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Assessing of Farmers' Opinion towards Floating Agriculture as a Means of Cleaner Production: A Case of Barisal District, Bangladesh

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Authors' contributions

This work was carried out in collaboration between all the authors. In this article, author SSH contributed to the research design, organized the research flow, data analysis and interpretation. Author AM contributed to the data collection and data preparation. Author MKG contributed to the manuscript editing and author MIK contributed to the interpretation of the results. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Bangladesh, as a low-lying country, is vulnerable to global climate change and affected by floods and water logging. Hence, the country needs to adopt sufficient adaptation strategies which are based on local people traditional knowledge and locally available materials; hence, floating agriculture is that type of agriculture. Through this article we examine the floating agriculture related farmers opinion towards floating agriculture as a means of cleaner production

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Study Design: A descriptive survey research design is followed for the study and interview schedule is the main data collection instrument of the research.
Place and Duration of Study: The study area was Banaripara and Wazirpur Upazila of Barisal District of Bangladesh. Data was collected from the farmers who were involved with floating agriculture.
Methodology: A total number of 385 farmers of the two Upazilas were the population and out of them 140 farmers were selected as the sample of the study. The interview schedule was developed according to the objective of the research. We used five points Likert scale to judge the opinion towards floating agriculture. We administered multiple regression analysis using SPSS for finding out the influence of farmers' socio-demographic characteristics on their opinion towards floating agriculture as a means of cleaner production.
Results: The farmers of the study area had moderately to less a favorable opinion (83%) towards floating agriculture as a means of cleaner production. Three of the characteristics of the farmers (eg. their age, family size and training participation on floating agriculture) had an influence on their opinion according to the regression results. Therefore, the higher the listed three characteristics according to the regression result the higher will be the opinion of the farmers towards floating agriculture.
Conclusion: These findings suggest that it is important to explore knowledge and arrange training for the farmers on floating bed preparation, selecting suitable crops, the intercultural operation of crops and so on. Moreover, future research should be carried out on floating agriculture's role as a means of women and unemployed employment opportunity, community development, and identify challenges of this technique.

Keywords: Floating agriculture; farmers opinion; cleaner production; assessment.

1. INTRODUCTION

Bangladesh is rural and agricultural dominated [1] one of the least developed countries of the world [2] and is highly sensitive to the impact of adverse global climate change [3,4], and the most destructive outcome is the flooding risk [5]. The flooding depth changes of the three major rivers of Bangladesh, the Ganges, Brahmaputra and Meghna under the influence of climate change [6] will adversely affect more at the central and northeastern areas of the country. Some other studies [like 7-11] also addressed the same issue of effect global climate change on the increasing flooding risks in Bangladesh. The agricultural sector is the most adversely affected and damaged sector due to flood in Bangladesh [12]. About 25% of the total population of Bangladesh is living in extreme poverty condition and the food security status of those people become the poorest during the monsoon period [13].

Since some parts of Bangladesh remain flooded for a prolonged period of the year, agriculture is the hardest hit [10,12], which has a serious impact on the lives of the farming population. The farming communities of the long-term water logging areas who are completely dependent upon the land based agriculture affected seriously for water logging conditions. This situation accelerates hunger, disease, unemployment and ultimately social and economic insecurity in the farming communities [6,12,14]. In such a flooded and long water logging condition, the farmers of some parts of Bangladesh have been tackling this situation and sustaining their lives by utilizing self-innovated "floating agriculture". The floating agriculture is a crop production practice in soilless floating beds prepared with locally available materials like water hyacinth mainly and other aquatic weeds. Scientifically it is known as 'hydroponics' which is a method of cultivating plants without the help of soil by utilizing other inert growing materials like gravel, vermiculite, sand, clay etc. and organic materials for plant nutrition [15]. Locally this technique is known as "Dhap Agriculture" and it practiced from many years in the flood prone and water logging areas of Barisal, Gopalganj and Pirojpur districts [16-19]. The procedure of making the floating bed is usually the same, however the size, shape and local materials vary from region to region [17,20]. Various local materials are used to build the floating layers. The most commonly used material is water hyacinth (*Eichhornia crassipes*), but other aquatic weeds, wood ash, and dissected coconut fibers are also used [17]. Moreover, no chemical input is needed for crop production, low labor costs, and good market price of the crops is accepted as a means of cleaner production.

Floating agriculture is a possible local knowledge based technology which would help in attaining sustainable livelihood security in vulnerable waterlogged areas. Floating agriculture could be a sustainable and profitable practice in Bangladesh and for other countries facing a similar situation [20]. People who are practicing floating-bed cultivation are enjoying a better life economically, than those in other flood-affected areas who have not yet adopted this practice [21]. Through another study, Irfanullah et al. [22] confirmed that floating cultivation practice helps to supplement people's income, which contributes towards the alleviation of poverty, and provides greater food security by increasing the landholding capacity of poor as well as landless people by allowing them to grow vegetables and crops with lower input costs, mainly due to the minimal infrastructure requirement. However, Chowdhury and Moore [23] chalked out the gap of field-based investigation as future research. They stressed the importance of assessing the farmers' efforts to address the impact of floating agriculture on the social, economic and environmental point of view.

In view of the above evidence, through this study, we will examine the opinion of the farmers towards floating agriculture as a means of cleaner production. At the same time, we will also investigate the influence of selected socio-demographic characteristics of the farmers on their opinion towards floating agriculture

2. METHODOLOGY

We followed descriptive survey research design and used interview schedule as the instrument of the current research. The respondents of the study were the farmers who practiced floating agriculture. We purposively selected two Union each of the two Upazila (smaller administrative unit of Bangladesh), namely, Banaripara and Wazirpur, Upazila of Barisal District, as the study area. The selected Unions were Bisarkandi and Udaykati of Banaripara Upazila; and Satla and Otra of Wazirpur Upazila, respectively. All the farmers who practiced floating agriculture at the study areas (ie., four Union of two Upazila) were the population of the study. The total number of farmers practicing floating agriculture was 200 (Banaripara) and 185 (Wazirpur), that means a total of 385 which were the population of the study. Among the population, a total number of 140 farmers (75 from Banaripara and 65 from Wazirpur) were selected as the sample utilizing the Equation 1 developed by Kothari [24] and followed by Hasan et al. [25].

$$n = \frac{z^2.\sigma^2.\ N}{e^2\ (N - 1) + z^2.\sigma^2} \quad (1)$$

Where, n is the sample size, z is the value of the standard variety at a given confidence level. In the present study it was considered standard normal deviate at 95% confidence level = 1.96; σ is population standard deviation obtained from past research and here it is 0.76; e is the acceptable margin of error and usually considered as 0.10; N is the population size.

We converted the English interview schedule into the Bengali language for easily understandable to the respondents. We also divided the interview schedule into two parts: (a) personal and professional characteristics of the farmers and (b) their viewpoint (opinion/attitude) towards floating agriculture as a cleaner production and at this part 20 opinion measurement statements were employed [2, 26-30]. We then collected data randomly from 140 farmers by face to face interview method and by using simple random sampling technique.

2.1 Measurement Technique of Different Variables

2.1.1 Measurement of dependent variable

The opinion of the farmers towards floating agriculture as a means of cleaner production is the dependent variable of this study. The interview schedule contains 20 statements which were administered for judging the farmers opinion. The opinion statements were aligned with the three areas of cleaner production including, environmental, economic and social and cultural areas [23]. The farmers were asked to indicate the extent of their agreement on each of the 20 statement utilizing a Likert-type five-points scale like strongly agree, agree, undecided, disagree and strongly disagree with assigned scores of 5, 4, 3, 2 and 1, for positive statements, respectively and vice versa for negative statements. Different scales are used for measuring opinion of the respondents, although the Likert scale is the most widely utilized technique for opinion measurement [31]. The Likert-type scales utilize fixed type and close form of responses to measure opinion or attitude [32-33]. For conducting the present study, we employed five point Likert-scale and according

the respondents were asked about their agreement or disagreement of each of the statements.

2.1.2 Calculation of reliability of the opinion statements in the interview schedule

We measured the reliability of the opinion statements in the interview schedule with the help of Cronbach's Alpha test, as this test is the reliability indexing method associated with fluctuation and the Alpha coefficient varies from 0 to 1 [34]. Increase of Cronbach's Alpha dependents on the increase of inter-correction among the test items. For the current study, the Cronbach's Alpha was calculated using the formula 2, below:

$$\alpha = \frac{K\overline{C}}{(\overline{v} + (K\text{-}1)\ \overline{C})} \quad (2)$$

where, K is the number of scale items,v is the average variance of each component (item), and c is the average of all covariances between the components across the current sample of persons (that is, without including the variances of each component).

We calculated the Cronbach's Alpha of 10 respondents' opinion statement and the value was 0.832. The commonly accepted rules of thumb to explain internal consistency of the value of Cronbach's Alpha is as like, > 0 .9 is Excellent, > 0.8 is Good, > 0.7 is Acceptable, > 0.6 is Questionable, > 0.5 is Poor, and < 0.5 is Unacceptable [35-37]. So the opinion statements of the current interview schedule were reliable based on the value of Cronbach's Alpha.

2.1.3 Measurement of independent variables

There were eight independent variables of the study and those were farmers' age, level of education, family size, farm size, family annual income, extension media contact, training participation on floating agriculture and knowledge on floating agriculture. Age of a respondent was measured by counting the years from the time of his/her birth to the time of interview. The level of education was measured by the number of years of schooling. Family size was measured by the total number of members including the respondent himself, spouse, children and other permanent dependents who lived together as family unit. The farm size possessed by the farmer under farm including share cropping and leased and homestead was the basis of measuring farm size and which was expressed in hectare for the current study. Family annual income of a respondent was determined on the basis of his total earnings from agriculture, service, business, and other sources. For measuring extension media contact of the respondent, a four-point scale *i.e*., not at all, rarely, occasionally and frequently was used and appropriate weights were assigned to quantify the variable as against five different types extension media and assigned scores were 1, 2, 3, and 4, respectively. Training participation on floating agriculture was measured by the total number of days that a respondent had encountered training experience in his entire life from different agricultural related organizations and from other organizations o floating agriculture. Meanwhile, the farmers' knowledge on floating agriculture was calculated by answering 15 questions related to floating agriculture. The assigned score against each correct, partially correct and incorrect answer was 2, 1, and 0, respectively.

2.2 Statistical Analysis

We utilized Statistical Package for Social Science (SPSS) version 16 for analyzing the data of this study. We calculated the mean and standard deviation to achieve the objectives of the study and used different categories for classifying the data. Different statistical tests like frequency count, percentage, mean, and standard deviation were applied to analyze and interpret the data based on the purpose of the study.

To explore the relationship between the socio-demographic characteristics and the opinion of the farmers and for quantifying the influence of all of the eight independent variables on the dependent variable, we utilized multiple regressions with 0.05 and 0.01 level probabilities. The multiple regression proceeds with the following formula 3, below:

$$y = \beta_o + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \epsilon \quad (3)$$

where, y is the probability of the dependent variable, that is opinion under the eight independent variables: $X_1, X_2 \ldots\ldots\ldots, X_n$ indicate the variables such as age, education level, extension media contact, training participation etc, while $\beta_1, \beta_2, \ldots\ldots\ldots, \beta_n$ are the coefficients of regression analysis of independent variables. β_0 is constant.

Table 1. Opinion statements analysis from SPSS output

Item total statistics	Scale mean if item deleted	Scale variance if item deleted	Corrected item total Correlation	Cronbach's Alpha if item deleted
Statement 1	76.5000	43.833	0.130	0.786
Statement 2	76.4000	41.822	0.470	0.772
Statement 3	76.3000	40.678	0.769	0.763
Statement 4	76.6000	42.267	0.357	0.776
Statement 5	76.9000	41.433	0.622	0.768
Statement 6	78.4000	43.600	-0.023	0.822
Statement 7	76.7000	39.789	0.757	0.759
Statement 8	76.7000	37.344	0.837	0.746
Statement 9	76.7000	38.678	0.669	0.756
Statement 10	77.3000	53.122	-0.611	0.849
Statement 11	76.9000	41.433	0.622	0.768
Statement 12	77.7000	37.789	0.528	0.762
Statement 13	77.9000	36.544	0.521	0.762
Statement 14	76.9000	38.767	0.401	0.773
Statement 15	77.2000	35.289	0.859	0.736
Statement 16	76.9000	43.878	0.167	0.784
Statement 17	76.6000	39.378	0.806	0.756
Statement 18	76.6000	40.267	0.664	0.763
Statement 19	78.5000	41.167	0.193	0.791
Statement 20	77.2000	44.178	0.169	0.784
Reliability Coefficient for case 10			**Cronbach's Alpha**	**Standardized Item Alpha**
			0.832	0.859

Source: Surveyed data collected by the author's in this study.

3. RESULTS AND DISCUSSION

3.1 Results

The farmers' opinion towards floating agriculture was measured by collecting and calculating 20 opinion statements of the interview schedule. All the opinion statements were grouped into three (Table 2), namely, environmental, economic and social and cultural aspects of cleaner production and they were ranked based on the average value.

The information of Table 2 exhibits that "Floating agriculture was just a waste land" this negative statement ranked first with the highest average score of 4.31. The second ranked statement was "I am willing to establish in this profession and like to obtain more knowledge for my own betterment" whose average score was 4.17. Accordingly the third ranked statement was "floating agriculture helps to increase annual family income" ranked 3rd and the score was 4.11.

Chowdhury and Moore [38] stressed that production from the floating agriculture is valuable from economic, environmental, and social and cultural perspective. These multi-sectoral advantages of this technique help it to sustain more in flood and water logging condition. The production is eco-friendly and organic in nature which requires less investment. Findings from the different study [19,39-43] indicate that the floating agriculture an environment-friendly production technique and it helps to achieve food security of the local community. During the water logging and flood situation, the floating agriculture is effective against poverty and hunger [40,41] and encourage local people to work together [19,39,44]. Floating agriculture requires less capital investment and labor forces than the normal agricultural practices [45-46], and utilizes the locally and readily available raw materials [44] which help to make this technique economically sound [17,19,45] agricultural practices. Moreover, it is a good income source for the unemployed people and also for the women [17,19,39,42,44]. The floating agricultural practices are beneficial from the economic, ecologic, social and cultural perspective for the farmers and local people that are multi-sectoral benefits. Moreover, the technique also helps the farming community to preserve traditional knowledge from the time being, safeguarding

against poverty, proving women employment and empowerment opportunity, team working of the local people, and adapting to the adverse climatic condition [38].

3.1.1 Opinion of the farmers towards floating agriculture as a means of cleaner production

The perception scores towards floating agriculture as a means of cleaner production of the farmers ranged from 66 to 76, with an average of 71.46. On the basis of the opinion scores, the respondents were classified into the flowing three categories and Hasan et al. [26] also classified farmers attitude into three categories as shown in Table 3.

It is evident from the data in Table 3 that, about 83% of the respondents possessed moderately to less favorable opinion towards floating agriculture as a means of cleaner production.

Table 2. Farmers' opinion statements towards floating agriculture as a means of cleaner production

SL No.	Statements	Sustainable factors	Average	Rank
01.	FA production increases as old floating bed residues can use there (+)	Environmental aspect	4.05	4
02.	FA require using less chemical fertilizer (+)		3.81	9
03.	Organic crop production is possible with FA (+)		3.92	6
04.	Insect and pest infestation is less in FA (+)		3.74	12
05.	FA is an eco friendly technique (-)		3.22	17
06.	FA sustain in excess rain, flood and tidal condition (+)		3.05	20
07.	FA ensure the best use of resources (+)		3.80	10
08.	FA is less expensive as compare to normal agriculture (+)	Economic aspect	3.57	15
09.	FA ensure optimum use of local resources (+)		3.75	11
10.	FA helps to increase annual family income (+)		4.11	3
11.	FA is a mean of self employment opportunity (+)		3.85	8
12.	FA is a source of more income with short time (+)		3.58	14
13.	FA is just a wastage of land (-)	Social and cultural	4.31	1
14.	I like to establish at this profession as it is profitable and sustainable although it is risky (+)	aspect	3.91	7
15.	FA is helpful to sustain indigenous knowledge and technique (-)		3.10	19
16.	FA is a good weapon of fight against poverty and hunger for the rural people (-)		3.59	13
17.	I am willing to establish in this profession and like to obtain more knowledge for my own betterment (+)		4.17	2
18.	FA creates working opportunity for women and youth (+)		3.97	5
19.	FA is laborious and it reduces prestige (-)		3.23	16
20.	Obtaining crops from FA help to fulfill Daily food requirement (+)		3.14	18

Note: FA = Floating agriculture
Source: Surveyed data collected by the author's in this study.

Table 3. Distribution of the farmers according to their opinion towards floating agriculture as a means of cleaner production

Category	Respondents		Mean	Standard deviation
	Number	Percent		
A. Less favorable opinion (score up to76)	32	22.9		
B. Moderately favorable opinion (score 77-83)	84	60.0	71.46	5.39
C. Highly favorable opinion (score over 83)	24	17.1		
Total	140	100		

Note: A = Less: Mean – 2SD < B ≤ Mean – SD; B = Moderate: Mean - SD < C < Mean +SD; C = High: Mean + SD≤ D < Mean + 2SD

Source: Surveyed data collected by the author's in this study.

Perception and opinion of a person may be accelerated by education, training, knowledge and awareness. Education and training enables a person to gain knowledge and helps him become rational which in turn increases his attitude and perception. The findings of several studies [27-28] are also similar to the current findings.

The floating agricultural practices are similar to the 'sustainable development' concept on the basis of the definition by the Brundtland Commission (1987), as sustainable development that meets the present without hampering the future generations. Accordingly floating agriculture has the capacity to meet the farmers food and nutritional demand for current and future generations. Moreover, the benefits obtain from the floating agriculture as environmental protection, economic growth, and social progress are considered as to the main parameters of sustainable development [47]. Additionally, farmers of some regions of Bangladesh are practicing this technique for more than 100 years [17,45]. For this reason, this practice is considered as sustainable practice as it is a long enough time to claim that [23]. So proper planning and management of the floating agriculture may contribute to the agricultural production, environment, economic, social and cultural sector of Bangladesh.

3.1.2 Farmers' demographic characteristics

The main floating agriculture practicing districts of Bangladesh are Barisal [18,42], Gopalganj [18,48,49] and Pirojpur [17,50]. Although, this technique were transferred to other flood prone areas of Bangladesh either extensively or some extent, like, Madaripur [39,45], Satkhira [17], Habiganj [51], Kishoreganj [19,52], Gaibandha [38,53], Khulna [54-55], Sunamganj [19,51,56], Netrokona [51,57], Faridpur [58], Lalmonirhat [59], and Jessore [40,60-61]. At these regions, different types of monsoon and winter crops are grown. The main crops are tomato, spinach, potato, chilies, bottle gourd, pumpkin, wax gourd, brinjal, cabbage, cauliflower, amaranth, papaya, cucumber, bitter gourd, water arum, onion, garlic, sweet gourd, okra [17-18,39,62]. While, the farmers of the Barisal district frequently raise seedlings of different crops like bottle gourd, pumpkin, wax gourd, papaya, beetroot, brinjal, cabbage, chili, bitter gourd, and tomato [18]. So the farmers get an opportunity to cultivate diverse crops during flooding and water logging conditions that ensure food supply during this adverse condition. So it is crucial to learn about the socio-demographic characteristics of the farmers who are related with floating agricultural.

Eight socio-demographic information of the farmers like age, educational attainment, family size, farm size, annual income, extension contact, and training received are displayed in Table 4. The table represents categories, frequencies, and percentage for all these demographic variables. Data exhibited in the Table 4 showed that most percentages of farmers (34.2%) were in less than 30 years of age compared to 31.4% were in between 31 to 40 years and followed by 41 to 50 years category (25.7%). Although the average age of the respondents was about 37 years which means younger age of the respondents. The findings of Hasan et al. [26] are similar to these results. Younger respondents generally tend to have broader outlook and have much social as well as mass media contact than the older one. It helps them to become more aware and conscious about linkage issues. It is a good picture that more than 80% of the respondents were educated either in primary, secondary or tertiary level in which 40.0% of the respondents got secondary level education which was the

highest. This is a good sign of education level improvement of the country (Bangladesh). The highest proportion (48.60 %) of the respondents had medium family size compared to (42.80%) large family size. Hasan et al. [26] also exhibited the similar kind of findings. The data also indicate that average family size (5.20) of the farmers were higher than the national average of 4.4 [63]. The highest proportion (88.60%) of the respondents had small farm size of 0.02 to 1.01 hectares.

It might be an indication that small and medium farmers were more involved in floating agricultural activities since the total percentage of small and medium farms comprised 100% of the total farm size. The average income of the respondents of the study area was Tk.68000.78 (850 USD) which was lower than the national average that is more than Tk.77700 (972 USD) [64]. Majority proportion of the farmers (>70%) belonging to the low to medium extension media contact category and most percentages of the respondents (95.70%) had no training exposure on floating agriculture of the study area. In their study Hasan et al. [65] also classified the extension media contact into three groups and found the similar type of findings of medium extension contact. So the Department of Agricultural Extension (DAE) can play a vital role to strengthen their services with this regard. Knowledge scores of the farmers on floating agriculture ranged from 16 to 24, with an average score was 19.97. According to the knowledge on floating agriculture of the farmers, is it seen that 82% of the farmers had 60% to 80% correct knowledge on floating agriculture. As floating agriculture of the study area is an old practice so the respondents possess good knowledge on floating agriculture. Better Knowledge in the use of floating agriculture is helpful to make the individual more confident. They are practicing this specific type of agriculture for many years on their own effort.

Table 4. Demographic characteristics profile of the respondents (n= 140)

Variable	Categories	Frequencies	%
Farmers' age (Mean = 37.60, SD = 10.72)	Less than 30 years	48	34.2
	31 to 40 years	44	31.4
	41 to 50 years	36	25.7
	51 to 60 years	6	4.4
	61 to 70 years	2	1.5
	More than 70 years	4	2.8
Level of Education (Mean = 5.22, SD = 3.29)	No Education/Illiterate	24	17.10
	Primary Education	52	37.10
	Secondary (SSC level)	56	40.00
	Upper SSC level (Upto HSC level)	8	5.08
Family size (Mean = 5.20, SD = 1.33)	No. 1-3	12	8.60
	No. 4-5	68	48.60
	No. more than 6	60	42.80
Farm size (Mean = 0.44, SD = 0.51)	Small (0.02-1.01 ha)	124	88.60
	Medium (1.01-3.03 ha)	16	11.40
	Large (>3.03 ha)	0	0
Family annual Income [Mean = 68000.74 BDT (850USD)]	Up to 40000 (500 USD)	44	31.4
	40001 to 60000 (500.01 to 750 USD)	52	37.2
	More than 60000 (more than 750 USD)	44	31.4
Extension media contact (Mean = 9.21, SD = 0.23)	Low (up to 6)	8	5.7
	Medium (7-10)	92	65.7
	High (> 10)	40	28.6
Training participation on floating agriculture	No training	134	95.70
	Training	6	4.30
Knowledge on floating agriculture (Mean = 19.97, SD = 2.44)	90% and above correct knowledge	0	0
	80% and above correct knowledge	16	11.40
	70% and above correct knowledge	44	31.40
	60% and above correct knowledge	56	40.0
	50% and less correct knowledge	24	17.20

Source: Surveyed data collected by the author's in this study.

Table 5. Farmers' characteristic and their influence on response towards floating agriculture for sustainable development and food security

Sl. no.	Variables	Coefficient (b)	*t*-value	*P*
X_1	1. Farmers' age**	-0.159	-2.856	0.006
X_2	2. Level of education	0.165	0.902	0.370
X_3	3. Family size**	0.586	3.586	0.001
X_4	4. Farm size	3.196	2.106	0.039
X_5	5. Family annual income	-2.745	-1.882	0.065
X_6	6. Extension media contact	4.284	1.409	0.164
X_7	7. Training participation on floating agri.*	1.189	2.090	0.010
X_8	8. Knowledge on floating agriculture	0.382	1.537	0.130

Source: Based on surveyed data collected by the author's in this study.

3.1.3 Influence of farmers' characteristics upon their response towards floating agriculture

This section examines the farmers' characteristics that influence opinion towards floating agriculture as a means of cleaner production. Regression results in above Table 5 indicate that among eight characteristics that entered into the model, three were found to be statistically significant predictors. These were 1); farmers' age 2) level of education, and 3) training participation on floating agriculture that influences on respondents' opinion towards floating agriculture as a means of cleaner production. Farmers who possessed one or more of these characters at a higher level were found to have a higher level of opinion towards floating agriculture; hence they can adopt and practice floating agriculture as a cleaner production system for improving their production level.

Through a study, Faroque and Takeya [66] found that education level, farming experience, farm size, family size, fertilizers use and communication exposure had an influence on perceptions of integrated soil fertility and nutrient management. While Saghidi [67] also found that through his study on "Assessing Farmers' Sustainable Agricultural Practice Needs: Implication for a Sustainable Farming System" that technical knowledge, age and access to information of the farmers had contribution over farmers sustainable agricultural practice needs. Similarly at this particular study similar types of findings were found.

Chowdhuruy and Moore [23] identified that for the continuation of floating agriculture in a more sustainable manner, it is needed to provide need-based knowledge and training to the farmers along with enough logistics and financial support from the starting to the crop harvesting and storage stage. They also focused on arranging training (eg. floating bed preparation, different intercultural operation and so on) for the farmers and also dissemination of this knowledge to other farmers within the locality so that they can practice this technique through generations [68]. Considering the importance of the floating agriculture, Bangladesh Government through the Department of Agricultural Extension has already started a project in 42 Upazilas of the south-central districts for strengthening the capacity building of the farmers and transferring this technique to similar areas of the country [48]. Moreover, some NGOs, like Wetland Resource Development Society (WRDS), CARE, IUCN, Practical Action provided training facilities to the farmers on floating agriculture throughout the country [51,52,69-70].

In Bangladesh it is a common practice of using excessive and imbalance chemical fertilizer in crop fields which reduce the yield of crops and deteriorate the environment [71], though the soil fertility is an important matter of the integrated plant nutrient management [72]. From that point of view the floating agricultural practice is organic type agricultural practice. Hiwasaki et al. [73] pinpointed that integration of local and indigenous knowledge should be integrated before policy formulation and taking future action related to disaster risk reduction and climate change. So it is important to formulate future in-depth research work related to the long-term social, economic and environmental impact of floating agriculture and also identify its scientific basis. The Bangladesh government took the policy to establish the sustainable environment and defending the country from global warming as well as adverse climate impacts [74]. For the current study, we only took eight characteristics of the farmers and identify their opinion towards

floating as a means of cleaner production. Therefore, in future, other socio-demographic characteristics should be incorporated with the current variables. Moreover, field-based research can be carried out on the role of floating agriculture as a means of employment opportunity for the women and unemployed people, community development, identifying the challenges and role of NGOs of dissemination of floating agriculture.

4. CONCLUSION

The present study was conducted to assess the farmers' opinion towards floating agriculture as a means of cleaner production who were involved with floating agriculture in flood affected and water logged low-lying two Upazilas of Barisal District of Bangladesh.

Important findings exhibited that most percentage (95%) of the farmers in this study were in between 50 years of age, while about 84% of them were educated either primary, secondary or more. The average family size of the farmers was 5.20, while 91% of the farmers had the family size from 4 to more than 6. Although the farmers of the study area had smaller (88%) farm size of 0.02-1.01 hectare. The average family annual income of the farmers was 850USD which was lower than the average national income of the Bangladesh. The farmers of the study area had low to medium (71%) extension contact and 96% of them did not receive any training on floating agriculture and related issues. Meanwhile, 82% of them had 60-80% correct knowledge on floating agriculture. Hence, these factors might affect their opinion towards floating agriculture as a means of cleaner production.

About 83% of the farmers maintained moderately to less favorable opinion towards floating agriculture as a means of cleaner production. Additionally, farmers age, their family size and training participation on floating agriculture had an influence on their opinion towards floating agriculture. These findings indicate that higher level of these three characteristics will result higher of the opinion of the farmers towards floating agriculture as a means of cleaner production. The farmers should be provided with different types of need-based training related to floating agriculture. Hence, the government and non-government organization should take proper steps with this regard.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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