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FOOD SECURITY CHALLENGES AND OPPORTUNITIES: A STUDY OF LOCAL PERSPECTIVES IN KODAGU DISTRICT

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ABSTRACT

This study attempted to examine the primary challenges to food security exclusively in the Kodagu district which is largely dependent on agriculture. It also tries to assess the possibility of developing initiatives within the region focused on sustainable agriculture and community development to overcome these challenges. Data were collected from 391 respondents revealing high incidences of post-harvest losses, climate variabilities, and transportation constraints as major issues holding the respondents from food security. Sustainable practices identified are crop diversification, rainwater harvesting, and agroforestry, while cooperative farming and collaboration among local shareholders are recognized as valuable community-driven solutions. The regressions indicate that sustainable practices and the community-driven interventions will improve food security significantly, although the effect of sustainable practices is slightly greater. The results indicate that a balanced mix of sustainable agriculture and community-driven efforts is necessary for increased food security in Kodagu.

KEYWORDS: *Food Security, Sustainable Practices, Community-Based Solutions, Agricultural Challenges, Kodagu, Crop Diversification, Rainwater Harvesting, Cooperative Farming, Stakeholder Collaboration, Climate Variability.*

INTRODUCTION

It continues being one of the most important issues in developing economies, over all in agricultural economies, such as put Kodagu district, India. As defined by FAO, food security is a situation in which, at all times, all people have physical and economic access to sufficient, safe, and nutritious food for a healthy and active life. It involves availability, accessibility, and affordability. Kodagu, with its agricultural richness, diversification, biodiversity, and reliance on monsoon-dependent farming, presents a unique case for studying the dynamics of food security in search of sustainable solutions. At the country level, India faces multiple challenging issues regarding food security for an increasing population. Climate change, along with land degradation, declining agricultural productivity, and socio-economic inequalities, worsens the problem. Singh, From India, in his 2016 research, states that food security in India has come to be very severely affected by climate change through an alteration in crop patterns as a direct impact factor on yield decrease and extreme weather events' increased frequency. As these macro-trends resonated in Kodagu, it made erratic rain and soil erosion big concerns.

The agricultural economy of Kodagu is based on coffee, spices, and paddy cultivation. While they are responsible for the region's economic development, these economies may constitute very complex dimensions of food security because of limited diversification within the food production system. Gahukar (2011) states that generally, the food production and distribution challenge in India is related directly to monoculture practices and inadequate infrastructure for storage. Dependency on cash crops affects food availability and affordability in Kodagu in times of drought or other economic depressions. Other socio-economic factors include differences in income levels, which, as indicated by their varying access to markets, are determining factors of food security in Kodagu. According to Dev and Sharma, food security policies in India must deal with production and distribution inequities in order to achieve holistic solutions (2010). Similarly, Lumpkin mentions the need to think of inclusive approaches advancing agricultural innovations and policies that empower marginalized communities (2013). The tribals and rural people of Kodagu are very vulnerable to food insecurity, as they very often have restricted access to resources and markets.

Another determinant, with gravity, of food security in Kodagu, is how the global and national policies affect the district. Sarkar and Thanai suggest that India's food security policies has to adjust to the socio-economic and environmental pressures, since these factors constantly put the country in rapid changes. The government schemes like the PDS and MGNREGA having a mixed result might support the argument for the need localized strategies in closing the policy gaps for Kodagu. Chadha identifies technology and innovations as the driving forces on the challenges to food security as cited in (2016). Kodagu's productivity and resilience can be improved greatly and even more with the implementation of sustainable agriculture methods focused on precision farming, modern weather prediction, and advanced irrigation systems. In addition, Singh S.P. stated that more on the ground collaboration among farmers, policymakers, and researchers is necessary in the development of area specific policies.

In a place like Kodagu, where there is uniquely high potential and opportunity and big geographical and cultural problems, one could design food security-related opportunities and challenges. Kodagu has infinite problems, including environmental degradation and climate change, monoculture farming, and social and economic inequalities. But, the prospect of these natural resources with strong social ties can strongly complement the hoped-for pursuit of alternative sustainable solutions in the area. Equitable food distribution becomes the hurdle failure against food security, a challenge that certainly resonates with Kodagu's attempts at improving resilience (Gahukar 2011). Locally, this makes an opportunity for people there to reflect on and understand how adversity and opportunity are interplayed in their interaction. The study will illuminate the food security challenges in the Kodagu district by suggesting actions that would bridge gaps in the areas of availability, access, and affordability, hence, ensuring sustainable development.

LITERATURE REVIEW

Food security in India, which happens to be one of the key concerns in India, refers to availability, access and affordability of food by citizens. The literature exposes a plethora of challenges and opportunities provided by rapid economic growth, rapid globalization and intra-regional diversities on ensuring food security. Umali-Deininger and Sur have studied food security in a much globalized world in 2007. They suggested that although globalization brings about developments in food systems brought about by technology and trade, it also challenges such highly demanding international standards, and the access to such advancement is inequitable. Such geography applies clearly in India where, in contrast to growth in agricultural exports, food safety regulations are not uniform, thus leaving an impact on both the domestic and international markets.

Rice is an important staple and chosen specially for considering its importance in food security for India, as added by Mohanty and Yamano (2017). Issues listed as challenges included climate change, resources, and declining productivity growth. On the other hand, authors identified the prospect for the improvement of production through better technologies and improved practices in agriculture. This indicates another crop-specific strategy to be adopted in food security matters in India. Thus, Pingali et al. (2019) provided a rather comprehensive view of the food systems of India under enormous challenges and opportunities by the time it gets to 2050. Modernizing the staple and towards the increase of income and urban lifestyle, people develop new food choices and increase the demand for diversification in food and richer nutrition. Therefore, agriculture has to face deep changes, from the view and policy on a staple-creating agriculture to that in which agriculture is seen within the wider agri-food systems that are by nature sustainable and nutrition-sensitive. The food-land-water nexus, yet another serious issue concerning food security as mentioned by Kumar et al. (2012). It talks of the competition for land and water resources in India at the present, further worsened by population increase, urbanization, and climate variability. The study underlines the need for integrated resource management in forestalling the above-mentioned challenges for food production in a sustainable way.

Gandhi and Zhou compared the food security challenges in India and China and stated that in both these countries one thing is common, which is a brisk growth in economies, thus, escalation in food demand. Generally, India is considered to have a different challenge as compared to China because of slow growth in the agricultural sector, increasing density of population, and reliance on more traditional forms of farming. Modernization of agriculture, policy intervention measures associated with regions, productivity enhancement, with the reduction of regional disparity were discussed in detail by these authors. Implementation of the National Food Security Act really proves to be a significant policy measure towards combating food security in India. The issues and challenges in its implementation under study by Tanksale and Jha reveal inefficiencies in the distribution systems, leakages in public distribution networks, and inadequate storage infrastructure. These inefficiencies highlight the importance of informed governance and technology inputs for strengthening the impact of the NFSA.

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Food security is one of the burning issues, as commented by Mahadevan and Suardi. The example of national food security best brought in India as on various levels of productivity in agriculture, infrastructure, and socio-economic conditions, national food security policies can be well impacted. Sufficient evidence suggests that even locale conditions have been designed to address food security problems specific to areas. These studies-fascinating, complex picture of food security in India-have been shaped, quite actually and closely knitted by forces of globalization, resource availability, the exercise of policy implementation, and regional diversities. There will always be bottlenecks; however, some windows of opportunity do open up innovation, technology, and policy reform towards sustainable solutions. This multidimensional approach may be needed in terms of customized solutions to different bottlenecks mentioned above with appropriate crop-specific strategies being integrated in resource management, governance reforms, and local interventions for food security at all levels.

OBJECTIVES OF THE STUDY

1. To examine the key challenges affecting the food security in Kodagu district from the perspective of the local residential population.
2. To explore opportunities for improving food security through sustainable practices and community-based solutions in the Kodagu district.

METHODOLOGY

The research is qualitative-descriptive in meaning of trying to understand the existing scenario of challenges and opportunities concerning food security. Kodagu's district unique topography and dependence on agriculture make it an ideal area to investigate food security issues and their socio-economic impact. Respondents considered included residents of Kodagu district such as farmers, agricultural laborers, and local residents who are directly or indirectly affected by food security issues. The study employed Quota sampling to choose the participants, the quota was that, the sample who possessed the relevant knowledge and experience related to food security in the district. This method would ensure that the sample represents the population most affected by concerns related to food security. A sample size of 391 respondents has been drawn for insights into the food security challenges and opportunities in Kodagu district. Data was collected through structured questionnaire.

ANALYSIS AND INTERPRETATION

Herein percentage analysis was performed to identify the characteristics of the population in Kodagu district, here for the study it is categorized into gender, age, and employment.

Table No. 1: Percentage Analysis – Demographic Profile

Gender	Male	355	90.8
	Female	36	9.2
	Total	391	100.0
Age	Less than 30 Years	39	10.0
	30 - 40 Years	159	40.7
	41 - 50 Years	168	43.0
	Above 50 Years	25	6.4
	Total	391	100.0
Employment	Farmer	141	36.1
	Agricultural Labourer	163	41.7
	Agricultural Trader	60	15.3
	Local Resident	27	6.9
	Total	391	100.0

Source: (Primary data)

The demographic summary of the respondents indicates that around nine in every ten people belong to the male gender 90.8%. Only 9.2% represent the female, which indicates a considerable disparity in gender participation. Speaking about age, the largest portion of the respondents would fall under the middle-aged brackets: that is, 43.0% are between the ages of 41 and 50 years, and 40.7% are 30 to 40 years, which again confirms the composition of the target study population as mainly economically active adults. In terms of percentage, below 30 constitutes a small population i.e. 10.0%, while there are few people i.e. 6.4% above age 50 indicating limited involvement by younger and older age groups in the activities under survey. On employment status, the majority category consists of agricultural laborers which is estimated to be 41.7%; next is followed by the farmers which is 36.1%; agricultural traders make up about 15.3%; and local residents comprise the remaining 6.9%. From this composition, the majority of the respondents can be identified as directly involved in agricultural jobs, which again shows the preeminence of this sector as part of the living structure in this study area's livelihoods.

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The descriptive statistics summarize the perceptions of respondents on various challenges affecting food security in Kodagu district, ranking them based on their ranks obtained from the mean scores of each questions considered under the factor.

Table No. 2: Descriptive Statistics – Challenges Affecting Food Security

Descriptive Statistics			
	N	**Mean**	**Rank**
Availability of arable land is insufficient for meeting local food demands.	391	3.8517	10
Limited access to irrigation facilities affects agricultural productivity.	391	4.2276	4
Frequent climate variability, such as erratic rainfall, poses significant risks to crop yields.	391	4.2916	2
Transportation challenges hinder effective food distribution in the region.	391	4.2839	3
Market price fluctuations create instability in the local food supply chain.	391	3.9233	7
Post-harvest losses due to inadequate storage facilities significantly impact food availability.	391	4.2992	1
Dependency on monoculture crops reduces food diversity and resilience.	391	3.9386	6
Lack of access to modern agricultural technology limits productivity.	391	3.8568	9
Limited government support in agricultural subsidies and infrastructure affects food security.	391	3.9668	5
Socio-economic disparities reduce access to affordable and nutritious food for vulnerable communities.	391	3.8951	8

Source: (Primary data)

The highest challenge would be post-harvest loss from inadequate storage facilities with a mean of 4.2992 as a basis for the need for better storage infrastructure in minimizing food wastage. Climate variability with a mean of 4.2916 and transport challenges having a mean of 4.2839 further indicate that the region continues to be open to irregular weather patterns and logistic issues hampering the food supply chain within the area. Lack of access to irrigation facilities, which has a mean of 4.2276, and lack of government support regarding agricultural subsidy and infrastructure, which has a mean of 3.9668, ranks as the fourth and fifth, respectively, in indicating system constraint toward agricultural productivity. On the contrary, challenges such as availability of arable land (mean = 3.8517) and access to modern agricultural technology (mean = 3.8568) are not so pressing, although still quite worrying.

The table presents descriptive statistics on the effectiveness of community-based solutions in enhancing food security in Kodagu district based on the rank obtained from the mean score.

Table No. 3: Descriptive Statistics – Opportunities for Improving Food Security through Community-Based Solutions

Descriptive Statistics			
	N	**Mean**	**Rank**
Community-based initiatives can improve the distribution of locally grown food.	391	4.2097	5
Cooperative farming practices can increase agricultural efficiency and output.	391	4.2916	1
Local awareness programs can enhance knowledge of nutrition and food preservation techniques.	391	4.2506	3
Collaboration among local stakeholders can strengthen food security initiatives.	391	4.2762	2
Community participation in decision-making processes improves the effectiveness of food security programs.	391	4.2148	4

Source: (Primary data)

The descriptive statistics reflect perceptions of the respondents on community-based measures that can be instituted in the Kodagu district to improve food security. Cooperative farming practices has the highest mean score of 4.2916, which demonstrates the collective efforts in agriculture for making it the best means to increase efficiency and productivity. The second most preferred is collaboration among local stakeholders having the mean score of 4.2762, which is clearly earmarked for partnerships and cooperative approaches that reduce the problems of food security. Followed by the local awareness programs which mean score is 4.2506 and community participation in decision-making processes hold the next highest rank with the mean score of 4.2148 are also ranked in the upper echelon, thereby indicating that knowledge-sharing and governance inclusive of its citizens can considerably tighten food security initiatives. Community-based initiatives advocating the distribution of locally grown food also holds a significant mean score of 4.2097 bring out the positive grassroots effort that sharpens access to fresh and locally sourced food.

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Herein the table represents a descriptive statistics on sustainable practices that can improve food security in Kodagu district, highlighting their perceived effectiveness based on respondents' views.

Table No. 4: Descriptive Statistics – Opportunities for Improving Food Security through Sustainable Practices

Descriptive Statistics			
	N	**Mean**	**Rank**
Organic farming practices can enhance soil health and long-term productivity.	391	4.1944	6
Adoption of rainwater harvesting techniques can mitigate water scarcity for agriculture.	391	4.2737	2
Use of renewable energy sources in farming operations can reduce costs and environmental impact.	391	4.2251	4
Crop diversification practices can improve resilience to market and climate changes.	391	4.2992	1
Implementation of agroforestry practices can increase food production and conserve biodiversity.	391	4.2532	3
Sustainable waste management practices can enhance compost production and soil fertility.	391	4.1995	5

Source: (Primary data)

The most preferred sustainable practice was found to be crop diversification whose mean score is 4.2992. Then follows further adoption of rainwater-harvesting methods (mean=4.2737) as an essential factor to address the problem of water scarcity in the agricultural activities of the region. The other high-value practice is agroforestry (mean = 4.2532) since it intends to increase food production while conserving biodiversity. Use of renewable energy sources (mean = 4.2251) and organic farming practices (mean = 4.1944) are known to add up in reducing costs while improving long-run productivity, whereas sustainable waste management (mean = 4.1995) enhances soil fertility with compost production.

The table presents the correlation analysis between two key factors for improving food security: sustainable practices and community-based solutions to identify whether there is a significant relationship between the each of the factors.

Table No. 5: Correlation Analysis – Relationship between Opportunities for Improving Food Security through Sustainable Practices and Community-Based Solutions

Correlations			
		Opportunities for Improving Food Security through Sustainable Practices	**Opportunities for Improving Food Security through Community-Based Solutions**
Opportunities for Improving Food Security through Sustainable Practices	Pearson Correlation	1	.685**
	Sig. (2-tailed)		.000
	N	391	391
Opportunities for Improving Food Security through Community-Based Solutions	Pearson Correlation	.685**	1
	Sig. (2-tailed)	.000	
	N	391	391

Source: (Primary data)

The estimated significance value is less than 0.05, meaning the null hypothesis is rejected. therefore, there is a significant relationship between the two factors considered for the study. Hereby, the correlation analysis indicates a positive relationship between Opportunities for Improving Food Security through Sustainable Practices and Opportunities for Improving Food Security through Community-Based Solutions. This indicates that as the adoption of sustainable practices increases, the potential for enhancing food security through community-based initiatives also rises significantly.

This table presents the results of the regression analysis examining the impact of sustainable practices and community-based solutions on the challenges affecting food security in Kodagu district.

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Table No. 6: Regression Analysis – Impact of Sustainable Practices and Community-Based Solutions on Challenges Affecting Food Security

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.702[a]	.493	.491	.28714
a. Predictors: (Constant), Opportunities for Improving Food Security through Sustainable Practices, Opportunities for Improving Food Security through Community-Based Solutions				

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	31.142	2	15.571	188.858	.000[b]
	Residual	31.990	388	.082		
	Total	63.133	390			
a. Dependent Variable: Challenges Affecting Food Security						
b. Predictors: (Constant), Opportunities for Improving Food Security through Sustainable Practices, Opportunities for Improving Food Security through Community-Based Solutions						

Coefficients[a]						
		Unstandardized Coefficients		**Standardized Coefficients**		
Model		**B**	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	1.700	.123		13.799	.000
	Opportunities for Improving Food Security through Community-Based Solutions	.224	.037	.299	6.040	.000
	Opportunities for Improving Food Security through Sustainable Practices	.331	.035	.463	9.328	.000
a. Dependent Variable: Challenges Affecting Food Security						

Source: (Primary data)

A multiple regression analysis indicates that the sets of independent variables - as in Opportunities for Improving Food Security through Sustainable Practices and Opportunities for Improving Food Security through Community-Based Solutions - are strongly related to Challenges Affecting Food Security, the dependent variable. The R square value is 0.493, it means that about 49.3% of the variance in challenges affecting food security can be determined by both of the predictors together. The ANOVA significnace value is less than 0.05, which approves that the model is fit.

The coefficients table shows that both predictors significantly positively influence food security interventions. Thr opportunities for Improvising the Food Security through Sustainable Practices (β score is 0.463) has found to be having a greater influence than Community-Based Solutions (β score is 0.299). This implies that promoting more sustainable agricultural practices is likely to have greater effect in addressing food security challenges than solutions developed within communities. Overall, the findings point to the conclusion that the improvement of barriers to food security in the study site can be largely addressed through the integration of sustainable practices with community initiatives.

FINDINGS

Among the considerable demographic considered for the survey at Kodagu district is the overwhelming presence of a male workforce at 90.8%. Furthermore, a 83.7% of the respondents belonged to the age group between 30-50 years, the age group actually engaged chiefly in agriculture, and has a great contribution to the food security perception front. This is further observed in employment data that rural labor (41.7%) and farmers (36.1%) are over represented in the district, which call for attention to food security challenges in the agricultural sector. To mention the key concerns of Kodagu with respect to food security, postharvest loss due to poor storage (mean = 4.2992), climate variation (mean = 4.2916), and transportation crisis (mean = 4.2839) were found to rank the highest among the system weaknesses. Poor access to irrigation facilities (mean = 4.2276) and inadequate government support (mean = 3.9668) aggravated the situation whereas land availability (mean = 3.8517) and modern technology (mean = 3.8568) were considered not very adverse but certainly important.

There were high rankings bestowed on community solutions, especially cooperative farming (mean = 4.2916) and collaboration among local stakeholders (mean = 4.2762), probably perceived as the best ways to enhance food security. These are the merits of local awareness campaigns, means to participate with the public, and activities to distribute food products growing in the locality; they demonstrate grassroots involvement that gets translated to food security challenges. Talking about sustainability, crop diversification and rainwater harvesting, resilient improvement in agriculture is significantly enhanced. Further from the study, it was found that afforestation and using renewable energy sources would improve productivity in the long term with reduced environmental damage. Waste management practices are seen as critical elements in enhancing soil health and fertility. The result from the correlation analysis indicated a positive relationship between sustainable practices and community-based solutions; thus, the two factors complement each other in enhancing food security. Furthermore evident in the regression analysis was found that, both sustainable practices and community-based solutions account for just below half (49.3%) variance towards food security challenges. Sustainable practices (Beta = 0.463) wields slight greater influence than community-based solutions (Beta = 0.299) underlying the significance of both strategies in curbing food insecurity in Kodagu.

DISCUSSION

The food security study carried out in Kodagu characterizes agriculture as the mainstay of livelihoods where predominantly male (90.8%) workforce members exist aged between 30 and 50 years old. Women are not allowed to participate in agriculture because of gender barriers, and hence food security interventions are impaired in cases where such concerns are ignored. Food security in various challenges has its losses incurred from the harvest, varying weather patterns, and transportation problems. The result signify the need to develop better infrastructure and storage systems to curb food wastage in Kodagu district. The Community-based mechanisms and sustainable agriculture practices should be induced to farmers and people associated with agriculture for integrating local knowledge and grassroots participation. Bottom-up approaches shoul be utilized to enhance food literacy and community resilience to respond adequately to emerging food security issues. Sustainability practices, such as; crop diversification, rainwater harvesting, and agroforestry, help maintain agricultural productivity, minimizing environmental impacts in the Kodagu district. Thus, the sustainable practices and community solutions only serve to strengthen food security efforts in Kodagu. This, however, illustrates the importance of balancing sustainability with community initiatives with respect to food insecurity issues.

CONCLUSION

This study focuses on the challenges related to food security in the Kodagu district. Kodagu district continues to address fundamental issues of climate changes, infrastructure, post-harvest losses, and transportation, with negative ramifications of variable irrigation, harvest losses, and food security assistance stagnation. Addressing these challenges is the pursuit of restorative and resilient agricultural frameworks and infrastructure. The study notes that problem-solving food security effectively can include cooperative farming, local awareness campaigns, and stakeholder collaboration. Regression showed the strongest impact of community sustainable frameworks on food security and the challenges of food security. The results need to meet Kodagu's long-term food security objectives through grassroots participation and relational sustainable agricultural practices.

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