P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating: 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 7; Issue 9; August 2024; Page No. 737-747

Received: 25-07-2024
Accepted: 03-09-2024

Indexed Journal
Peer Reviewed Journal

Assessing livelihood outcomes for fishing communities engaged in cooperative society: A case study in Bangladesh

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DOI: https://doi.org/10.33545/26180723.2024.v7.i9j.1133

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Abstract

Bangladesh is a located on the delta part of Bay of Bengal along the India Ocean in South Asia. This offers rural communities with opportunities for aquaculture. However, fishing community have remained neglected in terms of extension services and investment assistance. While cooperative societies have historically provided a model for rural development based on synergy around social capital, fishing communities remain unorganized and struggling to improve their investment. Hence this paper answers the question: What are the factors that contribute to changes in the livelihood outcomes of fishing communities operating under fishery cooperative society as a model for rural development in Bangladesh? Data were collected from two villages and analyzed using stepwise Multiple Linear Regression Models. The aim was to determine factors that influence the livelihood changes of the fishing community. Findings indicated that fishing had significant influence on the livelihood of members of the fishing community. The main factor included annual family income, farm size, and knowledge on fishing activities. Collectively, the factors explained 53% variation in the livelihood changes of members of the fishing community for more than two-third (82 percent) of the respondents. The most influential challenges, from highest to lowest, included corruption and nepotism, poor training facilities, and political interference. We conclude the Department of Fisheries need to undertake policy reforms including regulation against corruption and accountability of extension services providers, extension services provision to improve the knowledge and practices for fishing community, and political willingness of the ruling regime in supporting policy implementation.

Keywords: Fishing communities; Cooperative societies; extension interventions, livelihood outcomes; policy reforms

1. Introduction

Globally, it is estimated that in 2019 aquatic food accounted for about 17% of animal proteins and 7% of all proteins. For the 3.3 billion people, aquatic food provides at least 20% of the average per capita intake of animal protein. According to FAO projects, it is estimated that by 2030 as 15% growth in global aquatic food production will be required with the growing global food demand (FAO, 2017) [26].

Bangladesh is a located on the delta part of Bay of Bengal along the India Ocean in South Asia. This offers the country the opportunity to engage in fish production from inland open waters and marine fish capture. In 2020, Bangladesh occupied the 3rd position in global capture fish production with 1.25 million tons of fish which was 11% of the total global figure for the year (Halwart, 2022) [29]. In addition, over the same year, Bangladesh produced 2.6 million tons of aquaculture making it 5th largest world's aquaculture. When all inland and marine captures are combined, the country ranked 10th globally in fish production. However, Bangladesh ranked 25th in annual marine capture production with 670,000 tons (Ghose, 2014[28]; Shamsuzzaman *et al*., 2017[65]). Globally, the sector has experience multiple uncertainties due to effects of pandemic, global economic crisis including the Ukraine-Russian that is being association with drastic and high increase in food prices; and effect of climate change; and environmental degradation and pollution of water sources.

Fish production in Bangladesh is done in the vast water bodies that include rivers, haors, baors, beels, ponds, floodplains, and marshes (Debnath *et al*., 2020 [19]; Kashem *et al*., 2021[41]; Islam *et al*., 2022[38]). The fisheries sector in the country plays a significant role in provision of nutrition, employment and foreign exchange earner (Islam *et al*., 2021) [37]. It contributes around 3.50% to the national GDP and constitutes 25.72% of agricultural share of the GDP (DoF, 2019 [23]; Islam *et al*., 2022 [38]). About 12% of the country's total population directly or indirectly depend on fisheries and aquaculture for livelihoods (DoF, 2019 [23]; Islam *et al*, 2022 [38]). Rural communities engage in the production of fish fry, aquaculture, and it management, fish capturing and enhanced fisheries, fish trading, dry fish processing net/trap and boat making, fisheries labor, etc. Aquaculture commonly means farming fish and other aquatic animals in a controlled environment as opposed to

fish produced in rivers and other inland open-water sources.

Bangladesh's growth for fisheries sector is not in tandem with growth in human population and rapid urbanization and subsequently, the demand for animal-source foods. The country is faced by several challenges that span across the global to local levels of governance leading to multiple uncertainties in the growth of the sector. There is a decline in fresh and marine biodiversity and thereby, low productivity in freshwater fishing and aquaculture due to poor governance and management of the sector (Mia *et al*. 2022 [44]; Rahman *et al*., 2018 [59]). Scholarships have identified weakness in formulation and enforcement of policy and legal framework to contribute to problem low investment in development of human capital; overfishing (Rahman *et al*., 2018 [59]; Islam, 2020 [36]) and thereby, decline in inland and marine aquatic stock; poor governance of cooperation societies; degradation of aquatic landscape; and dilapidation of related infrastructure (Hossain *et al*., 2006 [31]; Rashid, 2005 [60]; Alam & Thomson, 2001 [7]; Ibrahim, 2018 [33]). These challenges are imposing great pressures on both inland and coastal resources and limiting their capacity to meet rural livelihoods needs, growing food supply in the country, and export exchange earner.

Locally, fishing is adversely being affected by extreme weather events, market instability, overfishing, and resource degradation. There is also degradation of water sources through pollution from widespread major road construction works across and use of pesticides and fertilizers the country; erection of embankments and flood control structures; and drainage of wetlands and construction of dams in the upstream parts of the major river (Hossain *et al*., 2006 [31]; Rashid, 2005 [60]; Alam & Thomson, 2001 [7]).

Consequently, these challenges undermine the sector productivity, market access, and resilience of sector which adversely affects the sustainability of the livelihoods of majority of the small-scale fishing communities with great impact on open water fishery resources within the country (Sadekin *et al*., 2018 [64]; Islam *et al*., 2022 [38]; Rahman, 2010 [57]).

Notably, the literature argues that farmers can tackle these challenges enhancing both their individual household capital and social capital by getting organized and working through cooperatively society as a model for rural development (Birchall and Simmons, 2009 [11]; Bibby and Shaw, 2005 [10]; Ahmed *et al*., 2020 [2]). In Bangladesh, the idea, and initiatives on cooperative society as a model for rural development was initially established in 1940s. Over 100 cooperative societies were established in the fishery sector across the country. Over the period after 1960s, cooperative societies were re-organized by linking of village level societies to the regional set up to improve on their functionally effective (Wasave *et al*., 2015 [72]; Islam *et al*., 2014 [34]; Islam, 2019 [35]). The concept of cooperative refers to any group of people who have voluntarily agreed to pool and work together to participate in the development rural development activities and provide several services for the collective benefits to the members (Wasave *et al*., 2015 [72]). When formed around fisheries, smallholder fishing communities come together to participate in various fishing and aquaculture activities such as production or caching fish, preserving and marketing of the fish stocks for eventual sharing of accruing benefits. Successful cooperatives can play important role in empowering small-scale fishing communities, accessing inputs and services at negotiated prices; improving productivity and bargaining for better market prices; collectively tackling environmental and socio-economic shocks including effects of catch shortfalls, natural disasters, hunger, and sickness; and psychosocial support system for members (FAO, 2012[25]; Basurto *et al*., 2013[12]; Sari and Rahmayanti, 2022[64]). This helps to create opportunities for multiple streams of livelihood benefits (Ostrom, 1990[54]; FAO, 2012[25]; Adugna, 2013[1]; Mhembwe and Dube, 2017[43]). The literature argues that Cooperative societies play significant role of organizing, planning, and implementing development initiatives that contribute to positive and sustainable changes in the livelihoods or rural communities (Mhembwe and Dube, 2017[43]; Pérez-González *et al*., 2021[55]; Mohlala, 2020[47]). Wasave *et al*, 2015[72] has argued that fishing cooperative societies improve the social capital of rural community to knowledge and skills for governance, production, processing, and marketing; credit facility; input and services, equipment, and appropriate technology. However, despite these benefits, the literature argues of instance where cooperative society fail in changing the livelihoods of smallholder farmers (Ahmed *et al*., 2017[3]; Miroro *et al*., 2023[45]). Some the challenges that limit the effectiveness of cooperative society include weak governance and management competences and lack of enabling policy and legal framework (Deininger et al., 2012[20]; FAO, 2012[25]; Wasave, 2015[72]).

There are existing gaps in knowledge on ways to strengthen the role that cooperative society play in contributing to the sustainable changes in the livelihoods of rural smallholder fishing communities under the context of multiple uncertainties. There is limited scholarship that deals examines the factors that ensure cooperative societies deliver sustainable changes in the livelihood of fishing communities in the face of global to local uncertainties (Mhembwe, and Dube, 2017[43]; Rahman and Hickey, 2020[58]; Nayak, 2017[52]; Mozumder *et al*., 2018[48]). This paper contributing to closing these gaps by developing a conceptual framework and methodology to guide the study (see section 2 and 3), applies the framework on two fishing communities organized and functioning under cooperative society to provide insights status and challenges facing their efforts to sustainably improve their livelihood (see section 4), and then draws conclusion and recommendations (see section 5).

2. Conceptual Framework of the Study

This research explores the factors that contribute to changes in livelihood outcomes from sustainable rural development initiatives. It answers the question: To what extent, if any, can fishing system when organized through the cooperative society model of rural development contribute to changes in the livelihood of fishing communities.

The paper develops a conceptual framework (see Figure 1) based on Sustainable Livelihood Framework (SFI) developed by the Department for International Development (1999) [22]; Human Development Index (HDI) of the United Nations compiled by United Nations Development Programme (Conceição, 2022) [16] and the Sustainable Development Goal (SDG) (Jha, 2016) [39]. The SFI focuses

on changes in human livelihood needs at the community level when the members collectively self-organize and build their productive and marketing activities using the cooperative society model of development. The HDI focuses on human development outcomes with respect to health, education, and employment. The SDG's advocates through Goal 16 strong institutions for inclusive society while addressing corruption; Goal 4 on ensuring education including developing human capital; Goal 5 ensure gender equality; Goal 10 on reducing inequalities; Goal 13 on taking climate action; and Goal 14 on preserving and conserving life below the water can contribute towards sustainable livelihood outcomes for fishing communities. Notably, the SFI need to examine changes in the human livelihoods-based levels of individual human capital and social capital. However, the sustainable of the framework must take cognizance of the multiple uncertainties that disrupts and creates new opportunities. This paper recognizing the adverse effects of climate change, the pandemics such as COVID-19 and global insecurity and conflicts. Thus, the paper combined insights from the SIF, HDI, and SGD to argue on the factors influencing and challenges that undermine the achievement and sustainability of changes in the livelihood outcomes for rural fishing communities operating through cooperative society as a model for rural development.

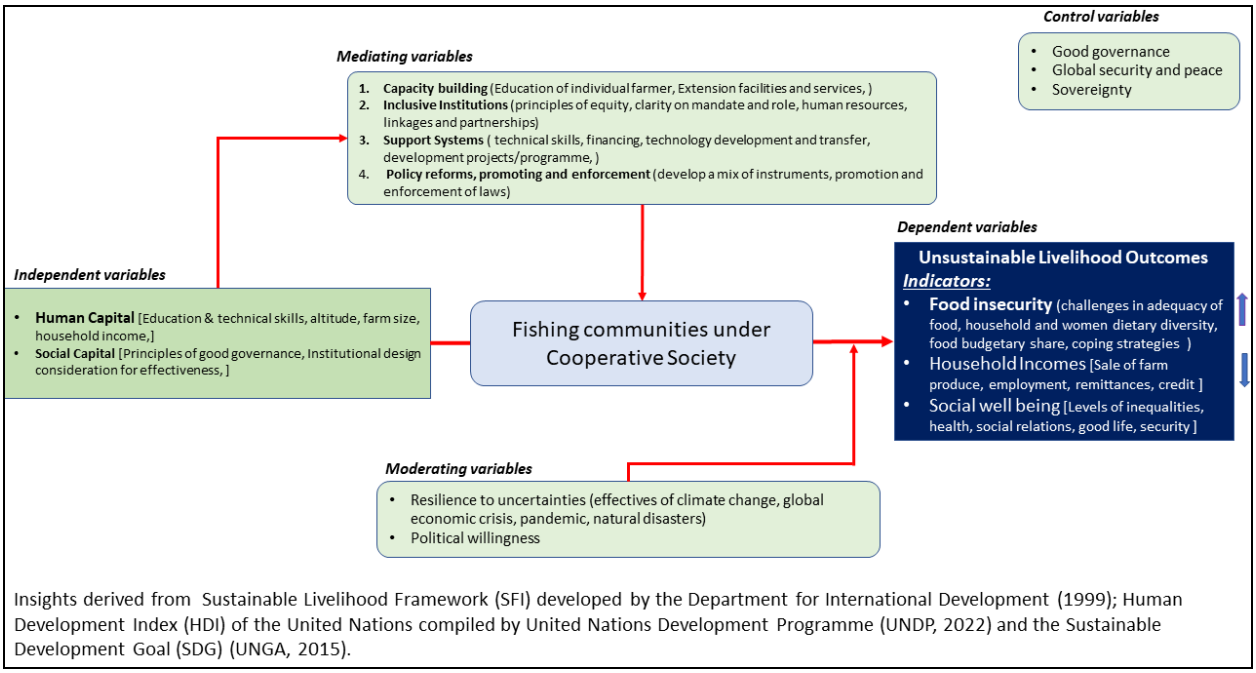

Fig 1: Conceptual framework for guiding the study

The literature argues that agricultural cooperative model offers smallholder farming communities the needed critical economic and social pillars for rural development (Sebhatu *et al*., 2021 [63]; Conceiçã and Tiago, 2022 [15]; Wanyama, 2014 [71]). Agriculture cooperatives are considered as helps members opportunity for collective negotiation for quality farming inputs and services at affordable and thereby increased profits and incomes for members (Conceiçã and Tiago, 2022 [15]; Tran *et al*., 2023 [68]; Sebhatu *et al*., 2021 [63]; Sari, and Rahmayanti, 2022 [62]); Allahdadi and Aref, (2011) [8] has argued that over time agricultural cooperatives can generate social capital for members at a higher rate than shareholders can generate for investment firms. Social capital can enhance economic efficiency and long-term developing gains (Serageldin and Grootaert, 2017 [66]; Allahdadi and Aref, 2011 [8]).

Cooperative societies allow farmers to create synergies for meeting individual livelihood needs. Using their collective power, to negotiate and access quality input supplies and services at affordable prices; pool their diverse and complementary competences, labor, and capital for efficiency of farming activities; harness collective power labor for production; access negotiated low-interest financial instruments; provide a platform for developing, transferring, and adoption of appropriate farming technologies; establish linkages and partnerships for improved farming systems; and concerted force of dealing with uncertainties. Thus, when well governed cooperative society can serve as vehicle for sustainable livelihood transformation for rural societies.

This paper applies the insights from the Sustainable Livelihood Framework onto two fishing communities to examine changes in changes three key indicators of livelihood i, that is income, well-being, and food security. These indicators can help to define and explain changes in livelihood from farming system under the context of cooperative society as a model of rural development. The framework argues that the process of livelihood changes for fishing community members is influenced by multiple interacting forces such as ecological characteristics; governance of the cooperative society; and individual member factors including age, education, gender, incomes, knowledge, and attitude. However, attempts to investigate all these factors through a single study can be daunting. Hence, this paper only considers three categories of indicators. First, it examines the indicators related to members of the cooperative society including age, education, family size, annual family income, farm size, and

experience in fishing process. Second, it examines indicators related to cooperative society including membership to the cooperative society; access to credit, extension media, and training services; members' perceptions towards the cooperative society model. Third, it briefly discusses the roaming uncertainties facing rural farmers including adverse effects from COVID-19 pandemic, climate change, and Ukraine-Russia war.

3. Methodology

3.1 Study area, sampling, and data collection

The study focused on two fishing communities in the northern parts of Bangladesh within the Mesta village in Sadar Upazila (sub-district) of Jamalpur district (see Figure 2). Specifically, the study was conducted in two study villages that is, Fularpara and Beermollikpur, located within Mesta union (see Figure 2). The area has dense network of river tributaries including into Jamuna Jamuna River, old Brahmaputra, Jhenai, Banar, Jirjira and Chhatal rivers making the districts prone to severe flooding which threatens lives and limits farming options (DAM, 2013 [17]; Akter, 2022 [6]). Consequently, the area is rated as one of the poorest and most disaster-prone districts of Bangladesh. It vulnerable to risks of floods, seasonal water scarcities, riverbank erosion, high illiteracy levels, and low household incomes. Thus, the community is poor and ever migrating to evade disaster (Akter, 2022 [6]; Mukta, 2020 [49]). Majority of the community members relies on fishing for livelihood. The study focused on the fishing community of Jamalpur Sadar Upazila as there organized into Cooperative Society and therefore making it easy to examine the factors of livelihood change related to human capital of individual members and social capital of cooperative society. It also assists to examine the uncertainties that undermine changes in livelihood.

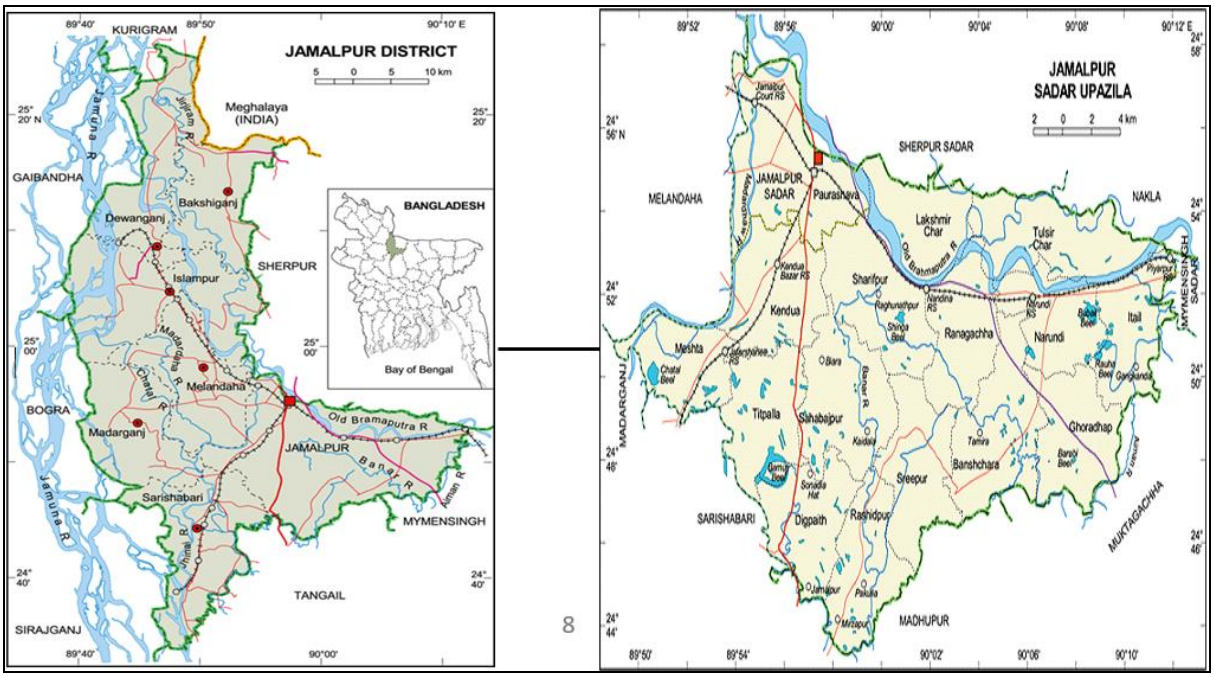

Fig 2: Map of Jamalpur district and Jamalpur Sadar upazila (sub-district) showing the study.

The two fishing communities had total of 200 members. A purposive random sampling framework was adopted to collected data. The framework considered the two-fishing cooperation society, geographic zones, river catchment, gender, and vulnerability to floods. Data was collected over the period September 3rd 25, 2020 through exploratory visits, focused group discussions and field-based survey. Exploratory visits were undertaken across the villages with Focused Group Discussion (FGD) involving ten (10) members conducted with each of the fishing cooperative society. The aim was to provide insights their engagement in fishing activities and empirical the changes in their livelihood from involvement in the cooperative society. The insights assisted to develop questionnaires for data collection based on the overall and specific question for the study. A survey was conducted targeting 50 households purposively from each of the two-cooperating society.

3.2 Measurement of variables

This section briefly discusses the conceptual changes in livelihoods and related factors.

3.3 Extent of livelihood changes of fishermen

The study measured the extent of livelihood changes for fishing communities based on three indicators of livelihood outcomes which include food security, income, and well-being. Food security comprises, at a minimum, the quick availability of nutritiously adequate and safe foods as well as the assurance of being able to obtain appropriate foods in socially acceptable ways (Keenan *et al*., 2001[42]). In this research food security refers respondents' perceptions on the availability of necessary food over the previous twelve months based on engagement in the cooperative society activities as recalled by community members. Household income indicator considered seven sources of income including crops, livestock, fisheries, service, business, remittance, and others. Indicators for social wellbeing

include better food and clothing, change in physical assets, better health facilities, better nutrition and sanitation facilities, capacity of providing better education to children, and improved housing condition.

The extent of change in livelihood outcomes were measured using a score based on three-point rating scale (0 - 3), where 0 stands for decreased', 1 for 'unchanged', and 2 for 'improved'. The overall extent of livelihood change for each outcome was computed by aggregating the individual scores for all respondents. Each extent of change could vary from a score of 0 to 24 while 0 indicated the lowest and 24 indicated the highest level of food security. The overall score was calculated by summing up scores from three selected indicators of livelihood outcomes. The overall score for changes in the livelihood of cooperative members ranged from 0 to 50, where 0 indicate no livelihood changes and 50 indicate high livelihood changes.

3.4 Factors affecting livelihood status.

The second question was answered by considering the factors affecting the livelihood status of the members of fishing cooperative society and performing regression analysis. The factors included age, level of education, annual family income, farm size, experience in fishing, involvement in cooperative society, knowledge of cooperative societies and its activities, and training received. Data was collected through survey and analysis using Statistical Package for Social Science (SPSS) var. 22 and results presented using summary tables, charts, and graphs.

In addition, a multiple regression analysis, both enter and stepwise methods, was performed to identify factors affecting the livelihood status of the members of fishing community. Stepwise regression analysis helped to quantify the individual contribution of factor variables after removing insignificant variables from the model (Quddus and Kropp, 2020). The regression equation used is as follows (Eq. (1)

$$y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \in_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, y_i =livelihood status of the members of fishing cooperative society, β_0 = constant, X_1= age, X_2= level of education, X_3 = family size, X_4 = annual family income, X_5=farm size, X_6= experience in fishing, X_7= involvement in cooperative society, X_8= credit received, X_9= Extension media contact, X_{10}= attitude toward cooperative society, X_{11}= knowledge on cooperative society and its activities, X_{12}= training received, $\in i$= Error term

3.5 Problems faced by the fishermen while working in cooperative society.

The perceived problems by members of fishing cooperative society while working under the cooperative society model were measured from opinion expressed by respondents. They include extent of exposure to shocks which was measured using a four-point rating scale (0 - 3). The rating were 0 for 'Not at all', 1 for 'Low', 2 for Medium', 3 for 'High' for or each problem score. Overall problems by respondents were calculated by summing up the scores for all selected problems. The total problem for could range from '0' to '36', where '0' indicated no problems and '36' indicated highest level of problems.

3.6 Explanatory variables of the study

The extent of changes for the livelihood of fishing community was determined from twelve selected characteristics. These included age, level of education, family size, annual family income, farm size, experience in fishing, participation in the cooperative society's activities, access to credit; access to media for extension; and competences in terms of knowledge and attitude as well as received and possessed by members of the cooperative society.

4. Results & Discussion

4.1 Personal profile of the fishermen

Table 1 present data on socio-economic characteristics of the respondents. It reveals that almost half (46%) of the fishermen were from middle age groups (36-55). In addition, it show that majority of the participants had primary to secondary level of educational attainment (59%); and 41% of the participants had no formal education.

Table 1: Socio-economic characteristics of the respondents

Characteristics (Measuring unit)	Score range		Respondents		Mean	SD*
	Possible	Observed	Categories	Percent (n=100)		
Age (Year)	Unknown	22-72	Young (18-35)	25	47.66	1.29
			Middle aged (36-55)	46		
			Old (>55)	29		
Level of Education (Year)	Unknown	0-10	No education	41	2.70	3.09
			Primary (1-5)	38		
			Secondary (6-10)	21		
Family size (No. of members)	Unknown	2-15	Small (up to 4)	20	6.24	2.20
			Medium (5-7)	53		
			Larger (>7)	27		
Annual Family Income ('000' taka)	Unknown	50-480	Low (up to 150)	80	126.44	57.89
			Medium (151-300)	18		
			High (>300)	2		
Farm size (Hectare)	Unknown	0.05-1.00	Landless and marginal (0.02-0.2)	62	0.226	0.15

			Small (0.21-0.99)	37		
			Medium (1.0-2.99)	1		
			Large (>3.0)	00		
Experience in Fishing (Year)	Unknown	3-60	Low (up to 10)	5	33.73	13.62
			Medium (11-20)	21		
			High (>20)	74		
Involvement in Cooperative Society (Year)	Unknown	2-17	Low (1-6)	7	13.39	4.00
			Medium (7-12)	25		
			High (>12)	68		
Credit received ('000' taka)	Unknown	0-260	No credit (0)	62	24.45	4.93
			Low (1-30)	16		
			Medium (31-60)	11		
			High (>60)	11		
Extension Media contact (Score)	0-27	2-10	Low (1-9)	99	4.69	1.72
			Medium (10-18)	1		
			High (>18)	0		
Attitude towards cooperative society (Score)	0-32	6-22	Unfavorable (up to 15)	30	16.14	3.56
			Neutral (16)	10		
			Favorable (17-32))	60		
Knowledge on cooperative society (Score)	0-27	4-21	Low (up to 9)	16	12.69	3.58
			Moderate (10-18)	79		
			High (>18)	5		
Training received (No. of days)	Unknown	0-17	No (0)	92	0.45	2.02
			Short term (1-6)	5		
			Medium term (7-12)	2		
			Long term (>12)	1		

Source: Author's field survey, (n=100); *SD= Standard deviation.

The fishing communities had an average family size of was six persons (6.24). It is estimated that 53% of members had a family size of five to seven people, 27% had a family size of above seven people and 20% had a family size of up to four people.

With respect to land, it is estimated that majority of the respondents (62%) were landless and marginal land category and none of them had large farm size. The annual income range indicates that almost majority (80%) of the members earn up to 150,000 Bangladesh Taka (BDT). It is also shows that a substantial proportion of the members (74%) had farming experience of above 20 years, while 26% of the members experience of between 1 and 19 years. The findings also shows that more than half (68%) were members of the cooperative society, and only 7% were not members. In terms of access to credit facility, more than half of the participants (62%) reported they had no access to credit support. Analysis indicated that a significant proportion of the respondents (99%) had low access to extension media.

With respect to attitude towards cooperative society, about 60% of the members had positive regards towards cooperative society as a model of rural development, while 30% of the members were apprehensive towards cooperative society, and 10% expressed no opinion.

In terms of knowledge on role and benefits of cooperative society, majority of the respondents (79%) had moderate knowledge while 5% had now knowledge. concerning training opportunities, 92% of the respondents has knowledge on training opportunities for members.

4.2 Extent of livelihood change of fishermen involved in cooperative society.

Table 2 presents information about the extent of changes in the livelihoods of fishing communities from engagement in cooperative society. Findings indicate that majority (60%) of the respondent experienced medium level of change in three examined aspects livelihood outcome, 36% experienced high changes, 4% experienced low changes while none of them experienced no change. It means, involvement of fishermen in cooperative society played a crucial role on their livelihood changes.

Table 2: Extent of livelihood changes of the fishermen involved in cooperative society.

Score range		Respondents			Mean	Standard deviation
Possible	Observed	Extent of livelihood change	No.	%		
0-50	16-43	Low (0-17)	4	4	32.22	6.78
		Medium (18-34)	60	60		
		High (35-50)	36	36		

Table 3 presents the findings on changes in 25 aspects of livelihoods for the fishing communities. With respect to food security, majority of the respondents had highest access to the necessary food during Srabon (Mid-July to Mid-August) followed by Ashar and Bhadro (Mid-June to Mid-September). This is attributed to the abundance of fish in natural reservoir including river, haor, canal, and beel over the floods season. This compares well with the study by Hosain *et al*., (2013) [30] who found high fish cash during Ashar and Srabon.

Regarding income, the most significant change was attributed to business-related activities followed those attributed to crop and livestock. The communities majorly engage in several business activities such as boat building,

net weaving, fish selling, and marketing. This compares well with the study by Islam *et al*., (2022) [38] who observed that such business activities contribute to improvement economic status and subsequently livelihood conditions of fishing farmers.

With respect to social well-being, the findings showed positive changes of respondents that could be attributed to engagement in cooperative society. Notably, the respondents observed cooperative society helped to aggregate daily fish catch to attain quantities demands from the market and to negotiate for better prices. This provided them with incomes for meeting their livelihood needs such quality of food, clothing, sanitation facilities, and access to health services. The findings compare with similar study conducted in Ethiopia by Ahmed *et al*., 2017 [3] which attributed better incomes for farmers working through agricultural cooperatives and whose livelihood improve compared to those working outside cooperative society.

Table 3: Ranking of the aspects of livelihood change of the fishermen.

Aspects	Score	Rank
Food security		
Srabon (Mid-July to Mid-August)	180	1
Ashar (Mid-June to Mid-July)	178	2
Bhadro (Mid-August to Mid-September)	171	3
Jaistha (Mid-May to Mid-June)	155	4
Falgun (Mid-February to Mid-March)	149	5
Baishakh (Mid-April to Mid-May)	146	6
Poush (Mid-December to Mid-January)	144	7
Magh (Mid-January to Mid-February)	141	8
Agrahayan (Mid-November to Mid-December)	131	9
Ashwin (Mid-September to Mid-October)	100	10
Chaitra (Mid-March to Mid-April)	66	11
Kartik (Mid-October to Mid-November)	64	12
Income		
Business	153	1
Crops	133	2
Livestock	128	3
Service	125	4
Fisheries	99	5
Others	97	6
Remittance	85	7
Wellbeing		
Better food and clothing	162	1
Better nutrition and sanitation facilities	147	2
Better health facilities	146	3
Capacity of providing better education to children	142	4
Improved housing condition	106	5
Change in physical assets	103	6

4.3 Factors influencing livelihood change of fishermen due to involve in cooperative society.

This section presents findings and brief discussions from step-by-step multiple linear regression analysis to examine factors that can be attributed to changes in the livelihood of fishing communities due to involvement in cooperative society as model for rural development. It considered multiple variables which include annual family income, farm size, and knowledge on the role of and potential benefits from working through cooperative society.

The regression analysis results (Table 4) indicates that these variables could collectively explain 46% variation (Adjusted R^2 = 0.465) of factors that contribute to changes in the livelihood fishing communities from working through cooperative society with high statistically significant (F = 8.814, $p< 0.05$).

With respect to annual family income, findings indicates that an increase by one unit of income leads improvement of livelihoods by 0.041. The result is plausible as similarly observed by Ahmed *et al*. (2012) [4] and Mittra (2021) [46] and argued that that increase in annual income improves access to nutritious food, healthcare services, and shelter.

Table 4: Summaries of the linear multiple regression analysis

Explanatory variables	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	22.154	4.008	-	5.527	.000
Age (X_1)	-0.143	0.107	-0.274	-1.335	0.185
Level of education (X_2)	0.145	0.230	0.066	0.631	0.530
Family size (X_3)	0.040	0.256	0.013	0.155	0.877
Annual family income (X_4)	0.041	0.013	0.350	3.123	0.002
Farm size (X_5)	13.455	4.945	0.299	2.721	0.008
Experience in fishing (X_6)	0.095	0.107	0.192	0.893	0.374
Involvement in cooperative society (X_7)	0.162	0.164	0.095	0.982	0.329
Credit received (X_8)	0.006	0.011	0.044	0.553	0.582
Extension media contact (X_9)	-0.762	0.331	-0.194	-2.300	0.024
Attitude toward cooperative society (X_{10})	-0.131	0.199	-0.056	-0.661	0.510
Knowledge of cooperative society and its activities (X_{11})	0.734	0.160	0.382	4.587	0.000
Training received (X_{12})	-0.473	0.275	-.141	5.527	0.089
N=100, R^2 = 0.530, Adjusted R^2 = 0.465, F value= 8.184					

Regarding farm size, findings indicated that am increase of one unit of farm size leads to increase of 13.455 units in the livelihood of fishing communities to working through cooperative society. This is reasonable, because larger farms depict wealthier members and higher scale of fish production and improvement of income and livelihood outcome positively.

With respect to knowledge of fishing members on the role and potential benefits from working through cooperative society, an increase of one unit in knowledge leads to an increase of 0.734 in changes in the livelihood of fishing communities. The result is plausible as also argued in the study by Akter, (2022) [6] that farmers with prior knowledge on the role and potential benefits from working with community-based organization, local cooperatives or club benefited in adoption of improved technologies for crop production leading to reduce risks from flood and increase in productivity and income.

Table 5 presents findings from step-by-step multiple linear regression analysis to help understand the contribution of the significance of each variable in explaining variation in changes in the livelihood fishing communities from engagement in the cooperative society.

Table 5: Summary of the stepwise multiple regression analysis

Models	Multiple R	Multiple R^2	Variation explained (percent)	Significance level
Constant + X_4	0.581	0.338	33.8	0.000
Constant + X_4 + X_{11}	0.647	0.418	8.0	0.000
Constant + X_4 + X_{11} + X_5	0.687	0.471	5.3	0.002

Findings that annual family income (X_4) expresses 33.8%, knowledge on the role and potential benefits from engagement in cooperative society (X_{11}) expresses 8.0%, and farm size (X_5) expresses 5.3% on the changes in the livelihoods of fishing communities engaged in cooperative society. Similar results were found in the study by Akpan *et al*. (2012) [5] that annual family income of the farmers was a major factor that expressed the contribution of changes in the livelihoods of smallholder crop farmers in the Abak Agricultural Zone in Akwa Ibom State, Nigeria.

4.4 Extent of problems faced by the fishermen while working in cooperative society

Table 6 presents findings on the extent of challenges experienced by the fishing communities working through cooperative society to meet their livelihood needs.

Table 6: The extent of challenges experienced by fishing communities working through cooperative society.

Score range		Respondents			Mean	Standard Deviation
Possible	Observed	Categories	No.	%		
8-25	0-36	Low (0-12)	17	17	16.03	3.523
		Medium (13-24)	82	82		
		High (25-36)	1	1		

Findings indicates that a vast majority of respondent (82%) expressed having experienced moderate level of challenges, 17% with low level, and 1% expressing no challenges in working in the cooperative society.

Table 7: Challenges experience by fishing communities while working with cooperative society.

Problem faced by the fishermen	Score	Rank
Corruption and nepotism	175	1
Poor training facilities	170	2
Political interference	169	3
Lack of planning	168	4
Lack of technical knowledge of the person responsible	166	5
Poor linkage between the fishermen and service provider	136	6
Received poor services	129	7
Unequal distribution of services	115	8
Lack of confidence on society's service	111	9
Poor commitment of the service provider	100	10
Lack of unity and cooperation	96	11
Unequal participation in decision making	79	12

Results presented in Table 7 indicate the score of challenges experienced by fishing communities while working with cooperative society and their rank order. Corruption and nepotism among the management officials were rated as the major problems that the respondent encountered while working through cooperation society. This is consistent with the literature on rampant corruption in most cooperative society across different sectors (Boland, 2017 [13]; Brandão and Breitenbach, 2019 [14]; Dayanandan, 2013 [18]; Hu, Zhang, & Donaldson, 2017 [32]; Conceiçã and Tiago, 2022 [15]; Fulton *et al*., 2020 [27]). This main challenge impedes the effectiveness in the use of resource to the members to the cooperative society due to vested private interest by the official (Dayanandan, 2013 [18]; Conceiçã and Tiago, 2022 [15]) while excluding poorest and marginalized members of the cooperative society (Thorp *et al*. 2005 [67]; Francesconi and Heerinck, 2010[24]; Ahmed *et al*., 2017 [3]). Poor training facilities and services was ranked as the second most serious challenge that undermines the development human capital with respect to decision-making and technical knowledge, skills, attitude of member towards the role and potential benefits from working through cooperative society (Desruisseaux, 1969 [21]; Aranzadi, 1989 [9]; Vargas, 1995 [69]; Peris, 1990 [56]; Rodríguez and Moral, 2003 [61]; Kgati, 2013 [40]). This is closely related to the political interference, ranked third, where external economically and politically powerful actors attempt to by-pass the decision-making processes to influence the members and the management of the cooperative society for private gains. This agrees with similar observations in other area where political interference negatively influence benefit sharing arrangements to the detriment of the poor and marginalized members (Nanakali, 2021 [51]). Arguably, corruption, nepotism, and political interference greatly hinder overall governance and management of cooperative society while promoting inequalities among the members.

The challenge of lack of planning, ranked fourth, and undermine setting of goals, identification and prioritizing of needs, allocation of resources based on evidence on needs and returns from investment which undermine the potential benefits that cooperative societies can deliver to members. Other studies have found out that well-managed cooperative societies optimized investment in social capital, technology, government, and management for improved productivity, incomes, and psychosocial support to members (Mutiarni, 2024 [50]; Ngeywo *et al*., 2019 [53]).

The challenge of lack of technical knowledge was ranked fifth and limited the learning of new skills for technology adoption to improve efficiency of production and processing at the members and cooperative society levels. This problem is linked to poor training facilities and services which was ranked second. Similar studies identified lack of technical knowledge and poor training facilities and services to undermine the production and processing functions of cooperative society (Rodríguez and Moral, 2003 [61]; Wanyama, 2016 [70]).

5. Conclusion

This paper has analyzed the extent of changes in the livelihoods for fishing communities under cooperative society model to rural development in Bangladesh. The key findings of the study regarding livelihood outcomes changes

were satisfactory as most of the fishermen had changed their livelihood outcomes at moderate to high level particularly on food security, income and wellbeing. However, based on the results of the study, the following conclusions have summarized:

First, cooperative society model of rural development offers smallholder farmers opportunity for building social capital that in turn helps them to develop human capital needed to change their livelihood outcomes. Analysis shows that about a third of members of fishing community (36%) experienced high changes in livelihood outcomes while majority of the members (36%) experienced medium change in their livelihood outcomes. Thus, social capital is needed in creating synergies among smallholder farmers ensure sustainable livelihood outcomes including food security, income, and well-being. Second, there are several factors that influence the direction and level of changes to the livelihood that fishing communities can gain through the cooperative society model of rural development. The factors include household income, farm size, education level, technical skills about fishing, and attitude towards cooperative society. Analysis shows that these factors explained 53% variation in the livelihood changes of members of the fishing community. Therefore, policy makers and concerned authorities should emphasis the factors while taking policy measure in this regard. Third, the extent to which fishing communities can benefit from carrying out their production and marketing activities can be limited by numerous challenges. Analysis shows that 82% of the respondents experience some problems that limited their desired extent of changes in livelihood outcomes. The problems included related to governance of cooperative society included corruption, nepotism, poor training services, and political interference leading to infectiveness of cooperative society to facilitate the desired positively changes in the livelihood of members. Tackling these challenges require efforts on improving the human capital for members such technical skills, appropriate attitude towards cooperative society and their reformation; and operating capital to finance production and market. In addition, improving the social capital of cooperative society that leads to positive changes in the livelihood of members require institutional and governance strengthening. This entails promoting participatory governance to allow members to participate in decision making processes fully and meaningfully; adopting principles of equity and downward accountability of the leadership for the cooperative society; clarifying the mandate and principles of governance; establishing linkages and partnership with other actors in fishing and other related sectors. Cooperative also need to provide opportunities for improving the adaptive capacity for members and the provision of support include technical skills, financing, and technology development and transfer to enhance production and marketing function and ability to deal with uncertainties such as COVID-19 pandemic, effects of climate change, technological disruptions, and escalation of prices for inputs due to global economic crisis. This paper notes the limited scholarship on sustainability of changes in the livelihoods that results from the social capital provided by cooperative recommends. Thus, it recommends more research on how cooperative societies can provide help in dealing with effects from global uncertainties in the Anthropocene including new waves of pandemic, disruptive technologies, effects of climate change, growing inequalities.

References

1. Adugna H. Co-operative approach to community livelihood improvement: The case of Ada'a district, Oromia regional state, Ethiopia. Int J Dev Sustain. 2013;2(3):2124-45.
2. Ahmed SK, Khan MM, Khan RA, Mujtaba BG. The relationship between social capital and psychological well-being: The mediating role of internet marketing.
3. Ahmed MH, Geleta KM, Tazeze A, Mesfin HM, Tilahun EA. Cropping systems diversification, improved seed, manure and inorganic fertilizer adoption by maize producers of eastern Ethiopia. J Econ Struct. 2017;6:1-16.
4. Ahmed MK, Halim S, Sultana S. Participation of women in aquaculture in three coastal districts of Bangladesh: Approaches toward sustainable livelihood. World J Agric Sci. 2012;8(3):253-68.
5. Akpan SB, Udoh EJ, Nkanta VS. Factors influencing fertilizer use intensity among smallholder crop farmers in Abak Agricultural Zone in Akwa Ibom State, Nigeria. J Biol Agric Healthcare. 2012;2(1):54-66.
6. Akter MS. Understanding flood forecast information provision for agriculture in Bangladesh. PhD Thesis, Wageningen University; c2022.
7. Alam MF, Thomson KJ. Current constraints and future possibilities for Bangladesh fisheries. Food Policy. 2001;26(3):297-313.
8. Allahdadi F, Aref K. Agricultural production cooperatives in Iran: Challenges and opportunities. J Am Sci. 2011;7(12):471-4.
9. Aranzadi D. Actualidad de los valores de la formación en el cooperativismo. Anuario de Estudios Cooperativos. 1989;1:167-82.
10. Bibby A, Shaw L, editors. Making a difference: Co-operative solutions to global poverty. Manchester: Co-operative College; c2005.
11. Birchall J, Simmons R. Co-operatives and poverty reduction. Manchester: Co-op College; c2009.
12. Basurto X, Bennett A, Hudson Weaver S, Rodriguez-Van Dyck A, Aceves-Bueno J-S. Cooperative and noncooperative strategies for small-scale fisheries' self-governance in the globalization era: implications for conservation. Ecol Soc. 2013;18(4):38. Available from: http://dx.doi.org/10.5751/ES-05673-180438.
13. Boland M. An introduction to cooperation and mutualism. Minnesota: University of Minnesota Libraries Publishing; c2017.
14. Brandão J, Reitenbach R. What are the main problems in the management of rural cooperatives in Southern Brazil? Land Use Policy. 2019;85:121-9. doi:10.1016/j.landusepol.2019.03.047.
15. Conceição C, Tiago M. Assessing corruption in agricultural cooperatives: Differences in the perceived level of corruption using microdata. Stud Bus Econ. 2022;17(2):1-15. doi:10.2478/sbe-2022-0025.
16. Conceição P. Human development report 2021/2022.
17. Dhaka Ahsania Mission. Regional strategy paper: Jamalpur region. Jamalpur, Bangladesh; c2013.

18. Dayanandan R. Good governance practice for better performance of community organizations – myths and realities. J Power Politics Governance. 2013;1(1):10-26.
19. Debnath P, Hussain MA, Nasren S. Fish diversity of Halir Haor, Sunamganj, Bangladesh: A checklist. Int J Nat Soc Sci. 2020;7(4):73-80.
20. Deininger K, Selod H, Burns A. The land governance assessment framework: Identifying and monitoring good practice in the land sector. Washington, DC: World Bank Publications; c2012.
21. Desruisseaux JP. La organización del trabajo en las cooperativas. Zaragoza: Escuela de Gerentes Cooperativos; c1969.
22. DFID. Sustainable livelihoods guideline sheet: Origin and objectives. London: DFID; c1999.
23. Department of Fisheries. Yearbook of fisheries statistics of Bangladesh 2018-2019. Dhaka: Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh; c2019.
24. Francesconi GN, Heerink N. Ethiopian agricultural cooperatives in an era of global commodity exchange: Does organisational form matter? J Agric Econ. 2010;61(1):37-50. doi:10.1093/jae/ejq036.
25. FAO. Cooperatives in small-scale fisheries: enabling successes through community empowerment. Rome: FAO; c2012. Available from: http://www.fao.org/docrep/016/ap408e/ap408e.pdf.
26. FAO. The future of food and agriculture – trends and challenges. Rome; c2017.
27. Fulton ME, Giannakas K. Corruption in agricultural processing firms: A comparison of cooperatives and investor-owned firms. Can J Agric Econ. 2020;68(4):445-60.
28. Ghose B. Fisheries and aquaculture in Bangladesh: Challenges and opportunities. Ann Aquacult Res. 2014;1(1):1-5.
29. Halwart M. Aquaculture in SOFIA 2022. FAO Aquaculture Newsletter. 2022;66:7-8.
30. Hossain M, Akteruzzaman Md, Parvin Mst T, Bhuiya M, Hossain S. Marketing channel of fish and value addition by different actors in Haor area of Netrakona District. Bangladesh J Crop Sci. 2013;24:131-40.
31. Hossain MM, Islam MA, Ridgway S, Matsuishi T. Management of inland open water fisheries resources of Bangladesh: Issues and options. Fish Res. 2006;77:275-84.
32. Hu Z, Zhang Q, Donaldson J. Farmers' cooperatives in China: A typology of fraud and failure. China J. 2017;78:1-24. doi:10.1086/691786.
33. Ibrahim HD. Harnessing the potentials of blue economy for sustainable development of Nigeria.
34. Islam MJ, Azim M, Karim MM, Begum MA. An overview on co-operative societies in Bangladesh. Eur J Bus Manag. 2014;6:33-40.
35. Islam MS. Cooperative based rural development in Bangladesh: A revisiting. Soc Change. 2019;XIII(2):1-18.
36. Islam MM. Challenges of policy implementation: A case study of Hilsa protection in Bangladesh. MS Thesis, North South University; c2020.
37. Islam MF, Rahman MS, Sharker MR. A study on fish marketing system in Jamalpur, Bangladesh. Int J Nat Soc Sci. 2021;8(2):1-7. Available from: https://doi.org/10.5281/zenodo.4783324.
38. Islam MF, Ali MF, Rahman MS, Haque SA, Juthi RA. Assessing socio-economic patterns and trends of livelihoods of fisher's community of the Old Brahmaputra River: A case study in Jamalpur, Bangladesh. Arch Agr Environ Sci. 2022;7(4):611-7. Available from: https://dx.doi.org/10.26832/24566632.2022.0704021.
39. Jha A. United Nations General Assembly (UNGA). c2016.
40. Kgati E. Developing an integrated human resource development plan for office-based educators in the Free State Province. PhD Dissertation, Central University of Technology, Free State; c2013.
41. Kashem MA, Tasnim N, Rahman M, Bapary MAJ, Akanda MA. Consumer's attitudes toward fish consumption during pandemic Covid-19 in Bangladesh. Int J Nat Sci. c2021;11(1).
42. Keenan DP, Olson C, Hersey JC, Parmer SM. Measures of food insecurity/security. J Nutr Educ. 2001;33-S58. doi:10.1016/s1499-4046(06)60069-9.
43. Mhembwe S, Dube E. The role of cooperatives in sustaining the livelihoods of rural communities: The case of rural cooperatives in Shurugwi District, Zimbabwe. Jàmbá: J Disaster Risk Stud. c2017;9(1). Available from: https://doi.org/10.4102/jamba.v9i1.341.
44. Mia MR, Uddin MS, Alam MT, Pandit D, Mazumder SK. Habitat and biodiversity degradation of the Surma River, Bangladesh and implications for future management. J Bangladesh Agr Univ. 2022;20(1):103-15.
45. Miroro OO, Anyona DN, Nyamongo I, Bukachi SA, Chemuliti J, Waweru K, Kiganane L. Determinants of smallholder farmers' membership in co-operative societies: evidence from rural Kenya. Int J Soc Econ. 2023;50(2):165-79. Available from: https://doi.org/10.1108/IJSE-03-2022-0165.
46. Mittra PK. Livelihood diversification pursued by rural women farmer: The case of Bangladesh. J Agriculture Food Environ. 2021;2(1):93-96. doi:10.47440/JAFE.2021.2116.
47. Mohlala MP. The role of cooperatives in community development: The case of the Motloulela Farming Cooperative. [MS Thesis]. Stellenbosch University; c2020.
48. Mozumder MM, Hoque M, Abdul W, Simo S, Petra S, Mohammad MI. Enhancing social resilience of the coastal fishing communities: A case study of Hilsa (Tenualosa ilisha H.) fishery in Bangladesh. Sustainability. 2018;10(10):3501. doi:10.3390/su10103501.
49. Mukta MZN. Understanding interactions and relationships in pest management innovation processes in Bangladesh. [PhD Thesis]. Wageningen University; c2020.
50. Mutiarni R. The influence of Islamic human capital on Islamic cooperative's performance as mediated by Islamic social capital, Islamic spiritual capital, and technological capital. [Doctoral dissertation]. Universitas Brawijaya Malang; c2024.

51. Nanakali HAM. Rural sustainable development policies in the Kurdistan Region of Iraq and their impact on migration. [Thesis]. c2021.
52. Nayak PK. Fisher communities in transition: understanding change from a livelihood perspective in Chilika Lagoon, India. Marit Stud. 2017;16:13. doi:10.1186/s40152-017-0067-3.
53. Ngeywo J, Ayuma C, Were E. Influence of process plan on agricultural cooperative societies performance in Kenya. South Asian J Soc Stud Econ. 2019;3(2):1-9.
54. Ostrom E. Governing the commons: The evolution of institutions for collective action. New York: Cambridge University Press; c1990.
55. Pérez G, María del C, Lidia VP. Cooperative societies and sustainability: A spatial analysis of Andalusia as a tool for implementing territorial development policies, strategies and initiatives. Sustainability. 2021;13(2):609. doi:10.3390/su13020609.
56. Peris JR. La participación en la cooperativa: un baremo de la formación del socio. Agricultura y Cooperación. 1990;76:9–10.
57. Rahman A. Participation in rural youth in fish farming activities. [MS Thesis]. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh; c2010.
58. Rahman HT, Hickey GM. An analytical framework for assessing context-specific rural livelihood vulnerability. Sustainability. 2020;12(14):5654.
59. Rahman MA, Lee SG, Molla MHR, Asare OE, et al. Fisheries management and governance in Bangladesh. MOJ Eco Environ Sci. 2018;3(6):381–385. doi:10.15406/mojes.2018.03.0018.
60. Rashid S. Common property rights and indigenous fishing knowledge in the inland open water fisheries of Bangladesh: The case of Koibortta fishing community of Kishorgonj. [PhD Thesis]. Curtin University of Technology; c2005.
61. Rodriguez JR, Moral AM. Educational level and training of human resources in farm cooperatives in the knowledge-based society: An empirical study. J Rural Cooperat. 2003;31(2):1-21.
62. Sari DK, Rahmayanti AY. Fishery cooperatives and sustainable blue economy: Scoping review from a business perspective. Proceedings. 2022;83:30. doi:10.3390/proceedings2022083030.
63. Sebhatu KT, Gezahegn TW, Berhanu T, Maertens M, Van Passel S, D'Haese M. Exploring variability across cooperatives: Economic performance of agricultural cooperatives in northern Ethiopia. Int Food Agribusiness Manag Rev. 2021;24(3):397-419.
64. Sadekin MN, Ali J, Islam R. Livelihood vulnerability index: An application to assess the climatic vulnerability status of inland small-scale fishing livelihood. Int J Sustainable Dev. 2018;21(1-4):75-101.
65. Shamsuzzaman MM, Islam MM, Tania NJ, Al-Mamun MA, Barman PP, Xu X. Fisheries resources of Bangladesh: Present status and future direction. Aquac Fish. 2017;2(4):145-156.
66. Serageldin I, Grootaert C. Defining social capital: An integrating view. In: Evaluation and Development. Routledge; c2017. p. 201-217.
67. Thorp R, Stewart F, Heyer A. When and how far is group formation a route out of chronic poverty? World Dev. 2005;33(6):907–920. doi:10.1016/j.worlddev.2004.09.016.
68. Tran GTH, Nanseki T, Chomei Y, Nguyen LT. The impact of cooperative participation on income: The case of vegetable production in Vietnam. J Agribusiness Dev Emerg Econ. 2023;13(1):106-118. doi:10.1108/JADEE-05-2021-0108.
69. Vargas Sánchez A. La identidad cooperativa y la cooperativa como empresa: luces y sombras. Rev Estud Cooperativos. 1995;61:179-192.
70. Wanyama FO. Cooperatives and the Sustainable Development Goals: A contribution to the post-2015 development debate. c2016.
71. Wanyama IK. Challenges facing the sustainability of adult and continuing education programmes in Kenya. Mediterr J Soc Sci. 2014;5(5):159-166.
72. Wasave S, Sharma A, Wasave S. A glance of fishermen's cooperative societies of various countries around the globe. J Exten Syst. 2015;31(1):63-76.