Quest Journal of Management and Social Sciences
Volume 6 Issue 1: 96-106
ISSN Print: 2705-4527
ISSN Online: 2705-4535
Web: https://www.quest.edu.np

Bridging Climate Resilience and Financial Inclusion: The Role of Digital Financial Products in Flood-Affected Communities of North Bengal, Bangladesh

Md Rubel Mia[1], Chad David Anderson, PhD[1], Al Mahmud[2], Iman Ali Dewan[3] & Md Jahirul Islam[4]*

[1]Public Administration, Incheon National University, Academy-ro 119, Songdo-dong (12-1) Incheon 22012, Republic of Korea
[2]School of Historical Studies, Nalanda University, India
[3]School of Ecology and Environment Studies, Nalanda University, India
[4]Government of the People's Republic of Bangladesh
[*]Corresponding Email: mohammad.rubelk23@gmail.com

Received: 27 February 2025
Revised: 26 May 2025
Accepted: 04 June 2025
Published: 30 June 2025

How to cite this paper:
Mia, M. R., Anderson, C. D., Mahmud, A., Dewan, I. A., & Islam, M. J. (2025). Bridging Climate Resilience and Financial Inclusion: The Role of Digital Financial Products in Flood-Affected Communities of North Bengal, Bangladesh. *Quest Journal of Management and Social Sciences, 7*(1),96-106. https://doi.org/10.3126/qjmss.v7i1.82012

Abstract

Background: Climate change has exacerbated the frequency and severity of flooding in Bangladesh, particularly in the North Bengal regions of Bogura and Kurigram. These floods disrupt livelihoods, exacerbate poverty, and pose long-term recovery challenges. Digital Financial Products (DFPs), such as mobile banking, micro-insurance, and mobile-based credit, are important facilitators of climate adaptation among the people suffering from the floods. The role of DFPs in improving financial inclusion and climate resilience in these vulnerable communities.

Purpose: This study aims to assess the role and potential of DFPs in enhancing climate resilience among flood-affected communities to economic stability, disaster preparedness, and post-disaster recovery and improve financial inclusion in flood-prone areas.

Methods: A purposive qualitative participatory rural appraisal (PRA) approach was employed using focus group discussions (FGDs), in-depth interviews (IDIs) and key informant interviews (KIIs) with stakeholders, including affected community members, local government officials, NGO representatives, and digital financial service providers. The study focuses on two flood-prone Upazilas: Sariakandi in Bogura and Nageshwari in Kurigram.

Findings: The study reveals that people in the affected area are familiar with mobile banking, which ensures rapid and secure financial transactions, facilitating immediate access to remittances and emergency funds during crises. Benefits include receiving financial aid, immediate access to funds, lower-cost financial services, and reduction of risks. However, barriers such as the cost of maintaining reliable mobile service access, lack of digital literacy, lack of trust due to security concerns, and inadequate infrastructure hinder the widespread adoption of DFPs in flood-prone areas for climate resilience. These factors have led to a widespread recognition of DFP's potential but underutilisation in practice.

Conclusion: While the benefits are consistent with the literature, they need further study as actual users were more concerned with aid and immediate access, non-users with lower costs, over the more common benefit in the literature of reduced risk. The potential of DFPs remains unrealised in rural Bangladesh due to several barriers that can be addressed by financial institutions, policymakers, and development agencies through education and digital literacy training, design of inclusive services, infrastructure expansion, and public support and use of DFPs that cater to the specific needs of vulnerable communities, thereby fostering sustainable climate resilience in North Bengal.

Keywords: Digital Financial Products, Climate Change, Flood, Financial Inclusion, Bogura, Kurigram, Bangladesh.

JEL Codes: O16, Q54, G21, D14

Introduction

Climate change has caused many natural disasters worldwide, including erratic rainfall patterns, increased frequency of flash floods, rising sea levels, and melting glaciers. Growing evidence indicates climate change will increase flood hazards (Hirabayashi et al., 2013). Bangladesh remains one of the most vulnerable countries to climate change, facing severe and escalating climate risks. The European Commission has determined that Bangladesh is one of the most disaster-prone countries in the world due to its geography and population density.

Bangladesh is in a delta region with tributaries flowing into the Bay of Bengal, and the nation experiences severe flooding yearly during the monsoon season from March to September. The major rivers, Brahmaputra, Ganges, Padma, Jamuna, Surma, Teesta, and Buriganga and their tributaries are flooded during the monsoon season by Himalayan glaciers and rains with a high water flow (Major Rivers Of Bangladesh, 2017). Every year, there are expected to be worse floods than before, and the international community is raising concerns about the flood situation in Bangladesh (Rahman et al., 2024). Bangladesh ranks second in the top 15 countries at high flood risk (Verwey et al., 2017). Moreover, Bangladesh experienced particularly massive and destructive floods in 1988, 1991, 1998, and 2022.

The flood-prone area in the country increased by 18% after the 1998 floods, and 34 cities in the eastern and central regions were categorised as at risk of flooding since 2009 (Kabir et al., 2021). Many areas have been badly affected, and the impact on agricultural land affects the livelihood of many people. An average of about 1094 billion cubic meters of water flows through Bangladesh every year, and about 1.5 million hectares of agricultural land are affected by floods (Climate Change Cell, 2009). An estimated 216 million people could be displaced by 2050 floods exacerbated by climate change (Shalal, 2021).

The North Bengal area in Bangladesh frequently experiences severe flooding, leading to devastation of livelihoods, disruption of agricultural activities, and exacerbation of poverty. The incorporation of digital financial services, such as mobile banking, micro-insurance, and digital credit, is a means to provide vulnerable groups in affected areas with crucial financial resources and support systems for enduring and recovering from climate-induced challenges. Digital financial products have become an instrument for bolstering climate resilience for communities affected by floods in Bangladesh.

According to the existing literature, more work must be done in this field. The application of digital financial services has been weakly studied in disaster relief and climate resilience, and coverage of its application in Bangladesh and the most vulnerable countries. This study aims to contribute to improving the understanding of the use of digital financial services in these vital contexts. The objective of this study is to assess the impact of digital financial products on enhancing climate resilience among flood-affected communities in North Bengal, analysing the effectiveness of various digital financial solutions, such as mobile banking, micro-insurance, and digital savings platforms, in providing timely financial support and resources to vulnerable populations facing recurrent flooding events. Additionally, the study seeks to identify the barriers to adopting these digital tools and explore the potential for integrating climate risk assessments into financial products to better address the specific needs of affected individuals and households.

Flooding in Bangladesh

Natural disasters involve floods, droughts, earthquakes, heat waves, landslides, tropical cyclones, volcanic activity, and wildfires and are impacted and exacerbated by climate change and, as a result, vulnerable communities are affected (Banholzer et al. 2014). As noted above, flooding has intensified, worsened, and become less predictable following climate change, and Bangladesh is particularly prone to these effects. Millions of people are badly affected by the severe flooding across the country, particularly in northern Bangladesh (Pandey, 2017). Poor people are especially vulnerable to disasters such as flooding since they face not only the immediate risk of drowning, snakebite, and diarrhoea, but also the possibility of losing their livelihoods as well. Apart from that, flooding can have devastating effects on poor communities,

exacerbating existing vulnerabilities and creating new challenges such as loss of shelter, health risks, food insecurity, increasing vulnerabilities to exploitation and psychological impacts. Because of these underlying vulnerabilities, river flooding has devastating consequences in Northern Bangladesh, especially in Bogura and Kurigram.

Bogura District is prone to frequent flooding, which is characterised by varying intensities annually. This recurring issue significantly impacts the region's development, with heavy rains often leading to substantial flooding. Severe flooding in Bogura affects millions of people who lose their livelihood, damaging homes and infrastructure. The district's geographical and climatic conditions make it particularly vulnerable to these floods, which disrupt daily life and pose serious challenges to the affected populations of Bogura District.

Bogura District has a tropical climate with heavy rainfall in the monsoon season, lasting from late June to October. Bogura is on the banks of Karotoya, and the Jamuna River, the largest tributary of the Ganges, also runs through the district, making it one of the most flood-prone districts in Bangladesh. Enormous floods inundate homes, farmlands, and other physical infrastructure during the monsoon season.

Kurigram District is also located in northern Bangladesh. Flooding is an annual phenomenon in the Kurigram District due to geography, as in Bogura. The maximum floods occur in July and August. The Brahmaputra, Teesta, and Dharla rivers going through this district give rise to frequent flooding (Shahriar, S. 2020). The leading causes of flooding in Kurigram are excessive rainfall during the monsoon period, the unsmooth water flow of the Brahmaputra River (Islam, S. 2016), and riverbank decay (Shafie & Rahman, 2009), in addition to climate change significantly impacting agriculture, infrastructure, and socio-economic conditions (Shahriar, 2020). The floods come annually and have a destructive effect on Kurigram, particularly damaging agricultural land, homes, and infrastructure, and poor people are highly vulnerable (Sadiqu & Kamruzzaman, 2021).

The Kurigram District only cultivates once a year unlike the rest of Bangladesh, which manages three crops leading farmers and farm labourers to face an extreme lack of jobs due to this condition (Islam et al., 2011) and a poverty rate over 50% (Imam et al., 2020), though the district also has some small fisheries that help the local economy (Hossain et al., 2015). Bangladesh is a developing country, and poverty is a common phenomenon. The economy is vulnerable to disruptions from floods, erosion of riverbanks, and the uncontrolled water flow of rivers (Islam, 2016).

The government of Bangladesh has taken many steps to mitigate the damage during the floods. The government makes many efforts, such as supplying food, medicine, and building embedments and shelters (Islam, S. 2016). The early warning system also has a significant role in flood management preparedness (Rahman et al., 2024). An early warning system monitors risk reduction during flood time in flood-affected Bogura, Kurigram, and other parts of Bangladesh (Hasan et al., 2018).

People live mainly off agriculture in the rural flood-affected areas around Kurigram, as around Bogura (Bogura, 2024). Most workers are day labourers who earn low wages and only work seasonally. They are badly affected by floods, lose their livelihood, and easily become destitute, with almost nothing to do for a living. People affected by flooding face health problems such as cholera, typhoid or malaria as well as mental disorders (Mamun et al., 2021). During and after severe floods, many people migrate from highly active flood-prone areas to different areas of the country where they feel safe (Rana & Islam, 2015). Many migrate to cities looking for work for themselves and their children, eventually shifting to overcrowded and unsafe slums, exacerbating urban problems.

Digital Financial Services

In general, digital finance is how new technologies affect the financial services sector, including various products, applications, processes and business models that have transformed the traditional way of providing banking and financial services. More specifically, digital financial services or products are financial transactions made using a digital device or digital technologies like smartphones, the internet,

or other electronic devices (Pazarbasioglu et al., 2020; Malyshev, 2023; Rubel, 2023). Standard digital financial products include methods to electronically store and transfer funds, to make and receive payments, to borrow, save, insure and invest, and to manage a person's or enterprise's finances such as via mobile banking, e-wallets, micro insurance, and digital credit platforms (Alliance for Financial Inclusion, 2019; Rashid, 2020). The world economy is gradually becoming dependent on digital financial technology.

These digital financial products may also include mobile financial services and banking (Rubel, 2023). Much like the rapid spread of mobile technology has allowed poorer and underdeveloped areas to bypass the need for sophisticated wired telecommunications infrastructure, digital finance permits people and communities to access financial services without major developed financial institutions (World Bank, 2025). In this vein, financial services that rely on digital technologies for their smooth delivery and use by consumers are particularly attractive for poor people, providing significant financial services and promoting economic resilience through developing access to insurance, savings, and credit (Alliance for Financial Inclusion, 2019; World Bank, 2025). In sum, these products can make it easier, more economical, and more effective for consumers to obtain financial services, particularly lowering the barriers for poor communities.

Although there is a vast facility for digital financial products in poor and disadvantaged communities, digital products and services also have limitations. While digital literacy has spread with mobile technology, lacking basic financial literacy impacts digital financial services, especially among poor people in underdeveloped rural areas (Mandal & Madaan, 2021). Some risks in payment systems may be vulnerable to scams and electronic and digital interference, especially without the in-person interaction that customers may have with a physical financial institution (Burton, 2020).

Despite the disadvantages, digital finance can also give individuals access to financial resources that help them control risks, absorb shocks, and strengthen their resistance to climate change's effects, which lead to economic and social infrastructure losses through natural disasters. For instance, digitally delivered micro insurance programs can also reduce losses during disasters such as floods (Ozaki, 2016; Sheehan et al., 2023) and digital finance can reduce risks and even damage itself by storing financial resources safely away from flood damage (Sandhu & Raja, 2019) as in digital e-savings accounts (Serfiyani, 2019).

Digital financial products may play a significant role in climate resilience. They can develop more comprehensive data sharing for commercial banking systems that can be used as tools for climate resilience (He et al., 2022). Digital financial products ensure immediate access to funds during disasters and are essential for meeting the basic needs of affected individuals, such as through safe mobile banking money transfers, positively affecting disaster resilience (Pazarbasioglu et al. 2020). Saving accounts can accumulate funds and build financial buffers that enhance resilience (Churchill et al., 2023). Online platforms positively impact donor funds collection for flood-affected people (Behl et al., 2019).

This study assumes digital financial products, such as mobile banking, can be pivotal in disaster resilience, particularly in flood-affected regions like Bogura and Kurigram. These kinds of products may enable rapid disbursement of emergency funds directly to individuals' mobile wallets, ensuring they have immediate access to money when it is most needed. Swift access can save lives during disasters by providing financial services in flood-affected areas. Additionally, digital financial services may provide a safety net for affected individuals by incorporating climate risk insurance and offering payouts that help cover losses and damage, thus speeding up recovery. Digital financial services facilitate quicker economic recovery in flood-hit areas while maintaining financial stability and supporting the local economy. They also promote financial inclusion by providing banking services to people in remote and vulnerable regions who might not have access to traditional banking, thereby enhancing their financial resilience against future disasters.

Many digital financial products are available in Bangladesh. These include bKash, which provides fast, secure, and convenient money transfers and payment services via mobile phones to the people of Bangladesh, and Dutch-Bangla Bank Rocket, which provides real-time online banking. Such services provide essential services likes customer registration, cash-in (cash deposits), cash-out (cash withdrawals),

mobile top-up, person to person transfers (P2P), foreign remittances, salary disbursements, balance inquiries, bill payment and payment to merchants, micro-insurance programs, digital credit initiatives, etc. bKash and Rocket are significant digital financial products in Bangladesh (Tammi, 2022).

Methodology

The research is based on a mix of qualitative methods using participatory rural appraisal (PRA) tools. Three of the authors are trained in PRA and have conducted a total of more than twenty appraisals collectively. The only author not trained in the methodology was not involved in the data collection or direct supervision of research efforts. PRA was originally developed out of NGO aid groups' rapid rural appraisal methods for gathering immediate feedback on assistance efforts, and it has since been more widely used in broader anthropological and social science research (Campbell, 2001). The method is widely employed in Bangladesh, particularly in areas facing disasters and disaster responses. It typically includes a mix of focus group discussions (FGD), key informant interviews (KII), and in-depth interviews (IDI) of affected people, done through purposive sampling to include respondents representing key players and affected people in the area. Two district sub-units, Upazilas, that were seriously affected in the most recent flooding were selected: Sariakandi in Bogura and Nageshwari in Kurigram.

Multiple groups of men (teachers, labourers, businessmen, farmers, garment workers), women (housewives, self-employed, garment workers, small business owners), and community stakeholders (teachers, businesspeople, religious leaders, community leaders, local government members) were invited to participate in focus groups. The groups discussed how flood-affected people adopt and use digital financial products; how digital financial products could be leveraged to improve climate resilience among local flood-prone communities; and how digital financial products contribute to the economic stability and rehabilitation efforts of local flood-affected households. Purposive semi-structured key informant interviews were conducted in both Upazilas, covering the same questions. Each Upazila included interviews of one male and one female community leader or member of local government, one male and one female NGO representative, the responsible local representative of the Ministry of Social Welfare, and two representatives of local digital financial service providers (all male). Finally, purposive semi-structured in-depth interviews were conducted covering the same questions with male and female minority community members in each Upazila, along with male and female digital financial service users, and male and female non-users. Table 1 includes more details about the composition of the focus groups, key informant interviews, and in-depth interviews.

The focus groups and interviews were supplemented with observations and primary and secondary data sources.

Table 1: Summary of KIIs, IDIs and FGDs with stakeholders

Tools Techniques	Bogura	Kurigram	Total
FGD			
i. FGD with men	2 (Students, business, teacher, day labourer, farmer, potter)	2 (Teacher, labourer, business, farmer, garment worker)	4
ii. FGD with women	1 (Community leader, teacher, housewife, student, entrepreneur, craft worker)	2 (Housewife, self-employed, garment workers, small business owner)	3
iv. FGD with stakeholders	2 (Teacher, community leader, NGO representative, Digital service provider, Businessman, entrepreneur, religious leader)	3 (Teacher, business, religious leader, community leader, local government)	5

KII			
I. Local government and community leaders	1 (women), Union Parishad Member	1 (men), Chairman, Union Parishad; 1 (women), Union Parishad Member	3
ii. NGOs representatives	1 (men), TMSS	1 (men), MJSKS; 1 (women), ESDO	3
iii. Government Official	1 (men), MoSocial Welfare	1 (men), MoSocial Welfare	2
iv. Digital service provider	1 (women) Nagad, Upay, Bkash	2 (men) Bkash, Nagad, Upay	3
IDIs			
i. IDI with the minority community (Hindu, others)	1 (women)	1 (women), 1 (men)	3
ii. IDI user (Digital service)	1 (women), 1 (men)	1 (women), 1 (men)	4
iii. IDI Non-user (Digital Service)	1 (women), 1 (men)	1 (women), 1 (men)	4

The table sets out the qualitative research activities undertaken in Bogura and Kurigram. It includes focus group discussions (FGDs), key informant interviews (KIIs), and in-depth interviews (IDIs) with a range of participants. The FGDs included males, females and stakeholders from different professions. The KIIs included local government officials, NGO representatives, government officials, and digital service providers. The IDIs included in-depth interviews targeting minority communities and users and non-users of their digital services. Ultimately, the research study had 12 FGDs, 11 KIIs, and 11 IDIs conducted in the two regions, capturing diverse perspectives on community, governance and accessing digital services.

Data Analysis and Discussion

Three general themes emerged from the discussions and subsequent interviews. The first of these was familiarity with various digital financial products and services. Next were the benefits of digital financial products and services in mitigating climate-related disasters and promoting resilience. The final theme covered several barriers to the wider use of digital financial products and services in disaster response, recovery, and resilience.

Familiarity

The first theme to emerge from the focus groups and interviews was familiarity with various local digital financial service products. It was often mentioned that many people from this region migrate to work in Rangpur, Dhaka, and other parts of Bangladesh, and almost all of them send money to their families through bKash, Nagad, Islami Bank, Dutch-Bangla Bank, UCB and other digital methods. One of the female respondents noted that money from her husband helps meet all the needs of daily life, including children's education expenses.

The people in the flood-affected areas are familiar with various digital financial services, particularly mobile banking. Among these, bKash, Rocket, and Cash are the most widely used platforms. While many residents have traditional bank accounts, they prefer using mobile financial services.

One of the female respondents from Bogura shared,

"I own a smartphone and use it to access different digital financial services directly through apps. However, like everyone else in this area, I've never received formal training on using these digital financial products."

Overall, there was a broad consensus that various digital financial services were familiar, recognised, trusted, and even preferred when they provided a convenient alternative to cash, offline banking services, and other traditional methods of finance, particularly when combined with mobile technology. This is consistent with research that digital technologies are attractive for convenience and smooth delivery, especially via mobile technologies (Alliance for Financial Inclusion, 2019; World Bank, 2025).

Benefits

The second common theme to emerge was the benefits of digital financial products in times of accelerating flooding. Most of those interviewed agreed that the digital transfer of money during natural disasters benefits the people of this region during floods or other disasters. The common cash transfers via bKash, Nagad, Islami Bank, Dutch-Bangla Bank, UCB and other digital methods from family members outside the area play a special role in disaster management. The female respondent who received support from her husband emphasised that his transfers were especially important during emergencies such as the floods.

Participants in focus group discussions highlighted the potential of digital finance in crisis and post-crisis situations. They noted that while food and essential supplies are typically provided during and after floods, corruption and local political interference often hamper distribution. Most respondents suggested that direct transfers of funds to mobile phones would ensure more equitable and efficient distribution of aid to affected individuals.

A female Union Parishad member reported her active involvement in post-disaster relief distribution. She mentioned that although some government and private sector assistance is available during floods and other disasters, no one in her area had received financial aid through digital channels. Flooding causes significant harm to people's lives and livelihoods, with the agriculture and aquaculture sectors experiencing substantial losses. Crops are heavily damaged, and farmland remains submerged for extended periods, typically 4-5 months. The gap between the potential benefits of digital financial aid and the actual provision of aid digitally, about which she spoke in detail in her key informant interview, was also mentioned by several others. This is consistent with the literature about the usefulness of digital finance in addressing disasters (Behl et al., 2019; Pazarbasioglu et al., 2020; Churchill et al., 2023).

In the in-depth interviews with users and non-users of digital financial products, a consensus emerged across both groups on four benefits of the utility of mobile-based financial products, both generally and in terms of responding to climate-related disasters. All respondents cited receiving financial aid, immediate access to funds, lower cost services, and reduced risk associated with flooding and other disasters. There was a split, however, in that users were likelier to emphasise the relative importance of immediate access and receiving financial aid, whereas non-users perceived lower costs and reduced risks as more important benefits. These benefits have been mentioned in the literature, though risk reduction has been emphasised more (Ozaki, 2016; Sandhu & Raja, 2019; Sheehan et al., 2023; Serfiyani, 2019) than financial aid (Alliance for Financial Inclusion, 2019), immediate access (World Bank, 2025) or lower cost services (Alliance for Financial Inclusion, 2019). This suggests that more research may be needed on the latter three benefits, which are not mentioned as much in the literature.

Barriers

The final theme of barriers was also particularly widely covered. The proliferation of digital fraud and security concerns associated with online services has engendered a pervasive lack of trust among the general populace, as evidenced by the respondents. This issue was mentioned as particularly pronounced in demographics with lower literacy rates, where there exists a palpable sense of insecurity regarding the utilisation of digital technologies. While most respondents reported smartphone ownership, they noted that the prohibitive cost of mobile internet services presents a significant barrier to consistent data access for many. This financial constraint impedes the regular procurement of mobile data packages, limiting users' ability to fully engage with digital platforms and services. Despite the potential for these technologies to mitigate flood-related hardships, their implementation and utilisation remain suboptimal.

A critical factor contributing to this inadequacy is the absence of comprehensive training programs on digital financial products, which could otherwise empower flood-affected individuals to effectively leverage these tools in crisis management. The female respondent cited above noted she had no training in using digital financial products despite her mobile phone use. Still, some noted such unfamiliarity as an obstacle to others less familiar with the technology or with financial products in general.

The adoption of digital services is severely limited by financial illiteracy. Many people are unaware of digital financial products or find it difficult to comprehend their intricacies. Inadequate regulation also prevents these payment systems from expanding. Security and trust can also be key issues for digital financing in flood-affected areas like Kurigram and Bogura, and especially in areas with a low literacy rate.

One of the respondents from Kurigram shared:

"I was a victim of fraud and lost roughly BDT 8,000 from my bKash account. This incident demonstrates how inadequate the security controls are. Once the money is gone, I didn't find any solution. There doesn't seem to be much that the authorities can do to stop fraudsters from accessing our information, and I have stopped using Digital Financial Services."

Further, one of the respondents from KII shared,

"The benefits of digital banking are not as widely distributed in our area due to the lack of an institutional training program. Furthermore, there appears to be a deficiency in coordination across crucial institutions. Therefore, encouraging inclusion may greatly impact the growing use of digital financial services.

The concern with digital financial literacy (Mandal & Madaan, 2021) and online security (Burton, 2020) echoes concerns in the literature.

Low-income levels and restricted smartphone access further impede the growth of digital financial services in flood-prone and disaster-affected communities. An NGO worker noted the immense importance of digital finance and advocated introducing programs in both the public and private sectors. Besides, he recommended giving special importance to providing proper training. Governments and policymakers can play a crucial role by creating the policy environment, which creates space and momentum for fintech innovations to emerge, mature, and expand. For example, financial institutions such as traditional banks and other digital platforms can create customised digital financial products for areas at high risk of flooding.

Furthermore, the lack of sufficient information and cooperation from authorities regarding various online payment systems poses an additional barrier to widespread adoption and efficient use of digital financial solutions. This complex interplay of factors underscores the urgent need for a multifaceted approach to improve the accessibility, understanding, and application of digital financial products in flood-prone areas, ultimately enhancing affected communities' resilience and financial stability. This was particularly noted as a problem for respondents in positions of authority or who had to deal with higher levels of authority.

Technological infrastructure encompasses the essential components that enable digital communication and connectivity. This includes "internet connectivity", which refers to internet access availability and quality, allowing individuals and businesses to engage in online activities. Additionally, "mobile network coverage" is crucial, as it provides wireless communication services through mobile devices, facilitating access to information and communication on the go. Together, these elements form the backbone of modern technology, supporting various economic, social, and educational activities.

Civil society organisations can promote financial literacy and present examples of the micro level with digital inclusion. Finally, local community leaders and educators can ensure that the target population is aware and adopts new technologies related to digital finance by using their influence in their communities. Together, these actors can create a vibrant ecosystem that aims to strengthen vulnerable communities' financial resilience and climate change adaptation.

Conclusion

Digital financial products are gradually emerging as critical tools for building climate resilience for flood-affected communities in North Bengal, Bangladesh. Recurring floods accelerate poverty and livelihood destruction, and throttle recoveries. Traditional financial systems have often let these poor populations down, especially during distress. It does so by emphasising how such challenges have so far been overcome in practice through digital financial services, including mobile banking, micro-insurance, and digital credit that provide rapid access to the most valuable financial resources. Mobile banking is very important, enabling rapid and secure transactions that are critical during and after disasters. This allows victims of floods to receive remittances and government aid without delay and significantly raises the capacity of households to manage immediate financial shocks. Moreover, micro-insurance programs designed to cover damages from floods provide an essential safety net, enabling households to recover more quickly, thereby reducing their vulnerability to future climate events. On the one hand, digital credit services will lead to more significant investments in climate-resilient infrastructure and practices by small-scale farmers or local entrepreneurs, but on the other hand, financial support from the former promotes long-term economic stability.

This study verified the potential for digital financial products to play a greater role in fulfilling that potential, as study respondents expressed with both the general technology and with specific local examples. They also expressed general confidence in the applicability of the technology and the available products and services to deliver more benefits. Most envisioned the direct transfer of funds digitally to people in need of aid along the lines of family assistance they had already received in times of difficulty. Although they did mention risk mitigation as a benefit, they were more likely to stress lower cost, the ability to receive financial assistance in a disaster, and immediate access to funds when and where needed. These three concerns have been covered less as benefits in the literature and should be explored in greater detail in future research.

Despite these benefits, it highlights several barriers that hamper the wide reach of digital financial services among flood-prone populations. The high cost of reliable and uninterrupted access to digital technology was a concern, especially for poor rural people. Digital literacy remains one of the major challenges. Most people, especially in rural areas, still lack the knowledge and skills to use such services. More important is the issue of trust, especially among populations not familiar with the digital mechanisms, wherein fears of fraud and security breaches deter people from mobile financial services. In addition, poor infrastructure in most remote areas denies access to digital platforms.

Based on the results of the present study, recommendations include several policy actions that could allow digital financial products to realise their full potential in improving climate resilience. These include targeted education campaigns to improve digital literacy, expansion of mobile network infrastructure to remote areas, and the provision of assurances of security features for the digital platforms to inspire user trust. There is a need for financial institutions and development agencies to collectively take up the design of inclusive digital financial products that address the needs of flood-affected populations. The public sector can also provide infrastructure, lower costs to maintain reliable access, and help provide more assistance directly through digital channels to promote trust and familiarity with the technology among late adopters. These efforts will contribute to immediate recovery and long-term sustainable development by enhancing the financial resiliency of vulnerable communities.

References

Alliance for Financial Inclusion—Digital Financial Services (DFS). (2019, April 12). *Alliance for Financial Inclusion - Digital Financial Services (DFS)*. https://www.afi-global.org/working-groups/dfs/

Banholzer, S., Kossin, J., & Donner, S. (2014). The impact of climate change on natural disasters. In Z. Zommers & A. Singh (Eds.), *Reducing disaster: Early warning systems for climate change* (pp. 21–49). Springer.

Behl, A., Dutta, P., & Chavan, M. (2019). Study of e-governance and online donors for achieving financial resilience post-natural disasters. *Proceedings of the 12th International Conference on Theory and Practice of Electronic Governance* (pp. 27–35). ACM.

Bogura. (2024). *SOS-Barnebyer*. Retrieved May 7, 2024, from https://www.sos-barnebyer.no/asia/bangladesh/bogura

Burton, J. (2020). "Doing no harm" in the digital age: What the digitalisation of cash means for humanitarian action. *International Review of the Red Cross, 102*(913), 43–73.

Calderone, M., Weingärtner, L., & Kroessin, M. R. (2019). Investing in financial inclusion for climate resilience and adaptation. *The Role of Islamic Financial Services, 12*(3), 45–62.

Campbell, J. R. (2001). Participatory rural appraisal as qualitative research: Distinguishing methodological issues from participatory claims. *Human Organisation, 60*(4), 380–389.

CCC. (2009). *Environmental cost of climate change*. Climate Change Cell, Department of Environment, Ministry of Environment and Forests.

Churchill, C., Jain, P., & Dalal, A. (2023). *How savings, credit and insurance can protect the working poor*. RFILC. www.rfilc.org/wp-content/uploads/2023/09/Integrated-financial-services-for-better-risk-management.pdf

Hasan, M. K. (2018). *Flood warning system: A cost-benefit analysis of northern Bangladesh* [Doctoral dissertation, BRAC University].

He, C., Qiu, W., & Yu, J. (2022). Climate change adaptation: A study of digital financial inclusion and consumption among rural residents in China. *Frontiers in Environmental Science, 10*, 889869.

Hirabayashi, Y., Mahendran, R., Koirala, S., Konoshima, L., Yamazaki, D., Watanabe, S., Kim, H., & Kanae, S. (2013). Global flood risk under climate change. *Nature Climate Change, 3*(9), 816–821. https://doi.org/10.1038/nclimate1911

Hossain, M. A., Haque, M. E., & Alam, M. S. (2015). Livelihood and food security status of fisher's community in the northern districts of Bangladesh. *International Journal of Natural and Social Sciences, 2*, 23–29.

Imam, M. F., Islam, M. A., Alam, M. A., Hossain, M. J., & Das, S. (2020). Small area estimation of poverty in rural Bangladesh. *Bangladesh Journal of Agricultural Economics, 40*, 1–16.

Islam, M. T., Das, P. R., Mahmud, A. F. M. S., Hasan, M. E., Jahan, F. I., Syeda Seraj, S. S., ... & Mohammed Rahmatullah, M. R. (2011). A survey of non-conventional plant items consumed during food scarcity in two randomly selected villages of Kurigram district, Bangladesh. *Journal of Ethnobiology and Ethnomedicine, 7*(1), 1–10.

Islam, S. (2016). Coping strategies, preparedness and emergency response of char-land peoples in flood disaster: A case study in Kurigram, Bangladesh. *International Journal of Science and Engineering Research, 7*, 169–179.

Kabir Uddin, & Mir, A. M. (2021). Potential flood hazard zonation and flood shelter suitability mapping for disaster risk mitigation in Bangladesh using geospatial technology. *Progress in Disaster Science, 11*, 100185. https://doi.org/10.1016/j.pdisas.2021.100185

Malyshev, A. (2023). What is digital banking? Meaning, types and benefits. *SDK.Finance*. https://sdk.finance/what-is-digital-banking/

Mamun, M. A., Safiq, M. B., Hosen, I., & Al Mamun, F. (2021). Suicidal behaviour and flood effects in Bangladesh: A two-site interview study. *Risk Management and Healthcare Policy, 14*, 129–142.

Mandal, A., & Madaan, D. G. (2021). Digital financial literacy: Opportunities and challenges in rural India. *Contemporary Issues in Sustainable Management Practices & Technology Innovation (ICCISMPTI21)*.

Ozaki, M. (2016). *Disaster risk financing in Bangladesh* (ADB South Asia Working Paper Series No. 46). Asian Development Bank. http://dx.doi.org/10.2139/ssrn.2941319

Pandey, S. (2017). Flooding affects millions in Bangladesh, India, and Nepal: Relentless rainfall, monsoon floods, and landslides claim lives, destroy homes, and ruin food stocks. *UNICEF*. https://www.unicef.org/stories/flooding-affects-millions-bangladesh-india-and-nepal

Pazarbasioglu, C., Mora, A. G., Uttamchandani, M., Natarajan, H., Feyen, E., & Saal, M. (2020). *Digital financial services*. World Bank.

Rahman, M. M., Shobuj, I. A., Islam, M. R., Islam, M. R., Hossain, M. T., Alam, E., ... & Islam, M. K. (2024). Flood preparedness in rural flood-prone area: a holistic assessment approach in Bangladesh. *Geomatics, Natural Hazards and Risk*, *15*(1), 2379599.

Rana, M. S., & Islam, M. R. (2015). Impact of flood hazards on the agricultural production and livelihood shifting in rural Bangladesh: A comparative study. *5th International Conference on Water & Flood Management (ICWFM-2015)* (pp. 71–80).

Rashid, M. H. (2020). Prospects of digital financial services in Bangladesh in the context of the fourth industrial revolution. *Asian Journal of Social Science, 2*(5), 88–95.

Rubel, M. (2023, March 5). Digital financial products will enhance financial inclusion in Bangladesh. *South Asia Monitor*. https://www.southasiamonitor.org/spotlight/digital-financial-products-will-enhance-financial-inclusion-bangladesh

Sadique, M. Z., & Kamruzzaman, M. (2021). *Flood management perspectives in Bangladesh: An assessment of monsoon flood in 2020*. Centre for Policy Dialogue.

Sandhu, H. S., & Raja, S. (2019). *No broken link: The vulnerability of telecommunication infrastructure to natural hazards*. World Bank.

Serfiyani, C. Y. (2019, August). Characteristics of digital savings accounts as the latest innovation in digital banking services. *International Conference on Science, Technology & Environment (ICoSTE)*.

Shafie, H., & Rahman, S. (2009). *Traditional coping strategies of rural people living in flood-prone areas in North-West Bangladesh*. Rangpur Dinajpur Rural Service (RDRS). http://rdrsbangladesh.org

Shahriar, S. (2020). Impacts of floods and riverbank erosions on the rural lives and livelihood strategies in Bangladesh: Evidence from Kurigram. *Handbook of Climate Change Management: Research, Leadership, Transformation*, 1–26.

Shalal, A. (2021, September 20). Climate change could trigger internal migration of 216 million people—World Bank. *World Economic Forum*. https://www.weforum.org/agenda/2021/09/climate-change-could-soon-force-216-million-people-to-leave-their-homes-according-to-a-new-report/

Sheehan, B., Mullins, M., Shannon, D., & McCullagh, O. (2023). On the benefits of insurance and disaster risk management integration for improved climate-related natural catastrophe resilience. *Environment Systems and Decisions, 43*(4), 639–648.

Tammi, R. T. (2022). An examination on the challenges and issues of the fintech company "bKash" in Bangladesh. *Journal of Financial Technology, 3*(2), 45–58.

Verwey, A., Kerblat, Y., & Chia, B. (2017). *Flood risk management at the river basin scale*. World Bank. https://doi.org/10.1596/27472

World Bank. (2025). *Financial inclusion is a key enabler to reducing poverty and boosting prosperity*. https://www.worldbank.org/en/topic/financialinclusion/overview