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COMMENTARY

Community-based circular food systems in Pakistan: A path to sustainable food security

SPECIAL ISSUE
Community-Based Circular Food Systems

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Introduction

Pakistan, a nation grappling with the imperative of food security amidst environmental degradation and resource limitations, stands at a pivotal juncture in its agricultural trajectory. The transition to community-based circular food systems emerges as a promising avenue to address these pressing challenges sustainably (Patel, 2009; El Bilali et al., 2021). Circular food systems, characterized by their emphasis on waste reduction, efficient resource utilization, and localized production-consumption cycles, offer a holistic approach to food production and distribution (Fassio and Chirilli, 2023; De Bernardi et al., 2023). In the unique context of Pakistan, where agriculture serves as a cornerstone of the economy and communities are deeply interconnected, the adoption of such systems holds significant potential. By integrating circular principles into the fabric of its agricultural landscape, Pakistan could not only enhance its food security but also promote environmental sustainability and bolster community resilience (Amanullah, 2020; Fanzo et al., 2020). This commentary highlights the potential of circular food systems to address Pakistan's agricultural challenges while fostering sustainable development.

The agricultural sector in Pakistan is a vital component of its economy, supporting livelihoods and contributing significantly to the nation's gross domestic product (GDP). However, the sector faces multifaceted challenges, including water scarcity, soil degradation, and fluctuating market conditions (Amanullah & Khan, 2024; Perdana et al., 2022). In this context, the shift toward community-based circular food systems (presents an opportunity to transform agricultural practices (Sachet et al., 2021). These systems encourage the efficient use of resources, such as water and nutrients, while

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minimizing waste through practices like composting and recycling (Parfitt et al., 2010; Żmieńka & Staniszewski, 2020). By fostering local production and consumption loops, circular food systems can reduce dependency on external inputs and strengthen local food networks (Bonilla Cedrez et al., 2023). This commentary underscores the potential of circular food systems to address the challenges confronting Pakistan's agricultural sector, offering a pathway toward sustainability and resilience.

Furthermore, the implementation of circular food systems in Pakistan aligns with broader sustainability goals, including climate resilience and social equity (Martinho, 2021; Perdana et al., 2022). Climate change poses a significant threat to agricultural productivity in Pakistan, with increasing occurrences of extreme weather events and shifting precipitation patterns (Amanullah et al., 2023; De Bernardi et al., 2023). Circular food systems, with their focus on diversified cropping systems and sustainable land management, offer resilience against these climate impacts. Additionally, these systems can promote social inclusivity by empowering local communities, particularly small-scale farmers and marginalized groups, through improved access to markets and equitable participation in food production (Fassio & Chirilli, 2023; El Bilali et al., 2021). Thus the adoption of community-based circular food systems (C-B CFSs) in Pakistan represents a transformative step toward a more sustainable, resilient, and equitable food future. This commentary emphasizes the potential of circular food systems to address climate change impacts and promote social inclusivity in Pakistan's agricultural sector.

Discussion

Community-based circular food systems (C-B CFSs) hold significant potential in Pakistan to address both food insecurity and malnutrition among the country's poor population, ultimately contributing to a healthier nation. Pakistan faces formidable challenges concerning food security and nutrition, with a significant portion of its population struggling to access nutritious foods. This issue is exacerbated by environmental degradation, resource constraints, and limited access to diverse food options. In response, the concept of C-B CFSs emerges as a holistic approach that integrates principles of a circular economy and community participation to ensure sustainable food production, distribution, and consumption. By focusing on local production-consumption loops, waste reduction, empowerment of small-scale farmers, and nutrition education, C-B CFSs offer a pathway to improve access to nutritious foods, diversify diets, and enhance community resilience against food insecurity and malnutrition. This discussion explores how C-B CFSs can be a transformative solution for Pakistan, addressing the root causes of food insecurity and malnutrition while promoting environmental sustainability and community well-being.

Figure 1 illustrates how C-B CFSs can serve as a transformative approach to addressing Pakistan's agricultural and food security challenges. By emphasizing resource efficiency, local food networks, and sustainable practices, C-B CFSs contribute to a more resilient and self-sufficient food system.

One of the key benefits of C-B CFSs is *increased access to nutritious food*, ensuring that communities, especially vulnerable populations, have a steady supply of fresh, locally produced food. This leads to *diversification of diets*, encouraging consumption of a wider range of fruits, vegetables, and grains, which improves overall public health and reduces malnutrition. Furthermore, these systems *empower small-scale farmers* by creating direct market linkages, reducing dependency on middlemen, and enhancing their economic stability through fair pricing and local demand-driven production.

Another significant advantage is the *reduction of food waste*, as C-B CFSs promote efficient resource utilization, composting, and redistribution of surplus food within communities. By integrating local production with waste management strategies, food systems become more sustainable and environmentally friendly. Moreover, incorporating *nutrition education* into these initiatives can enhance awareness about healthy eating habits, fostering long-term improvements in public health and food consumption patterns.

By adopting C-B CFSs, Pakistan can create a more equitable and sustainable agricultural landscape that benefits both farmers and consumers. These systems not only support food security but

Figure 1. The Role of Community-Based Circular Food Systems in Sustainable Agriculture

also contribute to environmental conservation and economic empowerment at the grassroots level.

1. Increased Access to Nutritious Food

One of the primary advantages of C-B CFS is the emphasis on local production and consumption loops. By promoting small-scale farming and community gardens, these systems can ensure a steady supply of fresh, nutritious foods to local communities. This increased availability of diverse, locally grown produce can combat malnutrition by providing essential vitamins, minerals, and other nutrients that are often lacking in diets of the poor.

Increased access to nutritious food is a significant advantage of C-B CFSs, particularly through their emphasis on local production and consumption loops. In Pakistan, where malnutrition is a pressing issue among impoverished communities, C-B CFSs can play a pivotal role in addressing this challenge.

Local Production and Consumption Loops

C-B CFSs promote small-scale farming and community gardens, which create local production and consumption loops. This means that food is grown locally and consumed within the community, reducing the need for long-distance transportation and its associated carbon footprints. This not only supports local farmers but also ensures a steady and reliable supply of fresh, nutritious foods to local residents.

Diverse, Locally Grown Produce

By encouraging crop diversification and the cultivation of a wide range of fruits, vegetables, grains, and legumes, C-B CFSs promote a diverse food supply. This diversity is crucial for addressing malnutrition as it provides a variety of essential nutrients that may be lacking in monotonous diets. For instance, micronutrient-rich vegetables like spinach, carrots, and tomatoes can be grown locally and made readily available to communities.

Nutrient-Rich Foods

Local and fresh produce tends to be more nutrient-dense compared to processed and imported foods. For example, leafy greens, fruits, and legumes grown in local gardens are rich in vitamins (such as vitamin C and vitamin A), minerals (like iron and calcium), and dietary fiber. These nutrients are

essential for overall health, growth, and development, particularly in vulnerable populations such as children and pregnant women.

Combatting Malnutrition

Malnutrition is not just about lack of food; it is also about the lack of essential nutrients. C-B CFSs addresses this issue by ensuring that communities have access to a variety of nutrient-rich foods. For instance, a community garden may grow a mix of vegetables like spinach, carrots, and bell peppers, providing a diverse array of vitamins and minerals to combat deficiencies.

Empowerment of Local Farmers

C-B CFSs empowers small-scale farmers to grow nutritious foods and sell them within their communities. This not only supports local livelihoods but also ensures that the foods produced are culturally appropriate and familiar to residents. When people have access to foods they are accustomed to, they are more likely to consume them regularly, contributing to improved nutrition outcomes.

Long-Term Health Benefits

The consistent consumption of fresh, locally grown produce can lead to long-term health benefits for communities. Reduced reliance on processed and packaged foods, which are often high in unhealthy fats, sugars, and additives, can help prevent diet-related diseases such as obesity, diabetes, and cardiovascular disorders.

The emphasis on local production and consumption loops in C-B CFSs offers a promising solution to address malnutrition in Pakistan. By promoting small-scale farming, crop diversification, and the availability of diverse, locally grown produce, C-B CFSs ensures that communities have access to nutrient-rich foods that are essential for good health. This approach not only addresses immediate nutritional needs but also contributes to the long-term well-being and resilience of communities.

2. Diversification of Diets

C-B CFSs encourage crop diversification, which means growing a variety of fruits, vegetables, grains, and legumes. This diversity in food production not only improves soil health and ecosystem resilience but also translates into diverse diets for consumers. In Pakistan, where many people rely heavily on staple crops such as wheat and rice, the introduction of a wider range of nutritious foods through C-B CFSs can address the malnutrition caused by a lack of dietary diversity.

The following points describe how C-B CFSs encourages and supports this diversification.

Crop Diversity

C-B CFSs initiatives promote the cultivation of a wide range of crops including fruits, vegetables, grains, and legumes. This contrasts with conventional farming practices that often focus on monoculture or a limited set of crops. The introduction of diverse crops improves soil health, reduces the reliance on chemical inputs, and enhances ecosystem resilience.

Improved Nutrition

The diverse range of crops grown in C-B CFSs translates directly to more varied and nutritious diets for local communities. For instance, incorporating fruits like mangoes, guavas, and citrus alongside staple grains like wheat and rice provides essential vitamins (A, C, E), minerals (iron, calcium), and dietary fiber. Legumes such as lentils and chickpeas add valuable protein and micronutrients to diets, addressing common deficiencies.

Addressing Malnutrition

In Pakistan, where malnutrition remains a significant challenge, particularly among the poor, the lack of dietary diversity contributes to nutritional deficiencies. C-B CFS initiatives can play a pivotal role in addressing this issue by promoting the consumption of locally grown, diverse foods. For example, adding leafy greens, carrots, and tomatoes to diets provides essential vitamins (K, A, C) and minerals (iron, potassium) that are often lacking.

Cultural Relevance

C-B CFSs also consider cultural preferences and local food traditions, ensuring that the introduced crops are well-accepted and integrated into local diets. This cultural relevance increases the likelihood of sustained consumption of these diverse

foods, contributing to long-term improvements in nutrition.

Resilience to Climate Change

Diversified cropping systems in C-B CFSs are inherently more resilient to climate variability and extremes. For example, in times of drought, certain drought-tolerant crops like millets and sorghum can still thrive, providing a food source when others fail. This resilience ensures a more stable food supply even in the face of climate challenges.

Economic Benefits

Diversification also brings economic benefits to small-scale farmers participating in C-B CFSs. Growing a variety of crops allows for more stable incomes, as farmers are not solely reliant on one crop that may be vulnerable to price fluctuations or environmental risks. This economic stability can further contribute to improved access to food and nutrition for farming households.

The diversification of diets through C-B CFS initiatives in Pakistan offers a multifaceted solution to address malnutrition. By promoting crop diversity, improving nutrition, addressing cultural preferences, building resilience to climate change, and providing economic benefits to farmers, C-B CFSs lay a foundation for healthier and more sustainable food systems. This approach not only addresses immediate nutritional needs but also contributes to the overall well-being and resilience of communities.

3. Empowerment of Small-Scale Farmers

C-B CFSs prioritize the involvement of small-scale farmers and marginalized communities in food production. By providing training, resources, and market access to these farmers, C-B CFSs not only boost their livelihoods but also ensure a sustainable supply of locally grown, affordable food. This empowerment helps to lift farmers out of poverty, enabling them to feed their families nutritious meals and contribute to the overall health of their communities. C-B CFSs in Pakistan are empowering small-scale farmers in significant ways, leading to improvements in both livelihoods and local food systems.

Training and Capacity Building

C-B CFS initiatives provide essential training and capacity-building programs to small-scale farmers. These programs cover sustainable farming practices, organic cultivation methods, efficient water management, and integrated pest management. By equipping farmers with these skills and knowledge, C-B CFSs enhance their ability to produce high-quality, nutritious crops in an environmentally friendly manner.

Resource Access

Access to resources such as seeds, tools, and organic inputs is crucial for small-scale farmers. C-B CFS projects often facilitate the provision of these resources, either through direct distribution or by establishing community seed banks and resource-sharing networks. This ensures that farmers have the necessary inputs to grow a diverse range of crops sustainably.

Market Linkages

One of the significant challenges for small-scale farmers is accessing markets to sell their produce. C-B CFS initiatives work on creating market linkages, connecting farmers directly with consumers, local markets, restaurants, and institutions like schools and hospitals. This direct marketing approach not only ensures fair prices for farmers but also provides consumers with fresh, locally grown produce.

Income Generation

Empowering small-scale farmers through C-B CFSs leads to increased income generation. By diversifying their crops and accessing premium markets for organic and locally produced foods, farmers can fetch higher prices for their produce. This economic empowerment lifts farmers out of poverty, enabling them to invest in their farms, homes, and children's education.

Food Security

When small-scale farmers have the resources and knowledge to grow a variety of crops, it directly benefits their families' food security. They are no longer solely reliant on a single crop for sustenance. Instead, they can cultivate a mix of fruits,

vegetables, grains, and legumes, ensuring a diverse and nutritious diet for their households.

Community Health Impact

The empowerment of small-scale farmers has a ripple effect on community health. As farmers adopt sustainable practices and produce nutritious foods, the overall health of the community improves. Reduced pesticide use, increased consumption of fresh fruits and vegetables, and access to organic foods contribute to lower rates of malnutrition and related health issues.

Sustainable Agriculture

By promoting sustainable practices such as agroforestry, crop rotation, and soil conservation, C-B CFSs not only benefit farmers but also promote long-term sustainability. Healthy soils, diverse cropping systems, and reduced chemical inputs contribute to ecosystem health and resilience, ensuring that future generations can continue to benefit from the land.

The empowerment of small-scale farmers through C-B CFSs in Pakistan is a critical step toward building resilient and sustainable food systems. By providing training, resources, market access, and income opportunities, and improving food security and community health, C-B CFS initiatives create a positive impact on both farmers and their communities. This approach not only addresses immediate challenges of poverty and malnutrition but also lays the groundwork for a healthier, more prosperous future for Pakistan's agricultural sector.

4. Reduction of Food Waste

Circular food systems place a strong emphasis on reducing waste throughout the food supply chain. By implementing practices such as composting, recycling, and efficient use of resources, C-B CFSs can minimize food loss. This means more food reaches those in need, reducing food insecurity and ensuring a healthier population.

In the context of Pakistan, where food insecurity and malnutrition are pressing issues, the reduction of food waste through C-B CFSs holds immense importance.

Here is how the reduction of food waste can have a significant impact:

Minimizing Losses

Pakistan faces challenges in food production, storage, and distribution, leading to significant losses along the supply chain. C-B CFS initiatives focus on minimizing these losses by implementing efficient practices. For example, improved post-harvest handling techniques, proper storage facilities, and transportation systems help prevent spoilage and wastage of fresh produce.

Composting and Recycling

C-B CFSs promote the use of organic waste for composting, turning waste into valuable resources. Farmers can use compost to enrich their soils, improving soil fertility and crop yields. Additionally, organic waste can be recycled to create biogas for cooking or heating, reducing reliance on fossil fuels and promoting sustainable energy practices.

Efficient Resource Use

In C-B CFSs, every part of the food system is considered valuable. By using resources efficiently, such as utilizing food scraps for animal feed or creating nutrient-rich soil amendments, C-B CFSs minimizes waste generation. This holistic approach ensures that all resources are maximized, contributing to a more sustainable and efficient food system.

Increased Access to Food

The reduction of food waste means more food is available for consumption. In a country like Pakistan, where millions suffer from food insecurity, every bit of saved food can make a difference. By ensuring that edible food reaches those in need instead of being wasted, C-B CFSs directly addresses the issue of hunger and malnutrition.

Healthier Population

Wasting less food means more nutritious meals for individuals and families. In Pakistan, where malnutrition is a significant concern, access to fresh, nutritious food is crucial for improving health outcomes. By reducing food waste and ensuring that surplus food reaches vulnerable populations, C-B

CFSs contributes to a healthier and more nourished population.

Economic Benefits

Food waste reduction also has economic benefits for farmers and communities. When less food is wasted, farmers can sell more of their produce, increasing their income. This, in turn, stimulates local economies and creates opportunities for small-scale producers to thrive. Additionally, reducing waste reduces the financial burden on consumers, making nutritious food more accessible and affordable.

Environmental Impact

Food waste is not just a social and economic issue but also an environmental one. When food is wasted, all the resources used to produce that food, such as water, energy, and land, are also wasted. By reducing food waste, C-B CFSs contribute to a more sustainable use of resources and reduces the environmental footprint of the food system.

The reduction of food waste through C-B CFSs in Pakistan is crucial for several reasons. It directly addresses food insecurity and malnutrition by ensuring that more food reaches those in need. It also has economic benefits for farmers and communities, promotes environmental sustainability by minimizing resource wastage, and contributes to a healthier population overall. As Pakistan works towards building a more resilient and sustainable food system, reducing food waste must be a central focus to achieve a healthier and more prosperous nation.

5. Promotion of Food Sovereignty

C-B CFSs promote food sovereignty, which means communities have control over their own food systems. This allows communities to prioritize nutritious, culturally appropriate foods that meet their dietary needs. By strengthening local food systems, C-B CFSs reduce reliance on imported, processed foods that are often less nutritious and more expensive.

The promotion of food sovereignty through C-B CFSs in Pakistan is a critical aspect that can significantly impact the health and well-being of its population. Below is a detailed discussion on how C-B CFSs promote food sovereignty.

Community Empowerment

C-B CFSs empower local communities to take control of their food systems. This means that communities are actively involved in decision-making processes regarding what crops to grow, how to grow them, and where to distribute them. This empowerment allows communities to prioritize their nutritional needs and cultural preferences when it comes to food choices.

Diverse and Nutritious Diets

Food sovereignty emphasizes the importance of diverse and nutritious diets. In Pakistan, where malnutrition is prevalent, promoting diverse food options is crucial for addressing nutrient deficiencies. C-B CFSs encourage the cultivation of a variety of fruits, vegetables, grains, and legumes, ensuring that communities have access to a wide range of essential nutrients.

Cultural Relevance

One of the key aspects of food sovereignty is respecting and preserving cultural food traditions. C-B CFSs support the production of traditional crops and foods that hold cultural significance for communities. This not only promotes cultural heritage but also ensures that people have access to foods that they are familiar with and enjoy.

Reduced Reliance on Imported Foods

Many developing countries, including Pakistan, rely heavily on imported and processed foods. These foods are often less nutritious and more expensive than locally produced alternatives. C-B CFSs aim to reduce this reliance by promoting local food production. By growing their own food, communities can access fresh, nutritious foods at a lower cost, improving their overall health and well-being.

Resilience to External Shocks

Food sovereignty also enhances community resilience to external shocks, such as economic crises or natural disasters. When communities have strong local food systems, they are less vulnerable to disruptions in global food supply chains. This resili-

ence ensures that communities can continue to access food even during challenging times.

Environmental Sustainability

C-B CFSs promote sustainable farming practices that are in harmony with the environment. By reducing reliance on chemical inputs and promoting agroecological methods, C-B CFSs contribute to healthier soils, cleaner water, and biodiversity conservation. This sustainable approach ensures that future generations will also have access to nutritious and culturally relevant foods.

Economic Benefits

Food sovereignty can also have economic benefits for communities. By promoting local food production and consumption, C-B CFSs support small-scale farmers and local food businesses. This, in turn, creates economic opportunities in communities and strengthens local economies.

The promotion of food sovereignty through C-B CFSs in Pakistan has the potential to transform the nation's food landscape. By empowering communities, promoting diverse and nutritious diets, respecting cultural food traditions, reducing reliance on imported foods, building resilience, promoting environmental sustainability, and creating economic opportunities, C-B CFSs lay the foundation for a healthier and more prosperous nation. It is an approach that not only addresses immediate food security and malnutrition issues but also fosters long-term sustainability and resilience in Pakistan's food systems.

6. Integration of Nutrition Education

Alongside C-B CFS implementation, nutrition education programs can be integrated into communities. These programs can teach people about the importance of balanced diets, proper nutrition for different age groups, and how to make the most of locally available foods. Empowering individuals with knowledge about healthy eating habits can have a lasting impact on reducing malnutrition.

In Pakistan, where malnutrition and food insecurity are prevalent issues, integrating nutrition education into C-B CFS initiatives can have a profound impact. Below is a discussion of how the integration of nutrition education can contribute to a healthier nation.

Promoting Balanced Diets

Nutrition education programs in C-B CFSs can teach communities about the importance of balanced diets. Individuals learn about the various food groups and the role each plays in maintaining health. By understanding the need for a diverse range of foods, people are more likely to make informed choices when it comes to their meals, leading to improved nutrition.

Customizing Nutrition for Different Age Groups

Nutrition education can tailor information to different age groups, focusing on the specific dietary needs of children, pregnant women, and the elderly. For example, educating mothers about the importance of breastfeeding and introducing complementary foods at the right age can prevent malnutrition in infants. Similarly, educating the elderly about nutrient-dense foods can address issues related to aging and nutritional deficiencies.

Utilizing Locally Available Foods

C-B CFSs emphasize local food production, and nutrition education can highlight the nutritional value of these locally available foods. Communities can learn about the benefits of indigenous crops, seasonal fruits and vegetables, and traditional recipes that are both nutritious and culturally significant. This not only promotes food sovereignty but also encourages the consumption of fresh, nutrient-rich foods.

Cooking and Meal Preparation Techniques

Nutrition education can also include practical lessons on cooking and meal preparation. Communities can learn how to prepare nutritious meals using local ingredients, emphasizing simple yet healthy cooking methods. This empowers individuals to make the most of the foods available to them, maximizing nutritional intake and minimizing food wastage.

Addressing Malnutrition

By integrating nutrition education into C-B CFSs, communities are equipped with the knowledge and

skills to combat malnutrition effectively. They learn about the signs and consequences of malnutrition, preventive measures, and strategies for improving nutritional status. This proactive approach can lead to a reduction in malnutrition rates, especially among vulnerable groups such as children and pregnant women.

Creating Sustainable Behavior Change

Education is a powerful tool for behavior change. By instilling a deeper understanding of nutrition and its impact on health, nutrition education in C-B CFSs can create lasting behavior change within communities. This includes choices related to food purchasing, cooking practices, and dietary habits, all of which contribute to improved nutrition outcomes.

Empowering Communities

Integrating nutrition education empowers communities to take charge of their health and well-being. When individuals understand the importance of nutrition and how it affects their lives, they are more likely to advocate for improved food systems, access to nutritious foods, and healthier environments. This bottom-up approach to community empowerment fosters sustainability and resilience in the face of food-related challenges.

The integration of nutrition education into C-B CFSs in Pakistan is a multifaceted approach to addressing malnutrition and promoting a healthier population. By promoting balanced diets, utilizing locally available foods, and teaching practical cooking skills, communities are empowered to make informed choices about their nutrition. This not only improves individual health outcomes but also contributes to food sovereignty, sustainability, and community resilience. As Pakistan works to build a healthier nation, nutrition education within C-B CFSs plays a vital role in shaping positive health behaviors and ensuring a brighter future for all.

C-B CFSs in Pakistan offer a transformative solution to address food insecurity and malnutrition among vulnerable populations. Through increased access to nutritious foods, diversified diets, empowerment of small-scale farmers, reduction of food waste, promotion of food sovereignty, and integration of nutrition education, C-B CFSs can pave the way for a healthier nation. This comprehensive approach not only meets immediate nutritional needs but also establishes sustainable and resilient food systems for Pakistan's future.

To build upon existing agricultural practices and community networks, C-B CFSs can leverage farmers' cooperatives, local markets, and community supported agriculture initiatives as foundational elements. These systems aim to minimize waste by promoting practices such as composting, recycling nutrients, and utilizing agricultural by-products efficiently. For instance, agricultural residues can serve as valuable inputs for animal feed or compost, contributing to waste reduction and improved soil health. Establishing local food processing units can further enhance the circularity of the system by creating value-added products.

In terms of resource efficiency, integrating precision agriculture technologies and water conservation practices into C-B CFSs can yield significant benefits. Techniques like drip irrigation can reduce water usage, while organic fertilizers and biopesticides can minimize chemical inputs, promoting sustainability. Community engagement is vital for success, as educating farmers and consumers about the advantages of C-B CFSs and encouraging participation in local food networks fosters a sense of ownership and responsibility.

Moreover, C-B CFSs can enhance community resilience in the face of climate change. Practices such as diverse crop varieties, agroforestry, and integrated pest management contribute to ecosystem health and resilience. During climate-related shocks such as floods or droughts, these diversified and locally adapted food systems are better equipped to ensure food security.

The development of C-B CFSs in Pakistan presents a significant opportunity to tackle the intertwined challenges of food security and environmental sustainability. By reducing waste, improving resource efficiency, and fostering community participation, these systems can contribute to a more resilient and sustainable food system. Collaborative efforts involving government, NGOs, farmers, and consumers are essential for the successful implementation and scaling of C-B CFS initiatives.

Conclusion

Community-based circular food systems offer a promising avenue for Pakistan to address food insecurity and malnutrition while promoting environmental sustainability. By integrating access to nutritious foods, diverse diets, empowerment of small-scale farmers, reduction of food waste, promotion of food sovereignty, and nutrition education, C-B CFSs lay the foundation for a healthier and more resilient nation. Collaboration between stakeholders and community engagement are key to the success of these systems.

Recommendations

Figure 2 outlines key recommendations for developing a resilient and sustainable food system in Pakistan. *Investment in small-scale farming* is crucial to enhance productivity and livelihoods, while the *promotion of agroecological practices* ensures environmentally friendly and climate-resilient agriculture. Strengthening *support for local markets* helps create direct farmer-consumer linkages, reducing dependency on imports and stabilizing food prices. *Education and awareness* initiatives can empower communities with knowledge about sustainable agriculture, nutrition, and food security. Effective *policy support*, backed by *research and innovation,* will drive long-term solutions for food sustainability. Lastly, fostering *partnerships and collaboration* among stakeholders and implementing *monitoring and evaluation* mechanisms will ensure that sustainable practices are effectively adopted and continuously improved.

Figure 2. Recommendations for Building Sustainable Food Systems in Pakistan

1. **Investment in Small-Scale Farming:** Provide support and resources to small-scale farmers to enhance their productivity and sustainability.
2. **Promotion of Agroecological Practices:** Encourage the adoption of agroecological practices such as crop diversification, agroforestry, and organic farming.
3. **Support for Local Markets:** Strengthen local markets and value chains to promote the consumption of locally produced foods.
4. **Education and Awareness:** Increase awareness about the benefits of C-B CFSs and sustainable food practices among farmers, consumers, and policymakers.
5. **Policy Support:** Develop and implement policies that incentivize and support the transition to circular and sustainable food systems.
6. **Research and Innovation:** Invest in research and innovation to develop technologies and practices that enhance the efficiency and sustainability of food production.
7. **Partnerships and Collaboration:** Foster partnerships between government, NGOs, academia, and the private sector to drive forward sustainable food system initiatives.
8. **Monitoring and Evaluation:** Establish monitoring and evaluation mechanisms to assess the impact of CBCFS on food security, nutrition, and environmental sustainability.

References

Amanullah (Ed.). (2020). *Agronomy: Climate change & food security*. IntechOpen. https://doi.org/10.5772/intechopen.78102

Amanullah & Khan, U. (2024). Enhancing public health through modern agronomy: Sustainable and nutrient-rich practices [Commentary]. *Journal of Agriculture, Food Systems, and Community Development, 13(2)*, 11–18. https://doi.org/10.5304/jafscd.2024.132.014

Amanullah, Ondrasek, G., & Al-Tawaha, A. R. (2023). Editorial: Integrated nutrients management: An approach for sustainable crop production and food security in changing climates. *Frontiers in Plant Science, 14*, Article 1288030. https://doi.org/10.3389/fpls.2023.1288030

Bonilla Cedrez, C., Andeweg, K., & Casu F. A. M. (2023). *Circular food systems around the world: Exploring concepts, ideas and opportunities*. Wageningen Livestock Research. https://doi.org/10.18174/638397

De Bernardi, P., Bertello, A., & Forliano, C. (2023). Circularity of food systems: A review and research agenda. *British Food Journal*, *125*(3), 1094-1129. https://doi.org/10.1108/BFJ-05-2021-0576

El Bilali, H., Strassner, C., & Ben Hassen, T. (2021). Sustainable agri-food systems: Environment, economy, society, and policy. *Sustainability*, *13*(11), Article 6260. https://doi.org/10.3390/su13116260

Fanzo, J., Bellows, A. L., Spiker, M. L., Thorne-Lyman, A. L., & Bloem, M. W. (2020). The importance of food systems and the environment for nutrition. *The American Journal of Clinical Nutrition, 113(1)*, 7–16. https://doi.org/10.1093/ajcn/nqaa313

Fassio, F., & Chirilli, C. (2023). The circular economy and the food system: A review of principal measuring tools. *Sustainability*, *15*(13), Article 10179. https://doi.org/10.3390/su151310179

Martinho, V. J. P. D. (2021). Food and consumer attitude(s): An overview of the most relevant documents. *Agriculture*, *11*(12), Article 1183. https://doi.org/10.3390/agriculture11121183

Parfitt, J., Barthel, M., & Macnaughton, S. (2010). Food waste within food supply chains: Quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society B: Biological Sciences, 365*(1554), 3065–3081.

Patel, R. (2009). Food sovereignty. *Journal of Peasant Studies, 36(3)*, 663–706.

Perdana, T., Chaerani, D., Hermiatin, F. R., Achmad, A. L. H., & Fridayana, A. (2022). Improving the capacity of local food network through local food hubs' development. *Open Agriculture*, *7*(1), 311–322. https://doi.org/10.1515/opag-2022-0088

Sachet, E., Mertz, O., Le Coq, J.-F., Cruz-Garcia, G. S., Francesconi, W., Bonin, M., & Quintero, M. (2021). Agroecological transitions: A systematic review of research approaches and prospects for participatory action methods. *Frontiers in Sustainable Food Systems*, *5*, Article 709401. https://doi.org/10.3389/fsufs.2021.709401

Żmieńka, E., & Staniszewski, J. (2020). Food management innovations for reducing food wastage—A systematic literature review. *Management*, *24*(1), 193–207. https://doi.org/10.2478/manment-2019-0043