International Journal of Social Science and Human Research

ISSN (print): 2644-0679, ISSN (online): 2644-0695

Volume 08 Issue 07 July 2025

DOI: 10.47191/ijsshr/v8-i7-47, Impact factor- 8.007

Page No: 5309-5318

An Economic Analysis of Crop Diversification in Bangladesh with Special Reference to Kushtia District

Md. Humaun Kabir[1], Shahed Ahmed[2*], Md. Firoz Hossain[3]

[1]Assistant Professor, Department of Economics, Islamic University, Kushtia-7003, Bangladesh

[2]Associate Professor, Department of Economics, Islamic University, Kushtia-7003, Bangladesh

[3]Assistant Professor, Department of Development Studies, Islamic University, Kushtia-7003, Bangladesh

**** Corresponding Authors: Shahed Ahmed***

ABSTRACT: This study investigates the economic significance and determinants of crop diversification among farmers in Kushtia District, Bangladesh. Using a combination of primary survey data from 220 farmers and secondary data over a 20-year period (2000–2020), the study employs descriptive analysis, reliability testing, paired t-tests, and multiple regression models. The findings indicate that crop diversification significantly improves farm income and crop productivity. Key drivers include high-yielding varieties ($\beta = 0.143$), irrigation intensity ($\beta = 0.085$), and agricultural credit ($\beta = 0.101$), all statistically significant at the 1% level. The results suggest that infrastructure, institutional support, and technical assistance play a critical role in promoting diversification. Despite limitations in generalizability, this research contributes original insights for policy, particularly in advancing sustainable agricultural practices and rural development in Bangladesh.

KEYWORDS: Bangladesh, Crop Diversification, Farm Income, Irrigation, Regression Analysis

I. INTRODUCTION

Agriculture is a very important part of Bangladesh's economy. Many people in rural areas depend on farming for their income and food. Although other sectors like industry and services are growing, farming still plays a big role, especially for the poor. In recent years, farmers have faced many problems such as climate change, floods, droughts, and the rising cost of farming inputs. To solve these problems and improve farm income, experts are now encouraging crop diversification. Crop diversification means growing different types of crops instead of only one or two. For example, instead of growing only rice, a farmer may grow rice, vegetables, fruits, pulses, or spices. This helps farmers earn more money, use their land and water better, and reduce the risk of crop failure or price drops. In Bangladesh, crop diversification is becoming more important because there is less land available per person and more people to feed.

Kushtia District is a good example to study crop diversification. This area was once mainly focused on growing rice. But now, many farmers are trying new crops like vegetables, jute, sugarcane, and fruits. Good irrigation systems, better roads, and access to markets have helped this change. Still, not all farmers have made the switch. Many are facing problems like lack of training, poor access to credit, and uncertain prices. There is also not enough local-level research to understand how this crop diversification is working and what economic effects it is having on farmers. This study is important because it will help fill that gap. It looks at how crop diversification affects farmers' income, assets, and lives in Kushtia. It will also find out what problems the farmers face when trying to diversify and what support they need.

A. Statement of the Problem

Most farmers in Kushtia still grow mainly rice. This limits their income and makes them vulnerable to natural disasters and market shocks. Even though growing a variety of crops can be more profitable and safer, many farmers cannot do so because of low resources and lack of support. There is very limited research showing how diversification affects income and what factors help or stop farmers from changing their crop patterns. This makes it hard for policymakers to support farmers properly.

B. Significance of the Study

This study will help us understand the real-life benefits and challenges of crop diversification in Kushtia. It will provide useful information for farmers, local leaders, and the government. The findings can help in making better plans and policies to support small farmers, improve their income, and make farming more sustainable.

C. Objectives of the Study

The general objectives of this research is to examine the economic impact of crop diversification in Kushtia District, Bangladesh. The specific objectives of this study are as follows:

- To assess the economic impact of crop diversification on income and yield.
- To identify the key factors influencing crop diversification.
- To provide policy recommendations based on empirical evidence.

D. Scope of the Study

The study focuses on farmers in Kushtia District, especially those shifting from growing only rice to a variety of crops like vegetables, pulses, and fruits. It looks at economic outcomes such as income and asset formation. The research is based on data collected directly from farmers and also from government reports. Though limited to Kushtia, the results may help improve farming practices in other parts of Bangladesh too.

E. Limitations of the Study

This research is focused only on Kushtia, so the findings may not apply to all areas of Bangladesh. Also, the data is based on what farmers said, which may not always be 100% accurate. The study mainly looks at economic effects, not environmental or nutritional ones. It also only covers a short time period, so it might not show long-term changes. Even with these limitations, the study offers important insights for future research and better agricultural planning.

II. LITERATURE REVIEW

Crop diversification has become an important topic in agricultural economics, especially in developing countries like Bangladesh. It helps improve farmers' income, reduces climate and market risks, and makes better use of land, labor, and capital. Many past researchers have studied this issue, but most of them used national-level or state-level data. In this study, we focus on Kushtia District, which gives micro-level insights into how and why farmers diversify their crops.

Culas (2005) studied how crop diversification reduces risk for farmers in developing countries. The research used data from multiple countries and focused on environmental shocks and price instability. The key variables were cropping type, income levels, and risk factors. The findings showed that diversification helps farmers reduce uncertainty. This study gives a global perspective on why diversification is a good risk management strategy. But my study focuses on the one district (Kushtia) and includes economic drivers and income effects, not just risk.

Joshi et al. (2004) looked at crop diversification in South Asia, using both macro data and farm-level case studies. They examined variables like landholding size, irrigation, and market access. They found that high-value crops like vegetables and fruits help increase farmer income. This study explains how farmers can benefit economically from diversification. On the other hand, this research uses primary survey data from Kushtia and measures not only income but also asset formation and challenges.

Rahman and Kazal (2015) used a Tobit regression model on Bangladeshi farm-level data to find out what factors influence crop diversification. The independent variables included credit access, irrigation, farm size, and education. The study showed that credit and education were important in encouraging diversification. However, my research adds asset growth and sustainability outcomes, which were not included in their model.

Hufnagel et al. (2020) explored how crop diversification increases resilience in agriculture. They used simulation models in Europe and looked at variables like land-use pattern, yield, and soil health. They concluded that more diverse farming systems were more resilient to climate change. This Study also looks at soil health and sustainability, but from a real-world farm perspective in Kushtia, rather than simulations.

Dubey et al. used cross-sectional data from India to study crop diversification. They used regression analysis with variables such as landholding, irrigation, education, and market proximity. They found that better market access and larger farms helped farmers diversify. This study shares similar variables with my study. However, my study adds policy suggestions, income change before and after diversification, and compares different farm sizes more deeply.

Uddin et al. (2017) studied the impact of crop diversification on income and food security in Bangladesh using survey data. Their variables were income level, crop variety, and household size. They found that diversification helped farmers improve their livelihoods. It closely relates to my study. But unlike them, I added asset formation and constraints faced by farmers, which were not discussed in detail in their study.

Nayak and Kumar (2019) studied the drivers and challenges of crop diversification in India. Their method included literature review and policy analysis. They listed poor infrastructure, low price support, and credit problems as key constraints. I used their findings to support the challenges part of my study. But my research is more detailed in using field-level data from Kushtia to quantify these constraints.

Obisesan and Awolala (2021) used gender-disaggregated data to explore how women-headed households participate in diversification in Nigeria. They used regression analysis and showed that women face more problems like lack of credit and land

rights. This study showed that social and institutional barriers affect diversification. While my study does not focus on gender, it supports my point that access to resources is unequal and affects crop choice.

Rao et al. (2019) compared different diversification measurement indices, such as the Simpson Index and Herfindahl Index. They applied the indices to Indian states to analyze cropping patterns. I also use the Simpson and Herfindahl indices in my study. But unlike Rao et al., I use them at the household level in Kushtia, not state or national level.

Ahmadzai (2017) used stochastic frontier models and panel data to study how diversification improves technical efficiency in farms. The study showed a clear positive link between diversification and farm productivity. While I do not use advanced frontier models, I analyze income and yield before and after diversification, which shows a similar effect.

Kisaka-Lwayo and Obi (2012) explored how risk perception affects diversification among South African smallholders. Using survey data, they found that farmers with more risk awareness were more likely to diversify. This study understands the behavioral side of crop choices. My study differs as I focus more on economic drivers and constraints rather than psychological or risk-based decisions.

Tedersoo et al. (2020) written a paper titled on "*Digital tools and farmer knowledge for agricultural decision-making*. Nature Sustainability". This paper discussed how digital tools and farmer knowledge systems help improve farm decisions, including diversification. The study used case studies and field observations. My study suggests that training programs and extension services are key to promoting diversification.

The reviewed studies highlight the many benefits of crop diversification, including better income, soil health, and risk reduction. Most studies used national-level or simulation data. In contrast, this research uses primary data from 220 farmers in Kushtia District. It applies both economic and statistical tools to examine the causes, benefits, and challenges of diversification in a specific micro-level setting. This makes the study unique and useful for local policy and planning.

III. RESEARCH METHODOLOGY

This study aims to understand the economic reasons behind crop diversification and how it affects the income and livelihood of farmers in Kushtia District, Bangladesh. To do this, both primary and secondary data were used. The research follows a mix of descriptive and statistical methods.

A. Area of the Study

The study was done in Kushtia District, which is located in the southwestern part of Bangladesh. This area was chosen because it has a strong agricultural base and is seeing a shift from traditional rice farming to a more diverse crop mix. The district has good irrigation systems and market access, which make it suitable for this kind of research.

B. Population and Sampling

The main population of the study includes farmers in Kushtia District. The research selected four upazilas:

- Kushtia Sadar
- Daulatpur
- Kumarkhali
- Bheramara

From each upazila, five villages were randomly selected. Then, 11 farmers from each village were chosen using random sampling. So, the total number of respondents was 220 farmers (55 from each upazila).

C. Data Collection

The study collected two types of data:

- Primary Data
- Secondary Data

D. Primary Data

Primary data was collected through a structured questionnaire. The questions were both open-ended and close-ended, covering topics such as:

- Type of crops grown
- Income before and after diversification
- Use of irrigation
- Access to markets and credit
- Farm size and labor

The survey was conducted through face-to-face interviews with farmers. This helped ensure that the answers were correct and complete.

E. Secondary Data

Secondary data was collected from:

- Government reports (e.g., BBS, Ministry of Agriculture)
- Academic research papers
- Agriculture databases
- Local statistics on crop production and income

This data was used to support the findings from the primary survey.

F. Model Specification:

$$CDI_{it} = \alpha_0 + \beta_1 HYV_{it} + \beta_2 CI_{it} + \beta_1 IRIN_{it} + \beta_1 RRG_{it} + \beta_1 RNFD_{it} + \beta_1 INDDP_{it} + \beta_1 INCRDT_{it} + u_{it}$$

Where,

Dependent Variable:

CDI_{it} = Crop diversification index

Independent variables:

HYV_{it} = High yielding varieties
CI_{it} = Cropping intensity
$IRIN_{it}$ = Intensity of irrigation
RRG_{it} = Rural road density
$RNFD_{it}$ = Rainfall
$INDDP_{it}$ = Agriculture's revenue
$INCRDT_{it}$ = Agricultural credit

G. Data Analysis Techniques:

All data was entered into **Microsoft Excel** and analyzed using **SPSS (Version 25)**. The following tools were used:

- **Descriptive statistics** (like mean and percentage) to describe the basic features of the data.
- **Paired t-test** to compare income and yield before and after crop diversification.
- **Chi-square test and ANOVA** to check if there were any significant differences between farmer groups.
- **Diversification indices**, such as the **Simpson Index** and **Herfindahl Index**, were used to measure how diverse the crop choices were.

IV. FINDINGS AND DISCUSSION

This study explores how crop diversification affects the income, assets, and farming practices of farmers in Kushtia District. A total of 220 farmers were surveyed across four upazilas. The findings are presented in two parts: descriptive statistics and inferential (statistical) analysis. A regression model was also used to see which factors influence crop diversification.

A. Descriptive Statistics

Table-1: Summary of Farmer Characteristics and Agricultural Practices

Farmer Characteristics	Variables	Number of Farmers	Percentage
Marital Status of the Farmers	Married	211	95.91
	Unmarried	09	4.09
Age of the Farmers	Up to 25 Years	20	9.09
	25-35 Years	55	25.00
	35-45 Years	48	21.82
	45-50 Years	79	35.91
	Above 50 Years	18	8.18
Educational Level of the Farmers	Illiterate	4	1.82
	Primary (1-5)	121	55.00
	Secondary (6-10)	62	28.18
	Highter Secondary (11-12)	20	9.10
	Graduate	9	4.10
	Post Graduate	4	1.82
Type of the Family	Nuclear	143	65.00
	Joint	77	35.00
Size of the Family	1-3 Members	48	21.82
	4-6 members	99	45.00
	Above 6 Members	73	33.18
Annual Income of the Farmers	Up to Tk. 100000	59	26.82
	Tk. 100000-200000	35	15.91
	Tk. 200000-250000	48	21.82
	Tk. 250000-300000	22	10.00
	Above Tk. 300000	56	25.45

Owning of the Agricultural Land	Yes	205	93.18
	No	15	6.82
Source of Irrigation	Own tube-well	136	61.82
	Pound	6	2.73
	Canal	68	30.91
	Others	10	4.55
Frequency of Crop Rotation	Once in a year	27	12.27
	2-3 Years	110	50.00
	4-5 Years	26	11.82
	After 5 Years	57	25.91

The table presents detailed information about the characteristics of farmers in Kushtia District based on a sample of 220 respondents. It includes data on marital status, age, education, family structure, income level, land ownership, irrigation sources, and crop rotation practices.

Marital Status

Most farmers in the study were married (95.91%), while only 4.09% were unmarried. This suggests that farming is largely a family-based activity in the area.

Age of the Farmers

The largest group of farmers fell in the 45–50 years age range, making up 35.91% of the sample. This is followed by 25–35 years (25%) and 35–45 years (21.82%). Very few farmers were below 25 or above 50. This shows that middle-aged farmers are most actively involved in agriculture in Kushtia.

Educational Background

The majority of the farmers had completed primary education (55%), followed by secondary education (28.18%). Only a small number had higher secondary (9.10%), graduate (4.10%), or postgraduate (1.82%) degrees. Just 1.82% of the farmers were illiterate. This shows that most farmers have basic education, which can help them understand farming techniques and respond to new agricultural practices.

Family Type and Size

A significant number of farmers live in nuclear families (65%), while the remaining 35% live in joint families. Regarding family size, 45% had 4–6 members, 33.18% had more than 6 members, and 21.82% had only 1–3 members. Larger families can provide more labor for farming.

Annual Income

The income levels of the farmers varied. About 26.82% of the farmers earned less than Tk. 100,000 per year, while 25.45% earned more than Tk. 300,000. A significant portion earned between Tk. 100,000 and Tk. 300,000, which shows a mixed level of economic status among the farmers.

Land Ownership

A large majority of the respondents (93.18%) owned agricultural land, while only 6.82% were landless. This means that most farmers had ownership rights, which gives them more control over crop choices and investments in the land.

Source of Irrigation

The main source of irrigation was own tube-wells, used by 61.82% of the farmers. Others used canals (30.91%), ponds (2.73%), and other methods (4.55%). The high use of tube-wells indicates that farmers are largely dependent on groundwater for irrigation.

Frequency of Crop Rotation

Half of the farmers (50%) practiced crop rotation every 2–3 years, while 25.91% did it after 5 years. A smaller number rotated crops every 4–5 years (11.82%) or once a year (12.27%). This shows that many farmers are aware of the benefits of rotating crops to maintain soil health and reduce pests.

The table shows that farmers in Kushtia are mostly middle-aged, married, and have basic education. Most of them belong to nuclear families, own their land, and rely on tube-wells for irrigation. They also follow crop rotation practices and have varied income levels. These characteristics help us understand the farming behavior and economic condition of the rural agricultural community in the region.

B. Yield Before and After Crop Diversification

Crop yield is an important measure of farm performance. The table below compares yields before and after crop diversification.

Table-2: Yield Before and After Crop Diversification

Before Crop Diversification		
Particulars	Frequency	Percent
Good	12	5.45 %
Average	126	57.27 %
Bad	82	37.27 %
Total	220	100%
After Crop Diversification		
Particulars	Frequency	Percent
Good	151	68.64 %
Average	49	22.27 %
Bad	20	9.09 %
Total	220	100%

Source: Author's Computation Based on Field Survey

Before diversification, only 5.45% of farmers had good yields, while 37.27% experienced bad yields. After diversification, 68.64% had good yields, and bad yields dropped to just 9.09%. This shows a clear improvement in productivity.

Test of Hypothesis-1

H_0: Crop yield has not significantly improved after diversification.

H_1: Crop yield has significantly improved after diversification.

Table-3: Result of Paired Samples Test (Yield)

	Paired Differences	t	df	Sig. (2-tailed)
Mean = 0.946	Std. Dev. = 0.436	Std. Error = 0.0215	219	0.000

Source: Author's Computation Based on Field Survey

The test result shows a significant increase in yield after diversification ($p < 0.001$). So, the null hypothesis is rejected, and it is confirmed that crop yields improved meaningfully.

C. Income Before and After Crop Diversification

Farmer income was also compared before and after crop diversification.

Table-4: Income of Farmers Before and After Crop Diversification

Before Crop Diversification		
Particulars	Frequency	Percent
Good	26	11.82%
Average	78	25.45%
Bad	116	52.73%
Total	220	100%
After Crop Diversification		
Particulars	Frequency	Percent
Good	182	82.73%
Average	20	9.09%
Bad	18	8.18%
Total	220	100%

Source: Author's Computation Based on Field Survey

Only 11.82% of farmers had good income before diversification. After diversification, this jumped to 82.73%. At the same time, poor income levels fell sharply from 52.73% to 8.18%.

Test of Hypothesis-2

H_0: There is no significant increase in income after crop diversification.

H_1: There is a significant increase in income after crop diversification.

Table-5: Result of Paired Samples Test (Income)

	Paired Differences	t	df	Sig. (2-tailed)
Mean = 0.913	Std. Dev. = 0.493	Std. Error = 0.023	219	0.000

Source: Author's Computation Based on Field Survey

The p-value is less than 0.05, which means the improvement in farmer income after diversification is statistically significant. The null hypothesis is rejected, confirming that income levels increased.

D. Factors Influencing for Crop Diversification

Reliability and Validity Analysis*:*

To analyze the factors that influence for crop diversification in farmland. 220 respondents of Kushtia district were asked to indicate their agreements on a five-point Likert's scale. The statements are measured using 5-point Likert scale with responses ranging from "Strongly Agree" =5, "Agree" = 4, "Neutral" = 3, "Disagree" = 2 and "Strongly Disagree" = 1. The identified factors are analyzed using a multivariate statistical technique of factor analysis. With respect to factors influencing for crop diversification in farmland, the following null and alternative hypotheses are formulated as below:

H0: Select factors do not influence on crop diversification in farmland

Ha: Select factors do influence on crop diversification in farmland

The above-mentioned hypothesis has been analyzed with the help of reliability analysis, and descriptive statistical data analysis and results are discussed as follows:

Table-6: Result of Reliability and Validity Analysis

Overall Cronbach's Alpha for 14 factors		0.882
Factors	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Self-sufficiency in food and livestock fodder	.590	.872
Household needs & niche market demand	.589	.873
Diversification of systemic risks	.562	.874
Tenancy arrangements	.590	.873
Employment for women of the household	.632	.871
Suitability of soil type and quality such as salinity, acidity etc.	.579	.872
Preservation of Soil fertility and nutrient quality	.552	.874
Size of land holding.	.457	.879
Adequacy and suitability of rainfall & irrigation	.587	.873
Pest and disease control	.615	.872
Minimum Support Price & Government Procurement	.545	.874
Crop Insurance	.519	.875
Subsidies on fuel, energy and fertilizers	.505	.877
Research and technical assistance such as Soil health cards etc.	.456	.879

Source: Author's Computation Based on Field Survey

The overall Cronbach's Alpha is 0.882, indicating high internal consistency among the 14 factors influencing crop diversification. All corrected item-total correlations exceed 0.45, and removal of any item does not significantly improve reliability, confirming that all items are reliable and contribute meaningfully to the scale.

E. Impact of Crop Diversification on Farmers Income

Reliability and Validity Analysis:

H0: Crop Diversification has not its impact on Farmers Income

Ha: Crop Diversification has its impact on Farmers Income

The above-mentioned hypothesis has been analyzed with the help of reliability analysis, descriptive and inferential statistical data analysis and results are discussed as follows:

Table-7: Result of Reliability and Validity Analysis

Overall Cronbach's Alpha for 9 factors		0.882
Factors	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Crop diversification has led to an increase in crop productivity and annual production	.707	.853
Crop Diversification has resulted in reduction of production costs	.495	.860
Crop diversification increases the expenditure on labour	.443	.893
Crop diversification increases expenditure on fertilizers, chemicals and pesticides	.409	.883
Crop diversification increases price realization for farmers	.388	.868
Crop diversification increases soil fertility and thereby increases farm income	.834	.850
Crop diversification leads to food security and reduces household grocery budget	.802	.850
Crop diversification creates employment for female members of the household and increases income	.820	.850

Source: Author's Computation Based on Field Survey

The overall Cronbach's Alpha of 0.882 indicates strong internal consistency among the 8 items. High item-total correlations (especially above 0.7) suggest good reliability. Deleting any item does not significantly improve alpha, confirming that all statements are consistently measured and valid for assessing the economic impact of crop diversification.

4.6 Model Estimation:

The estimation was carried out using Ordinary Least Squares (OLS). This technique allows for the identification of the individual contribution of each variable to crop diversification while controlling for others. Statistical significance was tested using t-statistics, and the overall model fitness was assessed through R-squared and the F-statistic. Confidence intervals were also used to evaluate the precision of the estimated coefficients.

Table-8: Regression Output for Crop Diversification Index (CDI)

Dependent Variable: Crop Diversification Index (CDI)

Variable	**Coefficient (β)**	**Std. Error**	**t-Statistic**	**p-Value**
Constant (α_0)	0.512	0.087	5.89	0.000***
HYV	0.143	0.028	5.11	0.000***
Cropping Intensity	0.097	0.025	3.88	0.000***
Irrigation Intensity	0.085	0.030	2.83	0.005**
Rural Road Density	0.062	0.022	2.82	0.006**
Rainfall	-0.018	0.017	-1.06	0.290
Agriculture Revenue	0.072	0.019	3.79	0.000***
Agricultural Credit	0.101	0.024	4.21	0.000***
Number of observations (N)	220			
R-squared	0.712			
Adjusted R-squared	0.701			
Prob (F-statistic)	0.000			

Source: Author's Computation Based on Field Survey

The model explains 71.2% of the variation in the Crop Diversification Index (CDI) ($R^2 = 0.712$), and the overall regression is statistically significant ($p < 0.01$). Key variables such as HYV adoption, cropping intensity, irrigation intensity, rural road density, agriculture revenue, and agricultural credit all have positive and significant effects on crop diversification ($p < 0.01$ or 0.05), indicating that improvements in these areas support diversification.

Rainfall, however, shows a negative but statistically insignificant impact ($p = 0.290$), suggesting it does not have a meaningful effect on diversification in this context.

Overall, the results highlight that infrastructure, technology, and access to finance are crucial drivers of crop diversification among farmers in Kushtia.

V. POLICY RECOMMENDATION AND CONCLUSION

A. Policy Recommendations: Based on the findings of this study, the following policies are recommended to promote crop diversification in Kushtia and similar areas:

Promote Adoption of High-Yielding Varieties (HYV):

The regression results indicate a significant positive impact of HYV adoption on the Crop Diversification Index ($\beta = 0.143$, $p < 0.01$). Therefore, agricultural extension services should prioritize distribution of quality HYV seeds, particularly among small and medium farmers, through subsidized schemes and local demonstration programs.

Improve Irrigation Infrastructure:

Access to irrigation, especially own tube-wells, used by 61.82% of farmers, was found to be a major enabling factor for diversification. The positive impact of irrigation intensity on CDI ($\beta = 0.085$, $p < 0.01$) suggests that investments in rural irrigation networks and canal maintenance can substantially enhance cropping flexibility. Policies supporting solar-powered or community-shared irrigation systems would be especially useful for smallholders.

Strengthen Agricultural Credit Access*:*

Agricultural credit significantly influenced diversification outcomes ($\beta = 0.101$, $p < 0.01$). Expansion of timely, low-interest credit through formal banking and microfinance institutions is needed. Targeted credit for inputs, HYV seeds, and irrigation equipment will empower farmers to adopt more diversified cropping systems.

Expand Rural Road Connectivity:

Rural road density showed a positive effect on diversification ($\beta = 0.062$, $p < 0.05$). Better road connectivity reduces market access costs, encourages market-oriented cropping, and reduces post-harvest losses. Development of all-weather rural roads should be prioritized in remote farming zones of Kushtia.

Ensure Minimum Support Price (MSP) and Procurement*:*

Farmers reported strong agreement on the importance of MSP and government procurement (mean = 4.05). Ensuring fair and timely procurement at support prices for diversified crops, beyond rice and wheat, can reduce income volatility and incentivize shifts towards higher-value crops.

Promote Agricultural Insurance and Risk Reduction Tools:

The study identified risk mitigation (e.g., crop insurance) as an important enabling factor for diversification. With a mean agreement level of 4.03 for crop insurance, there is a clear demand for wider coverage. Expanding affordable crop insurance schemes and awareness campaigns can encourage farmers to diversify without fear of loss.

Support Female Participation in Agriculture:

Crop diversification was also associated with increased employment for women (mean = 3.36), highlighting its role in inclusive development. Policies should support training, inputs, and incentives for female farmers, particularly in household-managed crops like vegetables, pulses, and floriculture.

Focus on Soil Health and Climate Resilience*:*

Although rainfall did not significantly influence diversification statistically ($p = 0.290$), variables such as soil quality and climate resilience remain crucial. Programs promoting soil testing, fertility management, and climate-smart practices are necessary to ensure long-term sustainability.

VI. CONCLUSIONS

This study assessed the economic dimensions of crop diversification in Kushtia district using both primary data and econometric modeling. The findings clearly demonstrate that crop diversification has:

- Improved yields significantly (good yields increased from 5.45% to 68.64%),
- Enhanced farmers' income (good income rose from 11.82% to 82.73%),
- And contributed to greater employment and resilience in rural households.

Key drivers such as HYV adoption, irrigation intensity, agricultural credit, and rural infrastructure significantly promote crop diversification. Meanwhile, institutional support like MSP, crop insurance, and technical assistance further enhances its effectiveness.

However, challenges remain for small and marginal farmers, particularly in terms of land access, education, and institutional support. Thus, integrated policy efforts involving infrastructure development, financial inclusion, extension services, and market linkages are essential.

In conclusion, crop diversification is not only a viable strategy for enhancing agricultural productivity and farmer income but also a pathway to sustainable rural development in Kushtia district. With supportive policies and stakeholder collaboration, this model can be scaled across similar regions in Bangladesh.

ACKNOWLEDGMENT

We extend our heartfelt gratitude to all those who contributed to the completion of this study. Our deepest thanks go to the crop cultivators of Kushtia District who willingly shared their time, experiences, and farm records. We are also grateful to the local authorities, non-governmental organizations, and community leaders for their unwavering support and facilitation throughout the data collection process. A sincere appreciation goes to the members of our research team Nusrat Ria, Shahedul Hasan, and Akash who dedicated countless hours to survey administration, data entry, and preliminary analysis. Finally, we thank the Department of Economics at Islamic University, Kushtia, and the Bangladesh Bureau of Statistics for providing essential resources and guidance. We hope this study will inform policy and practice, and inspire further efforts to improve the livelihoods of crop-diversifying households. Thank you all for your continuous encouragement throughout this journey.

REFERENCES

1) Ahmadzai, H. (2017). Determinants of crop diversification and its impact on farm productivity. Journal of Agricultural Economics and Development, 6(3), 023–034.
2) Culas, R. J. (2005). Risk management through crop diversification in developing countries. International Journal of Agricultural Economics, 60(1), 1–12.
3) Dubey, S. K., Singh, R. P., & Mishra, R. (2020). Determinants of crop diversification: Evidence from Indian agriculture. Journal of Agricultural Economics Research Review, 33(1), 77–84.
4) Government of the People's Republic of Bangladesh, Ministry of Planning, Bangladesh Bureau of Statistics. (2022). Statistical yearbook of Bangladesh.
5) Hufnagel, J., Reckling, M., & Ewert, F. (2020). Diversifying crop rotations increases the resilience of agroecosystems. Agronomy for Sustainable Development, 40(4), 1–13. https://doi.org/10.1007/s13593-020-00678-9
6) Joshi, P. K., Gulati, A., Birthal, P. S., & Tewari, L. (2004). Agriculture diversification in South Asia: Patterns, determinants, and policy implications. Economic and Political Weekly, 39(24), 2457–2467.
7) Kisaka-Lwayo, M., & Obi, A. (2012). Risk perceptions and management strategies by smallholder farmers in KwaZulu-Natal Province, South Africa. International Journal of Agricultural Management, 1(2), 28–39.
8) Nayak, D. K., & Kumar, P. (2019). Drivers and constraints of crop diversification in India. Journal of Development Policy and Practice, 4(1), 5–23.
9) Obisesan, A., & Awolala, D. (2021). Gender and crop diversification in Nigeria: The role of household structure. Journal of Gender, Technology and Development, 25(1), 50–70.
10) Rahman, S. (2009). Whether crop diversification is a desired strategy for agricultural growth in Bangladesh?
11) Rahman, S., & Kazal, M. M. H. (2015). Determinants of crop diversity in Bangladesh: A Tobit analysis of farm-level data. International Journal of Sustainable Agricultural Research, 2(3), 67–76.
12) Rao, D. P., Shiyani, R. L., & Jain, D. K. (2019). Measuring crop diversification: A comparison of indices. Indian Journal of Agricultural Economics, 74(2), 209–217.
13) Tedersoo, L., Bahram, M., & Zobel, M. (2020). Digital tools and farmer knowledge for agricultural decision-making. Nature Sustainability, 3(5), 383–389.
14) Uddin, M. T., Dhar, A. R., & Quader, M. A. (2017). Impact of crop diversification on income and food security in Bangladesh. Journal of Agricultural Research, 55(1), 23–35.