International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 11, Issue 3 [May.-June. 2022] PP: 811-818

Development of Fisherfolk Management Information System With SMS Gateway

***Sheila Mae S. Pagayonan[1], Sharra Mae B. Fernandez[2]**
[1][2]Institute of Information and Computing Studies, Northern Iloilo State University, Main Campus, Estancia, Iloilo, Philippines
sheila.pagayonan@gmail.com[1], sharramaefernandez@gmail.com[2]

Abstract

This paper aims to introduce the advancement of technology through information system by designing and developing a Fisherfolk Management Information System with SMS Gateway which will assist the DA-BFAR in Estancia, Iloilo in achieving its goal of providing quality and frontline services to its clienteles. A developmental-descriptive research design was used in this study. A total of 150 respondents evaluated its functionality, usability and performance. The data was collected using the PSSUQ instrument and a researcher-made questionnaire based on the ISO/EIC 9126 criteria. Rapid Application Development was also utilized as a model for software development. The results revealed that the system's functionality, usability, and performance were all rated "Very Good." This strong result suggested that the respondents were impressed by the system's features

Keywords: Fisherfolk Management, SMS Gateway, Rapid Application Development, BFAR, Information System

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Date of Submission: 14-06-2022 Date of Acceptance: 29-06-2022

I. INTRODUCTION

The Philippines is a maritime nation made up of 7,641 islands with a territorial sea covering 679,800 km^2 and an Exclusive Economic Zone (EEZ) covering 2,263,816 km^2. Coastal areas make up the majority of the Philippines, with about 70% of Filipinos estimated to dwell in the area [1].

In the Philippines, fishing is extremely important for food security and the economy [2]. As poverty has remained persistently high and the Philippines' population has expanded, it is necessary to secure food supplies to keep people fed. The fisheries industry is separated into two categories: capture fisheries and aquaculture, subdivided into municipal, commercial, and inland fisheries.

In terms of income and employment, the Philippines' fisheries contribute significantly to the national economy. In 2015, total fish production was predicted to be 4.65 million metric tons, with the fisheries sector contributing over $4.33 billion to the country'sgross domestic products(GDP)[3]. In 2015, the fishing sector employed over 1.6 million people across the country and contributed 1.5 percent to GDP [3][4]. According to a FAO report, the Philippines ranked eighth in the world in fish production in 2014, and it is a major source of revenue for the country [3].In 2020, fisheries production volume decreased by -0.3%, according to preliminary statistics released by the PSA. The same preliminary statistics found that volume of production from municipal fisheries and aquaculture decreased, while production from commercial fisheries increased by 5%[5].

Meanwhile, fisher folk are group of people who earn their living by fishing [6]. Millions of people rely on fishing for their livelihood. Many of these millions are small-scale fishermen who rely on fishing for a living, with nearly half of them being women. Considered one of the poorest sectors in the country, fishers have become one of the unlikely heroes during the COVID-19 pandemic, providing food on our tables during the prolonged community quarantine [7].

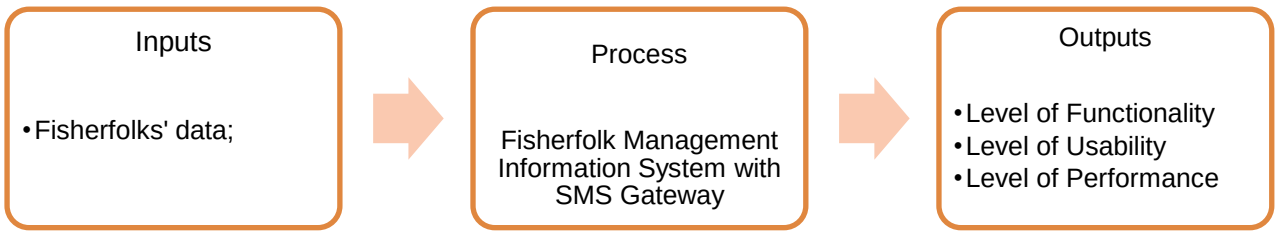
Information systems are in charge of functions including data collection, processing, storage, and analysis, as well as making optimal use of information technology in the form of hardware, software, databases, and communication networks in businesses. To ensure the overall efficiency of the system, all parts of management information systems are implemented at the same time [8].As technology has advanced, this job has evolved into the organization's backbone.Similarly, SMS is a popular mobile phone service that allows users to send and

receive short text messages of up to 160 characters. One of the roles of SMS technology is to transmit information to recipients by "pushing" it in one way [9].
Estancia is a commercial fishing center known throughout the country, hence it earned the name "Little Alaska of the Philippines" [10]. The fishing industry has contributed a lot in the municipality's income and tourism industry.
At present, the Department of Agriculture (DA) - Bureau of Fisheries (BFAR) in the Municipality of Estancia, Province of Iloilo finds difficulty in the management of fisherfolks' data. It is in this context, that the researcher designed and developed a system entitled "Fisherfolk Management Information System with SMS Gateway" to help the personnel in data profiling, record keeping, monitoring, and notifying registered fisherfolk on the upcoming programs of the government. Also, this system willalso serve as guide in determining the type of assistance that should be provided to improve the livelihood and quality of life of fisheries sector as well as the necessary assistance for the city or town.

1.1 Conceptual Framework of the Study

Figure 1 presented the conceptual framework of the study. The inputs were the essential part of the system in order to produce relevant output of reports such as:municipal fisherfolks'data, crew members of commercial fishing vessels, fishworkers, and fishery operator. The data inputs were securely processed and managed by theFisherfolkManagement Information System for a better output. The system's outputs includes identifying its level of usablity and level of performance.

Figure 1. The Conceptual Framework of the Study



1.2 Objectives of the Study

The main objective of the study is to design and create a simple and comprehensive web-based system for the convenience of Department of Agriculture (DA) - Bureau of Fisheries (BFAR) personnel in the Municipality of Estancia, Iloilo. The researcher also determines the level of functionality, usability and performance of the Fisherfolk Management Information System with SMS Gateway.

II. RELATED WORKS

In [11], they examine the feasibility of developing a generic (generally applicable) Fisheries Information Management System (FIMS) or database to improve the co-management and appropriate development of artisanal fisheries. Generic information requirements to support the main co-management roles of fisheries departments were identified from literature reviews and case studies of fisheries in Bangladesh and the Turks and Caicos Islands. Generic inputs (fields) to support these requirements were identified from common data fields found in survey forms and databases. This research has made a significant contribution to the development of improved strategies and plans for the management of capture fisheries important to poor people. Furthermore, fishery departments from both case study fisheries have expressed keen interest in the system and several requests for software and manuals have already been received.
In [12], results revealed that local government officials, extension workers, researchers and even co-fisherfolk, relatives, friends and neighbors are the knowledge sources within the CBCRM [community-based coastal resources management] knowledge and information system in Batan Bay. Their reliability, credibility and sensitivity to the knowledge user's concerns figure significantly in the knowledge acquisition, selection and adoption of Batan Bay fisherfolk. Knowledge content relevance, applicability, practicality and clarity together with the knowledge medium accessibility, credibility and effectiveness are factors to reckon with in the effective transfer and utilization of CBCRM knowledge. Economic and political factors have also brought about notable effects in the knowledge utilization behavior of the Batan Bay fisherfolk. The lack of financial resources hinders the acquisition and implementation of needed CBCRM knowledge while political interventions fueled by

political affiliations impede the effective knowledge transfer to target users i.e. the fisherfolk. The low level of involvement of LGU [local government unit] extension workers in the planning, implementation and evaluation of the CBCRM programs or activities in Batan Bay contributes to poor program sustainability, hence, decreases the potential for the development of a sustained and high level of community education.

In [13] for instance, they developed a vessel monitoring system (VMS). It is a satellite surveillance system primarily used to monitor the location and movement of commercial fishing vessels within U.S. jurisdiction and treaty areas. The system uses satellite and cellular based communications from onboard transceiver units, which certain vessels are required to carry. The transceiver units send position reports that include vessel identification, time, date, and location, and are mapped and displayed on the end user's computer screen.VMS is used to support law enforcement initiatives and to prevent violations of laws and regulations. VMS also helps enforcement personnel focus their time on areas with the highest potential for significant violations. It is used as evidence in the prosecution of many environmental laws and regulations including regional fishing quotas, the Endangered Species Act, and the Marine Mammal Protection Act.The VMS program currently monitors more than 4,000 vessels. It is the largest national VMS fleet in the world. The system operates 24 hours a day with near-perfect accuracy.

In the Philippines, Fisheries Registration and Licensing (FRL) is embodied in national fisheries laws and local (municipal/city) ordinances. The municipality of Bani in the Province of Pangasinan considers FRL as a feasible strategy to support the sustainable use of its municipal fisheries resources. Spearheaded by the Office of the Municipal Agriculturist (OMAg), Bani initially implemented an FRL system at the municipal level. There was very low compliance under this system primarily because fisher folk from far-flung villages were unable to afford the high transportation costs of going to the town center to register. In response, the local government of Bani devolved fisheries registration to the village level. Through Executive Order #03 enacted by the Municipal Mayor in 2006, village officials were mobilized to implement FRL systems in their jurisdictions. To build their capability to undertake such, they were trained by the OMAg with the assistance of the Sagip Lingayen Gulf Project. Based on the cost-benefit analysis, devolving FRL to the village level has decreased implementation cost and has also shortened the FRL cycle. Compliance rates from 2003 to 2007 revealed that the devolved system has also been effective in increasing the number of registrants. The devolved system is also credited with having facilitated easy and more reliable monitoring of fishing activities given the proximity of village enforcers to fisher folk. Policy-wise, more effective monitoring resulted in more accurate, valid and timely data inputting into the municipality's sustainable fisheries regulation and management decision support system. To date, not all coastal municipalities/cities in the country are implementing an FRL system, despite its crucial role in sustainable coastal governance and in conferring priority rights to municipal fisheries resources to local fisher folk. Given its merits, the Bani experience in devolving FRL could serve as a model that may be replicated in other areas in the Philippines with the same geographic configuration [14].

In [15], they conducted a study to describe the effectiveness of the system of registration and licensing of municipal fishers, fishing vessels, and fishing gears in three coastal municipalities of Panay Island and to identify problems and gaps of its implementation. The study sites include Brgy. Culasi, Roxas City, Capiz; Brgy.Polopina, Concepcion, Iloilo and Brgy.Pinamuk-an, New Washington, Aklan. Primary data were gathered through an interview schedule and key informant interview (KII) and further validated through focus group discussions (FGD). Data collection was done during the period September to December 2008 with 1,171 total number of respondents. With no uniform proceedure, process of registration and licensing system of the three study sites varies. Compliance rate for fisherfolk registration, fishing gear and fishing boat licensing is highest in Concepcion compared to New Washington and Roxas City. The case of the municipality of Concepcion has also demonstrated that "onestop-shop" strategy of bringing the registration team to the people can increase fishers' compliance. Some policy recommendations for the LGUs to improve its fisheries registration and licensing system include the following: determine the carrying capacity of the resource as basis for limiting entry, standardize the registration and licensing procedure, establish a fair basis for license fees, and provide funds for the establishment and maintenance of a databank of fishers and the status of their registration and licensing.

III. METHODOLOGY

This section provides an overview of the research, including the design, data collection technique, and statistical treatment.

2.1 Research Design

Research design is a blueprint or plan specifically created to answer the research question and to control variance [16]. Developmental and descriptive research designs were used in this study.Developmental research

is the systematic study of designing, developing and evaluating instructional programs, processes and products that must meet the criteria of internal consistency and effectiveness [17]. Developmental research seeks to create knowledge grounded in data systematically derived from practice. It is a pragmatic type of research that offers a way to test "theory" that has been only hypothesized and to validate practice that has been perpetuated essentially through unchallenged tradition. In addition, it is a way to establish new procedures, techniques, and tools based upon a methodical analysis of specific cases. As such, developmental research can have a function of either creating generalizable conclusions or statements of law, or producing context-specific knowledge that serves a problem solving function [18]. In addition, descriptive research describes systematic and accurate facts and characteristics of a given population or area of interest [19]. Descriptive research will be utilized to collect feedback on the system development via survey questionnaires.

2.2 Software Development Life Cycle Model

The study used the Rapid Application Development (RAD) paradigm as the software development life cycle for the software development operations. In the RAD model, prototypes are utilized as a working model that is merged into the final product [19]. It is required to use prototyping and iterative development. The process of developing the program includes the planning required to build the product. A prototype is a functional model of a product component that is almost identical to the real product [20]. Users are given the prototype to test and provide feedback, after which it is re-analyzed and changed, and a second prototype is created. The cycle repeats itself until users and developers agree on a final system [21].
The RAD model consisted of four phases namely requirements planning phase, user design phase, rapid construction phase and cutover phase [22]. At each phase, the researcher performs specific activities leading to the phase's deliverable. Figure 2 shows the RAD model.

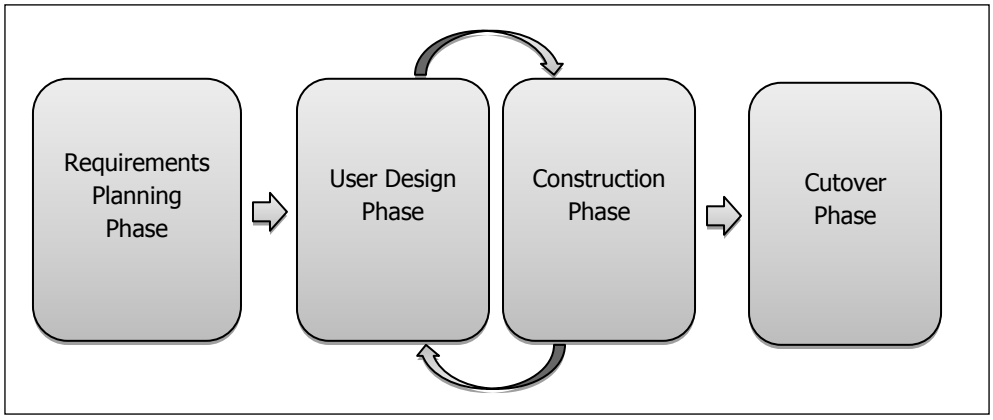


Figure 2. The Rapid Application Model

2.3 Physical Network Topology

The physical network topology depicted the communication mechanisms and layout of physical networks. The physical network topology depicts how the components in the network are connected. It illustrated how cables, PCs, and other equipment were connected. Since the system was web-based. It can run on one or more computers in a network and be accessed via a web browser using the server's given Internet Protocol (IP) Address to access the program and data manipulation. Figure 3 shows the physical network topology of the system.

Figure 3. Physical Network Topology of the System

2.4 Application Architecture Model

The application architecture model describes the recommended layouts for the core functions. The diagram depicted the hierarchy of the proposed system's primary logical components. Logical architecture identifies the software components required to implement a solution, displays their interdependencies, and distributes them along logical levels. The physical distribution of components and functions on servers, computers, networks, and remote sites was the focus of tiers. The N-tier architecture was used in this research. Client–server architecture divides the system's functionality into services, each of which is offered by a separate server. Clients are those who use these services and must connect to servers in order to do so [23]. It consists of four layers namely the presentation layer, the application and logic layers also known as the business layer, the data manipulation layer, and the database layer.

The presentation layer, often known as the graphical user interface (GUI), integrated the functionalities that allowed the user to interact with the system. The display layer was executed at the web browser via local hosting in the server version of FisherfolkManagement Information System with SMS Gateway. The business layer enclosed the required business logic and implemented the system's principal functionality. The suggested system's data manipulation layer implemented the procedures involving the management of fisherfolks' data. The database, tables, and records were all handled by the My Structured Query Language (MySQL) database server.

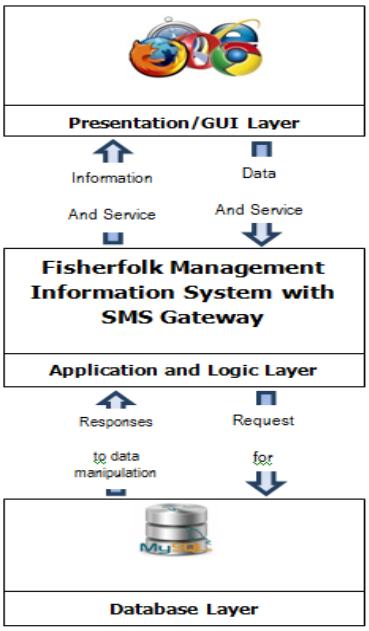


Figure 4.Application Architecture Model of the System.

2.5 Testing and Evaluation

Due to the finalization of the developed system, the researcher requested the testers to evaluate the system in terms of it level of functional suitability, level of usability, and level of performance efficiency. A survey questionnaire was given to the interface design as well as to test the system's usability, functionality and performance efficiency. A 5-point Likert scale comprising of 1 as Poor and 5 as Very Good was used on the developed system prototype. To statistically compute whether the developed system passed the evaluation criteria, the Mean statistics was applied.

The Mean is computed as: $\overline{X} = \frac{\Sigma X}{n}$

where :

is the mean is $\overline{X}$ the summation of individual raw scores
n is the ΣX number of populations

The obtained mean score was interpreted using the following verbal description:

Mean Score	Description
4.21 – 5.00	Very Good
3.41 – 4.20	Good
2.61 – 3.40	Average
1.81– 2.60	Fair
1.0– 1.80	Poor

IV. RESULTS AND DISCUSSION

The results obtained are as discussed below:

4.1 Functionality of the System Product

The table below shows the result of the respondent's feedback on the functionality of the system product in terms of functional appropriateness, functional correctness, and functional completeness. On the extent of designing the system product to end-users, the functional appropriateness (M= 4.55), functional correctness (M=4.64) and functional completeness (M=4.72) were described as "Very Good".

These findings simply suggested that with the system product when implemented, the management of fisherfolks' data, as well as the integration of SMS technology for wider dissemination of information had a high level of suitability. The recording and retrieving of fisherfolks' records in electronic format were provided in a fast and efficient way. As needed by the users, the system product enhances the day to day transactions being provided to the clienteles. Table 1 shows the results.

Table 1.Respondents' Feedbacks on the Functionality of the System Product.

Implementation Indicators		Mean	Verbal Interpretation
a.	functional appropriateness	4.55	Very Good
b.	functional correctness	4.64	Very Good
c.	functional completeness	4.72	Very Good

***Legend**: 1.00-1.80 (Poor); 1.81-2.60 (Fair); 2.61-3.40 (Average); 3.41-4.20 (Good); 4.21-5.00 (Very Good);*

3.2 Level of Usability

Usability features is the ability of the system product to be understood, learned, operated, accessed and provides visual appearance, under specified settings of the system. The level of usability of the system was evaluated in terms of understandability, learnability, operability, accessibility, and user interface aesthetics. The respondents' feedbacks for the level of usability in terms of understandability (M=4.60), learnability (M=4.75), operability (M=4.76), accessibility (M=4.75), and user interface aesthetics (M=4.72) were all interpreted as "Very Good". Findings revealed that the system product, when utilized, possessed a high level of usability wherein end-users were able to easily understand due to its simple design and features. Table 2 shows the result.

Table 2.Respondents' Feedbacks on the Usability of the System Product.

Implementation Indicators		Mean	Verbal Interpretation
a.	understandability	4.60	Very Good
b.	learnability	4.75	Very Good
c.	operability	4.76	Very Good
d.	accessibility	4.75	Very Good

e.	user interface aesthetics	4.72	Very Good

***Legend**: 1.00-1.80 (Poor); 1.81-2.60 (Fair); 2.61-3.40 (Average); 3.41-4.20 (Good); 4.21-5.00 (Very Good);*

3.3 Performance Evaluation of the System Product

Performance is the capability of the system product to provide total effectiveness in relation to the utilization of resources. The performance of the system was evaluated in terms of resource utilization and time behavior. The results showed that the performance of the system product in terms of resource utilization (M=4.82) and time behavior (M=4.80) were all interpreted as "Very Good".

Findings revealed that the system product upon evaluation was able to manage fisherfolks'data and SMS management in the day to day transactions of DA-BFAR in the Municipality of Estancia, Province of Iloilo. The respondents believed that the throughput procedure and response time were outstanding. The system product was able to deliver actual results and capable of assisting in the day to day transactions of the office. The most important transactions such as,management of fisherfolks' data and the integration of SMS technology in the systemprimarily catered the daily activities of the personnel of DA-BFAR. Table 3 shows the performance evaluation of the system product.

Table 3.The Performance Evaluation of the System Product.

Implementation Indicators		Mean	Verbal Interpretation
a.	resource utilization	4.82	Very Good
b.	time behavior	4.80	Very Good

***Legend**: 1.00-1.80 (Poor); 1.81-2.60 (Fair); 2.61-3.40 (Average); 3.41-4.20 (Good); 4.21-5.00 (Very Good);*

V. CONCLUSION

In view of the results of the study, the following conclusions were arrived:

In terms of functional appropriateness, correctness, and completeness, respondents assessed the Fisherfolk Management Information System with SMS Gateway as "Very Good." This indicates that the Fisherfolk Management Information System with SMS Gateway was able to handle daily transactions concerning the management of fisherfolks' data within the Municipality of Estancia, Iloilo.

Likewise, due to its straightforward design and features that are simple to comprehend, access, and apply, the Fisherfolk Management Information System with SMS Gateway proved to be user-friendly.

These findings simply suggested that with the system product when implemented, the management of fisherfolks' data, as well as the integration of SMS technology for wider dissemination of information had a high level of suitability. The recording and retrieving of fisherfolks' records in electronic format were provided in a fast and efficient way. As needed by the users, the system product enhances the day to day transactions being provided to the clienteles. In terms of performance efficiency, the system met the expectations of the personnel of DA-BFAR in Estancia, Iloilo, Philippines.

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