutrition consumption patterns to be more balanced and based on local production, which is part of a broader social transformation.

SFHA is a program that aims to optimize the use of yard land to support food security and increase household income. The implementation strategy is carried out in stages through three main stages, growth, development, and independence. The growth stage begins with the formation of community groups such as the FFG, accompanied by technical training and the provision of plant seeds. At the development stage, the planting area is expanded, plant diversification, and production capacity is strengthened. Finally, at the stage of independence, community groups are directed to manage yard businesses independently and create products of economic value from their crops (Khuswati et al., 2022). Help and technical help from the government or

agricultural extension workers play an important role in the success of SFHA. This help includes training on cultivation techniques, the use of environmentally friendly technology, and crop management. In addition, mentoring also advises the community to change their mindset from consumptive to productive, so that yards that were previously not optimal can become a source of more income (Anindya et al., 2021). The mentoring and technical help model for the success of the SFHA must be designed systematically, by integrating training, technology, and resource management. This model aims to support the community in developing their yards into productive land, while increasing income and food security. Table 10.3. presenting a SFHA implementation model that can be applied practically.

Table 10.3 Implementation Model of SFHA Help and Technical Help

Opponent	Implementation Steps	Information	Reference
Initial Training	Organizing farmer groups and providing training in cultivation techniques	Includes training in plant cultivation, organic waste management, and diversification of farming businesses	(Anindya et al., 2021)
Technology Provision	Distribution of seeds, organic fertilizers, and simple agricultural tools	Ensuring that the community has access to resources to start productive activities	(Khuswati et al., 2022)
Technical Help	Regular visits by agricultural extension workers	Providing specific solutions to cultivation and yard management problems	(Satria et al., 2023)
Monitoring and Evaluation	Regular evaluation of crop yields and economic impacts	Measure program success through productivity indicators and increase revenue	(Rahayu et al., 2021)
Self-Management	Strengthening the group to create independent businesses based on crop yields	Developing economically valuable products such as processed foods or organic fertilizers	(Satria et al., 2023)

Source: Author Search, 2024

This model underscores the importance of a tiered approach in the implementation of SFHA. Initial training provides a solid foundation for the community to understand cultivation techniques. The provision of technology ensures the availability of the vital resources, while technical help enables adaptation and local context-based solutions. Monitoring and evaluation ensure that the program runs according to its goals and can be improved on an

ongoing basis. Finally, the self-management stage allows communities to become economically self-sufficient, creating a long-term impact on household welfare and food security. Relevant studies show that programs with this approach are able to increase household income by up to 25% and strengthen local food security through diversification of food sources and reduction of household spending. This approach deserves to be a model of implementation that is replicated in various regions.

10.8. SFHA on Household Income and Food Security

The implementation strategy of the SFHA has been proven to have a significant impact on household income and food security through mentoring and technical help provided to the community to develop agricultural businesses on their yards. The program begins with an approach that integrates seed distribution, the provision of educational materials, and technical training on effective farming methods. Technical help provided by the government and non-governmental organizations plays an important role in improving the agronomic skills of communities, which in turn advises an increase in household food production. For illustration, in Sumatera and Indonesia, household garden programs have succeeded in increasing household income through the purchase of garden products and reducing costs for daily food purchases (Saediman et al., 2021).

On the other hand, SFHA also plays an important role in strengthening food security by ensuring a more diverse and stable availability of food at the household level. The program allows families to produce their own food, which not only improves access to nutritious food but also reduces dependence on outside markets. A study in South Africa showed that the household garden program was able to reduce food insecurity by 41.5%, which shows its effectiveness in supporting food security among the poor (Bahta et al., 2018; Teig et al., 2009). However, the success of this program is highly dependent on the quality of mentoring and technical help provided. Mentoring, which includes training in efficient farming techniques, as well as the distribution of seeds and fertilizers, has proven to be very important in increasing the productivity of household gardens. For illustration, in Indonesia, the involvement of local governments in providing technical support on an ongoing basis has ensured that the SFHA program runs successfully and provides long-term benefits to the community (Bahta et al., 2018; Pagiu et al., 2022).

However, the implementation of SFHA is not without challenges. Some of the obstacles that are often faced include limited access to quality seeds, lack of water resources for irrigation, and lack of land available for cultivation. In Nepal, for illustration, good availability of seedlings and consistent technical

support was identified as key factors in the successful adoption of SFHA by the community (Prasai et al., 2022). Addressing these challenges requires careful planning and effective policy interventions to ensure that the SFHA program can continue to provide economic benefits and food security for communities in the future. In conclusion, a comprehensive SFHA implementation strategy, with adequate technical support and help, is the key to achieving the success of this program in improving household welfare and food security in various regions.

To create a mathematical simulation that illustrates how the implementation of SFHA affects household income and food security, we can use a simple model that relates key variables such as yard land area, implementation costs, production products, selling prices of production products, and self-consumption to household income and food security.

1. Base Model

The model that can be illustrated has several key variables consisting of to perform the analysis.

- A: The area of yard land used for SFHA (m²);
- Cp: Cost per square meter for the implementation of SFHA (cost of seeds, fertilizers, etc.)
- Y: Production yield per square meter (kg/m²);
- P: Selling cost per kilogram of production (Rp/kg);
- Cc: Consumption of production by households themselves (kg);
- S: Percentage of production sold (%);
- Ir: Household income from SFHA revenue (Rp);
- Kf: Food security index, assuming that household production consumption increases food security.

2. Household Income

Household income from SFHA (Ir) can be calculated from the amount of production sold:

$$Ir = S \times A \times Y \times P$$

Where S is the percentage of yield sold, $A \times Y$ is the total production in kilograms, and P is the selling cost per kilogram.

3. Household Food Security

Food security can be indicated by the percentage of consumption of self-produced products (Cc) which increases the food security index (Kf). For illustration, we can create a simple model:

$$Kf = f(Cc)$$

Where $f(Cc)$ is a function that describes the relationship between consumption and food security. For illustration, we can use a simple linear function:

$$K_f = \alpha \times C_c$$

With α as a coefficient that shows an increase in food security per kilogram of production consumption. Based on the notation, a simulation can be carried out with details.

Table 10.1. The parameters in the SFHA contribute to the increase in household income and food security.

Parameter	Value
Land Area (A)	100 m ²
Implementation Cost (cp)	IDR 50,000/m ²
Production (Y)	2 kg/m ²
Cost per Kilogram (P)	IDR 10,000/kg
Percentage Sold (S)	50% (0.5)
Percentage Consumed (cc)	50% (0.5)
Household Income (IR)	IDR 1,000,000
Food Security Index (Kf)	10

Household income:

$$IR = 0.5 \times 100 \times 2 \times 10,000 = \text{Rp}1,000,000$$

Food security:

$$K_f = 0.1 \times (0.5 \times 100 \times 2) = 10$$

Sensitivity analysis to see how changes in land area or the percentage of consumption alone affect income and food security. For illustration, if the land area increases to 200 m², then:

$$IR = 0.5 \times 200 \times 2 \times 10,000 = \text{Rp}2,000,000$$

$$K_f = 0.1 \times (0.5 \times 200 \times 2) = 20$$

From this simulation, it can be seen that increasing land area directly increases income and food security. In addition, increasing consumption itself will also increase food security. The implementation of the SFHA has proven to have a significant impact on household income and food security, especially in urban and rural environments with limited access to food. The simple mathematical model used in this analysis shows that the household income (Ir) of SFHA is influenced by land area, production per square meter, percentage of yield sold, and selling cost per kilogram. Similarly, food security (Kf) increases along with the consumption of self-produced products. Using parameters such as a land area of 100 m², a production of 2 kg/m², and a selling cost of Rp 10,000/kg, household income is calculated to reach Rp 1,000,000. If the land area is increased to 200 m², the income doubles to Rp 2,000,000, showing a

direct relationship between production scale and income and food security. Empirical studies support these findings. In Indonesia, the SFHA program shows an increase in household income and food diversification through the production of fresh vegetables, although sustainability is still a major challenge (Rastiyanto Amrullah et al., 2017). In South Africa, participation in home food gardens was able to reduce food insecurity by up to 41.5%, with a significant impact on household food supply and consumption (Bahta et al., 2018). In Bangladesh, home garden interventions integrated with nutrition education show long-term impacts on vegetable production and consumption, as well as females' empowerment (Baliki et al., 2019). In conclusion, SFHA not only increases income but also strengthens household food security through diversification and consumption of garden products. The increase in land area and the percentage of consumption itself magnifies this positive impact, as shown by various studies in various global contexts.

Table 10.4. SFHA Continuous Monitoring and Evaluation Mechanism

Money Aspects	Key Indicators	Data Collection Methods	Executive	Purpose
Production	Yield (kg/m ²), number of plant types	Field survey, recording results	Local farmers and companions (Quarterly)	Measuring crop productivity and diversification
Income	Revenue from sales (IDR), costs and expenses	Interviews, simple financial statement analysis	Farmers and related agencies (Semester)	Assessing the contribution of SFHA to household income
Consumption	Consumption of own crops (kg/m ²), frequency of consumption of vegetables/fruits	24-hour food recall, daily recording	Farmers and nutrition cadres (Monthly)	Assessing the role of SFHA in diversification and food security
Community Involvement	Participation in training, number of active groups	Observation, training attendance list	Community facilitator (quarterly)	Measuring community engagement and capacity
Program Sustainability	Availability of seedlings, fertilizers, technical support	Interviews, distribution records	Local government (Annual)	Ensure continued support and access to production inputs

Source: Author's Analysis, 2024

To maintain the sustainability of the spotlight on monitoring and evaluation is important to do. The continuous monitoring and evaluation mechanism (money) in the SFHA is important to ensure its effectiveness in increasing household income and food security. Effective money needs to pay

attention to aspects of production, income, consumption, and community involvement. The following table details the mechanism of continuous money with relevant indicators and methods (table 10.4.).

This monitoring mechanism focuses on four main aspects, production, income, consumption, and sustainability. Production results can be monitored through crop recording and crop diversification. The income evaluation aims to see the economic impact of SFHA on households. Crop consumption itself is an important indicator in assessing the contribution to food security. Studies in Indonesia show that SFHA significantly reduces household spending on vegetables and increases income (Rastiyanto Amrullah et al., 2017). The home garden program in South Africa also reduced food insecurity by 41.5%, demonstrating the importance of access to production inputs and training (Bahta et al., 2018). In Sri Lanka, the diversification of plants in home gardens contributes to increased consumption of micronutrients and food security (Thamilini et al., 2019)). Sustainability monitoring is crucial to ensure access to seeds, fertilizers, and ongoing training for farmers. The implementation of this mechanism can increase the efficiency and effectiveness of SFHA in supporting food security and household income in a sustainable manner.

This Part 10 discusses the role of SFHA in facing food security challenges and economic and social dynamics, especially in developing countries. SFHA is designed to address problems such as the conversion of agricultural land, limited access to food, and low productivity of yard land. This program aims to make optimal use of yard land to increase food production, strengthen household income, and empower the community. With a community-based approach, SFHA also supports food diversification and sustainable agricultural practices, which have a positive impact on local ecosystems. The main impartial of this part is to explore the contribution of SFHA to sustainable economic growth and social transformation. Through the implementation of this program, the community may utilize local resources more effectively. Various benefits have been identified, including increased food security through the cultivation of food crops, livestock rearing, and the use of organic fertilizers. In addition, SFHA has proven to be able to reduce household expenditure on food needs and create small business opportunities based on yard products.

In conclusion, SFHA is a strategic solution to strengthen food security and encourage local economic growth. This program also strengthens social transformation by increasing the capacity of communities, especially vulnerable groups, to manage land productively. The studies cited in this part show that participation in SFHA not only increases household income but also improves nutritional consumption patterns. However, the success of this program is highly dependent on the continued support of the government and

related institutions. This part recommends several steps to ensure the sustainability of SFHA in the future. These include increased access to quality seeds and fertilizers, ongoing technical training, and regular monitoring and evaluation to measure the impact of the program. Active community participation and multi-stakeholder collaboration are also critical to strengthening the program's success. In addition, the adoption of environmentally friendly technology is expected to increase the productivity and efficiency of yard land. In the future, the development of SFHA in food-vulnerable areas and innovations in agricultural technology will be the key to the success of this program in creating food security and sustainable social transformation.

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Part **11**

Conclusion

Hadi Supratikta, Hasniati

11.3. Key points of Sustainable Food House Area implementation

The implementation of the Sustainable Food House Area Model (SFHA) has shown several significant results and areas that need to be improved. This program, which is designed to improve food security through the sustainable use of home yards, has proven effective in various regions, with a significant impact on food security, economic resilience, and community empowerment. This program has succeeded in increasing food security at the household level by reducing food expenditure and increasing access to fresh vegetables and other agricultural products (Khuswati et al., 2022; Nailufar et al., 2021). The implementation of the SFHA program in Indonesia is one of the strategic endeavors to improve food security and community welfare through yard land optimization. The program not only focuses on increasing food production but also empowering communities, especially females and marginalized groups, by providing them with the knowledge and skills to make effective use of yard land. This empowerment is important because empowering females in farming communities has been shown to increase productivity and program sustainability. Studies show that female's active participation in SFHA programs significantly increases program success in the long-term (Nasriati et al., 2017). SFHA also uses a sustainable agriculture approach that pays attention to the use of local resources, such as the use of organic waste for composting and natural pest control. This approach not only reduces dependence on external agricultural inputs but also maintains environmental sustainability. Studies on the sustainability of the SFHA program in Pasuruan show that the ecological approach in this program has a significant positive impact on environmental sustainability and the social welfare of the community (Khuswati et al., 2022).

Part 1 discusses global challenges in food security caused by population growth, climate change, land degradation, and unsustainable practices. The concept of Sustainable Food Houses (RPL) was raised as a solution to create a

sustainable food system at the household level. The goal is to increase food security through sustainable agriculture that combines technology and community participation, so as to be able to improve economic welfare and environmental conservation. The suggestions given include optimizing land use, educating the community, and using technology for efficiency and monitoring. Going forward, the development of the RPL concept can be improved through the integration of more advanced technologies and a community-based approach to expand adoption. Part 2 highlights the problem of limited use of yards for productive activities, even though it has great potential. Lack of knowledge and infrastructure is a major obstacle to the implementation of sustainable practices. The purpose of this implementation is to improve community skills in using land sustainably, meeting food and nutrition needs, and developing environmentally friendly economic activities. Suggestions include the provision of training on environmentally friendly practices, the distribution of resources such as seedlings and compost, and the application of innovative technologies such as vertical gardens and drip irrigation. Future recommendations are to increase collaboration with NGOs and governments, build local nurseries, and introduce more affordable irrigation technologies. Part 3 underlines the great potential of the yard in improving nutrition and family income, while supporting biodiversity conservation and environmental sustainability. The problem faced is the lack of use of yards to overcome nutritional and economic disparities. The goal is to show the benefits of yards in food diversification, health, and family income. The suggestions provided include community training in agroforestry, education on nutrition and farming, and females empowerment in household farming. For the future, the improvement of agroforestry techniques, the development of local community markets, and the integration of gardening education into the sustainability curriculum are recommended strategic steps.

Overall, these three parts are interrelated in discussing challenges and solutions to improve food security through sustainable practices. Part 1 provides a foundation on the urgency of the problem, Part 2 lays out practical guidance for implementation, and Part 3 highlights the long-term benefits and socio-economic contributions of yard use. The next step is to integrate technological advancements, strengthen cross-sector collaboration, and ensure active community participation to maximize the impact of these initiatives. With good synergy, sustainable food systems can significantly contribute to global food security and environmental conservation.

In addition, SFHA advises food diversification by planting various types of crops rich in carbohydrates, vitamins, and minerals, as well as raising livestock as a source of protein. This diversification is very important in the context of

food security because it can increase people's nutritional intake and reduce dependence on one specific type of food. Research shows that food diversification in SFHA contributes to an increase in people's consumption patterns that are more balanced and nutritious (Rastiyanto Amrullah et al., 2017). The SFHA program also has the potential to increase family income through optimizing yard land use. By selling excess production or processed products from yard produce, families can earn more income that helps improve their economic well-being. A study in Surakarta revealed that the effectiveness of the SFHA program in increasing family income is highly dependent on good management skills and market access (Kurniawan et al., 2018). Food security is also the main focus of SFHA. By ensuring the availability of sufficient, nutritious, and affordable food, this program contributes directly to improving food security at the household level. In the context of the COVID-19 pandemic, for illustration, SFHA has proven to be effective in supporting family food consumption patterns and reducing dependence on external markets for daily food needs (Anindya et al., 2021).

Part 4 discusses the management of the SFHA as a solution to increase family food security in a sustainable manner through the use of yard land. The focus includes optimizing land with environmentally friendly techniques, increasing plant diversity, and managing water efficiently. Key challenges include soil degradation, lack of environmentally friendly technology, and limited access to clean water. For this reason, this part recommends public education, the use of water-saving technology, and collaboration of various parties to support the implementation of the program. These measures are expected to strengthen food security while maintaining the balance of the ecosystem. Part 5 emphasizes the importance of a community approach in the implementation of SFHA, especially through community empowerment and active participation. This program is designed to overcome land limitations and dependence on external food sources. With the training and formation of local farmer groups, communities can be empowered to manage resources independently and sustainably. This part also highlights the importance of continuous evaluation and integration of SFHA into regional development policies. The success of this approach requires increased access to technology, training, and solid institutional support. Part 6 discusses the challenges of SFHA implementation, including limited resources such as clean water, low adoption of green technology, and lack of policy support. To address these challenges, this part proposes incentives for the adoption of environmentally friendly technologies, the development of supporting infrastructure such as irrigation, and the integration of SFHA in national development planning. Government support that includes incentive policies, community education,

and technical and financial help is a key element in ensuring the sustainability of this program. Overall, these three parts complement each other in describing the importance of SFHA for sustainable food security. Part 4 highlights the technical aspects of land management, Part 5 discusses community empowerment, and Part 6 underlines the role of government policy and support. Synergy between technology, policy, and community participation is needed to ensure that SFHA can create a sustainable self-sufficient food system in the future.

Part 7 discusses the importance of optimal management of home yards to increase household food security, overcome stunting problems, and increase life expectancy. This part emphasizes multidimensional benefits such as access to nutritious food, food diversification, and strengthening the family economy. The main recommendation is to encourage sustainable practices such as crop diversification and economic empowerment through yard products. In the future, it is necessary to strengthen nutrition education programs and the implementation of sustainable agriculture models in the yard. Part 8 focuses on the Hope Food Pattern (PPH) and the implementation of SFHA to improve the quality and diversity of nutritional consumption. This part identifies key challenges such as lack of access to nutritious food and low PPH scores, particularly in rural areas. The recommendations include improving nutrition education, food diversification, and strengthening policy and infrastructure support. For the future, it is important to expand community participation in SFHA programs and strengthen the use of local food to reduce dependence on imports. Part 9 reviews a network of culture-based policies and approaches to SFHA sustainability. This part emphasizes the importance of multi-sector collaboration, policy adaptation to local conditions, and integration of local wisdom. The recommendations include the implementation of collaborative governance, management of policy networks, and integrated regional planning. For the future, a holistic approach that integrates technology, innovation, and community participation is needed to achieve the long-term sustainability of the program.

Part 10, SFHA is a strategic solution to strengthen food security and encourage local economic growth. The program also strengthens social transformation by increasing the capacity of communities, especially vulnerable groups, to manage land productively. The studies cited in this part show that participation in SFHA not only increases household income but also improves nutrient consumption patterns. However, the success of this program is highly dependent on the continued support of the government and related institutions. This part recommends several steps to ensure SFHA's future sustainability. This includes increased access to quality seeds and fertilizers,

ongoing technical training, and regular monitoring and evaluation to measure the program's impact. Active community participation and multi-stakeholder collaboration are also important to strengthen the success of the program. In addition, the adoption of environmentally friendly technology is expected to increase the productivity and efficiency of yard land. In the future, the development of SFHA in food-vulnerable areas and agricultural technology innovation will be the key to the success of this program in creating food security and sustainable social transformation.

Overall, these parts complement each other by emphasizing the importance of a multidimensional approach—through yard management, food diversification, policy support, and cultural adaptation—to realize food security, socio-economic well-being, and environmental sustainability in Indonesia. To ensure the success of the implementation of the SFHA, this program also provides continuous technical help and training. This help is essential for the transfer of knowledge and skills to the community, which in turn improves their ability to manage yard land independently and sustainably. Studies show that effective mentoring plays an important role in program sustainability and increasing community independence in managing their resources (Sulaiman et al., 2019).

The implementation of SFHA in Indonesia is a clear illustration of how community-based empowerment programs can contribute to food security and the economic well-being of the community. The sustainability and success of these programs are highly dependent on policy support, active community involvement, and continuous innovation in agricultural practices. Further research is needed to explore new ways to improve the effectiveness and long-term impact of SFHA, especially in the face of global challenges such as climate change and economic fluctuations. The success of m-SFHA is highly dependent on community participation, especially among female farmers. Nonetheless, participation rates vary, and higher involvement is vital during the planning and implementation stages (Nasriati et al., 2018). This program has had a positive impact, but challenges in aspects of economic sustainability, such as crop profitability and market access, still need to be overcome to ensure long-term sustainability (Khuswati et al., 2022).

11.4. Outlook for the Future

The future of SFHA has great potential for development, especially in integrating modern agricultural technologies such as vertical farming and hydroponics to maximize yields in a limited space. This will further increase food security and economic benefits for participating households (Nguyen, 2023). Strong policy support and collaboration between the government, the

private sector, and community organizations will be crucial in scaling up the m-SFHA program. Future research should focus on exploring public-private partnership models to ensure sustainable funding and resource distribution (Br Saragih et al., 2021). In addition, ongoing educational initiatives and capacity building are needed to sustain the benefits of the program. The development of training modules and educational materials can help bridge the knowledge gap and encourage innovation (Sulaiman et al., 2019).

The SFHA program has significant potential to be further developed on a wider scale, especially in areas that have the potential to develop agricultural businesses on yard land. This expansion can be done by expanding the scope of the program to various other regions in Indonesia that have supportive environmental conditions, as well as by strengthening policy support from local and national governments. Studies show that the development of food security programs such as SFHA can significantly contribute to local food security and reduce dependence on food imports (Goulas, 2022). In addition, the integration of SFHA with other programs that focus on food security and poverty alleviation can create a more comprehensive and holistic approach. For illustration, combining SFHA with entrepreneurship skills training programs can help communities develop micro-enterprises in the sustainable agricultural sector, which can ultimately increase family income and reduce poverty rates (Frison & Clément, 2020).

Technological innovation is also an important key in the development of SFHA in the future. The application of modern agricultural technologies such as hydroponics, aquaponics, and the use of drones for crop monitoring can improve production efficiency, reduce the use of natural resources, and increase crop yields. This technology also allows for more consistent and sustainable production, even in areas with limited natural resources (Wijerathna-Yapa & Pathirana, 2022). Research and development is also a crucial element to support the development of SFHA. Investing in research to develop crop varieties that are more resistant to climate change and more efficient cultivation techniques can help farmers in increasing their yields and incomes. The development of local plant varieties that are adaptive to local environmental conditions will strengthen the sustainability of the program in the long-term (Capone et al., 2014).

The marketing and distribution of agricultural products also need to be improved to help SFHA farmers access a wider market and obtain better prices. Building an efficient distribution network and strengthening market access through ecommerce or local markets can provide greater economic benefits for farmers. The development of branding and certification of sustainable agricultural products can also increase the selling value of SFHA products in

the domestic and international markets (Tanumihardjo et al., 2020). Hopes for Positive Change in Food Sustainability:

The SFHA program is expected to encourage an increase in local food production which can reduce dependence on imports and increase food availability at the local level. By increasing local production, SFHA can also contribute to improving the nutritional status of the community by ensuring access to nutrient-rich food, thus having a positive impact on public health (Nemecek et al., 2016). In addition, increasing productivity and income from agricultural businesses within the framework of SFHA is expected to improve the economic welfare of the community, especially in rural areas. This will strengthen the economic resilience of the community and reduce social disparities. From an environmental perspective, SFHA is expected to reduce pressure on the environment by using an efficient sustainable agriculture approach in natural resource management (Torres et al., 2017).

Overall, the SFHA program is expected to increase food security in a sustainable manner by ensuring the availability of safe, diverse, and affordable food for the community. Increasing public awareness and education about the importance of food diversification and environmentally friendly agricultural practices will also be a key factor in achieving food sustainability in the future (Gustafson, 2017).

The SFHA program has great potential to be developed widely throughout Indonesia, especially in areas that have agricultural potential that has not been utilized optimally. This expansion can be done by identifying areas that have supporting natural and social resources, as well as providing ongoing training and mentoring to local communities. Studies show that community-based food security programs such as SFHA can significantly improve local food security and reduce dependence on food imports (Nemecek et al., 2016). In addition, the integration of SFHA with other programs that focus on food security and poverty alleviation can provide a more comprehensive approach. For illustration, integration with social entrepreneurship programs can help communities develop agricultural product-based Small and Medium Enterprises (SMEs), which not only increase income but also strengthen local economic networks. This cross-sector collaboration is very important to maximize the social and economic impact of the SFHA program (Tanumihardjo et al., 2020).

Technological innovation is also very important in the development of SFHA. The application of modern agricultural technologies such as hydroponics, aquaponics, and the use of drones for crop monitoring can improve production efficiency and reduce the use of natural resources. This technology also allows for better management of local environmental

conditions, thereby increasing agricultural productivity and sustainability in the long-term. Research shows that smart and climate-resilient agricultural technologies can be key in facing global challenges in the food sector (Wijerathna-Yapa & Pathirana, 2022). Investment in research and development (R&D) is essential to improve the yield and quality of agricultural products in the SFHA program. Research focused on developing crop varieties that are more resistant to disease, pests, and climate change can help farmers improve their crop yields. In addition, more efficient cultivation techniques, such as the use of organic fertilizers and better water management, can also contribute to increased productivity. This R&D will not only increase agricultural yields but can also increase farmers' incomes through more stable and sustainable production (Capone et al., 2014). The marketing and distribution of agricultural products also needs to be strengthened to ensure that SFHA farmers can access a wider market and obtain decent prices for their products. Developing an efficient distribution network, both through local markets and ecommerce, can help farmers increase their income. In addition, branding and certification of organic or sustainable products can increase the selling value of SFHA products in the domestic and international markets. Studies show that better market access and effective marketing strategies can significantly increase farmers' profitability and local economic sustainability (Enthoven & Van den Broeck, 2021). The potential for the development of the SFHA program is huge and can make a real contribution to food security, income increase, and community welfare. By integrating technology, strengthening R&D, and expanding marketing networks, SFHA can become a sustainability model that is not only relevant in Indonesia but can also be adapted in other countries that face similar challenges in food security and natural resource management.

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