Original Research Article

Green Cooperatives and the Empowerment of Rural Women Entrepreneurs: Insights from Sunamganj, Bangladesh

Abstract:
In developing countries, agriculture plays a vital role in reducing poverty and enhancing food security. In Sunamganj, Bangladesh, rural women significantly contribute to agriculture but face gender disparities and limited access to resources. Green cooperatives provide a promising model to empower these women through sustainable practices and economic support. This study explores the roles and impacts of green cooperatives on rural women entrepreneurs in Sunamganj, focusing on factors influencing their involvement, the benefits and constraints they face, and changes in empowerment before and after joining cooperatives. This study was conducted across five upazilas in Sunamganj, the sampled 200 women entrepreneurs-100 cooperative members and 100 non-membersusing purposive and snowball sampling techniques. Data was gathered via interviews, surveys, and focus group discussions (FGDs) and analyzed with SPSS and Microsoft Excel.Multiple regression analysis was used to identify key influencing factors and the Problems Confrontation Index (PCI) was utilized to assess the severity of challenges faced by members. The findings reveal that green cooperatives enhance women's socio-economic status through improved production, market access, financial stability, and decision-making roles. Education, credit access, input availability, training, and experience were key drivers of the cooperative engagement of rural women entrepreneurs. However, challenges like male dominance, limited training, transportation issues, labor shortages, and market information gaps persist. Despite these, women in green cooperatives benefit from fixed pricing for organic products, increased bargaining power, and timely access to inputs and training. The study highlights the need for improved education, continuous training, extension services, high-quality inputs, and better infrastructure to support women's participation further. The insights provided aim to guide policymakers in developing supportive policies that enhance the impact of green cooperatives, address gender-specific challenges and promote the use of digital tools for market access. Future research should explore longitudinal studies and regional comparisons for deeper insights into rural women's empowerment.

Keywords: *Green cooperatives, Empowerment, Rural women entrepreneurs, Sunamganj, Bangladesh.*

1. Introduction

1.1 Background and Rationale

In developing countries, agriculture is vital for reducing rural poverty, enhancing food security, and promoting sustainable development (Altenbuchner et al., 2017). Women play a crucial role in agriculture, especially in organic farming, which has the potential to improve livelihoods (Soltani et al., 2014).However, they face significant gender disparities, including limited access to resources, markets, and decision-making power (Waris et al., 2016). In addition to these challenges, women encounter environmental, economic, and social risks (Tomaš&Radovic´-Markovic´, 2018).

In South Asian countries like Pakistan, Afghanistan, Bangladesh, and India, women's property rights are often restricted by legal frameworks and cultural norms (Radovic'-Markovic', 2013; Kabir et al., 2019). For instance, despite progressive legislation such as India's Hindu Succession Act of 1956, patriarchal practices continue to hinder women's access to property (Agarwal, 1994). Similarly, in Bangladesh, despite reforms aimed at improving women's rights, traditional interpretations of Islamic law often limit their practical inheritance rights (Kabeer, 1988). In Pakistan and Afghanistan, tribal customs further undermine women's legal entitlements to property (Ahmed-Ghosh, 2004; Critelli, 2010). These constraints contribute to the undervaluation of women's roles in the rural economy (Radović-Marković, 2013; Kabir et al., 2019), limiting their access to education, land, and essential inputscompared to men (FAO, 2011),and restricting their participation in household decision-making (Das &Tarai, 2011).

In Bangladesh, where a significant portion of the rural population is female, women contribute substantially to agricultural production and family income (Huo&Kabir, 2011). Yet, they continue to occupy a subordinate social and familial position (Sourav, 2015) due to their lack of ownership, control, and management of key resources, particularly land (Uddin, 2011). Traditional norms in rural areas in Bangladesh further curtail their autonomy and decision-making power, underscoring the need for initiatives that foster women's empowerment and gender equality (Chandramohan et al., 2023). Teaching and encouraging women to build a strong, independent mindset can help them gain confidence and develop the strength to stand against oppression.To successfully escape a patriarchal society, women must be taught and encouraged to build a strong, independent mindset (Hossain, 2021). Establishing a new standard of personal independence will help women gain confidence in their capacity to govern their lives and develop the strength to stand strong in the face of subsequent oppression (Amin, 2023).

Increased participation of women in income-generating activities such as crop cultivation,rice husking, dairy, nursery, fisheries, poultry, and handicrafts. These activities not only enhance household incomes but also contribute to women's self-confidence and autonomy (Huo&Kabir, 2011). However, regions like Sunamganj, characterized by its unique geographical features, including vast wetlands and an abundance of natural resources, primarily rely on agriculture and fishing for livelihood (Himu et al., 2020). However, these traditional livelihoods in agriculture and fishing are increasingly insufficient for ensuring economic stability, particularly for women who face additional societal barriers. Additionally, environmental degradation and population growth are further straining natural resources, leading to a shift towards non-agricultural activities.Despite these challenges, recent shifts in rural Bangladesh's economic landscape have seen.

To address these challenges, green cooperatives have emerged as a promising model, promoting environmentally sustainable practices, and providing small farmers with economies of scale, market access, and modern inputs (McInerney, 2014). These cooperatives empower economically disadvantaged women by enhancing their bargaining power, reducing risks, and leveraging opportunities in organic farming, renewable energy, and eco-friendly crafts (World Bank, 2009). However, despite their potential, the full

empowerment of rural women entrepreneurs through green cooperatives in Sunamganj remains underexplored.

While numerous studies have examined the role of cooperatives and self-help organizations in economic and social empowerment of women in different parts of the world, including Bangladesh (Dohmwirth&Hanisch, 2019; Jeanne d'Arc, 2019; Quilloy, 2015; Hani, 2015; Woldu et al., 2015; Tesfay&Tadele, 2013; Sultana et al., 2020; Rabbania& Chowdhury, 2013; Islam et al., 2014; Islam et al., 2012), there remains a gap in understanding how green cooperatives specifically impact rural women entrepreneurs in this context in Bangladesh. Therefore, this study aims to fill that gap by exploring how green cooperatives in Sunamganj catalyze the economic empowerment of rural women entrepreneurs. Specifically, it seeks to identify the influencing factors that enhancerural women entrepreneurs'empowerment skills, the benefits and constraints they face, and the before-and-after changesin their involvement in green cooperatives towards economic empowerment in the selected study areas.

But to the best of the researcher's knowledge, no empirical study was conducted to focus on empowering rural women entrepreneurs through green cooperatives in the context of Sunamganj district in Bangladesh. Consequently, this study could be a modest attempt in this direction and help to attenuate the knowledge gap. By examining the current state of these cooperatives and identifying the specific challenges faced by women, the research seeks to provide insights and recommendations for enhancing the effectiveness of green cooperatives. Understanding the intersection of environmental sustainability and women's empowerment is crucial for developing holistic and inclusive rural development strategies. This research will contribute to the broader discourse on sustainable development and gender equality, offering valuable lessons for policymakers, development practitioners, and the local communities of Sunamganj.

1.2Research Questions

To better understand the objective of how rural women increase their capacity throughentrepreneurial skills, this study raises the following general research questions such as:

1. What are the factors influencing rural womenentrepreneurs to involve themselves in a green cooperative to increasetheir empowerment skills?
2. To what extentdo thosefactors affect rural womenentrepreneurs'increasing empowerment skills?
3. What are the benefits received and constraints faced by the rural women entrepreneurs involved in a green cooperative?
4. What are the effects of green cooperatives on rural women entrepreneurs towards economic empowerment as well as their overall empowerment situation?

2. Methodology

2.1Study Site Selection

This research was conducted in five adjacent upazilas of Sunamganj district: Tahirpur, SunamganjSadar, Sulla, Derai, and DakshinSunamganj. These upazilas are part of the Sylhet division in northeastern Bangladesh, where agriculture dominates the local economy. Women in these areas are engaged in both agricultural and non-agricultural activities. The chosen

upazilas are located near the district headquarters and have a rich history of enterprises and non-farm activities, as well as cooperative societies, including green cooperatives. According to local records, Sunamganj district has a total of 1,552 primary cooperatives, with 8 centrally registered cooperatives focused on "green" or sustainable practices, providing an excellent source for intensive data collection.

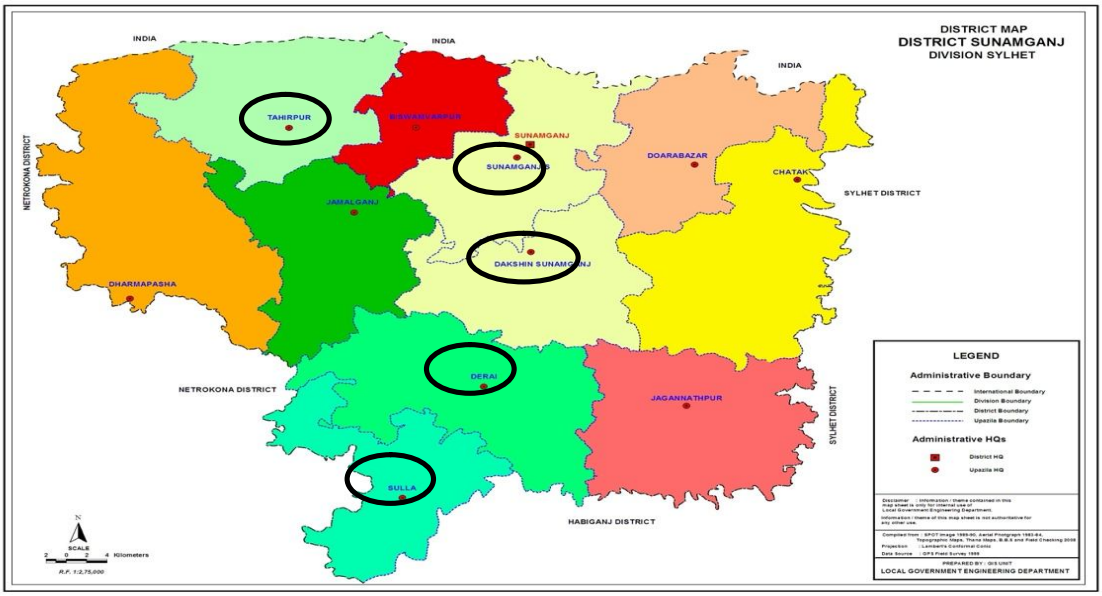

Figure 1: Location map of the study areas

2.2 Sample Size and Sampling Techniques

In this study, women entrepreneurs,both members and non-membersof green cooperativeswere selected as samples. The selection was based on the resource'savailability, the district's geographical setting, and local transportation options. Given the large and diverse population of rural women entrepreneurs in the study area, covering a range of business types and varying levels of experience, surveying the entire population was not feasible. Therefore, a sample of 200 women entrepreneurs was selected, comprising 100 green cooperative members and 100 non-members. This sample size was considered sufficient to capture a wide range of experiences and perspectives, ensuring the analysis reflected the broader population.

The 100 green cooperative members were drawn from the 1,552 cooperatives in Sunamganj district, including 8 centrally registered green cooperatives. This selection allowed for a balanced comparison between cooperative and non-cooperative entrepreneurs, with a specific focus on green cooperative practices. Participants were chosen using purposive and snowball sampling techniques from various upazilas to ensure diversity in business size, type, and location. Dividing the sample equally between cooperative members and non-members facilitated meaningful comparisons and provided insights into the factors influencing women's involvement in green cooperatives and the challenges they face.

Purposive sampling was well-suited for this study, as it allowed for the selection of participants with specific knowledge and experience relevant to the research. This method, often used in qualitative research, prioritizes depth of understanding over generalizability. By

carefully selecting participants, the quality of the data collected was enhanced. Snowball sampling, which relies on referrals from initial participants, was also employed to identify additional respondents, particularly useful when the target population is part of a network or community. This approach leveraged social connections to build a more robust sample.

2.3Data Collection and Analysis

This study employed both quantitative and qualitative survey methods. Both primary and secondary sources of data were used to assess the overall situation of women entrepreneurs, both cooperative members and non-members, from January 15, 2023, to February 23, 2023. Primary data was collected from both groups through face-to-face surveys, 20 in-depth interviews, and 10 focus group discussions (FGDs), each consisting of 5 respondents. Both methods complement each other: while in-depth interviews provide detailed individual insights, FGDs promote interactive discussions and group dynamics, allowing for the identification of shared experiences and differing opinions. The combination of these methods, alongside the questionnaire featuring both open and close-ended questions, ensures the collection of robust and reliable data from respondents.After preparing the questionnaire, it was pre-tested with 20 respondents to ensure its validity and reliability and to identify any inconsistencies in question phrasing or structure. This pre-test allowed for the correction of these issues, resulting in a final version that effectively elicited the necessary information from participants. Upon approval of the questionnaire, face-to-face interviews were conducted to gather the necessary data from respondents both at home and at the workplace, utilizing checklists and finalizing interview schedules after necessary revisions.Before the interview, each respondent was provided with a brief explanation of the study's nature and objectives, assuring them that it was conducted exclusively for academic research purposes. Secondary data were gathered from various published scientific papers, reports, articles, journals, books, and organizations such as the Bangladesh Bureau of Statistics (BBS), FAO, UN, World Bank, and other online resources. Data entry was performed by the researchers themselves. After completing the field survey, the collected data were coded, tabulated, and analyzed in line with the study's objectives.

2.4AnalyticalTechniques

In this study, both descriptive and analytical methods were utilized to analyze the collected data using relevant software tools, including SPSS (version 25) and Microsoft Excel.Descriptive analyses, including percentage, rank order, and ratio calculations, were performed to derive the expected findings.

To identify and assess the various factors influencing rural women entrepreneurs' involvement in green cooperatives and how these factors contribute to enhancing their empowerment skills, multiple regression analysis was applied. To measure the problems and constraints that are faced by the female entrepreneur as a member of a green cooperative, the Problems Confrontation Index (PCI) was used. Additionally, memory recall methods were used to gather data before and after involvement in green cooperatives through personal in-depth interviews with selected respondents. The impacts were examined by comparing the 'before' and 'after' scenarios.The logical explanation for selecting these econometric models is as follows:

Multiple Regression Models: Multiple regression analyzes the impact of multiple explanatory variables on a specific outcome. It assesses the relative influence of these independent variables on the dependent variable while keeping all other variables in the model constant.Thus, this approach helps to identify the impacts of several factors on rural women entrepreneurs' involvement in green cooperatives.

Problem Confrontation Index: To analyze the problems and constraints that are tabulated according to their severity, the problems confrontation index was implemented. This technique is suitable for finding the problems faced by women entrepreneurs after becoming members of a green cooperative.The empirical econometric models are given below:

Multiple Regression Models

$$Y_i = \beta_0 + \beta_1 \times X_1 + \beta_2 \times X_2 + \beta_3 \times X_3 + \beta_4 \times X_4 + \beta_5 \times X_5 + \beta_6 \times X_6 + \beta_7 \times X_7 + \beta_8 \times X_8 + \varepsilon i \ldots\ldots (i)$$

Where,

Y_i	=	Rural women entrepreneur involvement in green cooperative
		Independent variables:
X_1	=	Level of educational attainment (years of schooling)
X_2	=	Family size (number)
X_3	=	Farm size (acre)
X_4	=	Other sources of income (amount)
X_5	=	Input availability (yes or no)
X_6	=	Access to credit (amount)
X_7	=	Decision-making ability (yes or no)
X_8	=	Training and experiences (number of days)
β_0	=	Intercept
β_1 to β_8	=	Regression coefficients of the independent variables
ε	=	Disturbance term or error term

In this study, a significance level of 5% (0.05) was consistently used as the threshold for rejecting the null hypothesis.

Problem Confrontation Index

By using a structured questionnaire, the respondents were asked to give their opinions on selected problems during data collection. The PCI was calculated following the methods outlined by Islam et al. (2015) in "Livelihood Improvement of Small Farmers through Family Poultry in Bangladesh" and Kabir et al. (2019) in "The Determinants of Income of Rural Women in Bangladesh." A four-point rating scale was employed to determine the problem score for each respondent. Respondents rated each of the selected problems as "High," "Medium," "Low," or "No," with scores assigned as follows: "High" = 3, "Medium" = 2, "Low" = 1, and "No" = 0.

The Problem Confrontation Index (PCI) was computed by using the following formula:

$$PCI = Ph \times 3 + Pm \times 2 + Pl \times 1 + Pn \times 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

Where,

PCI	=	Problem Confrontation Index
Ph	=	Total number of rural women entrepreneurs that expressed "high" problems

Pm = Total number of rural women entrepreneurs that expressed “medium” problems
Pl = Total number of rural women entrepreneurs that expressed “low” problems
Pn = Total number of rural women entrepreneurs that expressed “no” problems

3. Results

3.1 Different Functions of Green Cooperatives

The study reveals that many women are working as agricultural entrepreneurs in the study areas, and a significant number have joined green cooperatives. Green cooperatives perform various functions to assist their members, encouraging more women to engage in their locality. A summary of these functions is provided below:

3.1.1 Provision of inputs, tools, and equipment

Green cooperatives encourage and involve members by providing high-quality seeds, modern agricultural tools, and equipment. Access to land is a significant issue in rural areas, particularly for women compared to men. To address this, green cooperatives offer opportunities for members to access land for collective or individual organic cropsspecifically vegetable production.This initiative inspires rural women to join cooperatives, empowering them economically.

3.1.2 Extension services

Green cooperatives offer various treatments through professional agricultural extension centers. A skilled extension officer affiliated with the cooperative visit’s members’ homes once a month to check on their growingvegetables, providing services free of charge.

3.1.3 Credit services

To attract and encourage members to participate and increase production, green cooperatives provide financial assistance for purchasing contemporary tools and equipment, freeing members from reliance on predatory lenders. Members can obtain interest-free loans of up to 15,000 Tk. Repayment is made through weekly deductions from vegetable sales, easing financial pressure. This system ensures 100 percent loan recovery with no defaults, motivating rural women to join cooperatives and gain economic empowerment.

3.1.4 Training services

Green cooperatives offer training on modern and efficient organic vegetable farming systems. Practical and theoretical training sessions are held monthly at the training center, providing valuable knowledge to those interested in joining.

3.1.5 Marketing services

Green cooperatives provide a market for members’ products, especially for women, who often lack access to guaranteed markets for their vegetables. These cooperatives help members sell their products regardless of quantity, eliminating the need for marketing and transportation concerns. They also protect women from exploitation by middlemen, who often offer low prices and use fraudulent weighing methods. The cooperative collects vegetables daily and pays them at the end of the week, ensuring a clean, transparent, and hygienic supply chain.

3.2 Socio-economic Characteristics of Green Cooperative and Non-Green Cooperative Women Members

Table 1 presents a detailed comparison of the socio-economic characteristics between women members of green cooperatives and non-green cooperatives. In terms of occupation, a higher percentage of green cooperative members are engaged in farming (65%) compared to non-green cooperative members (58%), while non-green cooperative members show slightly higher involvement in business and service sectors. Major income sources reveal that a majority of green cooperative members derive income from organic or green farming (63%), whereas non-green cooperative members have more diversified income sources including business, service, and other agricultural activities. In the case of education, green cooperative members exhibit higher levels of secondary education and above compared to non-green cooperative members, who have a higher proportion with no formal education or primary education. The age distribution shows a predominant presence of members aged 31-40 years in both groups. Marital status and land ownership patterns indicate similar trends between the two groups, with a significant portion of members being married and having no land ownership. Decision-making roles within households highlight that a larger proportion of green cooperative members are involved in selfdecision-making compared to non-green cooperative members. Family types show an even distribution between nuclear and extended families among both groups. Overall, the table provides insights into the socio-economic diversity among women entrepreneurs in cooperatives, underscoring the differences in occupational engagement, income sources, education levels, and decision-making roles that influence their participation and empowerment within cooperative frameworks (Table 1).

Table 1: Socio-economic characteristics of green cooperative and non-green cooperative women members

Particulars		**Green Cooperative member N = 100**	**Non-green cooperative member N = 100**
Occupation	Farming	65 (65%)	58 (58%)
	Business	5 (5%)	8 (8%)
	Service	7 (7%)	2 (2%)
	Others	23 (23%)	32 (32%)
Major income sources	Organic or green Farming	63 (63%)	57 (57%)
	Business	10 (10%)	21(21%)
	Service	12(12%)	13(13%)
	Other agricultural activities	7 (7%)	4 (4%)
	Others	8 (8%)	5 (5%)
Education	No formal education	12 (12%)	48 (48%)
	Primary education	20 (20%)	27 (27%)
	Secondary education	37 (37%)	16 (16%)
	Higher Secondary education	19 (19%)	6 (6%)
	Graduate	9 (9%)	3 (3%)
	Post-graduate	3 (3%)	0 (0%)
Age	20-30	24 (24%)	27 (27%)
	31-40	53 (53%)	50 (50%)

	41-50	16 (16%)	19 (19%)
	51-60	6 (6%)	4 (4%)
	More than 60	1 (1%)	0 (0%)
Religion	Islam	76 (76%)	73(73%)
	Hinduism	24 (24%)	27(27%)
	Buddhist	0 (0%)	0 (0%)
	Christian	0 (0%)	0 (0%)
Marital status	Married	82 (82%)	79 (79%)
	Unmarried	6 (6%)	9 (9%)
	Divorced	4 (4%)	5 (5%)
	Widowed	8 (8%)	7 (7%)
Land types	Owner of land	15 (15%)	33 (33%)
	Rented/Mortgaged land	37 (37%)	23 (23%)
	No land	48 (48%)	44 (44%)
	Others	0 (0%)	0 (0%)
Decision making	self-decision making	49 (49%)	28 (28%)
	Influence on decision-making	33 (33%)	14 (14%)
	No role in decision-making	7 (7%)	35 (35%)
	Dominated by male	11 (11%)	23 (23%)
Family types	Nuclear	43 (43%)	53 (53%)
	Extended	57 (57%)	47 (47%)

Source: Survey data, 2023

3.3 Production, Marketing,and Consumptionof Green or Organic Products by Green Cooperative and Non-Green Cooperative Women Members

The superior conditions of green cooperative members are shown in Table 2.Green cooperative members achieve a higher average daily yield of 500 kg compared to 430 kg for non-green cooperative members. Both groups consume an average of 200 kg/day of their produced vegetables. However, green cooperative members market a higher average quantity of 300 kg/day compared to 230 kg/day for non-green cooperative members.In terms of pricing, green cooperative members command a higher price per kilogram at 41 tk./kg compared to 32 tk./kg for non-green cooperative members. Similarly, the market price per kilogram for products sold by green cooperative members is higher at 48 tk./kg, whereas non-green cooperative members receive 38 tk./kg.This table provides a snapshot of the production efficiency, marketing capabilities, and pricing dynamics between women members of green cooperatives and those outside such cooperatives, illustrating the potential benefits of cooperative membership in enhancing production yields and securing better market prices for green or organic vegetables.

Table 2: Production, marketing, and consumption of organic or green products by green cooperative and non-green cooperative women members

Particulars	**Green cooperative member N = 100**	**Non-green cooperative member N = 100**
	Average	Average
Yield (kg/day)	500	430
Quantity Consumed (kg/day)	200	200
Quantity Marketed (kg/	300	230

day)		
Price (tk./kg)	41	32
Market price (tk./kg)	48	38

Source: Survey data, 2023

3.4 Benefits of Rural WomenEntrepreneurs as a Member of a Green Cooperative

The members of the green cooperative were asked to state the benefits of being a green cooperative member compared to the non-green member after they were operating individually. Therefore, itwas revealed that members increased their capacities (like self-help and self-motivation to try and do something on their own) by building and maintaining relationships with other members through active participation in the cooperative society which affects their production, income, and self-confidence. Table 3 outlines the benefits experienced by rural women entrepreneurs as members of green cooperatives. The benefits are ranked based on their reported significance. The most commonly cited advantage, reported by 23% of respondents, is the increase in individual capacities, highlighting personal development and skills enhancement through cooperative membership. Following closely at 17%, the ability to market green or organic crops and products at fixed prices is noted as a key benefit, providing stability and predictability in sales. Access to credit, essential for business expansion, is mentioned by 8% of members, while 13% emphasize the enhancement of bargaining power in the market and theprovision of inputs (10%), crucial for negotiating fair prices.

Table 3: Benefits of rural women entrepreneurs asgreen cooperative members

Sl. No.	**Benefits from the green cooperative**	**N = 100**	**%**	**Rank**
1.	Increase individual capacities	23	23	1
2.	Marketing of green or organic crops and products at a fixed price	17	17	2
3.	Access to credit	8	8	6
4.	Enhancing bargaining powerin the market	13	13	3
5.	Land for crops and vegetable production	7	7	7
6.	Provision of inputs	10	10	4
7.	Other extension services	4	4	9
8.	Training services	3	3	10
9.	Provision of tools and equipment	9	9	5
10.	High-quality seed for local crops and products	6	6	8

Source: Survey data, 2023

Overall, these benefits underscore the significant role of green cooperatives in empowering women entrepreneurs by providing essential resources, support services, and opportunities for economic growth and independence.

3.5 Constraints Faced by Green Cooperative and Non-greenCooperative Women Members

Table 4 compares problem confrontation among women in green cooperatives and non-green cooperatives.The PCI (Problem Confrontation Index) was calculated for rural women entrepreneurs, and values can range from 0 to 300, with green cooperative women members facing a range of 181 to 276, while non-green cooperative women members face 167 to 263.

The most severe problem faced by green cooperative women is male domination, with a PCI of 276, ranking first. Inadequate market information, inadequacy of labor to transport vegetables, and irregular supply of inputs and tools are also significant issues faced by non-green cooperative women members. Lack of training and technical knowledge is the second most severe problem, followed by disease prevalence due to lack of extension services and lack of market access. The study reveals that both green and non-green cooperative members face significant challenges, with male domination being more severe for non-green members due to a patriarchal culture or less effective strategies to address gender inequality.Green cooperative members face challenges in market information, labor, and resource allocation, which are crucial for them to make informed decisions. Additionally, logistical and labor issues, such as lack of labor for vegetable transportation, can impact cooperative operations efficiency.Irregular supply of inputs and tools affects green cooperative members' ability to maintain consistent production and quality of agricultural products.

Non-green cooperative members face challenges in adopting modern practices and improving productivity due to a lack of training and technical knowledge. Insufficient extension services contribute to disease prevalence, highlighting a gap in support for disease management and agricultural best practices. For both groups, spoilage and theft are significant issues, but green cooperative members experience these problems more acutely, likely due to differences in logistics and security measures. These findings underscore the critical role of cooperatives in mitigating logistical and market-related challenges for women entrepreneurs in agriculture (Table 4).

Table 4: Rank of problems confrontation by green cooperative and non-green cooperative women members

Problems	**Green Cooperative Women member**						**Non-green cooperative women member**					
	The extent of problemconfrontation				PCI	Rank	The extent of problem confrontation				PCI	Rank
	High (3)	Medium (2)	Little (1)	No (0)			High (3)	Medium (2)	Little (1)	No (0)		
Irregular supply of inputs and tools	58	20	13	9	227	4	43	38	15	5	220	6
Prevalence of disease due to lack of extension services	34	31	17	18	181	9	71	13	15	1	254	3
Lack of training and technical knowledge	33	29	27	11	184	8	66	31	0	3	260	2
Lack of access to the market	49	19	28	4	213	5	57	37	5	1	250	4
inadequacy of labor to transport vegetables	57	17	24	2	229	3	65	21	0	14	237	5
Spoilage of vegetables during transportation	46	17	23	14	195	7	34	12	41	13	167	9

Inadequate market information	61	26	13	0	248	2	17	58	21	4	188	7
Dominated by male members	82	12	6	0	276	1	76	11	13	0	263	1
Theft of vegetables from the field	31	53	10	6	209	6	16	49	35	0	181	8

Source: Authors estimation, (2023)

3.6Factors InfluencingRural Women Entrepreneurs' Engagement in Green Cooperative

Table 5 presents the results of a regression analysis examining the factors that influence rural women entrepreneurs' engagement in green cooperatives. The results show that education has a significant positive effect on their engagement, with a 1% increase in educational level leading to a 3% increase in engagement. Education empowers rural women with the knowledge and skills necessary to participate actively in cooperatives and adopt green practices.

Family size and farm size do not directly affect rural women entrepreneurs' engagement in green cooperatives in the study area. This suggests that women in rural areas often manage agricultural activities themselves due to the outmigration of male family members or the need for additional income through other means. The negative correlation between farm size and engagement in green cooperatives may reflect that smaller farms may face more significant challenges in adopting green practices without cooperative support (Table 5).

From table 5, other sources of income also positively influence engagement in green cooperatives, as additional income streams provide the financial stability needed for women to invest in cooperative activities. Input availability is crucial for the active participation of rural women in cooperatives, as access to necessary resources (such as seeds, fertilizers, and equipment) is essential for the adoption of sustainable agricultural practices and participation in cooperatives.Access to credit significantly influences engagement in green cooperatives, highlighting the importance of financial resources in enabling women to invest in cooperative activities and sustainable practices.

The study found that while decision-making ability is important, other factors like education, resource access, and financial stability play more significant roles in influencing engagement in green cooperatives. Increased experience and training significantly affect engagement in green cooperatives, emphasizing the importance of practical skills and knowledge. An adjusted R^2 value of 0.66 suggests that the independent variables in the model explain a significant portion of the variance in engagement in green cooperatives among rural women entrepreneurs. This high explanatory power of the findings from various studies emphasizes the multifaceted nature of factors influencing cooperative engagement, including education, income sources, access to resources, and training (Table 5).

Table 5: Factors influencing rural women entrepreneurs' engagement in green cooperative

Regression variables		Coefficient	t-statistic	p-value	Standard error
Intercept	α	-0.86	-1.54	0.18	0.42
Education	X_1	0.06	3.20	0.03***	0. 04
Family size	X_2	0.03	0.76	0.19	0.08

Farm size	X_3	-0.06	1.68	0.17	0.04
Other sources of income	X_4	0.08	2.42	0.01***	0.06
Input availability	X_5	0.04	0.80	0.04***	0.04
Access to credit	X_6	0.14	2.24	0.07**	0.07
Decision-making ability	X_7	0.04	0.19	0.28	0.14
Training and experiences	X_8	0.45	3.85	0.002***	0.13
Adjusted R^2			0.66		

Source: Authors' estimation, (2023)

Note: ***, **, and * denote 1%, 5%, and 10% levels of significance, respectively.

3.7 Before and after the Change in Rural Women Entrepreneurs' Engagement in Green Cooperative

Table 6 presents the before-and-after changes observed among rural women entrepreneurs upon joining a green cooperative. The study reveals that joining a green cooperative has significantly improved the economic outcomes and financial stability of rural women entrepreneurs. The average daily sales increased by 26.93%, and daily income surged by 36.36%. This increase can be attributed to improved market access, better product quality, and enhanced business practices facilitated by the cooperative. The cooperatives often provide training and resources to help members adopt more effective business strategies and improve their products, leading to increased sales and income. Expenditure on housing and land also rose, indicating a 10% growth. This suggests that members are investing in their living conditions and infrastructure, contributing to overall economic development. Investments made by these entrepreneurs also saw a notable uptick, rising from 22,000 Tk. to 35,000 Tk., a 59.09% increase. Savings also showed a significant rise, from 8,000 Tk. to 12,500 Tk., reflecting a 56.25% improvement. These findings underscore how membership in a green cooperative has positively impacted the economic outcomes and financial stability of rural women entrepreneurs, empowering them to increase their income, savings, and investments for sustainable livelihoods and future growth.

Table6: Before and after the change in rural womenentrepreneurs' engagement in green cooperative

Indicators	**Before Amount (Tk.)**	**After Amount (Tk.)**	**Percentage change**
Sales (per day)	16150	20500	26.93
Income (per day)	55000	75000	36.36
Expenditure on housing and land (per day)	25000	27500	10
Investment	22000	35000	59.09
Savings	8000	12500	56.25

Source: Survey data, 2023

4. Discussions

4.1 Summary of Key Findings and Comparison with Existing Literature

This study aimed to explore how green cooperatives catalyze the economic empowerment of rural women entrepreneurs in Sunamganj by identifying the factors influencing empowerment through cooperative involvement, assessing the benefits and constraints faced, and evaluating the changes in economic empowerment before and after joining green

cooperatives. Our findings reveal that membership in green cooperatives significantly enhances rural women entrepreneurs' capacities, including self-help, self-motivation, and the ability to build relationships with other members. These benefits lead to improvements in production, income, and self-confidence. The ability to market green products at stable prices, access credit, and improve bargaining power were identified as critical advantages. These findings align with previous research, which highlights the positive role of cooperatives in providing rural women access to resources, training, and markets (Lyon et al., 2010; Hellin et al., 2009).

However, this study reveals new insights into the persistent challenges faced by rural women, including male domination within cooperatives, inadequacies in market information, and labor shortages. These gendered challenges mirror broader gender dynamics in agricultural settings, where women often experience structural barriers and limited decision-making power, as noted in other studies (Farnworth et al., 2013). The inadequate availability of market information and the inefficiencies in logistics further hinder the success of cooperatives, aligning with research by Shiferaw et al., (2016) and Ahado et al., (2021).

The factors influencing rural women's involvement in green cooperatives, such as education, income sources, access to inputs and credit, and experience, were consistent with findings from the broader literature. Studies show that education plays a significant role in empowering women to adopt sustainable agricultural practices and participate in cooperative activities (Kabir et al., 2012; Quisumbing&Pandolfelli, 2010). Similarly, diversified income sources and access to inputs are key determinants for adopting sustainable practices and cooperative participation (Bachewe et al., 2018; Asfaw et al., 2019). The availability of credit is crucial for rural women entrepreneurs, enabling them to invest in green technologies and expand their businesses (Baffoe et al., 2014; Garg et al., 2024).

In terms of economic impact, the study highlights substantial improvements in income, savings, and investments among cooperative members. Daily sales and income significantly increased due to enhanced market access and better business practices. This is consistent with findings from other studies, which emphasize that cooperative membership can improve access to markets and resources, enabling rural entrepreneurs to scale their operations and invest in long-term assets (Henock, 2019; Ibem&Odum, 2011). Additionally, increased savings among cooperative members reflect improved financial management and stability, which are crucial for long-term economic resilience (Bharti, 2021).

5. Summary and Conclusion

The study highlights the significant role of green cooperatives in improving the socio-economic conditions of rural women entrepreneurs in Sunamganj, Bangladesh. Membership in green cooperatives leads to improved economic outcomes, better living standards, access to essential resources, and increased empowerment and capacity building. Benefits of cooperative membership include higher levels of education, better income from green farming, and more involvement in decision-making roles. Green cooperative members also experience higher yields and better market prices, resulting in better income stability and growth opportunities. The collective strength of cooperatives improves bargaining power in the market, access to credit, and provision of essential inputs, contributing to members'

economic well-being. Challenges such as male domination, inadequate market information, and irregular supply of inputs persist.However, education, access to credit, input availability, and training significantly influence women's engagement in green cooperatives. The positive economic impact of green cooperative membership is evident in significant increases in daily sales, income, investments, and savings. These improvements reflect the overall financial stability and growth potential fostered by cooperative activities, empowering women to achieve sustainable livelihoods and contribute to community development. Future research should explore the long-term sustainability of green cooperatives, the role of digital technologies in overcoming market and logistical challenges, and the impact of gender-focused interventions on cooperative success. Comparative studies across different regions can provide a broader understanding of contextual factors influencing the effectiveness of green cooperatives in empowering rural women entrepreneurs.

5.1 Limitations

This research has several limitations that should be acknowledged. Firstly, the reliance on memory recall from recently enrolled members may introduce recall bias, potentially affecting the accuracy of the reported changes in economic indicators. Secondly, the study is geographically limited to Sunamganj, Bangladesh, which may not fully represent the diverse experiences of rural women entrepreneurs in other regions. Thirdly, the cross-sectional design of the study does not allow for the assessment of long-term impacts and sustainability of the benefits derived from green cooperative membership. Additionally, the study primarily focuses on quantitative measures, potentially overlooking qualitative aspects such as personal empowerment and social dynamics within cooperatives.

5.2 Future Research Directions

Despite these promising results, the study emphasizes the need for more research to fill the remaining gaps. First, longitudinal studies are required to assess the long-term viability and impact of cooperative membership on women's economic empowerment. Comparative research across areas would also assist in generalizing the findings and identifying effective practices in a variety of scenarios. Furthermore, future studies should look at how digital technology might improve cooperative efficiency, increase market access, and overcome logistical constraints. The use of qualitative approaches, such as interviews and focus groups, may give more in-depth insights into the human and social dynamics of cooperatives, which are sometimes missed in quantitative research. Finally, the inadequate investigation of gender-focused interventions emphasizes the need for research into the role of male allies and gender training programs in fostering equitable participation and diminishing male dominance in cooperatives. Addressing these research gaps would help us gain a better understanding of how green cooperatives benefit rural women and guide policy solutions for sustainable development.

5.3Recommendations for Policy Implications

To improve the effectiveness of green cooperatives and support rural women entrepreneurs, several recommendations are proposed. These include improving educational attainment for rural women through accessible programs on agricultural practices, business management, and sustainable farming. Regular training programs should be institutionalized to offer practical knowledge of modern farming techniques and cooperative management, supported by strengthened extension services. Collaboration between government and non-governmental organizations should ensure consistent access to high-quality inputs, tools, and land. Infrastructure development is needed for the transportation and storage of agricultural products, reducing spoilage and logistical challenges. Access to credit with low-interest loans and flexible repayment options is crucial, and financial institutions should tailor products to rural women's needs. Digital platforms and mobile applications should improve market information dissemination, and marketing cooperatives should be developed to negotiate better prices and market access. Gender-focused interventions and longitudinal studies should be conducted to assess the long-term impact of cooperative membership on women's economic and social empowerment.

6. Disclaimer

This article is original and contains previously unreleased content. The authors confirm that each author has read and approved the manuscript.

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that generative AI technologies such as ChatGPT-4 (developed by OpenAI, accessed via the OpenAI platform) have been used during the editing of manuscripts, which were subsequently paraphrased and edited by the authors, and all final revisions were made by the authors.

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