HIDE-SHORE PORT MANAGEMENT ON THE ENVIRONMENTAL ISSUE - CASE STUDY OF LAEMCHABANG HARBOR CHONBURI PROVINCE

KRITCHAKHRIS NAWATTANAPRASERT

Faculty Industrial Technology, Phranakorn Rajabhat University, Thailand.
E-mail: kritchakhris@yahoo.com

Abstract- The research is to minimize environmental damage pertinent to maritime activities about the operation of lighter boat anchorage and its tugboat. The guidance on upgrading current harbor service and infrastructure has been provided to Laemchabang Municpality. This will involve a study of the maritime logistics of the water area under jurisdiction of the Sichang island Municipality and possible recommendations may involve charging taxes, regulations and fees. With implementing these recommendations will help in protection of the marine environment and in increasing operator functionality. Additionally, our recommendation is to generate a consistent revenue stream to the municipality. The action items contained in this research are feasible and effective, the success of these initiatives are heavily dependent upon successful promotion and enforcement. Promoting new rules and regulations effectively and peacefully can be done through theories and techniques used in the psychology of persuasion. In order to assure compliance with the regulations, the municipality must maintain stringent patrols and fines for violators. In order to become success, the Municipality must preserve a consistent, transparent and significant enforcement system. Considering potential opportunities outside of the current state of the municipality, the authors recommend that Koh Sichang be given additional jurisdiction to capture value from the master vessels, as well as to confront the more significant environmental challenges these vessels pose. Finally, the authors recommend that the Port of Koh Sichang Island obtain a free port status in order to increase economic viability and overall sustainability.

Keywords- Hide-shore port, Garbage Collection Service, Environment, Harbor, Logistics

I. INTRODUCTION

This research seeks to address the Laemchabang Municipality's ability to minimize environmental damage related to the maritime activities of light and tugboat operations. Our recommendation for these challenges recognizes the need to generate revenue for the municipality and provides guidance on upgrading current harbor services and infrastructure. The authors recommend that the Sichang Island Municipality assess a daily harbor usage fee, and commencea garbage collection service. Implementing these recommendations will protect the marine environment and increase operator functionality, while providing a consistent revenue stream to the municipality. While the action items contained in this report are feasible and effective, the success of these initiatives are heavily dependent uponsuccessful promotion and enforcement.statement of and significance of problem.

As it is a natural hide-shore port, the Sichang Island Harbor and has become a valuable resource and critical component of Thailand's maritime transportation industry. As the maritime industry has grown on a national level, so there are several vessel and boat traffic within the Sichang Island Harbor. In 2011, there are up to 500 light-boats and tugboats operate each day in the Si-Chang harbor. Though there were an increasing of harbor usage which has provided a slight boost for the local economy, the negative externalities - especially those related to the environment, threaten commercial fishing, tourism and related industries on the island. Due to a limited harbor waste collection infrastructure, an increase in pollution has been resulted. These facts necessitate the initiation of a formal harbor management system. From the research performed, the following are concluded :

The environmental degradation's primary sources are:

- Garbage dumping from anchored vessels
- Increased anchoring in environmentally sensitive areas
- Dumping associated with the cleaning and maintenance of light-boats
- Hazardous waste byproducts of commercial vessels (fuel, paint, etc.)

1.1 Objective of Study – Project Relevance and Application

The objective of this study is to support a legislative in Sichang Island through the design of an initial harbor management system which includes the establishment of a garbage collection system, and the collection of fees. This system will be served as the foundation for continued development of the harbor and assist in the economic growth and preservation of natural resources for future generations. The current recommendations relate solely to the light-boats and tugboats operating within the harbor. The use of the studying result will be as a guide for an expanded jurisdiction of the municipality to include areas where master vessels operate with more concerning on significant environmental issues.

This project focuses primarily on harbor user behavior since a formal harbor management system does not currently exist. The sentiments of both

owners and operators, and the steps required to catalyze changes in behavior and use patterns within the harbor. Currently, as garbage floats to their beaches, the Si-Chang Municipality is responsible for maintaining their coastline. Due to the considerable cost and the labor intensive nature of collecting trash, it has made this practice unsustainable. Additionally, as Sichang Island is largely dependent on the fishing industry, it is necessary for the island to address long term concerns which threaten their livelihood. Finally, Sichang Island has supported the maritime transportation industry with minimal reciprocal benefit. Due to the increase of trade within South East Asia and throughout the globe, a municipality sponsored garbage collection system is not feasible. The municipality has an unreasonable level of responsibility and cost for maintaining the harbor when they are not responsible for causing the pollution.

Scope of Study, Assumptions & Limitations

This study includes a cost-benefit analysis of a number of possible solutions with an analysis of pollution and environmental degradation within Sichang Harbor.

Three key assumptions at the start of this project are made based on information provided by the Sichang Municipality. These assumptions with the rationale for each are provided as follows:

Assumption 1 - The municipality can effectively enforce regulations within the Sichang Harbor.

- This assumption is based on the fact that the municipality has jurisdiction over the boundary indicated in the attached Figure 1 and that they have or can obtain the personnel and ability required to enforce compliance with a management program.

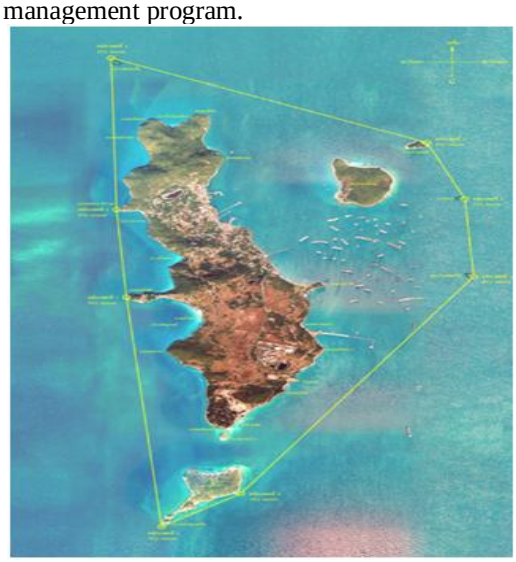


Figure 1 – Sichang Island and Harbor boundary

Assumption 2 – The Sichang Municipality can accommodate a moderate (~4 ton per day) increase in garbage

- This assumption is based on information obtained from the Sichang Municipality. Specifically, the authors were informed that the replacement of current system would be definitely required within few years.

Assumption 3 - All interviews and survey results obtained accurately reflect the beliefs/practices of the larger harbor user population.

- Interviews were conducted at random throughout the harbor over the course of two days. Names of interviewees were not recorded and the authors have no reason to believe that those contacted differ in any significant way (in respect to beliefs and behaviors) from the large population of harbor users.

Limitations/Out of Scope – This report does not address the following:

- Recommendations relating to master vessels as their operations are beyond the jurisdiction of the Sichang Municipality.
- The drafting of regulations or the recommendation of fines/punishment. The development of any regulatory or governmental proposals is outside of the project's scope.
- The operation and/or upgrade of the incinerator operated by the Sichang Municipality.

II. DETAILS EXPERIMENTAL

The research process detailed herein was comprised of multiple phases which led the authors from an initial issue comprehension phase through the final recommendation. There were four specific phases of our research process:

2.1 Comparables Analysis – This initial research phase provided an understanding of international standards for the maritime transportation industry and best practices at successful ports. Although Sichang is a unique port which currently accommodates traditional shipping methods (vs. container ships), many of the theories and practices learned from researching large international ports are universally applicable. Comparable analysis was especially relevant to the promotion and enforcement elements of this project. [1]

2.2 User Behavior Analysis – Once the authors achieved an understanding of the industry and challenges, they utilized user behavior analysis of owner/operators in Sichang Island Harbor. This phase of research primarily focused an understanding of the current habits and operations of boat operators in the harbor. A second goal of this phase was to develop an understanding of harbor user awareness of environmental issues and sentiments surrounding clean-up responsibilities [2]. Included in this goal was understanding the level of urgency among the harbor users. This phase of research involved surveys and interviews in Sichang Island and the Bangkok Port, as well as meetings with Koh Sichang Residents and the Port Authority of Thailand.

2.3 Feasibility Assessment – This third stage of the research process was dedicated to the analysis of garbage collection, fee assessment, and channel installation options. The option and criteria considered for garbage collection are detailed in below figure 1

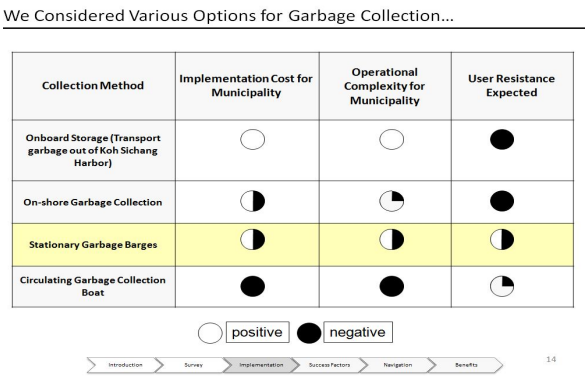


Figure I - . The option and criteria considered for garbage collection

The options considered for fee collection are presented in Figure 2. Generally, the criteria used were the municipal capabilities, user willingness to cooperate, and an assessment on the likelihood to succeed based on team interviews and observations. Sustainability and operational complexity was considered for each option [3].

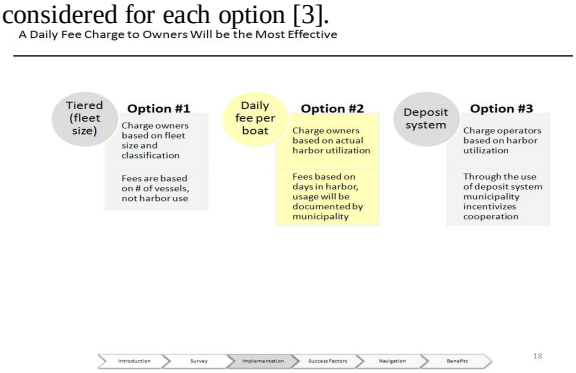


Figure 2 - The options considered for fee collection

Cost-Benefit Analysis – The final stage of our research was a cost benefit analysis of a number of garbage collection and fee assessment options [4]. Costs considered were those which impacted the municipality. These included costs related to infrastructure investment, employment and operational expenses.

Survey Reliability and Data Accuracy

The surveys completed by boat owner/operators in Sichang Island Harbor are believed to represent a fair sample of the attitudes and opinions of the greater harbor population. The survey respondents were selected at random and were interviewed without future knowledge of our purpose or intent. Survey respondents were not asked to give a name or identifying characteristic beyond their occupation and there is no reason to believe that the results were adversely affected by the survey design.

Statistically, the owner/operator survey results attained through field interviews are considered to be 95% accurate within 11% of the population mean. This is based on a sample size of 66 and a population of 400 owner operators (a 16.5% response rate) [5].

Primary Research Findings & Takeaways

Based upon our questionnaire findings, the authors gained insight into operator and owner preferences and an understanding of the situation. Below are significant survey questions and insights gained from them.

The first major finding resulted from the question "How do you store/contain garbage onboard your vessel?" From this question, the authors surmised that 95% of respondents have containment capabilities for their garbage. The containment varied between vessels but was primarily composed of small garbage cans and garbage bags. This result provided the insight that no behavior change was necessary to convince operators to collect garbage; however, since the operators are currently containing their garbage, the municipality must develop a method for collection and disposal.

The next behavioral insight came from the question "How do you currently discard of your waste/trash?" The authors discovered that 80% of respondents indicated that they threw their garbage overboard. As no disposal system is available, this is the only option for most operators. While a small number of operators retain their garbage and dispose of it on shore, the authors recognized that the disposal challenge is not a result of a few bad elements, rather, the challenge is pervasive throughout the entire population.

The authors gauged insight into the operators' attitudes and understanding of the challenge through the question "What is your current awareness of the pollution in Sichang Island harbor?" The finding resulted in 78% of respondents indicating that they were aware of the marine pollution problem in the Sichang Island harbor. The level of awareness indicates that the problem is substantial and that the municipality can focus the majority of their promotion efforts on describing corrective measures instead of creating awareness. 81% of respondents indicated that action should be taken to remedy the pollution in Sichang Island regardless if they realized that it as a problem or not.

The next survey question- "Who is responsible for cleaning up the Sichang Island harbor?"- gauged the respondents' attitudes relating to the environmental cleanup. For this question, respondents were given the ability to choose multiple parties which they believe are responsible for maintaining the harbor. The authors found that 67% of all respondents indicated that owners and operators were personally responsible for harbor maintenance while 49% of all respondents indicated that the municipality was responsible. This finding signifies that respondents believe there is joint responsibility between the owners/operators and the Sichang Island municipality. This is a positive result considering that

the harbor management system requires cooperation and communication between both parties in order to succeed.

The next survey question analyzed what services the respondents valued within a harbor management system. The question, "In order to maintain the harbor, what services should Sichang Island include?" provided the authors with an understanding of what services the operators most valued. Nearly 70% of all respondents said that Sichang Island should have a garbage collection service. In keeping with other findings, this result indicates that most operators do not need to be convinced that this service is necessary; rather, operators must have information about the system when it becomes available.

The last major finding on the survey resulted from the question "What could Sichang Island install in order to promote safety within the harbor?" The authors concluded that although the survey results were mixed, the vast majority of responses pointed to increased harbor organization. The results indicated that 9% of respondents asked for improved sign, 22% of respondents asked for designated anchoring areas, 30% of respondents asked for lighted navigational buoys, and 5% of respondents asked for channel markers. An additional 30% of respondents indicated that they had weather related concerns which were unfeasible to address. Taken as a whole, the best method to address all of these concerns is a lighted navigational channel.

Recommendation

Summary of Recommendation

Sichang Island faces both environmental and safety challenges within their harbor. In order to deal with these challenges, the municipality must take three corrective actions- develop a garbage collection system, implement a harbor usage fee for boat owners, in addition to creating a navigational channel for boats sailing in and out of the harbor.

Operational Overview

Garbage Collection

Based on the data collected, operators within the harbor are interested in a garbage collection and disposal system; however, currently there is no place available for them to dispose of their garbage. The authors additionally learned that the operators would refuse to pay any fee for garbage service, no matter how small. Given these considerations, successful garbage collection in Sichang Island must be convenient for operator use, as well as free of charge.

The first component of the garbage collection system consists of placing 4 barges within the Sichang Island harbor. These garbage barges provide convenience to light boat operators; furthermore, the placement of the barges can be adjusted to match weather conditions and light boat anchorages of the respective season. This collection will be provided without a fee to the operators who bring their garbage to the unmanned barge closest to them.

The second aspect of this system includes transportation of the barge to shore and transportation to the incinerator. The municipality will use a tugboat to transport the barge to shore and transport the garbage from the shore to the incinerator. With an estimated harbor population of approximately 1100 creating an average of 3.67 kilograms of solid waste a day, there will be an increase of approximately 4 tons of garbage per day.

Implementation of a Harbor Usage Fee

In order for the municipality to have the resources necessary to affect change, the system in place must have the capability to be sustainable, thereby generating revenue. Based on our research, owners are responsible for paying harbor usage fees at other ports but are unwilling to pay for a fee if it is directly linked to garbage collection. With these considerations, Sichang Island should implement a "harbor use fee" for boats to use their harbor in lieu of a "garbage collection fee".

The success of the fee collection depends upon consistent and reliable data gathered from tugboat operators who will radio in the information of the light boats they are pulling in and out of the harbor. When a tugboat operator has the information of light boats they are transporting to enter the Sichang Island jurisdiction, the operator will radio in this information to a designated radio channel monitored by a municipality employee. Upon receiving this information, the municipality radio operator will enter the information of the boats entering or exiting the harbor into a spreadsheet on the computer. Given this information, the municipality can then determine the length of stay for each light boat. For each day a boat is in the harbor, Sichang Island can charge the owners a daily rate and then calculate the number of days the boat is in the harbor.

Every month, the municipality will send a bill to the owners based on their harbor utilization. While the success of this system heavily relies upon informing the owners and operators, as well as enforcing the imposed fines, the system provides a fair method for collecting revenue from the boat owners. Given current cost estimates and complete success in collecting fees, the authors have concluded that the municipality will be profitable if it charges owners 10 baht/ per boat/ per day.

An additional consideration for the harbor usage charge is to limit the impact on the profitability of the owners. If the owners perceive the municipality to be unreasonable with the fee assessment, there will be a stronger resistance to cooperate. The municipality will also have the ability to adjust this rate as the system is accepted among owners; however, it will be easier for the municipality to achieve initial owner acceptance with a lower rate. The harbor usage fees will be assessed monthly to the light boat owners through the postal system and payments can be made via bank transfer.

Critical Success Factors

Promotion

One of the most important and challenging elements of this project will be inducing habitual change in people who are accustomed to their present way of life. Change in behavior is likely to be most successful if theories under the study of Psychology of Persuasion are used [6]. The Theory is based upon the same principles of the reasons why someone would receive a vaccine in defense of a virus. If all who will be affected by the change can become immune prior to implementation, the adjustment has been proven to be a more passive transition The main point of Inoculation Theory is that attacks make beliefs and attitudes stronger.

There are three steps of effective inoculation:

1.Warn the receiver of the impending change

2. Make a weak attack

3.Get the audience to actively defend the attitude

To warn the receiver of what is to come, Sichang Island should consider having frequent communication to their stakeholders through the use of schools, NGO's, local media and environmental groups, thereby, helping to ameliorate the process of introducing change.

The second step of the theory, making a weak attack, comes from addressing preemptive concerns which could arise. Identifying and proactively responding to what people could say would help the transition be more peaceful and with less confrontation. Harbor users could oppose the change by saying that new regulations could mean more work for municipal employees, while vessels could avoid the harbor, potentially impacting local economy, as well as stating that irrespective of any new laws, boat owners would simply ignore them.

Finally, the last step requires people to build a defense. This comes naturally after the second step is in place. Realizing their concerns are less serious than the potential harm which exists, people would naturally abide by the rules in order to avoid negative impacts. By following the laws, the audience would avoid excessive fines, improve safety within the harbor and protect resources for them and future generations. This comes through the realization of the permanent impact garbage has on oceanic chemistry, marine life and tourism.

Campaign

Encouraging the promotion must be a widespread effort throughout the island; one method to actively involve the audience would be to formulate a campaign. The participants of this project have created an example of what a potential campaign could resemble. It is meant to be only an example and should be amended to best fit its audience.

The "Save the Squid" campaign was created as a vehicle for all ages to participate in. A logo of a "Happy Squid" is used on a garbage can so that people have a jovial connection to a potentially malodorous subject. Some suggestions include: Producing a garbage bin which is given to boat owners and operators to remind them of the importance of using the garbage barge. The promotions can be done via banners, local media, billboards, flyers, T-Shirts. The municipality could also incorporate a regional holiday holding events to increase awareness and publicly recognize the efforts of those involved.

Proposed Implementation Timeline

We have suggested a way to methodically implement a scaled process to ease the audience into new behavior. In a similar manner as the Euro was introduced into 12 countries of the European Union, so to can the municipality introduce pollution control measures [7].

The "Phase in Process" could begin at least 6 months prior to inception. The first 3 months can be used to promote, educate and commence a campaign. Months 4-6 may be used to initiate a "soft start' where new services are offered on a free basis. The municipality would use this opportunity to refine procedures, identify and address challenges, along with issuing warnings to those who choose to disregard procedures. The last phase is when a start date has been chosen and the program firmly begins. The municipality must start collecting harbor use fees, perform random patrols and strict enforcement must begin. Those who are identified as ignoring procedures must be stringently fined and held accountable.

III. RESULTS AND DISCUSSION

Given the current state of the Sichang Island municipality and after extensive research, the authors recommend a harbor management system that includes a harbor usage fee, and a garbage collection system. Promoting new rules and regulations effectively and peacefully can be done through theories and techniques used in the psychology of persuasion. In order to assure compliance with the regulations, the municipality must maintain stringent patrols and fines for violators. Preserving a consistent, transparent and significant enforcement system is paramount to success. Considering potential opportunities outside of the current state of the municipality, the authors recommend that Sichang Island be given additional jurisdiction to capture value from the master vessels, as well as to confront the more significant environmental challenges these vessels pose. Finally, the authors recommend that the Port of Koh Sichang Island obtain a free port status in order to increase economic viability and overall sustainability.

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