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Research Article

Modified Tricycles as Public Transport During Tidal Flooding Events: The Case of Tikling in Hagonoy, Bulacan, Philippines

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Abstract: Public transportation is one of the sectors most affected by high tides in Hagonoy, Bulacan, Philippines. To overcome the challenges posed by these tides, local tricycles, a form of public transportation, have been modified with elevated sidecars and driver's seats that remain above the water level. These modified tricycles are locally known as Tikling. This study aims to identify the perceived risks associated with public transportation, specifically Tikling, during tidal flooding events in selected Barangays in Hagonoy, Bulacan, Philippines. The researchers employed a mixed-method design to gather the necessary information and address the study's objectives. Data were collected from 161 respondents, including 130 passengers, 25 Tikling drivers, and six representatives from local government units and the Municipal Disaster Risk Reduction Management Office. The findings revealed that passengers perceive riding Tikling under different weather conditions, flood levels, and ground clearance to pose moderate risks, as indicated by a mean score of 6.42, and that floods contribute to increased travel time and fare. The recommendations from the local government units include revisiting tariffs to establish accurate travel fees, conducting an Education Information Campaign to raise awareness about the risks associated with traveling, improving the structural quality of Tikling, and promoting coordination between the Pedicab Tricycle Operators and Drivers Associations (PETODA), a local association of tricycle drivers, and the local government office. The study suggests standardizing Tikling to minimize the risks involved. This standardization should address factors such as ground clearance, materials used, and the appropriate design of these modified public vehicles.

Keywords: Tidal Flooding; Modified Public Transport; Nuisance Flooding; Perceived Risk.

1. Introduction

For a prolonged period, Hagonoy, a low-lying coastal municipality in Bulacan, Philippines, has been grappling with a persistent issue: flooding. Numerous factors contribute to the town's vulnerability to floods, including intense typhoons, monsoon rainfall, back-flooding from adjacent provinces such as Pampanga and Nueva Ecija through the Pampanga River System, and tidal incursion from Manila Bay. As a "natural catch basin," Hagonoy becomes inundated with floodwater from elevated towns, leading to several days of road submersion and hardships for its residents [1].

Presently, the residents are once again urging concerned agencies to address the flooding issue in the area, which now occurs even without the influence of rainfall or storm surges. Nuisance flooding, recurrent tidal flooding, or sunny-day flooding has become more frequent within the coastal community due to rising sea levels caused by climate change and local land subsidence. Sea rise elevates the baseline water level near coastal cities, increasing the likelihood of flooding during high tides. This results in public inconvenience through road closures, disruptions in transportation, damage to properties and vehicles, the strain on stormwater systems, infrastructure deterioration, and financial burdens on local governments

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[2]–[4]. Although this type of flooding may be perceived as less severe, often labeled as a "nuisance" or a minor inconvenience, the cumulative expenses over time can be equivalent to the catastrophic damage caused by major storms. Water exposure accelerates road erosion [2], [5], and contact with salt weakens roadways, with repeated exposure exacerbating the damage [2], [6]. This trend is expected to intensify as the impacts of climate change worsen.

Consequently, public transportation in the municipality of Hagonoy is significantly affected by high tides. A study titled "Flood Impact Assessments on Transportation Networks: A Review of Methods and Associated Temporal and Spatial Scales" by [7] emphasizes that these flood events hinder citizens' accessibility and movement by disrupting the transportation network and its connectivity. Passenger services, transportation of goods, and various other services are curtailed, rerouted, or canceled when roads become flooded, closed, or unsafe to traverse.

To cope with the challenges posed by flooding, some tricycle drivers in Hagonoy, who operate a local mode of transportation consisting of a motorcycle and a sidecar, have resorted to upgrading their vehicles. They have introduced what they call Tikling tricycles. In emerging Asian nations, all paratransit services are collectively referred to as LAMAT, or Locally Adapted, Modified, and Advanced Transport [8]. Inspired by the abundant long-legged bird species found in the Philippines known as the buff-banded rail (Gallirallus Philippensis), locally referred to as Tikling, this renowned tricycle features an elevated platform on the sidecars where passengers can sit [9]. Through this innovative form of informal transport, residents now have an alternative mode of mobility as the drivers continue to operate even when roads are submerged in water. In contrast, drivers of regular-sized tricycles suspend their operations during high tide episodes.

While the rapid adaptation of local drivers reflects the resilience and creativity of Filipinos, it is essential to acknowledge that this response also highlights the worsening nature of the problem rather than providing a comprehensive solution. In a segment called "*Dapat Alam Mo*" (You Should Know) by GMA Public Affairs, a national broadcasting station [9], an engineering expert expressed concerns during an interview. The expert emphasized that the innovation of Tikling tricycles may pose dangers to passengers and drivers, mainly if the vehicles are not adequately sturdy and safe.

> *"Yung ating tricycle original ay mababa ang center of gravity, ngayon dahil tinaas sya, tumaas siya. Ang basic lang niyan ay pag tumataas ang center of gravity, mas madaling mag overturn o matumba. Isa pa diyan syempre mataas yan, pag umaakyat ka lalo na yung matatanda, baka mamaya mabalian pa yan ng buto. Dapat siguro may pag-aaral na gawin meron naman tayong mga ahensya ng gobyerno, ang Department of Science and Technology, pwede silang mag conduct ng study, para matingnan yung kabuuan, kung safe ba talaga ito, at kung di man safe sa kanyang design ngayon, para at the end of the day ay meron tayong basehan kung safe ba or hindi safe ang ganitong klaseng alterasyon".*
> *(Tricycles initially have a lower center of gravity, but owing to innovation, the center of gravity has increased, making the vehicle more likely to topple over. At the same time, older people found it difficult to ride on these modes of transportation due to their higher height. As a result, it is preferable if additional studies are conducted regarding the entire structure of these Tikling by government agencies, particularly the Department of Science and Technology, to determine whether it is safe to ride in it. So, we have a basis for determining whether these alterations were safe)*

Supported by Tao et al. [10], transportation services, like any other system, are susceptible to accidents ranging from unexpected natural disasters to intentional attacks. These accidents can occur due to unseen dangers under the water, such as potholes, maintenance holes, humps, and barriers like rocks, which may pose risks for motorists. Additionally, "informal transportation" is often used negatively, implying that underdeveloped nations' public transportation systems are chaotic and unsafe [11]. Consequently, the challenges that persist alongside this unique method of transportation include traffic congestion, inadequate public transport, compromised safety, environmental deterioration, and insufficient transportation services. These issues are attributed to deficiencies in policy-setting, planning, financing, implementation, and management processes within the transportation system.

Crucial attention must be given to the role of local-level policies in governing public transportation, including tricycles. With this in mind, the researchers were motivated to identify the risks associated with the existing informal public transport system, specifically Tikling, during tidal flooding events in selected Barangays in Hagonoy, Bulacan, as perceived by the residents. The objective was to utilize these findings as a basis for policy implementation. The study specifically focused on several critical implications: (1) understanding how residents in selected Barangays are affected by transportation disruptions caused by tidal flooding, (2) examining the factors that drive public

transport drivers to upgrade their tricycles to Tikling, (3) assessing the risks of using Tikling under different weather conditions, flood levels, and ground clearance, and exploring how this information can be utilized to manage the risks, and (4) developing an action plan to address the potential risks of Tikling to the community.

2. Material and Methods

2.1. Research Approach

Qualitative and quantitative data are suitable for collecting information encompassing numerical data and personal experiences. Therefore, the researchers employed a mixed-methodology design to gather the necessary information and address the study's objectives. To gain a deeper understanding and analyze the risks associated with Tikling as a means of transportation in the municipality of Hagonoy, Bulacan, during nuisance flooding, the researchers required respondents from four distinct groups: (1) passengers, (2) Tikling drivers, (3) Barangay officials, and (4) a representative from the Municipal Disaster Risk Reduction Management Office (MDRRMO).

2.2. Sampling

The researchers employed different sampling methods based on the respondent groups. Convenience sampling was utilized among Tikling drivers and local officials, while systematic random sampling was used for passengers/commuters.

For the convenience sampling method, five representative Barangay officials, one from each selected Barangay and one representative from the Municipal Disaster Risk Reduction Management Office (MDRRMO), were chosen. These officials were selected to provide information on recorded incidents, existing programs, plans, and policies.

Regarding the Tikling drivers, 25 members from the Tricycle Operators and Drivers' Association (TODA) operating Tikling in the chosen Barangays were selected. These drivers were chosen to provide firsthand experiences and insights on Tikling as a means of transportation, both with and without flooding.

On the other hand, systematic random sampling was employed to gather responses from passengers/ commuters. The selected respondents were located in Barangay Mercado, Sto. Rosario, Sta. Cruz, San Roque, and San Pascual, amounting to a total of 130 respondents. The sampling aimed for a 5% margin of error and a confidence level of 90%. These Barangays were chosen due to their proximity to the coastline and high susceptibility to tidal flooding in Hagonoy, Bulacan.

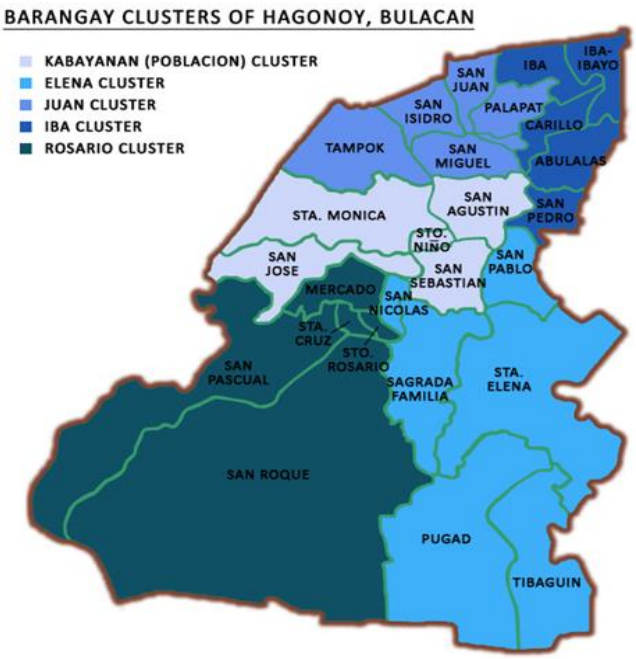

Figure 1. Map of Hagonoy Bulacan

2.3. Research Instruments

To gather information from the different types of respondents, the researchers developed separate questionnaires tailored to drivers, officials from Barangay and the MDRRMO, and passengers. This approach helped streamline the data collection process. For the passenger respondents, a door-to-door survey approach was employed. The survey questionnaire consisted of close-ended questions supported by a ten-point Likert scale, allowing respondents to indicate the intensity of their responses. Additionally, open-ended questions were included to capture experiences and perceptions in greater detail.

Data privacy was given due consideration given the nature of the study, which required residents to provide survey responses on the perceived risks of riding Tikling tricycles. To ensure the security of respondents' data and compliance with Republic Act No. 10173 (Data Privacy Act of 2012), the researchers took measures to protect privacy. Participation in the study was voluntary, and all respondents were provided with a signed informed consent form addressed to the Barangay captain and mayor. This form outlined the objectives and methodology of the study and included a privacy consent or agreement, ensuring that respondents' information would be handled confidentially.

2.4. Research Procedures

The researchers initiated the data collection by addressing formal letters to the respective Barangays: Barangay

Mercado, Sto. Rosario, Sta. Cruz, San Roque, and San Pascual. In these letters, the researchers requested the presence of an available official, specifically a Disaster Risk Reduction Management expert, for the research study. Before conducting the data gathering activities in their respective Barangays, the researchers informed them about the nature and scope of the survey, explicitly targeting passengers and Tikling drivers.

Furthermore, the researchers contacted the Municipal Disaster Risk Reduction Management Office (MDRRMO) to request the participation of a representative from their office for an interview. Along with the formal letter, the research questionnaire was provided to the MDRRMO representative to facilitate the interview process, ensuring a well-prepared and structured discussion. This approach aimed to avoid any on-the-spot interviews and allowed the representative to familiarize themselves with the research objectives and questionnaire beforehand.

In the formal letter addressed to the Barangays and the MDRRMO, the researchers emphasized that the information and data gathered would be used solely for academic purposes. The confidentiality and privacy of the respondents' information were assured, following the guidelines set forth by Republic Act No. 10173 (Data Privacy Act of 2012).

By following these research procedures, the researchers aimed to establish a collaborative and informed approach to data collection, respecting local officials' involvement and ensuring the data's reliability and confidentiality.

2.4.1. Assessing the effect of transportation disruptions caused by tidal flooding on the residents.

The researchers assessed the impact of transportation disruptions caused by tidal flooding on the 130 respondents. The assessment involved ranking the respondents' transportation preferences among tricycles, jeeps, and Tikling and gathering information on their estimated travel time and fare with and without flooding. This data allowed the researchers to determine how residents' travel patterns were affected by flooding in terms of time and cost.

2.4.2. Assessing the factors that cause public transport drivers to upgrade their tricycles to Tikling.

This section assessed the factors that led public transport drivers to upgrade their regular tricycles to Tikling. The researchers provided three options: income, convenience for passengers, and adaptation to the current situation. Respondents were asked to rank these reasons from one (1) being the most important to three (3) being the least important. This ranking approach provided valuable information for the researchers to understand the drivers' motivations behind upgrading to Tikling and allowed respondents to provide additional insights by explaining their reasons for the upgrade.

2.4.3. Assessing the risks of using Tikling and how they use that information to manage the risk within the different (a) weather conditions, (b) flood levels, and (c) ground clearance.

(a) 2ft. Ground Clearance

(b) 3ft. Ground Clearance

(c) 4ft. Ground Clearance

Figure 2. Ground Clearance Variation of Tikling

This research assessed the perceived risk of using Tikling tricycles under different circumstances. A ten-point Likert scale was utilized, with one (1) indicating the lowest level of risk or not risky at all and ten (10) showing the highest level of risk or extremely risky. The scale allowed the respondents to express their preferences or ideas regarding the level of risk associated with using Tikling tricycles in various situations.

Using the Likert scale, the researchers obtained valuable data from the 130 respondents, enabling them to analyze and understand their perceptions and preferences based on the given conditions. This information played a crucial role in assessing the risks associated with Tikling tricycles and contributed to the study's overall findings.

2.4.4. Determining action plans of the local government in addressing the potential risks of Tikling to the community.

During the interview, the Barangay officials and MDRRMO were questioned about their plans for dealing with tidal flooding, the potential risks associated with using Tikling during such flooding, and whether they had any current action plans to manage these risks.

2.5. Data Analysis

Researchers analyzed the gathered data from the survey and interview questionnaires and computed the mean and percentage for each question. This analysis aimed to assess and identify the risks associated with Tikling. The mean level of risk for each question was computed, analyzed, and interpreted based on the responses provided by the respondents through the questionnaire. The respondents indicated their perception of risk as either not risky, with some as complex or extremely risky. The mean serves as a measure of the central tendency of a random variable's distribution.

The results were categorized into three main areas: perception of risks, challenges faced by Tikling drivers, and existing and potential solutions. The researchers utilized the listing method to present individual perspectives and recommendations for the standardization of Tikling in their communities. These perspectives and suggestions were gathered from the respondents and representatives from the Barangay and MDRRMO.

The researchers analyzed the survey and interview data to assess the risks associated with Tikling. They calculated the mean and percentage for each question and categorized the results into different areas. The listing method was used to present individual perspectives and recommendations from various stakeholders involved in the study.

3. Result and Discussion

3.1. Passenger's Responses to Tidal Flooding and Links to Perceptions of Risks and Perceived Ability to Respond

Table 1, it was found that on regular days, 92 percent of the respondents indicated a preference for tricycles as their primary mode of transportation. However, during days with tidal flooding, the priority shifted, with 72 percent of the respondents selecting Tikling as their primary mode of transportation. Some respondents mentioned that the level of tidal flooding in Hagonoy is only navigable by Tikling, while others stated that Tikling is their sole option in such circumstances.

Table 1. Transportation Preference Ranking on Normal Day Vs. Days with Tidal Flooding

	Without Flooding			With Flooding		
	1st	2nd	3rd	1st	2nd	3rd
Tricycle	92.00%	7.00%	2.00%	25.00%	70.00%	5.00%
Jeep	1.00%	31.00%	68.00%	4.00%	13.00%	83.00%
Tikling	8.00%	62.00%	30.00%	72.00%	17.00%	12.00%

Table 2. Comparing The Travel Conditions on Normal Days Vs on Days with Tidal Flooding

Travel Time	Sample	Mean (Minutes)	Sample	Mean (PHP)
Without Flooding	130	18.48	130	23.41
With Flooding	130	27.54	130	40.42

Based on the data presented in Table 2, the average travel time without flooding was 18.48 minutes. However, during days with flooding, the average travel time increased to 27.54 minutes. The table also indicates differences in fares. The mean fare on regular days without flooding was 23.41 PHP, whereas the average fare on days with flooding was 40.42 PHP. These findings are based on the responses of 130 respondents. The data demonstrate the increased travel time and fares associated with days of flooding.

Table 3. Transportation Preference Ranking on Normal Day Vs. Days with Tidal Flooding

Scale	Range	Response	Interpretation
1	1.00 – 4.00	Not risky at all	Low
2	5.00 – 6.00	With some risk	Moderate
3	7.00	Risky	Almost high
4	9.00 – 10.00	Extremely risky	High

A scale and range are provided for interpreting responses related to the risks of Tikling—scores on this scale range from 1.00 to 10.00. Scores between 1.00 and 4.00 are categorized as "Not risky at all," indicating a very low level of risk. Scores ranging from 5.00 to 6.00 are classified as "With some risks," meaning moderate levels of risk. Scores of 7.00 are categorized as "Risky," indicating an almost high level of risk. Finally, scores ranging from 8.00 to 10.00 are classified as "extremely risky," meaning a high level of risk. This scale can assess the risks of riding Tikling under different weather conditions, flood levels, and ground clearance.

Table 4. Level of Risks of Tikling in Different Weather Conditions

	Mean	Interpretation	Std. Dev.
Clear Weather	5.41	Moderate	2.82
With Flooding	5.88	Moderate	2.71
With Extreme Weather and Flooding	7.85	Almost high	2.52

Table 4 displays respondents' mean scores of perceived risks when riding Tikling under different variables. The overall interpretation of the responses indicated a "medium risk." The overall mean score of 6.42 demonstrates that most respondents perceived riding Tikling in various conditions as risky. They were first asked about riding Tikling in different weather conditions. The cumulative standard deviation of 2.53 suggests that respondents' answers were reasonably consistent, with minimal variation within each category. Riding Tikling during "clear weather" scored 5.41, indicating a moderate risk. Riding Tikling "with flooding" scored 5.88, also categorized as medium risk. Riding Tikling "with extreme weather and flooding" scored 7.85, indicating an almost high risk. The mean scores show that perceived risk increases as the severity of the weather conditions intensifies.

Table 5. Level of Risks of Tikling in Different Flooding Conditions.

	Mean	Interpretation	Std. Dev.
1ft Flooding	4.87	Low	2.56
2ft Flooding	5.77	Moderate	2.29
3ft Flooding	7.05	Almost high	2.67

In Table 5, respondents were asked about riding Tikling in different flood levels. Riding Tikling in "1-ft flooding" scored 4.87, considered a low risk. Riding Tikling in "2-ft flooding" scored 5.77, indicating a moderate risk. Riding Tikling in "3-ft flooding" scored 7.05, equivalent to almost high risk. The mean scores reveal that perceived risk increases as flood levels rise. Barangay representatives have mentioned that higher flood levels reduce road visibility, increasing the risk, especially on potholes and rocks.

Table 6. Level of Risks of Tikling in Different Ground Clearance Conditions

	Mean	Interpretation	Std. Dev.
2ft Ground Clearance	5.52	Moderate	2.72
3ft Ground Clearance	6.98	Moderate	2.35
4ft Ground Clearance	8.42	High	2.16
Overall Mean (Weather, Flooding, and Ground Clearance)	6.42	Moderate	2.53

In Table 6, respondents were asked about riding Tikling with different ground clearances. Riding Tikling with "2-ft ground clearance" showed a moderate risk with a score of 5.52. Riding Tikling with "3-ft ground clearance"

scored 6.98, also categorized as medium risk. Riding Tikling with "4-ft ground clearance" scored 8.42, equivalent to a high risk. The mean scores demonstrate that perceived risk increases as the ground clearance of Tikling increases. Barangay representatives claim that raising the height of Tikling also raises the risk. Therefore, the structural integrity and materials used in Tikling, which contribute to the threat, must be considered.

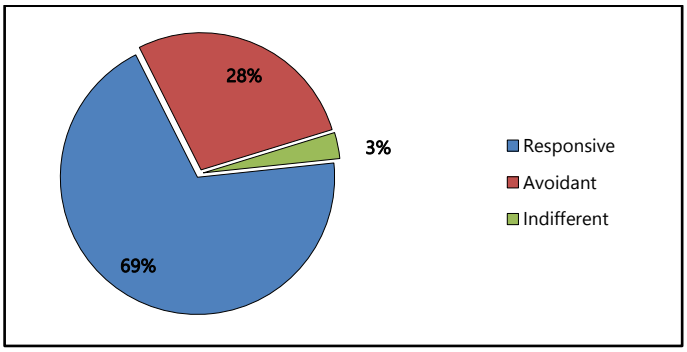

Figure 3. Passenger's Response to Tidal Flooding

Figure 3 shows the responses are coded, with 69% being responsive and 28% being avoidant, as supported by a study [7]. However, 3% of the respondents are indifferent. First, let us discuss the responsive residents who are the most capable and prepared when faced with tidal floods. They are aware of the dangers associated with floods and have confidence in their ability to take appropriate action. Most actively check their high tide calendar, engage in sandbagging, and elevate essential belongings at home. Some respondents even carry slippers or boots when venturing outside for work or school.

Additionally, they manage their solid waste properly to ensure water can flow through unclogged canals. Next, we have the avoidant residents. Unlike the responsive group, these individuals are less motivated to act. Instead, they tend to avoid circumstances where floods are likely to occur. For instance, they prefer to wait for the tides to subside and choose not to leave their houses during high tide periods. Lastly, we have indifferent residents. These individuals demonstrate a lack of concern and are more prone to risky behaviors. They underestimate the threats of tidal floods and lack the knowledge to deal with the associated risks effectively. When asked about their preparation for flooding, these respondents were among the few who stated they had made no preparations. The study revealed that most respondents displayed responsive behavior, actively taking precautions and preparing for tidal floods. However, notable proportions of avoidant and indifferent individuals were less proactive in addressing flood risks.

Figure 4 indicates that 70% of the respondents consider the amphibious nature of the Tikling as its main advantage, while 24% highlight its economic benefits. An additional 6% emphasize the convenience of this vehicle. Let us delve into each edge based on the respondents' answers.

The figure illustrates that respondents view Tikling's amphibious capability, economic benefits, and convenience as the key advantages of this vehicle. Its ability to traverse flooded roads, generate higher income, and offer a dry and accessible ride are highly valued by those surveyed.

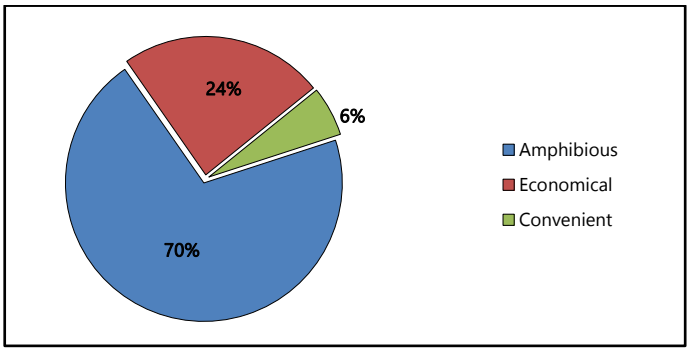

Figure 4. The Advantages of Tikling over Ordinary Tricycle

The Tikling's ability to navigate roads during tidal flooding and operate at varying flood levels is its primary advantage. This amphibious characteristic allows it to continue functioning even in floods. Respondents view this feature as valuable, enabling them to travel when other vehicles cannot. Secondly, respondents identify economic benefits associated with Tikling. They perceive it as the only vehicle capable of freely moving around during tidal flooding, resulting in higher earnings than ordinary tricycles. This suggests that Tikling provides a unique income opportunity for its operators during flood situations. Lastly, respondents appreciate the convenience provided by Tikling's design. Its elevated height and accessibility during high tides allow passengers to ride without getting wet or being reached by the water. This aspect is deemed convenient and advantageous. Respondents also mentioned that Tikling's availability enables them to reach their destinations and homes more efficiently, thus aiding them in their daily activities.

Figure 5 illustrates the disadvantages of Tikling based on the respondents' feedback. As shown in the chart above, 68% of the respondents stated that Tikling is risky, 21% mentioned it is costly, and 10% found it distressing. Only 1% of the respondents answered that there is no risk involved. Consequently, the primary drawback of Tikling is its high risk. This is supported by the findings in Table 4, where it is evident that riding Tikling poses moderate risks due to the respondents' awareness of the dangers

associated with its physical structure. These dangers range from the level of ground clearance to the materials used by operators to modify the tricycles. Furthermore, the respondents indicated that Tikling is unsafe for senior citizens to ride, as they may struggle with its elevated height.

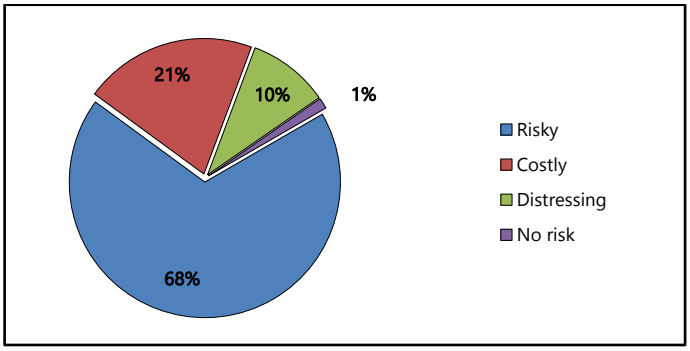

Figure 5. The Disadvantages of Tikling over Ordinary Tricycle

The second disadvantage is the cost. According to the respondents' answers, the expenses associated with Tikling are twofold: the operators' maintenance costs and the passengers' fares. Riding these vehicles has doubled compared to its typical cost, particularly during high tides. Lastly, 1% of the respondents answered that there is no risk involved, suggesting that they either do not consider or are unaware of the disadvantages associated with using and riding Tikling as a form of public transportation.

3.2. Tidal Flooding and Challenges for Tikling Drivers

Figure 6 illustrates the frequency of weekly flooding experienced by drivers in Hagonoy, Bulacan. The chart reveals that 56% of the drivers reported encountering flooding seven times a week or daily. Furthermore, 24% of the drivers mentioned facing flooding three to four times a week. In contrast, 20% of the drivers/respondents' experience flooding five to six times weekly.

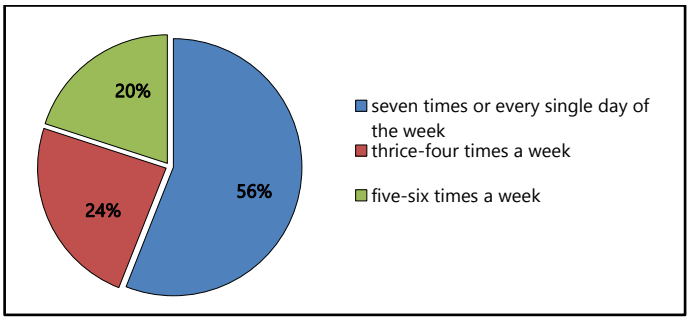

Figure 6. The Frequency of Tidal Flooding in Hagonoy

Figure 7 provides insights into the frequency at which drivers check their vehicles' maintenance every week. According to the chart, 12% of the drivers reported checking their vehicles three to four times a week. In contrast, 32% of the drivers mentioned conducting maintenance checks seven times a week or daily. However, the majority, comprising 56% of the respondents, visit their vehicle's maintenance once or twice a week.

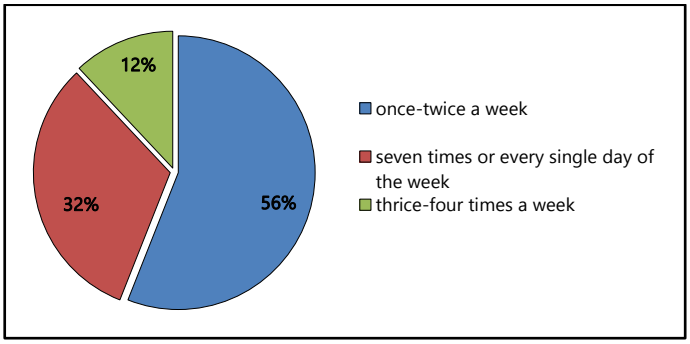

Figure 7. The Frequency of Tikling Driver's Maintenance Routine

Table 7 shows the parts the drivers modified to make their tricycles into Tikling. Based on the above data, out of 25 respondents, 24 or 96% of them adjusted the shock absorber and extended the front wheel fork part of the tricycle, while 4% or 1 did not. 80% of the respondents modified the angular bar, 20% did not, and 60% of the drivers altered the swing arm. In addition, out of the 25 drivers, 36% have other parts that have been modified, such as the flat bar and the elevation of the side wheel and sidecar.

Table 7. Parts Modified by The Divers to Turn a Regular Tricycle into Tikling.

	Shock Absorber	Extended Front Wheel Fork	Angular Bar	Swing Arm	Others
Parts Modified	96%	96%	80%	60%	36%
	4%	4%	20%	40%	64%

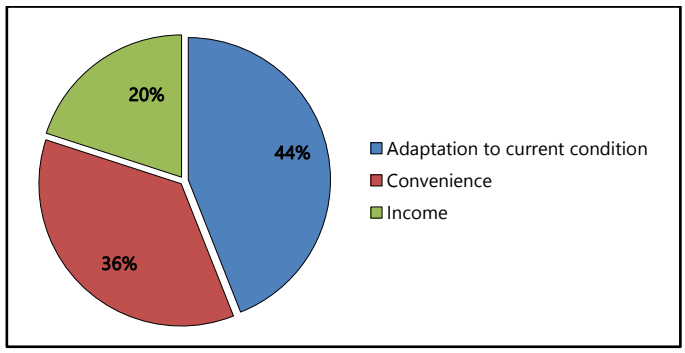

Figure 8. Reasons for Upgrading Tikling

Figure 8 shows the reasons behind the drivers' modifying vehicles. 44% answered adaptation to the current condition, while 36% responded for convenience. On the other hand, 20% of the drivers answer for income. Since most drivers, as indicated in Figure 6, suffer from

flooding daily, they upgrade their tricycles into Tiklings to adapt to the municipality's present conditions. Besides that, convenience for the passengers is the second reason which is the availability of a vehicle that can pass through floods without getting wet. Finally, income. The fact that regular tricycles frequently cease operation encourages drivers to switch to Tikling.

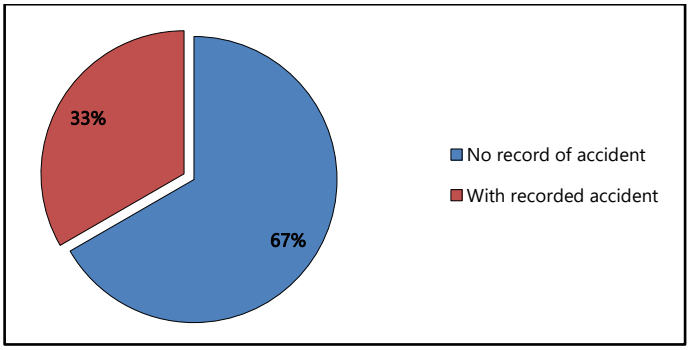

Figure 9. Recorded Accidents Involving Tikling over the Past Years

Figure 9 shows the recorded accidents involving Tikling over the past year, as Barangay officials and MDRRMO noted. The chart reveals that 67% answered no, while 33% said there had been recorded accidents regarding transportation Tikling. As mentioned by representatives from four Barangays, for the record, there is none. However, there has been news around the municipality that there is a case in Barangay San Sebastian where the front wheel fork of the Tikling broke as it climbed an inclined part of the road. In addition, according to the MDRRMO, they responded to a few cases of accidents within the municipality caused by Tikling.

Table 8. Lists of Existing LGU Action Plans on the Rapid Increase of Floods during High Tides

Clusters	LGU Plans
Barangay Mercado	1. Road Heightening 2. River Dredging
Barangay Sto. Rosario	1. Saturday Cleanup 2. Road Heightening 3. River Dredging
Barangay San Roque	1. Road Heightening 2. Solid Waste Management 3. River Dredging
Barangay Sta. Cruz	1. Pathways Heightening 2. Solid Waste Management 3. Government Assistance
Barangay San Pascual	1. Road Heightening
MDRRMO	1. Flood Gate 2. River Dredging 3. Coordination National Agency

The table filters the responses and highlights current plans for the municipality's tidal flooding problem. This supports the problem statement, which aims to evaluate the current action plans of their local government unit, which the local Barangay implements. Using them as a foundation, the researchers could point out and concur that the action plans offered needed more public awareness, implementation, community engagement, and consequences for those who did not follow.

As stated by Participant 1,

"Ang ating Solid Waste Management, sa pagbabasura, kasi isa din ito sa makakatulong, pag ang mga basura natin ay okay, di nagbabara ang mga kanal, so diretso ang tapon ng tubig."
(Solid Waste Management helps in the waste issue of the Barangay, as it prevents clogged drainage so water can continuously flow.)

The answer of Participant 2 supports this,

"Almost 85% iyong mga paraan dito talagang tapos na, may iba lang na ginagawa ngayon na panibago... Kailangan talaga hukay ilog after that sabay sabay na pagliinis, sabay sabay na segregation at source, iyon lang naman, paglalagay at pagtatapon sa tamang basurahan tapos iyong ginagawa na every Saturday cleanup. Iyon naman talaga eh Manila Bay cleanup drive iyon eh, every Saturday."
(Almost 85% of the road projects were already done, and the others are ongoing... River dredging and a cleanup drive are all we need, segregation, proper waste disposal, and the Manila Bay cleanup drive every Saturday.)

Furthermore, Participant 6 said,

"Isa pa sa mga pangmatagalang solusyon dito, bagamat nasimulan na noong nakaraang administrasyon, yung mga flood gate, sa mga kailangan natin, sa mga dike yun, siguro iyon na lang yung susudlungan nila... So nagkaroon na sila ng paghuhukay ilog, sa mga maliliit na estero o makipot na kailugan dito sa Barangay ng San Juan at San Isidro...So ayun, isa yun sa coordination sa national agency, para sa budget para sa flood control na pangmatagalang solusyon dito sa ating bayan."
(One of the most comprehensive solutions that started last administration is the floodgate along the dikes. Maybe they will continue that one... We were also currently dredging along canals and rivers of Barangay San Juan and San Isidro... So that is one of the coordination with the national agency for the flood control budget, which will serve as the most comprehensive solution here in our municipality.)

Hence, it is critical to understand the existing plans and programs regarding the flood issue because the public transportation system Tikling was invented due to the municipality's ongoing flooding issue. This means that more than the programs were needed to address the flooding in the locality, which happens now without the influence of rainfall or storm surge.

Table 9. Lists of Identified LGU Plans to Minimize Risks of Tikling

Clusters	LGU Plans
Barangay Mercado	1. Improve the Quality of the Structure of *Tikling*
Barangay Sto. Rosario	1. EIC–Education Information Campaign 2. Ordinances 3. Revisit Fare Tariff
Barangay San Roque	1. Standardization of *Tikling*
Barangay Sta. Cruz	1. Standardization of *Tikling*
Barangay San Pascual	1. Standardization of *Tikling*
MDRRMO	1. Coordination between PETODA and Local Government Unit 2. Standardization of *Tikling*

The table filters the responses and highlights local officials' suggestions and actions for reducing the hazards of public transportation Tikling. This addresses the problem statement, which seeks to define the course of action designed to address the possible risks that Tikling poses to the community—furthermore, most respondents' responses center on the need to regulate Tikling's structure/quality.

As stated by Participant 1,

> "*Kung magiging uso siya dito, ang magiging proposed ng barangay, ay bago nila ito maibyahe, makita muna namin yung design. Posibleng maging apat ang gulong, kahit na mataas, kasi medyo matatag. Tapos mas malalaking gulong ang gamitin, kesa sa maliliit. Kasi mabigat na rin naman yun*".
> *(If this Tikling is in nowadays, the Barangay will propose that before they operate publicly, the design must be checked by us. It is also possible to have four wheels; even though the height will increase, the structure will still be stable. In addition, it is also possible to use the big wheel, rather than the small ones, because it is heavy.)*

Moreover, as substantiated by Participant 2,

> *"Siguro ang una ay EIC –Education Information Campaign. Iyon naman talaga ang una eh. Kung talagang gagawa ang tricycle drivers' association – ipu-push talaga nila etong Tikling na ito, kung wala talagang plano sa pagbaha natin—kung hindi man maibsan, lalo pang tumaas eh magkaroon sila ng batas na ito ang standard tapos magbigay sila ng information sa tao... Oo, open naman. Kung pang bayang ordinances, ibaba naman iyan samin, iaano lang naming, kukuhanin naming iyong batas and then, gagawa kami ng kapasyahan dito para maibaba naming sa komunidad."*
> *(I think EIC – Education Information Campaign. Without a plan to fix the flooding problem, the tricycle drivers' association will push to make and use Tikling. If the water level rises continuously, there should be a law stating the standard that should give information to the community... Yes, if it is for the municipal ordinances, it will be passed to our Barangay then we will make decisions to pass down to the community.)*

Lastly, as per Participant 6,

> "*Magkaroon ng ugnayan at pag uusap sa pamamagitan ng pamahalaang bayan at mga lokal na transportasyon, may mga samahan kasi iyan, yung mga PETODA...Yung magkaroon sila ng limitasyon sa design ng mga gagawin nilang customized tricycle. Kung gaano kataas talaga kung gusto nila ng ganong customized, iyon ang dapat nilang pag-usapan, yung standard na taas."*
> *(We need to discuss the local government and PETODA... There must be limitations on the designs of the customized tricycles. They must set a standard height to alter their vehicles.)*

As noted by the Barangay representatives and the MDRRMO, other suggestions that should be prioritized are ordinances that will examine Tikling's designs and establish a standard fare tariff. Thus, a discussion regarding the "standardization" of Tikling between local government entities and the Committee of public utilities (PETODA) is necessary.

4. Conclusion

The research found that the flood level, the vehicle's ground clearance, and worsening weather conditions constitute an increasing risk in Tikling. The study revealed that discussions have occurred at the municipal level regarding this modified public transport. However, feasible and immediate plans are still needed to address the risk in the community. Therefore, the study recommends several ways to minimize the encountered risk. These include standardizing Tikling, which entails regulating ground clearance, materials used, and proper design of the modified public transportation. Lastly, it was suggested to

revisit tariffs to ensure accurate travel fees and an Education Information Campaign was proposed to inform drivers and passengers about the risks associated with travel.

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