

## **Empathizing With Cabetican: Elevating Flood Management Through Design Thinking**

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### **Abstract**

This study examines potential mitigation strategies that effectively address flooding issues during typhoons and heavy monsoon rainfall in Barangay Cabetican, Bacolor, Pampanga, Philippines. The authors collected initial data via extensive interviews with six key informants from the community, who expressed their perceptions of flooding, its effects on residents, and descriptions of existing mitigation efforts. The responses revealed that nature, systems, and people's behaviors, specifically in waste management, are the primary factors influencing flood control. Employing a design thinking approach, practical, community-driven solutions were developed that align with the United Nations' 11th Sustainable Development Goal of promoting sustainable practices to strengthen the community's socio-economic resilience. A community app and a rewards card were among the proposed solutions to promote proactive barangay efforts towards waste and flood management. The authors recommend actions toward cooperation between the local government unit and the community in addressing proactive measures related to disaster preparedness and flooding alleviation.

Keywords: design thinking, flooding, innovative governance, sustainable development goals

### **Abstrak**

Studi ini mengkaji strategi mitigasi potensial yang efektif mengatasi masalah banjir selama topan dan hujan monsun lebat di Barangay Cabetican, Bacolor, Pampanga, Filipina. Para penulis mengumpulkan data awal melalui wawancara ekstensif dengan enam informan kunci dari masyarakat, yang mengungkapkan persepsi mereka tentang banjir, dampaknya terhadap penduduk, dan deskripsi upaya mitigasi yang ada. Respons tersebut mengungkapkan bahwa alam, sistem, dan perilaku masyarakat, khususnya dalam pengelolaan sampah, merupakan faktor utama yang memengaruhi pengendalian banjir. Dengan menggunakan pendekatan pemikiran desain, solusi praktis berbasis masyarakat dikembangkan yang selaras dengan Tujuan Pembangunan Berkelanjutan ke-11 Perserikatan Bangsa-Bangsa untuk mempromosikan praktik-praktik berkelanjutan guna memperkuat ketahanan sosial-ekonomi masyarakat. Aplikasi komunitas dan kartu hadiah merupakan beberapa solusi yang diusulkan untuk mendorong upaya proaktif barangay dalam pengelolaan sampah dan banjir. Para penulis merekomendasikan tindakan untuk kerja sama antara unit pemerintah daerah dan masyarakat dalam menangani langkah-langkah proaktif terkait kesiapsiagaan bencana dan penanggulangan banjir.

Kata kunci: pemikiran desain, banjir, tujuan pembangunan berkelanjutan

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## **INTRODUCTION**

Flooding is a critical concern in the Philippines, especially in barangays like Cabetican in Bacolor, Province of Pampanga, where typhoons and heavy monsoon rainfall quickly lead to significant damages

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and losses. The country's geographic location, being positioned in the Pacific Ring of Fire and exposed to the Pacific Ocean, makes it naturally susceptible to typhoons. Pampanga is among the top flood-prone areas in the country. Its proximity to rivers and other bodies of water, combined with continuous urban development, further intensifies flood risks. Barangay Cabetican requires effective flood mitigation strategies to safeguard its community, properties, and livelihoods. Recent studies have explored various approaches, including structural and non-structural measures that the residents and the local government units can implement to reduce flooding. Still, gaps exist in providing practical solutions specifically designed to address the actual needs of local communities.

This study explores modern flood mitigation strategies that would effectively address the barangay's flooding issues. Using a design thinking approach, the research aims to develop practical, community-driven solutions. Additionally, it focuses on promoting sustainable practices to strengthen the community's socio-economic resilience.

By engaging the community in Cabetican, this study also aims to transform its residents' experiences and perspectives into valuable insights to develop more effective and customized flood mitigation strategies. Increasing the residents' concern for community awareness will more likely strengthen their disaster preparedness and community resilience, benefiting the whole of Barangay Cabetican.

## **LITERATURE REVIEW**

Flooding is due to various factors such as increased rainfall and intensified storms due to climate change, as well as human activities like changes in land use. These floods can be part of a natural cycle within ecosystems, providing direct and indirect benefits to natural resources and livelihoods (Vernick, 2024). However, when communities and infrastructure cannot withstand severe flooding, the consequences can be disastrous for the economy, society, and the environment. Understanding the causes and impacts of flooding and flood management strategies is crucial in developing effective mitigation measures. This literature review provides context on local communities' flooding challenges, explores applicable flood management approaches, and examines relevant laws and policies addressing these issues.

### **Barangay Cabetican**

Cabetican is one of the twenty-one barangays of the municipality of Bacolor, Pampanga, covering an area of 327 hectares. Located in a low-lying area with an estimated elevation of 10.6 meters above sea level, Cabetican has a geographic characteristic contributing to its susceptibility to flooding (PhilAtlas, n.d.). Inundation worsens since the barangay is close to two stagnant waterways: Cabetican Creek and the Pasig-Potrero River. Barangay Cabetican is classified as an urban area, with a population of 3,510 as of the 2020 Census. Agriculture is Cabetican's primary source of livelihood, with a total of 51 hectares dedicated to rice, corn, and other high-value crops, along with eight fishponds (Municipality of Bacolor, n.d.).

Barangay Cabetican is renowned for its remarkable resilience. The 1991 eruption of Mt. Pinatubo caused the barangay to be submerged under 3 to 6 meters of lahar due to the ravaging volcanic mudflow of 1995, which laid waste to what was once a thriving community and led to a severe population loss (De Guzman, 2019). Despite this catastrophe, the people of Cabetican have demonstrated incredible perseverance, rebuilding their community and emerging stronger.

At present, Cabetican stands as a symbol of historical and cultural strength. The barangay's church, the Archdiocesan Shrine of Our Lady of Lourdes, once featuring a grand 7-meter entrance, was reduced to

just over a meter by the lahar (BluPrint, 2024). The restored Sunken Shrine of Our Lady of Lourdes is a testament to the community's fortitude and has become a popular pilgrimage site.

### **Context of Flooding**

Barangay Cabetican faces unique challenges related to floodwaters. A Mendoza (2021) study indicates that the locals experience flooding at least twice a year, mainly due to seasonal rainfall patterns and insufficient drainage infrastructure. Backflow issues during heavy downpours also occur due to the barangay's lower elevation than the other barangays within Bacolor. Also, obstructions such as trash, debris, and narrowed waterways due to illegal constructions further contribute to the flooding problem.

Like the rest of Bacolor, lahar flows blocked the natural drainage paths of Cabetican, dramatically altering its flood dynamics (Alcantara, 2020). Lahar deposits that raised the ground level unevenly hindered the smooth flow of water. The Pasig-Potrero River, which serves as the main waterway for Cabetican, became clogged with ash and volcanic debris, forcing it to divert into a more minor tributary known as Gugu Creek. As a result, the main river channel tremendously reduced its capacity, and Gugu Creek frequently overflows its banks, heightening the flood risk of nearby areas, including the community in focus (Mendoza, 2021).

The study of De Guzman (2019) illustrates the historical context of recovery efforts in Cabetican following the Mt. Pinatubo eruption, which limited resources and inadequate coordination of local government units have hindered. The research emphasized the importance of formulating comprehensive flood mitigation strategies best suited to local conditions.

### **Approaches to Flood Management**

#### ***Pampanga River Basin Master Plan***

Developed and approved by the National Economic and Development Authority (NEDA) in 2019, the Pampanga River Basin Master Plan, formally known as the Climate-Responsive Integrated Master Plan for Pampanga River Basin (CRIMP-PRB), outlines a strategic framework designed to address the region's multifaceted challenges of flooding and climate change. Structural measures detailed in the plan include constructing and improving infrastructure such as drainage systems, dikes, and other flood control structures. These interventions aim to minimize flood risks by restoring natural flow patterns, reducing sedimentation, and increasing waterways' capacity to manage excess rainfall and prevent overflow into populated areas (NEDA, 2019). Non-structural measures include community-based flood management initiatives such as early warning systems, public awareness campaigns, and capacity-building programs to educate communities on flood risks and safety measures (Philippine Institute for Development Studies [PIDS], 2024). By fostering community engagement, the CRIMP-PRB aims to stimulate a culture of disaster preparedness that complements the physical infrastructure improvements. By integrating structural enhancements with community-driven strategies, the Master Plan is geared towards building resilience against flooding while addressing the long-term impacts of climate change.

#### ***Community-Based Flood Mitigation Management Program***

The Community-Based Flood Mitigation Management Program (CBFMMP) in the province of Bulacan illustrates a proactive approach to flood management, underscoring the importance of community involvement and non-structural measures. Initiated in 2004 as a response to severe flooding incidents, the program was meant to enhance the province's resilience against flooding through a holistic

approach that includes hydrological monitoring, information exchange, and disaster preparedness activities. Measures leading to a long-term solution for flood risk reduction through community-driven efforts included establishing an early warning monitoring system supported by trained local volunteers who monitor rainfall and water levels and empowering residents through workshops to understand flood risks and develop response strategies (PAGASA, 2023). The CBFMMP demonstrates how local governments can leverage active community involvement and technical expertise to address flooding challenges and effectively reinforce the community's resilience.

### ***Nature-Based Solutions***

In line with formulating long-term strategies, nature-based solutions have emerged as a promising approach to flood management, providing sustainable and cost-effective alternatives to traditional infrastructure-intensive methods. These solutions leverage the natural processes and ecosystems to mitigate flood risks while offering mutual benefits for communities and the environment; this includes a wide range of strategies, such as reforestation, wetland restoration, sustainable land management, rain gardens, permeable pavements, etc. Restoring wetlands can serve as natural buffers by absorbing excess water during heavy downpours, while reforestation improves soil structure and enhances water retention (Asian Development Bank [ADB], 2022).

### **Related Laws and Policies**

#### ***Local Government Code***

Republic Act No. 7160, or the "Local Government Code of 1991," states under Section 17. Basic Services and Facilities that local government units shall exert efforts to be self-sufficient and be accountable to provide basic services and facilities such as the following: "(v) Maintenance of barangay roads and bridges and water supply systems;" for barangay and "(viii) ..... communal irrigation, small water impounding projects and other similar projects; fish ports; artesian wells, spring development, rainwater collectors and water supply systems; seawalls, dikes, drainage and sewerage, and flood control; traffic signals and road signs; and similar facilities;" for municipality.

#### ***Disaster Risk Reduction and Management Act***

Republic Act No. 10121, or the "Philippine Disaster Risk Reduction and Management Act of 2010," defines "Disaster Prevention as the absolute avoidance of adverse effects of dangers and interrelated adversities, including "construction of dams or embankments that eliminate flood risks." Furthermore, "Disaster Risk" includes the potential harm from disasters such as floods. It may be lives, well-being, livelihood, resources, and amenities.

#### ***Climate Change Act***

Republic Act No. 9729, the "Climate Change Act of 2009," states that the country is "vulnerable to impending hazardous concerns of climate change, for instance, the changes in a) seascapes and landscapes, b) frequency and/or severity of disasters such as droughts, fires, floods, and storms, c) climate-related illnesses and diseases, and d) impairment to ecosystems." Various sectors should practice measures to prevent and reduce the influences of climate change. The government is continuously putting efforts into addressing the effects of recurrent and devastating floods due to climate change. Even so, after a

comprehensive review of laws, policies, and programs regarding flooding, it has been found that the Philippines lacks a national policy on stormwater management (Von Einsiedel, 2024).

## **RESEARCH METHOD**

This study utilizes a qualitative research approach guided by design thinking principles. Design thinking is a user-centered methodology emphasizing empathy and a deep understanding of stakeholders (Plattner, 2019). By prioritizing the experiences and perspectives of the target community, this method ensures that research outcomes are aligned with and relevant to their needs. It is important to note that design thinking is not a solo act, as it thrives on collaboration and teamwork (Plattner, 2019). This collaborative aspect respects diverse viewpoints and stimulates collective problem-solving, opening doors towards more effective and sustainable outcomes in addressing community challenges. Furthermore, teams use a non-linear, iterative process (Plattner, 2019) to understand the users and their challenges on a fundamental level, constructively challenge assumptions, refine and redefine problems, and create innovative solutions aptly suited for the community.

Design thinking consists of five iterative stages: empathize, define, ideate, prototype, and test (Plattner, 2019). In the “empathize” stage, the researchers obtained meaningful data through in-depth interviews with selected residents of Barangay Cabetican. The participants, consisting of four males and two females aged 35 to 59, were chosen to represent a range of social and marital statuses and diverse occupations. The researchers gathered important anecdotes and valuable experiences of flood incidents from individuals with first-hand understanding of the long-term impacts of flooding in their neighborhood. The interview questions were semi-structured, following three primary questions: (1) How did the flooding affect you?, (2) What preparations do you make every time it rains?, and (3) What recommendations can you give to mitigate or prevent flooding? This approach allowed the group to connect with the participants on a deeper level, visualizing the realities of their struggles and capturing their genuine commitment to supporting the community in reducing the effects of flooding through their proactive efforts.

The “define” stage followed the interviews, where the authors analyzed the data. From the transcriptions, the group discussed and systematically identified and grouped recurring similar statements from the responses and categorized sub-themes and themes—a process known as thematic analysis. This stage revealed the key challenges the residents of Barangay Cabetican encountered during flooding events.

Integrating the “empathize” and “define” stages showcases how collaboration is essential in design thinking. The method works best when teamwork and collective insights analysis lead to the systematic identification of key concepts. By engaging with residents and analyzing their experiences, the researchers obtained a richer understanding of the community’s needs, laying the foundation for tailored innovative solutions in the subsequent stages of design thinking.

Equipped with a more comprehensive perception of the community’s flooding issues, the study advanced to the “ideate” stage. The authors collaborated in a brainstorming session to generate potential strategies based on the themes generated, participants’ recommendations, and data collected from the barangay. Having considered multiple ideas, the group streamlined them into five primary recommendations.

With the recommendations, the study moved into the “prototype” stage, where the authors formulated a tangible product that encapsulates these solutions tailored to meet the community’s needs.

The importance of the prototype lies in its ability to test the viability of the formulated strategies through active collaboration of stakeholders, ensuring that the solutions are both practical and effective.

The study transitioned to the “test” stage after creating the prototype. During this phase, the authors presented the initial product to the stakeholders for feedback, suggestions, and possible improvement. Based on the newly acquired insights, necessary refinements were incorporated to improve the prototype and finalize the product.

The design thinking process extends beyond the “test” stage and differs from traditional research methods. In this study, the authors recognized the importance of the empathize stage while testing the prototype, as the feedback from the residents was essential in finalizing the product. Consequently, the team further refined and remodeled the prototype based on the participants' reactions and suggestions, guaranteeing the formulated solution's alignment with the community's specific needs.

## **RESULTS AND DISCUSSION**

The qualitative research on the flooding issue in Barangay Cabetican involved in-depth interviews with six residents. The transcriptions were analyzed and coded to reveal the significant themes and sub-themes related to the community's difficulties.

### **Flooding Situation in the Barangay According to Residents**

Flooding has been a persistent struggle in Barangay Cabetican, especially during the rainy season. Residents mentioned that sustained rainfall, even without typhoons, often results in significant water buildup. The geographic characteristics of the barangay contribute to its susceptibility to flooding, as water naturally accumulates in low-lying zones. Brief downpours typically lead to minor disruptions and inconvenience, while prolonged or heavy rains can result in widespread inundation. On the other hand, flooding in the barangay generally subsides in a day or two. This condition underscores the barangay's vulnerability to flash floods, emphasizing the need for preparedness, especially during the wet season.

The respondents described four natural challenges brought about by flooding: historical/seasonal flooding, overflow from neighboring areas, vegetation and narrowed waterways, and backflow due to relatively low elevation. They identified that flooding has become part of their lives over the years. Even floods that could reach chest-high are no longer unusual occurrences. The natural flow of water from higher parts of neighboring areas of Barangay Cabetican makes the barangay the catch basin, which causes the floodwaters to stay for two to three days. In addition, the growth of waterlilies by the riverbanks also obstructs the natural course of water into the river; this causes the water to flow back to the barangay's area. The low elevation of Barangay Cabetican then worsens flooding.

Although flooding is frequently viewed as an "act of God" or a natural disaster, factors brought about by human neglect contribute to the event's devastating impact, such as the absence of an efficient garbage disposal system, poor project management, insufficient drainage structure, lack of adequate resources, and inter-barangay coordination issues. Attempts have been made to rehabilitate the river, but these were futile. Residents hoped to develop an amicable agreement with the nearby barangays on the backflow problem, but nothing materialized.

Human indifference to dire situations, minimal support and delay in flood mitigation from officials, lack of accountability, and resistance to behavior change significantly contribute to the severity of the consequences of flooding. Even the sincerest attempts of some concerned residents proved to be problematic as well. Both barangay officials and residents of Cabetican have responsibilities to control

flood issues, yet they neglected their accountability to take initiatives and show greater concern for their community.

## **Flood Mitigation Efforts**

### ***Barangay Initiatives***

The barangay council has implemented essential measures to mitigate flooding, particularly through proactive drainage cleaning and waterway maintenance. They emphasized the importance of early action to prevent water blockages before the rainy season. These efforts include ensuring waterways are free from obstructions and routine maintenance of drainage systems. The barangay council utilizes pumps to channel water into nearby waterways. Lastly, they empower the residents by providing adequate knowledge about flood mitigation efforts through information dissemination and explaining the importance of community involvement in waste management towards effective flood mitigation. The barangay council's proactive and responsive actions during the rainy season have been evident and affirmed by its residents.

### ***Community Efforts***

A recurring theme among residents is the strong *bayanihan* spirit, with the community expressing willingness to help reduce flooding. When heavy equipment is not readily available, the people rely on manual labor, demonstrating resourcefulness. Residents work together to keep waterways clean before the start of the wet season. Moreover, residents near the main creek took the initiative to manually regulate water flow between the creek and the residential area. These collective efforts exemplify the community's resilience and cooperative disposition in addressing the barangay's inundation problems.

### ***Flood Situation Improvement***

Over the years, Barangay Cabetican has seen positive changes in its flood situation through better infrastructure, practical flood control measures, community efforts, and the forces of nature. Several residents have attested to how the severity of flooding has decreased, indicating improvement in flood mitigation in the area. Water levels have significantly reduced and no longer rise as high as before. The construction of canals near a resident's house proved to be an effective flood control effort. The inconvenience of riding boats to access food and other basic needs is no longer necessary. Residents have recently observed a remarkable difference in how swiftly flood waters subside. The overall improvement of the barangay's drainage system has sped up water dissipation, causing water levels to drop within days instead of weeks. While flooding remains a recurring challenge in Barangay Cabetican, the progress made by the community in flood management and preparedness is evident. With reduced water levels and shorter periods of inundation, residents see hope in minimizing flooding and its adverse effects on their homes and livelihoods. This progress can be further advanced by strengthening existing community efforts and providing additional support for flood mitigation, making a long-term improvement a reality.

### ***Residents' Feedback***

The residents have been trying to deal with the flooding in Barangay Cabetican. However, they also feel that there is still room for improvement. Their resilience and efforts, paired with innovation, can still

be further developed. Proactive efforts, resilience, education and awareness, routine cleaning activities, community-driven initiatives, and temporary structural modifications may be systematized.

Monitoring is also needed to maintain the effects of the flood mitigation activities. The *MENRO* office is crucial in maintaining cleanliness and a clog-free drainage system.

Furthermore, the residents call for the cooperation of various stakeholders, such as the whole community and local government units from their barangay and neighboring areas. A resident stated, "*Ang sa akin, yung cooperation ng ibang bayan kasi konektado talaga yung sapa dito sa may Minalin at Candaba. Una siyempre kailangan ng cooperation from local government tapos yung mga bagay na pwede mong gawin siguro garbage disposal ayusin*" [For me, it's the cooperation of other towns because the creek here is really connected to Minalin and Candaba. First, of course, we need cooperation from the local government, and then maybe things that can be done like improving garbage disposal] (*M*, 35 y.o.), emphasizing the connection with and participation from other municipalities and also the relevance of individual efforts.

Flooding in Barangay Cabetican can be visualized as a cycle in which nature, system, and people interact. The challenges enumerated in the foregoing primarily resulted from these three elements, but their interplay drives flood mitigation efforts that improve over time. By thinking outside the cycle and embracing innovation, more sustainable and effective strategies can emerge, safeguarding the community from flooding in the long term.

### ***Proposed Strategies***

In the ideation stage, the researchers brainstormed possible strategies to address the problem. Through a thematic analysis of the interview transcriptions from residents of Barangay Cabetican, the following recommendations address the ongoing flooding issues of the area:

#### **1. Enhancement of Existing Initiatives of Barangay Cabetican**

Recognizing the positive impact of community efforts and locally developed practices in reducing floods, acknowledging the challenges in implementing these practices, and strengthening the barangay's existing flood mitigation strategies will significantly improve long-term flood situations. Targeted clean-up drives at the onset of rainy seasons and during typhoons could be formalized into a structured, annual maintenance program of canals and waterways, ensuring consistent and effective flood management. Furthermore, information dissemination about waste management should be expanded, and practical lessons on disaster preparedness should be included.

#### **2. Proper Waste Management System**

Considering that the barangay has recently acquired a garbage truck but still has a limited budget to establish and operate its material recovery facility (MRF), a community-based waste collection system could be a viable solution. The barangay can partner with local junk shops to create a scheduled system where these shops regularly visit the community to purchase recyclable waste from residents at predetermined rates per kilogram. Providing residents with a consistent source of additional income while supporting local shops can promote proper waste segregation. Each *purok* or zone should have a designated garbage collector for non-recyclable and non-biodegradable materials to ensure regular waste disposal. The barangay can then transport the bulk waste to the nearest MRF, effectively managing the routine garbage truck service while significantly reducing costs.



3. Rewards System instead of Imposing Penalties

Activities such as contests and clean-up drives can be introduced to encourage people to remove waste from the environment, especially waterways. These events will provide participants with rewards. Sponsorship and funding through public funds and partnerships with private or non-government organizations could be legitimate sources of incentives for the residents.

4. Leveraging Technology for Educational Awareness Campaign

In the Digital 2024 Report issued by DataReportal, the Philippines still garnered the highest rate of social media usage. In the third quarter of 2023, 97.2 percent of online users in the country viewed any kind of online video at least once a week. It is higher than 92 percent, which is the global average rate. Moreover, 58.3 percent also used online platforms as a source of learning. This rate is the second highest globally (Mateo, 2024).

The presence of digitization efforts can increase the reach and engagement of the public. Social media platforms can post timely and relevant information on preventing, managing, and mitigating flooding. Without internet access, a community system may be organized to encourage social responsibility and *bayanihan*.

5. Improvement of the Drainage System

Ineffective and overwhelmed drainage systems primarily cause inundation in Barangay Cabetican during heavy and continuous rainfall. Water in the main creek tends to backflow due to the closing of floodgates downstream, resulting in stagnation. The barangay council establishes a coordination system with the downstream barangays to ensure a timely response during flooding. Addressing the problem of localized water stagnation in specific zones within the barangay due to their relatively lower elevations compared to the main culverts and creek would require correcting the gradient of drainage in the flood-prone zones with the elevated main culverts to allow for better drainage and minimize backflows. Excavation of the creeks will allow the natural outflows through gravity from the low-elevation areas, simultaneously increasing their capacity. Short-term recommendations would be the deployment of water pumps at the onset of the rainy season that will facilitate the transfer of water from lower elevations into the elevated main culverts. Installing check valves at the junctions of elevated culverts and canals will also help prevent backflows when water levels rise in the higher elevations.

### ***Prototyping***

The researchers developed various initiatives that build upon the barangay's existing efforts. To reinforce their impact, these initiatives are incorporated into the prototype.

1. Amplifying the existing Information Education Campaign (IEC)

The barangay officials and employees have been exerting physical and digital efforts by conducting community meetings broadcast live on social media (Facebook). Through this, they educate the residents about proper waste management. However, observations from the live recordings indicated that the audio and visual setup needs improvements to enhance clarity and expand the campaign's reach. Also, questions raised in the comments section of live recordings can be addressed; however, tracking and responding to all inquiries can be challenging. Therefore, the researchers recommend strengthening the ongoing Information Education Campaign through printed and online infographics to address common queries and inform those who cannot attend barangay meetings. Color-coding schemes for informational

materials can be used to enhance retention and understanding. Establishing a unified source of information and a dedicated venue for queries can enhance the efficiency of addressing concerns.

**2. Engaging Residents as Active Partners in Waste Management**

The barangay officials and employees, led by the barangay captain, visit households of Barangay Cabetican to demonstrate proper waste segregation, setting an example through actions. The researchers recommend the engagement of the residents as active partners through a reward system for outstanding waste management in households and zones. A point system for proper waste segregation, cleanliness, and innovative practices can be applied. Monitoring and checking of residents' cooperation may be done weekly or monthly. Individuals or households exhibiting commendable behavior may receive ample recognition and incentives, while those exhibiting unsatisfactory behavior may have to spearhead clean-up drives.

**3. Empowering Residents as Community Guardians**

Closed-circuit television (CCTV) footage of violators is posted on the social media site of Barangay Cabetican. Publication of the materials mentioned above will track the violators' identity and whereabouts. This practice could instill fear and embarrassment, potentially discouraging residents from engaging in illegal activities. However, it is time-consuming and ineffective, and may foster negative feelings within the community rather than encourage cooperative behavior. The researchers recommend empowering residents as co-guardians by encouraging them to monitor and report identified violators. Official reports with strong proof or evidence can be submitted online or at the barangay hall. A reward system is created to recognize or incentivize successful reporters, further motivating participation.

**4. Reducing Littering through Monitored Trash Bins**

Many residents have frequently been caught illegally dumping waste on CCTV. To reduce and prevent this adverse action, the researchers recommend installing clearly labeled trash bins in high-traffic areas, ideally near existing CCTV cameras for effective monitoring. Also, to lessen the economic burden on the barangay council, residents may be encouraged to host and maintain their public trash bins, with incentives offered for participation. To avoid the improper disposal of waste and to ensure appropriate guidance for the public, proper waste disposal infographics should be put up beside public trash cans.

**5. Igniting the Spirit of Volunteerism and Community Pride**

The regular clean-up drives have typically been attended only by barangay officials, staff, and several usual residents. To encourage greater participation, the researchers recommend breaking clean-up drives into short and manageable sessions rather than holding them for a whole or half-day. A schedule of upcoming clean-up activities may be posted on social media or at the barangay hall to inform the community. Documentation is improved by posting before-and-after photos of locations to showcase the effectiveness of clean-up drives; this could inspire the residents to appreciate the beauty of their barangay when it is clean and organized. The community organizes potlucks or simple gatherings to recognize volunteers and foster camaraderie for the culminating activity.

All the aforementioned initiatives are integrated into the research prototype, a mobile application called "Team One Cabetican App" inspired by the barangay's tagline. This app provides a platform for (a) centralized information dissemination and documentation within the community, (b) points and rewards

tracking system for actively participating in barangay activities, (c) simplified participation and sign-up process for barangay initiatives, (d) real-time monitoring driven by resident involvement, (e) time-sensitive notifications and alerts for disaster preparedness, (f) digital identification of residents, and (g) digitalization of barangay services. This app aims to enhance community engagement, encourage communication and feedback, and promote a more efficient and connected barangay.

The developed prototype was presented to the residents for consultation during the “test” stage and was well-received. They particularly loved the rewards system, which fostered a positive and uplifting sense of community by recognizing and showcasing good practices among neighbors. The residents also expressed enthusiasm for including public trash bins, citing the lack of such utilities in the barangay. They believe this could discourage the residents from burning trash or throwing garbage on illegal dumping sites.

However, the residents raised concerns about the reporting system and its potential to start conflicts and ruin the community’s camaraderie. It would be better to nominate model citizens instead of reporting violators. They do not want their community to be in chaos. Maintaining good relationships with one another is still imperative for them.

Moreover, the community welcomed the concept of an app as an innovative concept, but residents felt that this could be premature for the barangay. Given that the barangay’s social media page is not regularly updated and utilized, there is a concern about the lack of readiness to use and maintain the proposed app.

The researchers valued this feedback and assured residents that their additional insights would be thoroughly considered and incorporated into the final product to align with their preferences and needs. It is vital to the team that the formulated innovative solution upholds the voice of the stakeholders, ensuring that the outcome is effective and practical in addressing their concerns. By empathizing with the residents throughout the entire process, the researchers can guarantee that the product is feasible, sustainable, and supported by the barangay.

### **Final Prototype**

From the initial interaction with residents during the interviews to the prototype’s testing and feedback sessions, a clear and consistent message emerged, strongly communicated in different ways. The residents of Barangay Cabetican highlighted the importance of maintaining harmony and cooperation. They favored a positive system that recognizes and rewards outstanding behavior rather than a negative system focused on reporting and imposing penalties. The stakeholders recognize the close-knit nature of their community and the value of preserving its unity as they move forward and face future challenges.

In line with this, the researchers made substantial changes to the prototype to more effectively accommodate the residents’ preferences and aspirations. From a mobile app as the prototype, the final product evolved into a rewards program called the “Team One Cabetican Rewards Card” as shown below.



### **Team One Cabetican Rewards Card**

The Team One Cabetican Rewards Card reflects the positive system that the residents envision for Barangay Cabetican. It is an innovative solution designed to incentivize residents for active community involvement while promoting proper waste management and volunteerism with the ultimate goal of flood mitigation. Understanding the community's current challenges with shifting towards digital governance, this simple rewards card serves as a stepping stone towards a digitized future. The barangay can easily establish a digital population database by familiarizing residents with QR code-enabled cards as digital identification. Eventually, this system can expand to streamline access to barangay services, gradually reducing the need for repetitive form-filling and creating an efficient and effective government.

The rewards program uses the straightforward mechanics outlined in the following paragraphs.

All residents of Barangay Cabetican are eligible and can easily register, whether online through social media or in person at the barangay hall. Points are earned through various methods, such as the following:

1. Proper segregation and disposal during garbage truck collection.
2. Cleanliness of surroundings during inspection;
3. Hosting public trash cans;
4. Participation in barangay meetings and clean-up drives; and
5. Being nominated as Model Citizen of the Week.

Rewards are upon earning enough points. These rewards can be monetary or in the form of free seminars and training on various trades and crafts, free items during community events, and entries into barangay raffles for larger prizes. The rewards program will run throughout the year, and the barangay stakeholders will periodically assess its effectiveness.

The point-ups are updated through short message service (SMS) or Facebook Chat. Further updates will be provided through notifications of upcoming clean-up drives, barangay meetings, and the community bulletin board. The barangay may also create a simple Community Leaderboard to foster friendly competition among residents.

Through the Team One Cabetican Rewards Card, residents will be motivated to actively participate in barangay initiatives to reduce floods while granting them access to exclusive benefits and appropriate recognition.

## **CONCLUSION**

Typhoons and heavy monsoon rainfall have been common occurrences in the Philippines. These natural events have been negatively affecting various communities. The Barangay Cabetican is one of the

communities that has been heavily struck in the country since it is a low-lying area. Despite significant damages and losses throughout time, the residents of Barangay Cabetican remain steadfast.

With an innovative mindset, the authors were determined to provide appropriate and possible strategies. Steered by a design thinking approach, the researchers went to the neighborhood to empathize with the residents and develop feasible community-driven solutions. Nature, systems, and people were identified as main factors in flood management. Furthermore, they learned that inefficient waste management significantly contributes to flooding, and thus, it needs attention and action. The endless cycle has caused distress to the residents who have experienced flooding for an extended period.

An initial prototype, an app, was introduced and discussed with the target users. However, the researchers realized the need for adjustments since the residents were not yet ready for such intervention. Nonetheless, their feedback allowed the researchers to take a positive approach in addressing the problem. The Team One Cabetican Rewards Card was developed with this insight to promote waste management and community involvement. This product is a simple step towards digitalization and participation in barangay initiatives.

The employment of design thinking in this research enabled the authors to perceive the flooding situation based on the Cabetican residents' perspective which resulted to a variety of creative ideas that were polished through series of feedbacks. The end product is an innovation - the Team One Cabetican Rewards Card which offers a viable solution that could help mitigate flooding in Barangay Cabetican. Unlike the usual expensive flood control projects funded by government, the deployment of this Rewards Card is less costly and even promotes camaraderie. It is an example of a unique, unconventional, and community-driven strategy that emerges whenever citizens are given the chance to voice out their concerns and are listened to with empathy. As in the case of Barangay Cabetican, the authors argue that a genuine concern and action of the government in cooperation with local residents can lead to more sustainable and practical strategies that would elevate flood management in the country.

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