



Assessing NGOs micro-credit programs: a geo-spatial and socio-economic scenario from rural Bangladesh

Tanjinul Hoque Mollah¹ · Sharmin Shishir²  · Wahid Ullah¹ · Takaaki Nihei¹

Received: 21 November 2017 / Accepted: 10 October 2018 / Published online: 20 October 2018
© Springer-Verlag GmbH Germany, part of Springer Nature 2018

Abstract

Micro-credit programs have an enormous influence on the lives of millions of poor people from the rural areas of Bangladesh. This paper explores the significant contributions made by micro-credit concerning poverty reduction by increasing the income generating activities, empowerment of the rural poor so that they can properly get access to development services. This study is based on a household questionnaire survey, involving 533 respondents, and geographical information system (GIS) analysis to identify the concentration of NGOs, offering micro-credit in rural programs and find potential areas in need of such programs. A total of 30 NGOs with its 175 sub-branches were found in the study area. The NGOs have been considered the savior to the countless number of people who suffers from food, cloth, education and basic health facilities. Among others, the most prominent micro-credit institutions found were BRAC, Grameen Bank, RDRS Bangladesh and ASA. These institutions are working massively on poverty reduction, empowerment, and improvement of living standards for the poor people of the rural area. It indicates that NGOs have recognized to be very successful as a delivery system regarding relief and micro-credit inputs to the rural poor. However, in terms of poverty reduction, some individual achievements may have been made, but net welfare achievements at the union level remain nonexistent. The study suggests that NGOs should also focus on remote areas where such programs are severely needed to reduce poverty alleviation while working on improving their loan management system.

Keywords Poverty · Micro-credit · Rural area · Empowerment · Bangladesh · Non-Governmental Organizations

JEL Classification D04 · D14

✉ Tanjinul Hoque Mollah
thmollah@juniv.edu

¹ Department of Regional Sciences, Graduate School of Letters, Hokkaido University, Kita 10, Nishi 7, Kita-ku, Sapporo 060-0810, Japan

² Graduate School of Environmental Science, Hokkaido University, N-10 W-5, North Ward, Sapporo 060-0810, Japan

1 Introduction

In Bangladesh, socioeconomic development and poverty alleviation are crucial issues now, whereas micro-credit is considered as one of the vital tools for poverty alleviation (Banerjee et al. 2015; Rahman 2011; The Role of Micro-Credit in Poverty Alleviation 2009; Adam 2010; Copestake 2007; Copestake et al. 2005; Raihan 2014). Consequently, micro-credit services had established by the local NGOs (Non-government organizations) in the last few years particularly in Bangladesh. They are providing a lot of attention to the welfare of the rural poor people (Ahlin and Jiang 2008; Hasan 1991; Hashemi and Schuler 1996; Rahman et al. 2003). Grameen Bank, BRAC (Bangladesh rural advancement committee), RDRS (Rangpur Dinajpur rural service) Bangladesh, ASA (Association for social advancement) and other Microfinance Institutions (MFI) in Bangladesh are working for improving lives and livelihoods of the poor people living in rural areas (primarily targeting the poorest of the society, especially women) (Wahid 1993; Mahjabeen 2008; BBS 2010, 2012; BRAC 1990; Bangladesh Ministry of Finance 2014; Rahman and Hossain 1986). Therefore, the GDP (gross domestic product) growth tends to increase from 6.5 to 7.6 since 2004 until at present state (IMF 2018), which represents the economic development status of Bangladesh.

Furthermore, according to United Nations report published in (2005), micro-finance or micro-credit is defined as small-scale financial services to the poor and low-income people from rural areas, such as credit and savings accounts. Most of these investments or financial supports are profit oriented (Copestake 2007; Jehangir et al. 2002; Khatun et al. 2013; White 1992). Thus, the amount of loan, high-interest rate (national policy makers and also PKSF (Palli Karma Sahayak Foundation) fixed 12.5% interest rate or so-called service rate to be charged by MFIs to the poor people of the country) and early perseverance of microcredit payment; field workers make it difficult to generate quick economic return and thereby forces the borrowers into a grave sunken condition in the study sites (Rashid et al. 2011; Raihan et al. 2017). Microfinance is a powerful tool to fight poverty and help poor people from rural areas in order to raise their incomes, provide assets, empower women and uplift the entire community as well as mitigating themselves against external obstacles like natural disasters (Li et al. 2011; Mandelbaum 1988; CGAP 2004a; The Role of Micro-Credit in Poverty Alleviation 2009; Rahman 1986a, b; Ray 1987; Schuler and Hashemi 1994; Simmons et al. 1988).

In Bangladesh, the idea of micro-credit system was originally proposed by a Nobel Laureate Professor Muhammad Yunus (Hye and Islam 2012). These micro-credit services offered by NGOs particularly focus on financial or economic sectors (Rahman 2004; Rashid and Bashar 2010; Mason 1987; Pitt and Khandker 1998; Nilanjana 2013). For example, the micro-credit programs are engaged in agriculture, health, and sanitation, women empowerment, forest management, fisheries and educational programs (Revindo and Gan 2017; Li et al. 2011; Mazumder and Wencong 2013; Proshika 1999; Rahman 1986a, b; The World Bank Report 2016). These services are mostly provided in rural areas of Bangladesh in order to support their lives and livelihoods (Zohir et al. 2001; Uddin et al. 2012; Hasan 1998).

Most of the people along the Jamuna River have no savings (Uddin et al. 2014; CARE 2000; Arndt et al. 2002; GoB 1993; GoB 1998). Therefore, they are not being able to go for big investment in the business sectors. However, a good number of NGOs are providing credit facilities to the poor people (Hashemi and Schuler 1993). On the contrary, local NGOs are working on women empowerment within the rural community by providing credits and handicrafts training (Mokhtar 2011; Hossain 1988). Despite these positive activities, some studies found that NGOs credit is not effectively reaching to the very poor people along the river Jamuna, Bangladesh (Goetz and Sengupta 1996; Khatun et al. 2013). Therefore, the previous researches have several limitations, which include spatial distributions of NGO with the strength and weakness of NGOs. The overall goal of this paper is to identify the micro-credit services provided by NGOs along the riverside of Jamuna. The study also seeks to investigate the areas, which still need such services to boost their lives and livelihoods.

The broad goal of the study is to investigate the role of local NGOs in remediating poverty through micro-credit services in the landscaped along the riverside of Jamuna, Bangladesh. In the study area, around 3.5 million people inhabit *chars* which are mostly in the intervention areas, with around 1 million living on island *chars* that are surrounded by water for the majority of the year (Haque and Masahiro 2009; Hasan 1985). The significance of this study is to analyze micro-credit service provision of NGOs by providing GIS, GPS and Google Earth based-NGO's baseline information of microfinance services and recording the physical location and basic portfolio data of all MFI branches (175 branches) in the study area mostly located in and along the Jamuna River Systems. The specific objectives set to fulfill this aim includes (1) to explore NGOs and its contribution in alleviating poverty; (2) to identify areas where NGOs have more/less concentration versus people dependent on its services; (3) to identify NGOs and its linkage with growth/commercial centers in the study area and finally (4) to investigate the socioeconomic attributes of the rural inhabitants who were part of this study. In this study, Sect. 2 talks about the literature reviews, Sect. 3 emphasizes on the methodology, Sect. 4 analyses the results and findings, Sect. 5 discusses about the findings of the current and previous researches, and Sect. 6 deliberates the conclusion with the strategic recommendations, limitations and contributions of current research.

2 Relevant literature review

Microcredit is the delivery of small loans to rural poor people for self-development or community development projects that generate income. It is a new approach to fight against poverty by increasing income using NGOs credit (Morduch 1999). Microcredit is being recognized as an operational means of poverty alleviation. However, there are significant debates on the effectiveness of microcredit program and the characteristics of the recipients who are benefited from the local NGOs credit program (Chowdhury et al. 2004). The existing literature determined that microfinance has varied impacts on the livelihood of the rural poor. Microcredit has carried millions of poor people, especially women out of poverty and stimulated

economic sustainability likely they are able to increase their household income, decreased economic vulnerability and in some cases, wipe out poverty completely. (Glazer 2010; Bansal 2011). Besides that, they have been enjoying better nutrition, health facilities, and greater empowerment as a result of microfinance operations (Bauer et al. 2008; Swope 2005). Yunus (2004) said, microcredit has lots of positive impacts on families that receive from the local NGOs credit program. Murdoch and Haley (2002) led a widespread analysis of the effects of microfinance in poverty reduction and there has a sufficient positive impact of credit program on poverty reduction of the rural villagers as well as it relates to millennium development goals. Many NGOs have been working as a non-profit organization, whose aim is to help those people who would not have access to a loan from a traditional bank by funding to people (Fisher 1997). Godquin (2004) focused on microfinance repayment performance in Bangladesh and the improvement procedures of the allocation of loans by MFIs. He said that the main objective of the NGOs is to provide financial facilities, both as credit and savings to the rural poor in order to release financial limitations. He also said that “high repayment rates are largely linked with benefits both for the microfinance institutions and the borrower”. Fruttero and Gauri (2005) showed that NGOs play a progressive role in the delivery of public services to the rural poor in developing countries by determining the location decisions and by the charitable motivations of principal determinants.

Amin et al. (1998) also emphasized on NGOs significant initiatives to handle the poverty situation in Bangladesh considering certain aspects, i.e., speedy economic growth achievement process, human resource development and specific target setting for poor. He also describes the women’s empowerment with involvement in microcredit programs in his paper titled on NGO-promoted microcredit programs and women’s empowerment in rural Bangladesh in the *Journal of Developing Areas* in 1998. Consequently, Begum et al. (2004) provide an information and analyze the NGOs provided services to the local poor people in their paper titled on the role of NGOs in rural poverty eradication: a Bangladesh observation. NGO is a non-profit agency that serves some public interest and an association of peoples structured on a voluntary basis through the initiative of one or more dedicated person committed to the planning and implementation of any development projects at the grass root level. However, there are no specific researches on spatial distribution, strength and weakness of NGO’s. Most of the previous researches were conducted within small and separate area which acts as one of the major limitation. The present research provides the above-mentioned terms of NGO’s according to savers, borrowers, saving deposits and total loan outstanding in the rural areas of Bangladesh.

3 Methodology

3.1 Study area

Under the study area, there are 126 unions in 5 districts along the river side of Jamuna and 30 NGOs with 175 sub-branches working in the study site. All of these NGOs provide similar facilities in microcredit sectors (e.g., lending money and

saving deposit). The study area includes Sirajganj, Bogra, Jamalpur, Gaibandha and Kurigram district. The second largest of the three main rivers in Bangladesh is Jamuna River, a notable distributary channel of the Brahmaputra River, running from India to Bangladesh (Fig. 1). About 65% rural people are living in the *chars* (the islands that are surrounded by water) of Jamuna (Rahman et al. 2012; BBS 2011). Thus, *chars* are significant in providing land for human habitation in Bangladesh. *Chars* are enormously vulnerable to both erosion and flood hazards. A recent analysis of time series satellite images showed that about 75% of the *chars* had been

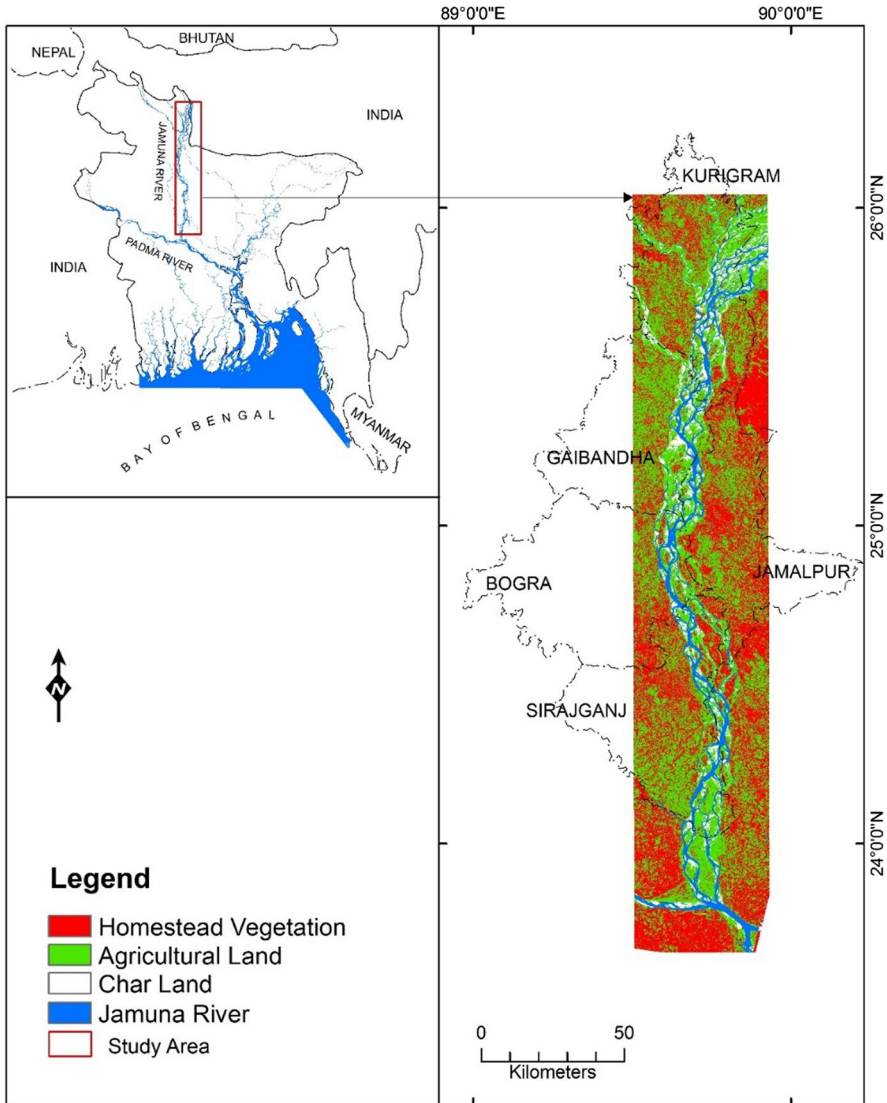


Fig. 1 Study area along the river side of Jamuna, Bangladesh (Source: author, 2017)

destroyed from one year to nine years, while only about 10% lasted for 18 years or more (Bayes and Patwary 2012). Besides that, *Chars* have occupied 40% of active river floodplain, which comprises about 6% of Bangladesh's total land (Bayes and Patwary 2012; Bulletin of Institute of Vocational and Technical Education 2008). Remote *chars* are found to be flooded more expansively than the attached *chars* (Grogan et al. 2012). Each year a large percentage of *chars* are flooded. If the flood comes early, it can damage crops and people's livelihoods (Bayes and Patwary 2012).

3.2 Data sources and methods

The primary data were collected from a distinctive group of respondents in 2017. In total 533 respondents were interviewed by semi-structured questionnaire using household survey method and 50 focus group discussions (each group consists 5–6 persons) were also conducted randomly at union council (combination of few villages) level along the river side of Jamuna, Bangladesh. The information on age of the respondents, sex, number of family members, educational background, condition of residential facilities, purpose of getting loan, occupational status (before and after joining to local NGOs credit program), monthly income (before and after joining to local NGOs credit program), current economic status, if they are facing problem in installment and finally, significant assets of the rural poor before and after the involvement into micro-credit was collected through household questionnaire survey. Absolute information regarding the locations of 30 NGOs with 175 sub-branches was collected using Global Positioning System (GPS). The study interviewed these following groups:

- (a) Local community (total 533 respondents, each house holds 5–8 members and 50 FGDs); and
- (b) Local NGOs managers who are involved in micro-credit program of 126 unions (focused group discussions and interviews with 175 branches of 30 NGOs).

Secondary data, such as year of establishment, number of savers, the total value of savings deposits, number of borrowers, the total value of loans outstanding, name and telephone number of the branch manager were collected from 30 NGOs (total 175 sub-branches). Furthermore, secondary data were acquired from Bangladesh Bureau of Statistics (BBS), Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS).

Survey track during fieldwork: automated track records of the GPS device have been mapped during the field survey of MFIs. The survey work is being done by boats, rickshaws, bikes, on feet, bus, tempo, baby-taxi, rail, horse carts and so on.

3.3 Data analysis

ArcGIS 10.2 is being used for detailed mapping and analysis of NGOs working area of the sample sites. A Garmin GPS device has been used to locate all MFIs accurately

and converted the collected waypoints in GIS and KML format. The purpose of the GPS survey was to record the latitude and longitude of each MFI branch in the listed island/*char* unions of Jamuna River, and also to report the year of establishment, number of savers, total value of savings deposits in Taka, number of borrowers, total value of loans outstanding and, finally name and cell number of branch manager. NGO's baseline information on micro-finance services, especially number of borrowers, number of savers, total value of savings deposits and total value of loans outstanding was analyzed regarding on their spatial distribution. Based on physical location of MFI branches (175 branches), this paper tried to find out working gaps area in the study sites using ArcGIS 10.2. Besides that, this paper had analyzed microfinance services (especially loans) with a number of borrowers of major four NGOs (ASA, BRAC, Grameen Bank and RDRS Bangladesh). In addition, financial growth or commercial centers were analyzed with the spatial distribution of NGOs in the study sites.

Statistical Package for the Social Sciences' (SPSS 16.0) software was also used for socioeconomic characteristic analysis, i.e., age of the respondents, sex, number of family members, educational background, condition of the residential facility, purpose of getting loan, occupational status (Before and after joining the local NGOs credit program), monthly income (Before and after joining the local NGOs credit program), current economic status, if they are facing problem regarding installment and finally, significant assets of the rural poor before and after involvement into micro-credit program of the study sites. Besides that, the correlation between monthly income and selected eight dependent variables was also analyzed using SPSS. The selected eight dependent variables are solar panel electricity, cemented toilet, tube well, television, radio, bicycle, electric fan, and wooden boat. Among the 533 respondents, 148 respondents used solar panel electricity, 179 respondents used cemented toilet, 220 respondents used tube well, 85 respondents used television, 498 respondents used radio, 68 respondents used bicycle, 139 respondents used electric fan, and 293 respondents used wooden boat. This paper has tried to make relation between eight dependent variables and income by the following correlation equation:

$$r = [\Sigma xy - \{(\Sigma x)(\Sigma y)/n\}] / [\{\Sigma x^2 - (\Sigma x)^2/n\} \{\Sigma y^2 - (\Sigma y)^2/n\}]^{1/2} \quad (i)$$

where X = Dependent variables, Y = Income, n = Number of unions and results, r lies between -1 and $+1$. A value near 0 means no correlation and near -1 and $+1$ means there have less or strong correlations between the variables and income. We also tested t test ($p < 0.05$) to find out the statistically significance of outcome variables after joining micro-credit program.

4 Major findings of microcredit service

4.1 List of NGOs and their contribution to poverty alleviation

Numerous non-governmental organizations were found in the study area, working in almost every sector. The purpose and scope of their work change along with the

type of project, for which they receive funding. NGOs like ASA, BRAC, Grameen Bank, RDRS Bangladesh are national level NGOs and work exclusively all around the country. A complete list of all NGOs presently working in our study area identified during household surveys and Focused Group Discussions (FGD) as well as in existing government reports are given in Table 1.

There are 30 NGOs (Non-Government Organizations) with 175 sub-branches helping locals to raise their economic status through micro-credit services in rural Bangladesh. The services of micro-credit include crops production, husking rice and rice frying, cattle fattening, domestic animal husbandry, fish farming, cultivation of vegetables, convenience store, bamboo and cane work, vegetables and raw materials business, cloth fabric, cottage industry, ready-made garments business, clothing business and finally, buying rickshaw or van.

NGO gives loan to deprived people in different ways where landless are given priority. The amount of loans provided by NGOs is minimum 118\$ and maximum ≥ 237 \$ with the weekly basis installment particularly in the study site. The installment period depends on the amounts of loans, the higher the amount, the longer the period and vice versa. But they suffer most in terms of payment system of loans with interest. Poor receive loans in condition of 12.5% (fix interest rate for NGOs by PKSF) interest monthly. Once they go through the installment weekly, it is calculated that at the end of installment they paid more than 30% to 40% interest instead

Table 1 List of NGOs in the study area

No	Branch name	No. of branches	No	Branch name	No. of branches
1	AKOTA	2	16	PRODIPON	1
2	ARBAN	1	17	PROGRESS	1
3	ARCHES	3	18	RDRS Bangladesh	22
4	ASA	35	19	RSDA	1
5	Atto Mohila Unnaion Somity	1	20	Sajida foundation	1
6	Bhomukhi Mohila Unnaion Somity	1	21	SAP	1
7	BRAC	31	22	SATU	1
8	DORP	1	23	SKS	7
9	GKS	1	24	SSS	6
10	Grameen Bank	31	25	Thangara Mara Mohila Sabuj Songo	1
11	GUK	9	26	TMSS (Thakurgan Mohila Sobuj Sango)	4
12	MMS	2	27	UDDIPAN	1
13	NDP	3	28	Uddog	1
14	PDBF	1	29	UDPS	2
15	Porosh	1	30	US	2
				Total	175

Source: Bangladesh Bureau of Statistics (BBS), The Center for Environmental and Geographic Information Services (CEGIS) and field survey 2017

of 12.5% (PKSF 2017). The borrowed amount is reduced by paying weekly installment where the rate of interest never counts with the reduced capital. For example, capital is 100 \$ with 10% interest and the number of installment is 10 weeks. In 1st week, borrowers paid 11\$ (10\$ installment + 1\$ interest) where main capital reduced to 90\$. In 2nd week, they also need to pay 1\$ interest where it should be 0.9\$ interest (10% of 90\$). Consequently, at the last week of installment they paid interest on 100\$ where they should pay interest on 10\$. Therefore, higher number of instalment makes more profit to the NGOs credit business.

The study area is a *char*-prone (island) area where approximately 15% of the total populations are still living below the poverty line due to lack of job opportunities. Among them the women are more vulnerable in terms of social, political and economic discriminations compared to male in the study sites. Therefore, local NGOs are creating job opportunities for the rural women to reduce dependency rate. Thus, microcredit has been a major support for rural women in along the Jamuna, Bangladesh. The positive effects of NGOs credit program can help to reduce poverty along with increase women's equality in the rural area.

4.2 Geospatial analysis of NGOs microcredit attributes

The main importance of this section is to find out the strength and position of NGOs in terms of services. This section also endeavors to locate the unavailability of NGOs where NGOs should concentrate on their establishment and services. This section presents a spatial distribution of local NGOs (30 NGOs having 175 branches) in respect to its borrowers (a), savers (b), saving deposits (c) and total loan disbursed among NGOs members (d). Agricultural practice, fishing and cattle farming are the major development levels and indicators. Local NGOs in the bank of Jamuna River are operating micro-credit activities intensively for the development of economic and social welfare of the rural poor of that region. The borrowers, savers are categorized into five classes based on population size. Saving deposits and total loan outstandings are categorized into three major classes to identify the strength and weaknesses of NGOs in the study area.

Results show that local NGOs are not equally distributed in the study area. The concentration of local NGOs is higher in the upper and lower part of Jamuna River, whereas in the middle part of Jamuna, the number of local NGOs is fewer. Figure 2a illustrates that there is a very high concentration of borrowers (4633–7194) in the upper and lower bank of Jamuna River, seeking money for agricultural or business purposes. Furthermore, in the northern part of Jamalpur and Bogra district, there are few scattered NGOs with a small number of borrowers, i.e., 1581–2919.

Figure 2b illustrates the number of savers of local NGOs. Five classes were made to show the concentration and spatial distribution of savers in the study area. Those five classes include (100 to 722), (723 to 1729), (1730 to 2641), (2642 to 4200) and finally, (4201 to 9026). Savers concentration results along the river Jamuna were analyzed using a five-point Likert scale, i.e., (1) very higher concentration (4201 to 9026), (2) higher concentration (2642 to 4200), (3) medium concentration (1730 to

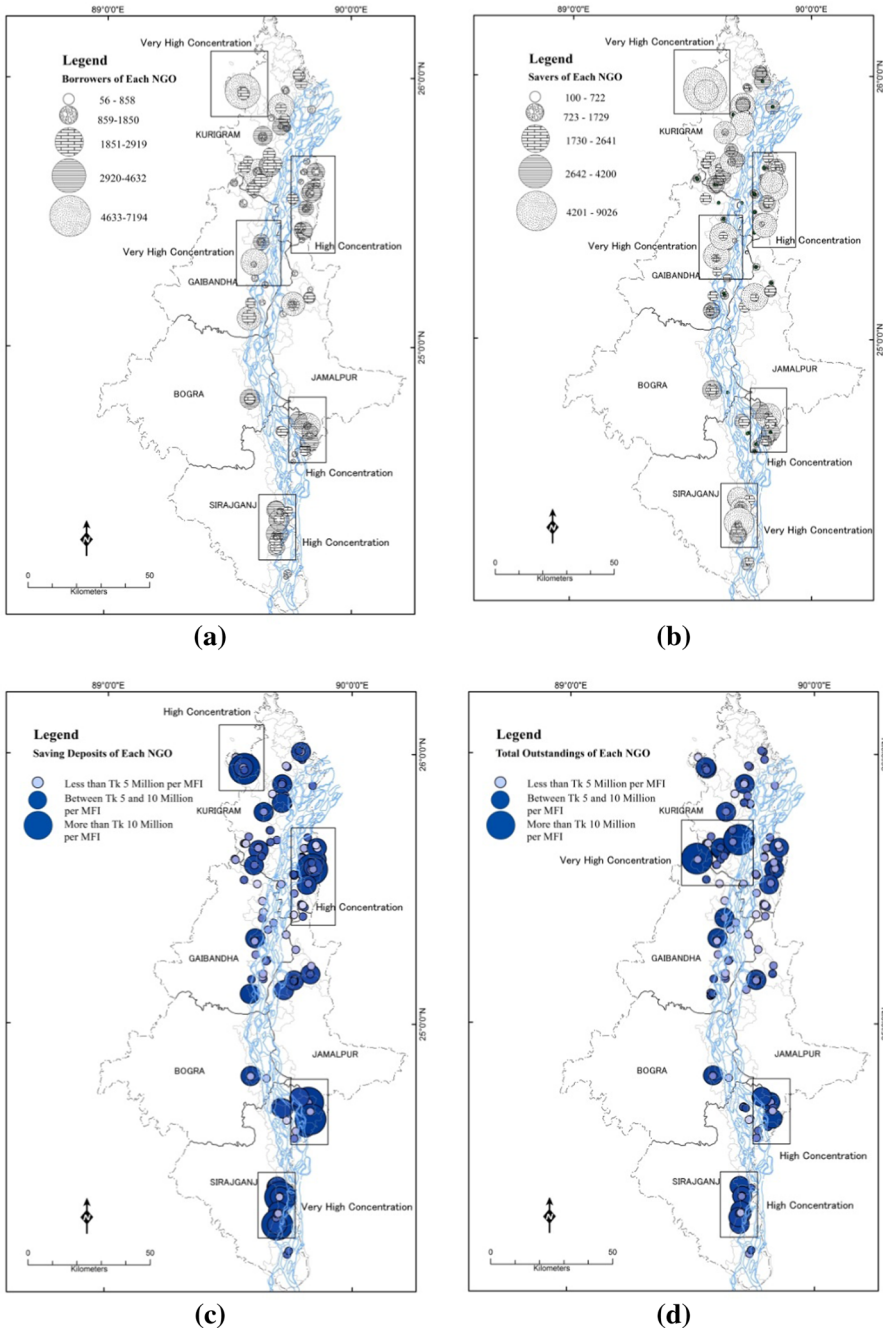


Fig. 2 (a–d) Geospatial attributes of 30 NGOs (175 branches) including borrowers (a), savers (b), saving deposits (c) and total loan outstandings (d)

2641), (4) low concentration (723 to 1729) and finally, (5) very low concentration (100 to 722).

Results reveal that total numbers of savers are highly linked with the economic development of individuals or families. Our results show a very high concentration of savers in the upper bank of Jamuna River, where the number of savers are 4201 to 9026 in majority of the branches such as in the Kurigram, Gaibandha and upper part of Jamalpur district. This high concentration of savers and NGOs might occur due to the close proximity of these districts to the Rajshahi division. Another possible reason for this could be that rural people have good opportunities to invest in the profitable sectors and earn more in that region. Moreover, they tried to save some money for future with the help of local NGOs by accumulating profitable interest. Figure 2b also shows that, in between Kurigram and Gaibandha district, lower part of Gaibandha district and upper part of Sirajganj district, there is medium concentration of savers (1730 to 2641) because of small population in those areas. In the middle part, covering districts of Bogra and lower portion of Jamalpur, a lower number of savers and concentration of NGOs was found.

Figure 2c demonstrates the savings deposits of local NGOs that are operating micro-credit activities along the Jamuna River. As shown in Fig. 2c, savings deposits were divided into three main categories based on finance capacity of NGOs, i.e., (1) less than TK 5 million per MFI; (2) between TK 5 to TK 10 million per MFI; and (3) more than TK 10 million per MFI. Results reveal that, in the upper part of Jamuna River especially in Kurigram district, there is high (more than TK 10 million per MFI) and medium (between TK 5 to TK 10 million per MFI) concentration of savings. This is because NGOs were increasingly involved in mobilizing the rural poor people to have some savings for their future economic security. For the savers, NGOs have been creating new employment opportunities and making easy access to large loans for business purposes. However, the higher and medium savings (more than TK 10 million per MFI and between TK 5 to TK 10 million per MFI) were also located in the upper and lower part of Sirajganj district. In the middle stream of Jamuna River (Gaibandha and Jamalpur district), medium savings were found with a higher number of local NGOs. There are only five NGOs have saving deposits of 5 to 10 million range and the rest of the region have a very poor rate of saving deposits compare to districts within the study region.

Figure 2d indicates the total loan outstanding of each NGO is also categorized into three broad categories as shown in Fig. 2c. There is higher and medium loan outstandings (more than Tk 10 million per MFI and between TK 5 to 10 million per MFI), located in the upper part of Jamuna river like in Kurigram district. In the higher and lower part of Sirajganj district, medium loan outstandings were seen and in the rest of the area especially in the middle stream of Jamuna, lower loan outstandings were observed. The savings deposits are higher in the Gaibandha and Sirajganj districts, but the total loans outstandings are lower in Sirajganj district. There might be two reasons for this, (1) the organizations are not willing to lend money to the people or (2) people are not willing to take the money from the organizations in Sirajganj district. The high loan outstanding indicates a very positive sign of frequent economic and business activities improving lives of rural people of the study area.

4.3 NGOs working area linkage with commercial centers and population density

Growth center or commercial center is the rural markets with trade facilities where rural poor people can access inputs for agricultural products such as seeds, fertilizers, agricultural tools, and pesticides. These centers play a significant role in the rural economy where people invest their money for the business purpose and trade their agricultural commodities. Hence, these growth centers have a strong relation with NGOs working area.

There are only 42 commercial/growth centers (used primarily by farmers for selling surplus production to local customers and local traders) and 30 NGOs (175 branches) working in the study sites. Majority of growth centers are located in the upper part of Jamuna River where NGOs loans providing facilities are higher than the middle and lower part of Jamuna River (Fig. 3a). There are 15 growth/commercial centers and 102 branches of NGOs located in the upper stream of Jamuna River, whereas 8 centers lie in the middle part and 24 branches of NGOs work for the economic improvement of the rural poor. Furthermore, there are rest of 19 growth/commercial centers and 49 branches of NGOs located in the lower stream of Jamuna River (Fig. 3a).

The distribution of loans (more than TK 10 million per MFI) is higher in Kuri-gram district than any other districts along the river Jamuna, Bangladesh. This might occur due to the number of commercial centers is higher in the upper part of Jamuna River, where rural people have good opportunities to invest in the profitable sectors. The loans distribution between TK 5 million to 10 million of NGOs are found in the lower part of Jamuna (Sirajganj districts), whereas in the middle part of Jamuna, distribution of loan is lower (less than 5 million per MFI). The reason is, in the middle part, number of commercial centers and NGOs are lower in number.

On the contrary, NGOs working area is very strongly related to population density, where NGOs have initiated micro-credit facilities, not only due to business purpose, but also they have involved local people to profit-making economic activities. Figure 3b shows that where population density is higher, NGOs concentration is more. For example, in the upper part (Kurigram district) and the lower part (Sirajganj district) of Jamuna River population density is 1182 to 4235 per sq km, whereas there are 102 and 49 branches of NGOs, respectively. Besides that, in the middle part of Jamuna River population density is 202 to 486 per sq km with a lower number of NGOs as shown in Fig. 3b. In conclusion, distribution of commercial centers, NGOs working area, and population density are strongly related to each other in the study sites.

4.4 Socioeconomic characteristics of households

In this section, socioeconomic attributes of the households interviewed during household survey are presented. Socioeconomic attributes include age, sex, number of family members, educational status, housing condition, purpose of getting loan, occupational status before and after receiving credit, monthly income before and

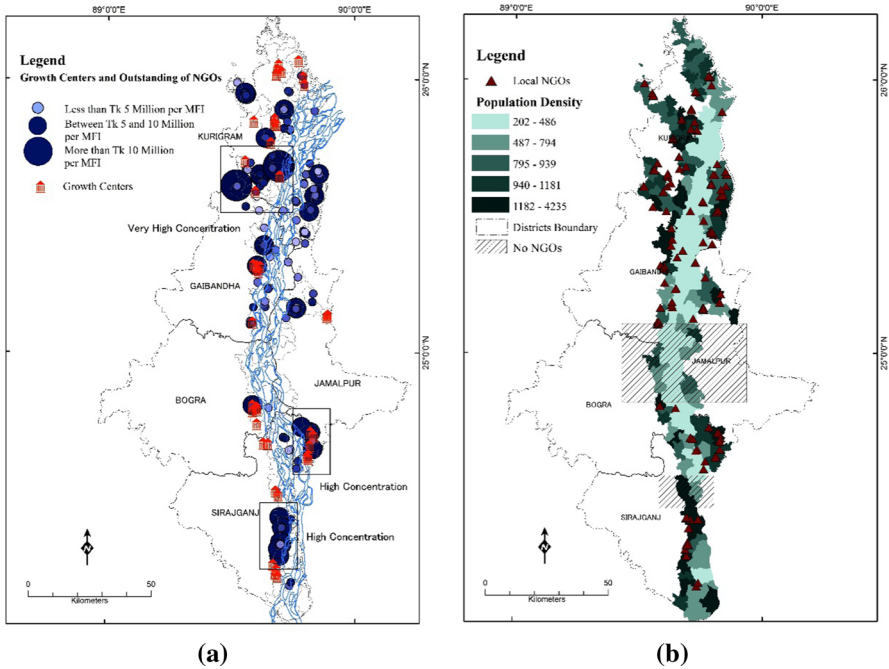


Fig. 3 (a, b) (a) NGOs working area's linkage with growth centers and (b) NGOs spatial distribution with population density, 2017 along the river side of Jamuna, Bangladesh. Source: Bangladesh Bureau of Statistics (BBS), Center for Environmental and Geographic Information Services (CEGIS) and field survey, 2017

after receiving credit, current economic status and facing problems in payment of installment.

Results reveal that slightly more than half of the sampled respondents (56.1%) were below or equal to 25 and 36.4% of the respondents were female, whereas the male respondents were 63.6%, both participating in farming activities. Household size was relatively large, i.e., 7 to 9 persons per household. Most of the survey respondents (58.9%) had 5 years of schooling, which might happen due to the relatively difficult access to schools in the rural areas and poverty. Around 78% of them had non-cemented houses with bad condition and very facilities available such as latrine, bathroom, and other necessary facilities.

Most of the respondents (38.8%) were getting loan for buying agricultural tools. There are 18.0% respondents having access to loan for buying cattle and rest of 15.8, 17.6, 3.6, 1.5 and 4.7% respondents were getting loan for business, kitchen gardening, house loan, gardening and poultry farm business, respectively. Among the respondents, most of them (40.2%) were involved in agricultural activities before receiving credit but after involvement to NGOs credit program; the number of agri-workers had decreased to 38.8%. The percentages of housewife had decreased from 36.4 to 31.3% after getting loan with NGOs credit program. Among the respondents, business persons were increased from 11.4 to 18.0% after getting loans from the NGOs. Before joining micro-credit program initiated by NGOs, majority of the

respondents (89.9%) were in the low-income group (less or equal to 63 USD/month), but joining the micro-credit program, low-income group decreased intensely to 41.3% by benefiting from micro-credit program. The economic condition of locals has also significantly improved after joining those programs as shown in Fig. 4.

4.5 Significant assets of the rural poor before and after involvement to micro-credit

Luxurious household assets in the perspective of rural Bangladesh include electricity, *pakka* toilet, sources of drinking water like tube well, television, radio, bicycle, fan, boat and agricultural tools. After involvement with local NGOs credit program, they capitalized money in different income generating activities like doing business, working in agricultural sectors, kitchen gardening and poultry farming business and improved their economic condition.

Before involvement with local NGOs credit program, there were 98.9% respondents unable to connect with electricity facilities. But after involvement with NGOs credit program, electricity non-consumers' percentage decreased to 72.2%. Different types of toilet users are found before and after joining the NGOs credit program. Figure 4 shows that after involvement with credit program, percentage of *pakka* toilet (metaled toilet) users increased from before. It shows that before involvement with local NGOs credit program, there were only 6.2% respondents who had *pakka* toilet before involvement with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 33.8% of the total respondents. Similarly, after involvement with credit program, percentage of tube-well users significantly increased from 2.3% to 41.3%. There were 98.7% respondents who had no television. But after involvement with NGOs credit program, number of people having television increased from 1.3% to 15.9%. Similarly increasing trends were observed in the case of owning radio, bicycle, and personal boat after joining NGOs credit

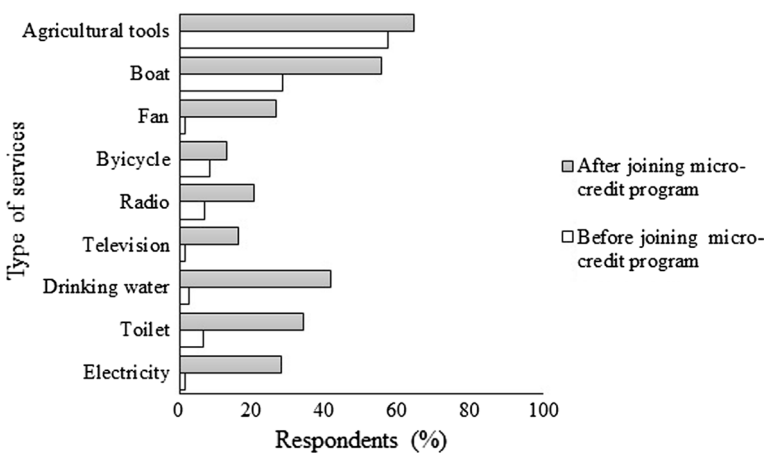


Fig. 4 Significant assets of the respondents before and after involvement with micro-credit program along the riverside of Jamuna, Bangladesh, 2017

programs. This clearly shows that the socioeconomic condition of rural inhabitants in our study area has significantly improved after joining such credit programs.

The *t*-test result revealed that the uses of assets increased significantly. The *t*-test performed that the use of television, electricity, agricultural tools, electric fan and bicycles was statistically significant ($p < 0.05$) variables after joining micro-credit program.

4.6 Correlation results of income and selected eight dependent variables

This section presents a correlation analysis performed to show how the selected dependent variables correlate with farmer's annual income (independent variable). Eight dependent variables were selected for this analysis including solar panel electricity, cemented toilet, tube-well water, television, radio, bicycle, electric fan and wooden boat.

The correlation analysis presented in Table 2 shows that the correlation of coefficient for solar panel electricity (r) equals to 0.763, indicating a significant relationship between solar panel electricity and their income ($r = 0.763$, $p < 0.001$). Lack of access to electricity services is one of the reasons for poverty and minimal growth in economic development. This might happen, because people with higher incomes tend to buy a solar panel for getting services from modern assets like television and electric fan. By using those assets, they want to improve their daily lifestyle as well as increase social status among the rural community.

In the rural areas, low-income householders cannot afford the cost for making latrines (cement, rod, and brick chips). The correlation coefficient is for making latrines equals to 0.519, indicating a significant relationship between increase of income and cemented toilet. As a result of joining NGOs credit program, their income and awareness regarding clean environmental conditions, sanitation has improved. Besides that, there were also positive and significant correlations between the number of luxurious assets such as tube-well water, television, radio, bicycle, electric fan and wooden boat with an increment in annual income and their correlation of coefficient (r) equals to 0.250, 0.773, 0.192, 0.507, 0.673 and 0.571, respectively. Finally, results of correlation coefficient show that access to micro-credit facilities, provision of livestock and agricultural loans made farmers able to improve profit from farming as well as improve their social status within the community by using luxurious assets.

5 Discussion

This research studied NGOs micro-credit programs and its contribution to poverty alleviation in the rural areas of Bangladesh. Because microfinance program had positive impacts on the status of rural poor people by generating higher volume of cash in the household, making program on formal and non-formal education with food, greater participation in making of major expenditure decisions and savings, ability to earn more income by using NGOs credit, greater role in business decision making,

Table 2 Correlation results of income and selected eight dependent variables

	TNP	THH	<i>p</i> value	<i>df</i>	Coefficient (r)
INC and SPE					
Pearson correlation					
Sig. (2-tailed)	3,406,272	828,183	0.000	1	0.763**
INC and CT					
Pearson correlation					
Sig. (2-tailed)	3,406,272	828,183	0.000	1	0.519**
INC and TW					
Pearson correlation					
Sig. (2-tailed)	3,406,272	828,183	0.005	1	0.250**
INC and TV					
Pearson correlation					
Sig. (2-tailed)	3,406,272	828,183	0.000	1	0.773**
INC and RD					
Pearson correlation					
Sig. (2-tailed)	3,406,272	828,183	0.031	1	0.192**
INC and BICY					
Pearson correlation					
Sig. (2-tailed)	3,406,272	828,183	0.000	1	0.507**
INC and EF					
Pearson correlation					
Sig. (2-tailed)	3,406,272	828,183	0.000	1	0.673**
INC and WB					
Pearson correlation					
Sig. (2-tailed)	3,406,272	828,183	0.000	1	0.571**

Source: Interview with local people of 126 unions (focused group discussions and interviews with 175 branches of 30 NGOs)

** Correlation is significant at the 0.01 level (2-tailed)

* *INC* income, *SPE* solar panel electricity, *THH* total household, *CT* cemented toilet, *TW* tube-well water, *TV* television, *RD* radio, *BICY* bicycle, *EF* electric fan, *WB* wooden boat, *TNP* total number of population

gaining more skills and increasing their network of friends and support system, and increased gaining of assets (ADB 2013). Moreover, the other countries, like, Nepal, India, Vietnam, China and the Philippines have commissioned for an assessment of MFIs, explaining the benefits of the microcredit program provided by NGOs such as better food security and nutrition, housing and health, school enrolment for children and adults, higher levels of literacy, food for school going children, women empowerment and mobility, emphasis higher average household income, building of human capital and assets and community participation, self-employment and employment of family members (Bedson 2009). Davis (2006) highlighted the important contributions of NGOs for the development of Bangladesh in the sectors of global poverty and sustainable solutions. The previous studies focused on the contribution sectors

but ignored the spatial distribution of NGOs. The importance and value of spatial analysis is to provide the equal service to rural poor in each region along the Jamuna River. This study performed a spatial analysis to identify areas where NGOs have initiated micro-credit programs along with the areas where such NGOs need to shift their focus for the same purpose. Micro-credit program has helped rural poor people to improve the socioeconomic status in the study area. Majority of the respondents had improved their poverty situation by proper utilization of the supports they got from NGOs credit programs. It indicates that there is a positive relationship between access to micro-credit and poverty reduction. On the contrary, there are some important causes for dropout of rural poor from local NGOs including high-interest rate, higher repayments of installment, difficulty in getting a large amount of loan, and poor management of loan system. Still, there are many rural poor who were not interested to get involved in the process of NGOs credit, while many local NGOs are operating credit services at their doorsteps. Further study should be conducted to identify more sectors where NGOs can provide loan and to find out the way how to minimize the amount of interest.

The geospatial analysis results showed that the distribution of local NGOs is not equal in the study sites. The NGOs attributes like savers, borrowers, saving deposits and their total loan outstandings indicate the strengths and weaknesses of the NGOs. From the point of view of NGOs' strength, the middle part of Jamuna River is the most unprivileged area in the study sites. Furthermore, NGOs working area is linked with growth/commercial centers and population density. It indicates that, where the number of growth center or commercial centers and population density are higher, NGOs activities are also higher those areas. Besides that, correlation results of income and selected eight dependent variables (solar panel electricity, cemented toilet, tube-well water, television, radio, bicycle, electric fan and wooden boat) have positive relations.

6 Conclusion

This paper suggests some strategic recommendations. The equal distribution of local NGOs and upsurge in income through proper utilization of micro-credit as well as appropriate monitoring system needs to be established among the microfinance institute in the study sites. Though the NGOs once established, it could not stay for a long time because of the erosional activities of the river dominated areas. Consequently, the NGOs couldn't establish permanently and disappeared after a certain period and the rural poor didn't get the facilities always which triggers the limitations of this study. This research assists the NGOs to find out the geospatial gaps of the NGOs locations and to establish new NGOs branch on the required area according to the findings of this research. Therefore, the main contribution of this research is to provide the geospatial information of presence and absence of NGOs in the riverside of Jamuna which was ignored by the previous research. This research could be helpful to find out the gaps of NGOs working area to ensure proper credit facilities in the other region of Bangladesh. The geospatial analysis and the subsequent

findings of this study are new technique in the research sector which can be used by other researcher, academics, and policy makers across the globe.

Acknowledgements We would like to thank the local community along the river Jamuna who gave their precious time for interviews, the Bangladesh Bureau of Statistics (BBS) and local NGOs in the study area. We are also thankful to the research promotion office of the graduate school of letters, Hokkaido University for providing funds to successfully conduct this study. We especially want to thank students from the Department of Geography and Environment, Jahangirnagar University, Bangladesh, for their endless efforts to successfully collect data.

Authors' contributions MTH, SS, WU, and TN designed the study; MTH performed data collection; MTH, SS and WU analyzed the data; MTH, SS, WU and TN wrote manuscript.

Funding No funding was received from any organizations.

Compliance with ethical standards

Conflict of Interest The authors declare no conflict of interest.

Ethical statement This study was endorsed by the department of Regional Sciences in the Graduate School of Letters, Hokkaido University, Japan, with all the necessary authorizations needed for research. All subjects gave their informed consent for inclusion before they participated in the study. There is no ethics committee in Hokkaido University to approve questionnaires. However, doctoral course supervisor has approved the questionnaire for field survey. The study does not involve any experiment on humans and animals. A verbal consent was given by the university as well as the NGOs and the local community to conduct our research. Prior to the start of the research activities, the project and team leader visited the study area. We explained research activities and its purpose and later, verbally asked the villagers for their agreement to those activities. At the beginning of each fieldwork, we again held a community meeting with the villagers to introduce our research team, study objectives and to ask the community for permission to start our research activities. In these meetings, we explained the whole agenda of our visit. We explained the scope of each activity. Prior to starting each focused group discussion, key informant interview and household survey, we re-explained to the participants the aim of the activity, how they were selected, voice recordings and how we were going to use the data we collect. All participants were asked to give their verbal consent before we proceed with the interview. We also collected personal and demographic information from participants, but it is only used for academic purpose in this study.

References

- Adam AM (2010) Financial openness induced growth and poverty reduction. *Int J Appl Econ Finance* 5:75–86. <https://doi.org/10.3923/ijaef.2011.75.86>
- ADB (2013) Asian development bank funded by the Japan fund for poverty reduction technical assistance consultant's report final report, Annex E river and char land morphology and river Engineering, December 2013
- Ahlin C, Jiang N (2008) Can microcredit bring development? *J Dev Econ* 86(2008):1–21. <https://doi.org/10.1016/j.jdeveco.2007.08.002>
- Amin R, Becker S, Bayes A (1998) NGO-promoted microcredit programs and women's empowerment in rural Bangladesh: quantitative and qualitative evidence. *J Dev Areas* 32(2):221–236. <https://doi.org/10.2307/4192755>
- Arndt C, Dorosh P, Fontana M, Zohir S, El-Said M, Lungren C (2002) Opportunities and challenges in agriculture and garments: a general equilibrium analysis of the Bangladesh economy. Trade and macroeconomics Discussion Paper No. 107. IFPRI, Washington, DC. <https://pdfs.semanticscholar.org/a0fe/85140c54f07ad26e1b3783889fe3c0c6f133.pdf>

- Banerjee A, Karlan D, Zinman J (2015) Six randomized evaluations of microcredit: introduction and further steps. *Am Econ J Appl Econ* 7(1):1–21. <https://doi.org/10.1257/app.20140287>
- Bangladesh Ministry of Finance (2014) Bangladesh economic review, Dhaka, Bangladesh. https://www.mof.gov.bd/en/index.php?option=com_content&view=article&id=304&Itemid=1
- Bansal D (2011) Impact of microfinance on poverty, employment and women empowerment in rural Punjab. Doctoral dissertation, Department of Economics, Punjabi University, Patiala, India. <http://hdl.handle.net/10603/3031>
- Bauer A, Hasan R, Magsombol R, Wan G (2008) The world bank new poverty data: implications for the Asian development bank. Sustainable development working Paper Series No. 2. Asian Development Bank. <http://www.adb.org/Documents/Presntations/New-Poverty-Estimates/PovertyData-Implications.pdf>
- Bayes A, Patwary FK (2012) An empirical analysis of the impact of agricultural credit from banks and microfinance institutions (MFIs) in GDP growth: Bangladesh perspective, Bangladesh Bank Working Paper. <https://www.bangladesh-bank.org/recentupcoming/news/jul162012newse.pdf>
- BBS (2010) Statistical year book of Bangladesh. Bangladesh bureau of statistics, Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka. <http://203.112.218.65:8008/WebTestApplication/userfiles/Image/SubjectMatterDataIndex/YB-2012.pdf>
- BBS (2012) Statistical year book of Bangladesh. Bangladesh bureau of statistics, Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka. <http://203.112.218.65:8008/WebTestApplication/userfiles/Image/SubjectMatterDataIndex/YB-2012.pdf>
- Bedson J (2009) Microfinance in Asia-trends, challenges and opportunities, 1st ed. Queensland, Australia. The foundation for development cooperation. http://arcfinance.org/pdfs/pubs/MF_Trends_Challenges_Opportunities.pdf
- Begum SF, Zaman SH, Khan MS (2004) Role of NGOs in rural poverty eradication: a Bangladesh observation. *BRAC Univ J* 1(1):13–22. <http://dspace.bracu.ac.bd/xmlui/handle/10361/483>
- BRAC (Bangladesh Rural Advancement Committee) (1990a) Half yearly report, June 1990, Dhaka, Bangladesh
- CARE (2000) CARE Bangladesh ANR sector: a report on participatory poverty assessment. CARE-Bangladesh April–May 2000, Dhaka
- CGAP (2004a) Building inclusive financial systems. Donor guidelines on good practice in microfinance, December. Washington, DC: Consultative Group to Assist the Poorest
- Chowdhury M, Mosley P, Simaowitz A (2004) The social impact of microfinance. *J Int Dev* 16(3):291–300. <https://doi.org/10.1002/jid.1087>
- Copstake J (2007) Mainstreaming microfinance: social performance management or mission drift? *World Dev* 35(10):1721–1738. <https://doi.org/10.1016/j.worlddev.2007.06.004>
- Copstake J, Dawson P, Fanning JP, Mckay A, Wright-Revollo K (2005) Monitoring the diversity of the poverty outreach and impact of microfinance: a comparison of methods using data from Peru. *Dev Policy Rev* 23(6):703–723. <https://doi.org/10.1111/j.1467-7679.2005.00309.x>
- Davis JK (2006) NGOs and development in Bangladesh: making poverty history or making poverty business? Anti Poverty Week Conference Global Poverty Sustainable Solutions. Murdoch University. https://www.researchgate.net/publication/236160476_NGOs_and_Development_in_Bangladesh_Making_poverty_history_or_making_poverty_business
- Extreme poverty policies of donors in Bangladesh: an overview (2007). http://www.extreme-poverty.org/files/Shiree_Donor_Policy.pdf
- Fisher WF (1997) Doing good ? the politics and antipolitics of NGO practices. *Annu Rev Anthropol J* 26(1997):439–464. <https://doi.org/10.1146/annurev.anthro.26.1.439>
- Fruttero A, Gauri V (2005) The strategic choices of NGOs: location decisions in rural Bangladesh. *J Dev Stud* 41(5):759–787. <https://doi.org/10.1080/00220380500145289>
- Glazer S (2010) Evaluating microfinance: do small loans for poor entrepreneurs help end poverty? *Glob Res* 4(4):81–101. <http://www.interestjournals.org/full-articles/impact-of-micro-credit-on-the-livelihood-of-borrowers-evidence-from-mekelle-city-ethiopia.pdf?view=inline>
- GoB (Government of the People's Republic of Bangladesh) (1993) National Housing Policy. Ministry of Housing and Public Works, Dhaka
- GoB (Government of the People's Republic of Bangladesh) (1998) The Fifth Five Years Plan, 1997–2002. Planning Commission, Ministry of Planning, Dhaka

- Godquin M (2004) Microfinance repayment performance in Bangladesh: how to improve the allocation of loans by MFIs. *J World Dev* 32(11):1909–1926. <https://doi.org/10.1016/j.worlddev.2004.05.011>
- Grogan PF, Lalnunmawia SK, Tripathi (2012) Shifting cultivation in steeply sloped regions: a review of management options and research priorities for Mizoram state, Northeast India. *Agroforest Sys* 84(2):163–177
- Goetz A, Sengupta R (1996) Who takes the credit? gender, power, and control over loan use in rural credit programs in Bangladesh. *World Dev* 24(1):45–63. [https://doi.org/10.1016/0305-750X\(95\)00124-U](https://doi.org/10.1016/0305-750X(95)00124-U)
- Haque S, Masahiro Y (2009) NGOs MFIs members impact assessment survey. *Int J Bus Econ Finance Manag Sci* 1(1):2009
- Hasan FRM (1985) Process in landless mobilization in Bangladesh: theory and practice. Bangladesh Institute of Development Studies, Dhaka, p 1985
- Hasan M (1991) A land development policy for low income housing in Dhaka metropolitan area. Unpublished MURP Thesis, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh
- Hasan M (1998) Spatial setting of manufacturing activities in the metropolitan cities of developing countries. The example of Dhaka, Bangladesh. Unpublished Ph.D. dissertation, Oxford, Oxford Brookes University.
- Hashemi SM, Schuler SR (1993) Delining and studying empowerment: a research note from Bangladesh, JSI Working Paper No. 3, John Snow Research and Training Institute, Arlington
- Hashemi SM, Schuler SR, et al. (1996) Rural credit programs and women's empowerment in Bangladesh. *World Dev* 24(4):635–653. http://siteresources.worldbank.org/INTEMPowerment/Resources/13314_hashemi_et_al.pdf
- Hossain M (1988) Credit for alleviation of rural poverty: the Grameen bank in Bangladesh, Research Report No. 65. International Food Policy Research Institute, in Collaboration with the Bangladesh Institute of Development Studies, Washington
- Hye MAQ, Islam F (2012) Does financial development hamper economic growth: empirical evidence from Bangladesh? *J Bus Econ Manag* 14(3):558–582. <https://doi.org/10.3846/16111699.2012.654813>
- IMF (2018) International Monetary Fund. World economic outlook. www.imf.org
- Jehangir WA, Ashfaq M, Ali A, Sarwar N (2002) Use of credit for poverty reduction by small farmers. *J Appl Sci*. 2:777–780. <https://doi.org/10.3923/jas.2002.777.780>
- Li X, Gan C, Hu B (2011) The impact of microcredit on women's empowerment: evidence from China. *J Chin Econ Bus Stud* 9(3):239–261
- Mahjabeen R (2008) Microfinancing in Bangladesh: impact on households, consumption and welfare. *J Policy Model* 30(2008):1083–1092. <https://doi.org/10.1016/j.jpolmod.2007.12.007>
- Khatun MA, Islam MA (2013) Majumder S (2013) Why some poor women in Bangladesh do not opt for micro-credit? *J Bangladesh Agricultural Univ* 11(2):285–292 (ISSN 1810-3030)
- Mandelbaum DG (1988) Women's seclusion and men's honor: sex roles in North India Bangladesh and Pakistan. University of Arizona Press, Tucson, p 1988
- Mason KO (1987) The impact of women's social position on fertility in developing countries. *Soc Forum J Eastern Soc* 2(4):718–745. <https://doi.org/10.1007/BF01124382>
- Mazumder MSU, Wencong L (2013) Micro-credit and poverty reduction: a case of Bangladesh. *Prague Econ Papers*. <https://doi.org/10.18267/j.pep.459>
- Mokhtar SH (2011) Microfinance performance in Malaysia. Doctoral dissertation, Lincoln University
- Morduch J (1999) The microfinance promise. *J Econ Lit* 37:1569–1614. https://wagner.nyu.edu/files/faculty/publications/1999-12Microfinance_Promise.pdf
- Murdoch J, Haley B (2002) Analysis of the effects of microfinance on poverty reduction. NYU Wagner Working Paper No. 1014. www.nyu.edu/wagner/publichtml/cgibin/workingPapers/wp1014.pdf
- Nilanjana B (2013) After much heartbreak, some good news at last for Bangladesh. *Time*. ISSN 0040-781X
- Pitt M, Khandker SR (1998) The impact of group-based credit programs on poor households in Bangladesh: does the gender of participants matter? *J Political Econ* 106(9):958–996. http://www1.worldbank.org/prem/poverty/ie/dime_papers/411.pdf
- Proshika (1999) Proshika's impact assessment study 1998–99. Dhaka, Proshika
- Rahman A (1986) Consciousness raising efforts of Grameen Bank, Grameen bank evaluation project Working Paper No. 3. Bangladesh Institute of Development Studies, Agriculture and Rural Development Division, Dhaka
- Rahman A (1986) Organizing the unorganized rural poor: Bangladesh field notes. Unpublished manuscript. Nijera Kori, Dhaka

- Rahman MH (2004) Financial development economic growth nexus: a case study of Bangladesh. *Bangladesh Dev Stud* 30:113–120. <http://www.jstor.org/stable/40795696>
- Rahman KMM (2011) Poverty and inequality in Bangladesh. Unnayan Onneshan Policy Brief. Dhaka, Bangladesh. http://www.unnayan.org/documents/RightsParticipation/policy_brief_poverty_inequality.pdf
- Rahman A, Hossain SM (1986) Impact of Grameen Bank operations on the level, composition and distribution of income and expenditure of the rural poor, Grameen Bank Evaluation Project Working Paper No. 5. Dhti Bangladesh Institute of Development Studies, Agriculture and Rural Development Division
- Rahman S, Mallik G, Raja PN (2003) Micro-credit programs and consumption behavior: are the borrowers better off? evidence from Bangladesh. https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=ESAM07&paper_id=213
- Raihan S (2014) Updating the social accounting matrix (SAM) of Bangladesh, India, Nepal, Pakistan and Sri Lanka for the Year 2012. Paper Prepared for UNESCAP Sub Regional Office for South and South–West Asia, New Delhi
- Raihan S, Osmani SR, Khalily MAB (2017) The macro impact of microfinance in Bangladesh: A CGE analysis. *Econ Model* 62:1–15. <https://doi.org/10.1016/j.econmod.2017.01.002>
- Rashid S, Bashar T (2010) Urban microfinance in Bangladesh Report Commissioned by the Institute of Microfinance, Dhaka
- Rashid S, Yoon Y, Kashem SB (2011) Assessing the potential impact of microfinance with agent-based modeling. *Econ Model*. 28:1907–1913. <https://doi.org/10.1016/j.econmod.2011.03.020>
- Ray JK (1987) To chase a miracle: a study of the grameen bank of Bangladesh. The University Press Limited, Dhaka, p 1987
- Revindo MD, Gan C (2017) Accessibility and impact of rural credit cooperatives microcredit programmes to rural households: a case study from Hubei Province, China. World Scientific Book, Singapore, 319–336.
- Schuler SR, Hashemi SM (1994) Credit programs, women's empowerment and contraceptive use in rural Bangladesh. *Stud Family Plan*. 25(2):65–76. <https://doi.org/10.2307/2138085>
- Simmons R, Baqee L, Koenig MA, Phillips JF (1988) Beyond supply: the importance of female family planning workers in rural Bangladesh. *Stud Fam Plann* 19(1):29–38. <https://doi.org/10.2307/1966737>
- Swope T (2005) Microfinance and poverty alleviation. Dissertation paper. www.rollins.edu/olin/rurj/mpa.pdf
- The Role of Micro-Credit in Poverty Alleviation (2009) The financial express. <http://www.thefinancialexpress-bd.com/2009/06/07/68933.html>
- The World Bank Report (2016) Dynamics of rural growth in Bangladesh: sustaining poverty reduction, Report Number 103244-BD. <http://documents.worldbank.org/curated/en/951091468198235153/Dynamics-of-rural-growth-in-Bangladesh-sustaining-poverty-reduction>
- Uddin GS, Kyophilavong P, Sydee N (2012) The causal nexus between financial sector development and poverty reduction in Bangladesh. *Int J Econ Financ Issues* 2:304–311. <https://econjournals.com/index.php/ijefi/article/viewFile/221/pdf>
- Uddin GS, Shahbaz M, Arouri M, Teulon F (2014) Financial development and poverty reduction nexus: a co-integration and causality analysis in Bangladesh. *Econ Model* 36(2014):405–412. <https://doi.org/10.1016/j.econmod.2013.09.049>
- United Nations (2005) Microfinance and microcredit: how can \$100 change an economy?. Web Document, Year of Microcredit
- Wahid ANM (1993) The grameen bank: poverty relief in Bangladesh (Boulder. Westview Press, CO, p 1993
- White SC (1992) Arguing with the crocodile: gender and class in Bangladesh. Zed Books Ltd, London, p 1992
- Yunus M (2004) Expanding microcredit outreach to reach the millennium development goals: some issues for attention. In: Ahmed S, Hakim MA (eds) *Attacking poverty with microcredit*, 2nd ed. The University Press Limited, Dhaka, pp 7–22. <https://pdfs.semanticscholar.org/1146/4763791439366492dd458dcd6b975edb0544.pdf>
- Zohir S, Mahmud S, Sen B, Asaduzzaman M, Islam J, Ahmed N, Mamun AA (2001) Monitoring and evaluation of microfinance Final report. (Mimeo) Institutions, Bangladesh Institute of Development Studies (BIDS), Dhaka