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DESIGN AND DEVELOPMENT OF PROJECT WATCH: WEB-BASED ANALYTICS AND TRACKING FOR CATCH AND HARVEST MONITORING AMONG COASTAL FISHERFOLKS

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Abstract

Coastal fisheries significantly contribute to local economies and food security in Philippine coastal communities, particularly in Aparri, Cagayan, where fishing remains a primary livelihood. However, monitoring of catch and harvest activities largely relies on manual recording methods, resulting in delayed, inconsistent, and unreliable data that hinder effective fisheries management and evidence-based decision-making. This study developed and evaluated Project WATCH: Web-based Analytics and Tracking for Catch and Harvest Monitoring, a technology-driven system designed to improve fisheries data collection and monitoring processes. Using a developmental research design, the study implemented a web-based platform capable of real-time monitoring, digital record management, and geospatial tracking of fishing activities. The system collected catch, effort, and location data to generate analytical outputs, including Catch Per Unit Effort (CPUE) and fishing hotspot mapping. System evaluation was conducted using ISO 25010:2023 software quality standards and the Technology Acceptance Model (TAM). IT experts assessed system quality attributes, while end users evaluated usability and acceptance through structured questionnaires analyzed using weighted mean. Results indicated an overall system quality mean of 4.76 (Very High Extent) and an end-user acceptance mean of 4.27 (Strongly Agree), demonstrating strong performance and high adoption readiness. Findings suggest that Project WATCH enhances monitoring accuracy, transparency, and data-driven fisheries governance, supporting sustainable resource management and coastal community resilience.

Keywords: *fisheries monitoring, sustainable fisheries management, coastal resource management*

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INTRODUCTION

Aparri is a prominent coastal town situated at the northernmost tip of the Cagayan Valley Region in Northern Luzon. It is situated at the mouth of Cagayan River where it meets the Babuyan Channel. It is often dubbed as the "Gateway to the North" and is popular for its fertile fishing grounds and it serves as a hub for seafood trade because of its strategic locations. Its economic activities are centered on export of products that include the red-soft shelled shrimp locally known as "aramang", rice, corn, copra and other fish products. Its local industries comprise of fishing, cattle raising, dried fish making and fish paste "bagoong" manufacturing.

The fishers in the municipality of Aparri has historically used manual methods for monitoring catches and harvesting, such as keeping handwritten logs and relying on verbal reports, which often lead to inconsistent and delayed data. These issues occurring on the current practices was leading into ineffective management of resources, unreliable accuracy of stock assessment, misleading of trend prediction for sustainable fishing practices, thus making it impossible for the local authorities and resource managers to conduct data-based decision for reliable resource management.

The implementation of web-based analytics and tracking systems offers a solution to existing fisheries monitoring challenges. Project WATCH provides real-time monitoring, digital record-keeping, and geospatial mapping of fishing activities, enabling reliable and accessible data for fisherfolk, local government units, and the Bureau of Fisheries and Aquatic Resources (BFAR). By integrating predictive analytics and user-centered design, the system supports sustainable fisheries management, strengthens regulatory compliance, enhances transparency, and promotes evidence-based decision-making. As a technology-driven initiative, Project WATCH contributes to the protection of marine resources in Aparri and supports coastal communities whose livelihoods depend on fisheries. Moreover, it enhances community resilience amid declining fish stocks, habitat degradation, and Illegal, Unreported, and Unregulated (IUU) fishing activities (Fabinyi, 2024).

Statement of the Problems

1. Determine the current practices, policies and problems associated in managing Aparri's fisherfolks catch and monitoring of fishing vessels.
2. Design, develop, and test a system solution to address the issues and implications of the analysis of monitoring.
3. Determine the IT experts' assessment of the developed systems' compliance with ISO 25010:2023 in terms of its:
    a. functionality suitability,
    b. performance stability,
    c. compatibility,
    d. usability,
    e. reliability,
    f. security,
    g. maintainability
    h. portability
4. Determine the end-users' assessment of the developed system using the Technology Acceptance Model in terms of its:
    a. Performance Expectancy
    b. Effort Expectancy
    c. Social Influences
    d. Facilitating Conditions
    e. Hedonic Motivation
    f. Habit
    g. Behavioral Intention
    h. Perceived Ease of Use
    i. Perceived Usefulness
    j. Self-Efficacy
    k. Response Efficacy
    l. Adoption Intentions

METHODOLOGY

The following are the different methods and materials used in processing this paper.

Research Design

The study utilized a Descriptive-Analytical Developmental research design, incorporating the System Development Life Cycle (SDLC) methodology in addition with the Agile framework, to lead a way to the design, development, and evaluation of Project WATCH a Web-based Analytics and Tracking system for Catch and Harvest monitoring among coastal fisherfolks. This plan of action not only helped to classify data and directed processes, but it also fabricated transparent and actionable insights. The Agile framework stimulates iterative development and frequent user feedback, guaranteeing that the system suffices the needs of the stakeholders.

Figure 1. Agile Model

Respondents

The research determined its participant group through the method of purposive sampling. The study participants were purposively selected, focusing on individuals who are knowledgeable, directly involved, and considered the primary users and beneficiaries of the proposed system. The study involved 87 fisherfolk from the Municipality of Aparri, 5 BFAR personnel/fisheries experts, 5 MAO Aparri personnel, and 10 IT experts from Cagayan State University Aparri Campus, which resulted in 107 participants. The selected respondents served as the most suitable respondents because their knowledge enabled them to deliver precise information which served vital functions in designing developing and evaluating the CATCHA system.

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Research Instrument

The instruments and materials utilized for data gathering in this study were carefully selected to align with its scope and objectives. A standardized checklist-based interview guide was employed to collect essential information regarding BFAR's existing data collection processes, challenges, and requirements for fisheries monitoring, ensuring systematic and consistent discussions focused on key concepts relevant to the design and development of Project WATCH. Additionally, structured questionnaire guides were developed to obtain quantitative data reflecting participants' perspectives and experiences with the developed system. The evaluation instrument was primarily based on ISO 25010:2023, an internationally recognized software quality standard used to assess system characteristics such as usability, dependability, performance efficiency, and security, providing an objective and organized framework for software evaluation. Furthermore, the Technology Acceptance Model (TAM) was integrated to measure users' perceptions, particularly perceived ease of use and usability, which are essential factors influencing technology adoption. The combined application of ISO 25010:2023 and TAM enabled a comprehensive evaluation approach that examined both technical system quality and user acceptance, ensuring a balanced assessment of performance and user-centered effectiveness.

Data Gathering Procedures

The researcher obtained ethics clearance from Cagayan State University Ethics Review Board with reference code: **CSU-IERB-2026-03-316**, before conducting the research which needed to follow ethical procedures and safeguard all participant rights and welfare and confidential information. The researcher's data collection for the study followed a well-planned sequence of steps to produce systematic and trustworthy results. At first, three possible thesis titles were suggested to the Graduate School faculty, and one of them was chosen as the final title for approval. Thereafter, a request letter was addressed to the Bureau of Fisheries and Aquatic Resources (BFAR), requesting permission and authorization to access study-related documentations that will be a necessity to the study.

Interviews with BFAR staff and IT specialists were then conducted to find out the current practices, policies, data management methods, and problems the agency faces in manual monitoring fishing vessel and recording of harvests, once the request had been granted. The ideas that came up during these interviews were used to create and devise the Project WATCH system.

Post system development, the system's performance and its quality were rated according to the ISO 25010:2011 standards, whereas user acceptance and usability were measured by the Technology Acceptance Model (TAM). This whole process was meticulously set up to enhance the precision, dependability, and purity of the data gathered, which in turn, added to the trustworthiness and legitimacy of the conclusions drawn from the research.

Data Analysis Plan

The data that was gathered and collected from the participants was be tabulated, validated, and analyzed through descriptive statistics. The following descriptive statistical tools were used in this study were shown in Table 1, Table 2, and Table 3.

A five-point Likert scale was used to rate each property, with descriptive values interpreted as follows:

The respondents' perceptions regarding the indicators included in the survey questionnaire were measured using weighted mean with 5-point Likert scale. The responses were analyzed using the weighted mean to determine the level of agreement of the participants.

Table 1. Interpretation table for Assessment of the Existing Fisheries Management and Monitoring Practices, Regulatory Frameworks, and Operational Challenges

Numerical Value	Scale Point	Descriptive Value
5	4.20 – 5.00	Strongly Agree
4	3.40 – 4.19	Agree
3	2.60 – 3.39	Neutral
2	1.80 – 2.59	Disagree
1	1.00 – 1.79	Strongly Disagree

ISO 25010: 2023, the system was evaluated by the IT experts, and analyzed in respect to the weighted mean with the following descriptive scale:

Table 2. Interpretation table for IT Expert assessment tool using ISO 25010:2023 software quality standards.

Numerical Value	Scale Point	Descriptive Value
5	4.20-5.00	Very High Extent
4	3.40-4.19	High Extent
3	2.60-3.39	Moderate Extent
2	1.80-2.59	Low Extent
1	1-1.79	Very Low Extent

Technology Acceptance Model, this measures the level of acceptance of end users to the developed system with weighted mean following descriptive scale:

Table 3. Interpretation table for end users using the Technology Acceptance Model (TAM)

Numerical Value	Scale Point	Descriptive Value
5	4.20-5.00	Strongly Agree
4	3.40-4.19	Agree
3	2.60-3.39	Neutral
2	1.80-2.59	Disagree
1	1-1.79	Strongly Disagree

RESULTS AND DISCUSSION

Current Practices, Policies, and Problems, Associated in Managing Aparri's Fisherfolks Catch and Monitoring of Fishing Vessels

The management of fisherfolks' catch and monitoring of fishing vessels in Aparri, Cagayan is primarily conducted through regulatory mechanisms implemented by the Bureau of Fisheries and Aquatic Resources (BFAR) in coordination with the Local Government Unit (LGU). Existing practices involve vessel registration, licensing verification, catch documentation, and periodic monitoring activities aimed at ensuring compliance with national fisheries policies and promoting sustainable utilization of marine resources. These procedures support fisheries governance; however, most monitoring and reporting activities rely on

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conventional and manually facilitated processes, limiting the efficiency of data collection and coordination among stakeholders involved in fisheries management.

Despite established policies and monitoring frameworks, several operational challenges persist in the current system. Data recording and reporting are often fragmented and paper-based, resulting in delayed submission and consolidation of catch information. The absence of real-time vessel monitoring creates difficulties in tracking fishing activities and enforcing regulations, particularly in preventing unauthorized fishing operations within municipal waters. Furthermore, limited accessibility to centralized and reliable fisheries data restricts evidence-based decision-making, policy implementation, and timely response to emerging issues affecting fisherfolk productivity and resource sustainability.

To address these challenges, the developed system, Project WATCH, was designed as an integrated digital platform aimed at monitoring and managing fishing vessels, documenting fish catch, and supporting the overall administration of the fishing sector in Aparri. The system introduces real-time tracking, centralized digital record-keeping, and analytics-driven monitoring to enhance transparency, operational efficiency, and regulatory compliance. By transforming traditional monitoring practices into a technology-enabled management approach, Project WATCH strengthens fisheries governance, improves data accuracy and accessibility, and contributes to sustainable and informed management of coastal and marine resources.

Developed System to Address Reporting Challenges in Coastal Harvest Activities

The developed system, Project WATCH, was designed to address the existing challenges in monitoring fishing vessels and managing fish catch activities in Aparri, Cagayan by introducing an integrated and technology-driven approach to fisheries management. The system provides a centralized digital platform that enables real-time monitoring of fishing vessel movements, systematic recording of catch data, and organized storage of fisheries information accessible to authorized stakeholders. By replacing fragmented and manual processes with automated data collection and tracking mechanisms, the system enhances accuracy, transparency, and efficiency in monitoring fishing operations while supporting compliance with fisheries regulations and management policies.

Furthermore, Project WATCH strengthens decision-making and operational oversight through analytics-based reporting and user-centered functionalities that assist BFAR personnel and local authorities in evaluating fishing activities and resource utilization trends. The system facilitates timely submission and validation of catch records, improves coordination among fisheries management stakeholders, and promotes accountability within the fishing sector. Through its integrated monitoring and management features, the developed system contributes to sustainable fisheries governance by enabling data-driven planning, improving regulatory enforcement, and supporting the long-term management of marine resources in Aparri.

IT experts' assessment of the developed software using the ISO 25010:2023 software quality standards

Table 4. Summary of the Level of Acceptability among experts utilizing the ISO 25010:2023

Summary Table	**Category Mean**	**Descriptive Value**
Functional Suitability	4.63	Very High Extent
Performance Efficiency	4.77	Very High Extent
Compatibility	4.75	Very High Extent
Usability	4.76	Very High Extent
Reliability	4.83	Very High Extent
Security	4.80	Very High Extent
Maintainability	4.80	Very High Extent
Portability	4.73	Very High Extent
Overall Mean	**4.76**	**Very High Extent**

The results presented in Table 4 indicate that the developed system achieved a very high overall evaluation across all assessed software quality attributes, demonstrating that evaluators perceived the system as effective, reliable, and aligned with established quality standards. The findings suggest that the system performs consistently and dependably while ensuring strong data protection and allowing ease of maintenance and future improvements. Evaluators also recognized the system as efficient in operation and user-friendly, indicating that users can interact with it with minimal difficulty while maintaining optimal performance. Furthermore, the system was viewed as adaptable and capable of operating across different environments, highlighting its flexibility and practical applicability. Although functional suitability received comparatively lower feedback, it still reflects that the system adequately meets user needs and intended functions. Overall, the evaluation confirms that the developed system possesses strong technical quality, usability, and adaptability, supporting its effectiveness and readiness for real-world implementation.

Level of Acceptability among users utilizing the Technology Acceptance Model (TAM)

Table 5. Summary of the Level of Acceptability among users utilizing the Technology Acceptance Model (TAM)

Summary Table	**Category Mean**	**Descriptive Value**
Performance Expectancy	4.41	Strongly Agree
Effort Expectancy	4.49	Strongly Agree
Social Influence	4.38	Strongly Agree
Facilitating Conditions	4.39	Strongly Agree
Hedonic Motivation	3.97	Agree
Habit	3.95	Agree
Behavioral Intention	4.43	Strongly Agree
Perceived Ease of Use	4.26	Strongly Agree
Perceived Usefulness	4.27	Strongly Agree
Self-Efficacy	4.25	Strongly Agree
Response Efficacy	4.20	Strongly Agree

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Adoption Intentions	4.21	Strongly Agree
Average Mean	**4.27**	**Strongly Agree**

Table 5 presents the overall evaluation of end users toward the established Project WATCH system, indicating a strong level of acceptance and positive perception among respondents. The results show that users generally view the system as useful, easy to use, and supportive of their work processes, demonstrating confidence in its performance, functionality, and practical benefits. Respondents expressed readiness and willingness to adopt the system, highlighting that it improves efficiency and assists them in completing monitoring and management tasks more effectively. While users recognize the system's value and effectiveness, some aspects related to enjoyment and habitual use suggest that the system is still in the early stages of integration into daily routines. Overall, the findings imply that Project WATCH is well-received by end users and has strong potential for sustained adoption, with minor enhancements capable of further strengthening user engagement and long-term utilization.

Conclusion

The study concluded that the developed Project WATCH system is highly effective, user-friendly, and well-received by end-users, addressing the needs of coastal fisherfolk in Aparri for improved catch management and vessel monitoring. Likewise, it serves as a valuable tool for sustainable fisheries management, supporting both the operational needs of fisherfolk and the enforcement of policies and regulations.

Recommendations

The study results lead to these recommendations, which will improve Project WATCH: Web-Based Analytics and Tracking for Catch and Harvest Monitoring Among Coastal Fisherfolks.

The Project WATCH system should be adopted by local fisheries authorities as the standard tool for catch recording and vessel monitoring to enhance data accuracy and policy compliance.

Coastal fishermen should receive training and continuous support to build competence and confidence in using Project WATCH effectively as part of their routine activities.

System developers and local governments should explore ways to make Project WATCH more engaging and habit-forming through interactive features, mobile access, and automated reporting to encourage regular use.

Future researchers should examine the long-term effectiveness and scalability of Project WATCH, including its application in other coastal areas and its impact on sustainable fisheries management.

Declaration of no conflict of interest

The author hereby declares that this article is his original work and that there was no conflict of interest.

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