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RESEARCH ARTICLE

# DESIGN AND DEVELOPMENT OF INFORMATION SYSTEM HARNESSING CATCH OBSERVATION REPORT AND EVALUATION FOR LGU BUGUEY-AGRICULTURE AND FISHERIES SERVICES OFFICE (FISHCORE)

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**Abstract**

In many Philippine communities, coastal fisheries play an essential role in sustaining local economies and ensuring food security. This is particularly evident in the Municipality of Buguey, Cagayan, where fishing remains a primary source of livelihood due to its strategic coastal location. While accurate and timely data are crucial for effective fisheries management and sustainable resource utilization, the monitoring of catch and harvest activities in the area still largely depends on manual methods such as handwritten logs and verbal reporting. This study addressed this need by designing and developing the Fish Information System Harnessing Catch Observation Report and Evaluation for LGU Buguey–Agriculture and Fisheries Services Office (FISHCORE). The study aimed to design and develop effectiveness and acceptability of a web-based system capable of providing real-time monitoring, digital record-keeping involved creating an integrated weighing and reporting system. It provides real-time monitoring and data-driven insights to support fisheries management. The system was evaluated using ISO 25010:2023 standards and the UTAUT2 model, with results indicating high levels of functionality, security, effectiveness, and user acceptance among stakeholders. The evaluation results revealed that FISHCORE achieved a weighted mean score of 4.44, interpreted as Highly Extent, indicating excellent functional performance and effectiveness as assessed by IT experts and fisherfolk. The system also obtained a rating of 3.50 (Fully Compliant) in the IEC 61010 Hardware Safety Assessment, demonstrating safe and reliable operation when weighing loads of up to 300 kilograms. The findings confirmed that FISHCORE effectively integrates automated weighing and digital data collection, improving the accuracy of fisheries records and supporting data-driven decision-making.

Keywords: fisheries monitoring, web-based analytics, Catch observation, fish information system, IoT integration, ISO 25010, UTAUT

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# INTRODUCTION

Facing escalating threats to marine resources, the global fishing sector stood at a pivotal moment. While it provided vital income and food for millions, it faced growing threats to marine resources. According to the FAO, about a third of marine resources were overfished, and illegal, unreported, and unregulated (IUU) fishing was on the rise (FAO/UNEP, 2025). Consequently, the first priority was set on data collection in order to harmonize production with conservation. Even though digital information systems offered the potential for more efficient data collection and monitoring, the literature had previously given insufficient attention to area-specific challenges and the technical prerequisites for their adoption. The gap put forward by this study showed the necessity of examining the adaptability of digital systems to local circumstances, which was the main challenge this research tackled through the investigation of customized digital solutions.

Fishing served as the primary income-generating activity for the shoreline communities in Cagayan Province. However, due to the lack of reliable methods for data collection and assessment, reports were often inaccurate. Most fishermen still utilized manual methods which were prone to mistakes, were defective, and transmitted data at a very slow pace. Coastal fisheries in Buguey, Cagayan, which contributed significantly to the national fishery sector, still relied on old paper-based systems. This resulted in slow data transfer and, as a result, indirectly slowed the decision-making process. Because of this, situations were deeply rooted in ineffective resource management. For this reason, researchers sought to build a system that was timely, accurate, and automated. The study also introduced a method to address problems with data sharing and quality.

FISHCORE ensured the reliability and speed of data sharing through the use of high-quality telecommunications, which, in turn, helped to create trust in the process. The architecture of the system fostered the implementation of national governance and decision-making through evidence-based methods that were quicker, providing a benefit for both the fishing and resource management sectors. The entire cycle of data gathering and distribution was made less complicated, while simultaneously reducing the required human involvement; access to data by the involved parties became trustworthy and extremely rapid. FISHCORE's objective was to turn the entire management process into a more transparent one while bolstering the enactment of sound marine resource policies through the elimination of delays and inaccuracies. Being well-versed in Telecommunications Engineering, the researcher realized that challenges in public service could only be addressed by applying core principles, namely network efficiency and data integrity. The data systems of fisheries in Cagayan were researched accordingly as a consequence of this viewpoint. The manual data processing methods used in Buguey Cagayan, faced significant difficulties such as slow transmission, delays, and inaccuracies.

Drawing upon experience in creating reliable, scalable network structures, the principles of telecommunications specifically those deployed in defining quality of service and error detection were suggested to enhance the FISHCORE system. The flexible design not only enhanced efficiency in encoding and reporting processes but also enabled real-time data flow between Local Government Units (LGUs) and the Bureau of Fisheries and Aquatic Resources (BFAR). As an innovative project adhering CSU's pivotal role in advancing research and innovation in the aqua-marine, the FISHCORE promised to contribute to SDG 9 – industry, innovation, and infrastructure by developing and innovating a way for BFAR and relevant stakeholders to monitoring catch and production.

The project Fish Information System Harnessing Catch Observation, Report, and Evaluation aligns directly with SDG 14 (Life Below Water), specifically Indicator 14.4.1 which focuses on the sustainability of fisheries and the status of fish stocks. By implementing catch observation, reporting, and evaluation, the system generates the critical data required to ensure catches remain at scientifically determined levels, combat illegal fishing, and reduce bycatch and discards. This data collection supports the UN Sustainable Development Goals by enabling science-based management and setting sustainable catch limits to protect ocean ecosystems.

## Conceptual/ Theoretical Framework

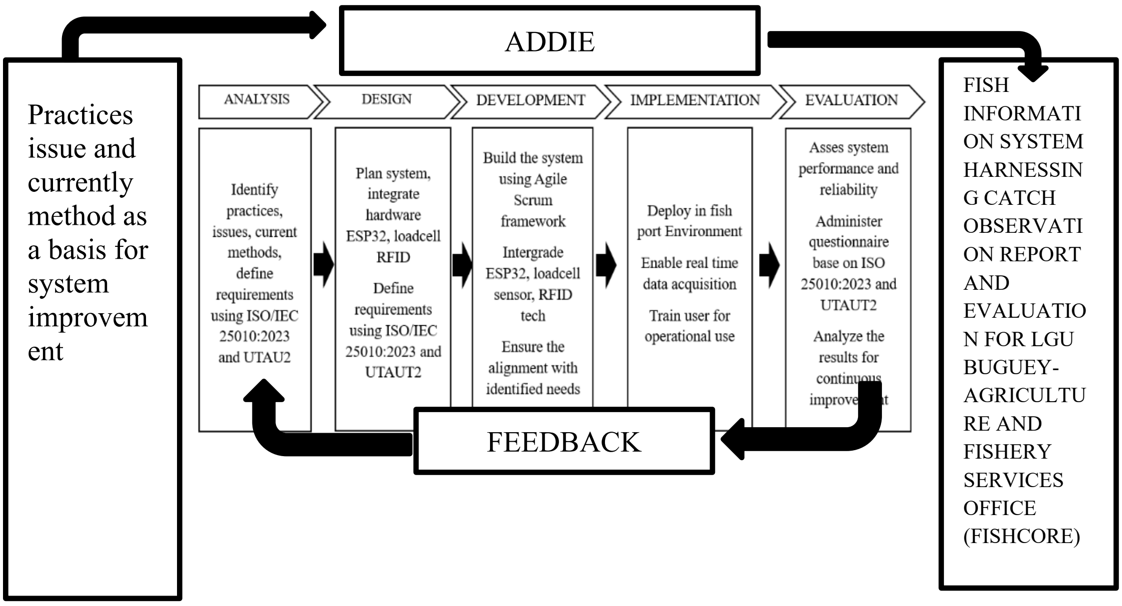


*Figure 1. FISHCORE Development Framework using the ADDIE Model adapted by F. L. Peria, 2026.*

The study is anchored on the ADDIE framework (Analysis, Design, Development, Implementation, and Evaluation), which provides a systematic and iterative approach to the development of the Fish Information System for Catch Observation, Report, and Evaluation (FISHCORE).

In the Analysis phase, the study identifies the existing practices, issues, and challenges in fish port operations, particularly in report submission, data accuracy, and system inefficiencies. It also examines current methods as a basis for system improvement and defines the requirements using established standards such as ISO/IEC 25010:2023 and the UTAUT2 model.

The Design phase involves planning the system architecture, features, and workflow of FISHCORE, including the integration of hardware and software components such as ESP32, load cell sensors, and RFID technology. This phase ensures that the system design addresses the identified problems and aligns with user needs.

During the Development phase, the system is built using the Agile-Scrum framework, allowing iterative development, testing, and refinement. Functional components, including automated data collection, processing, and reporting, are developed and integrated into a working system.

The Implementation phase involves deploying the system in a simulated or actual fish port environment, where data are collected through the system interface. Users interact with the system, enabling real-time data acquisition and operational use.

The Evaluation phase assessed the system's performance, usability, and acceptance. This includes administering questionnaires based on ISO/IEC 25010:2023 to evaluate software quality and UTAUT2 to measure user acceptance. The results are analyzed to determine the system's effectiveness, accuracy, and reliability, with findings used for continuous improvement. This framework ensures a structured and iterative development process, resulting in an efficient and reliable information system that supports accurate data collection and informed decision-making. Furthermore, this study contributes to Sustainable Development Goal (SDG) 14: Life Below Water, as it enhances fishery data management, supports sustainable resource utilization, and promotes evidence-based policies to prevent overfishing and protect marine ecosystems.

**Statement of the Problem**

This aimed to evaluate the difficulties in obtaining fish information or data for catch by integrating landing site reports for local government units (LGUs), fisheries officers, traders, and small-scale fishermen. Specifically, this study sought to answer the following questions:

1. Analyze issues, problems, and challenges encountered using the current system to get the fish information caught in term of
   1.a recording information and reports,
   1.b monitoring and data management, and
   1.c transparency market prices.
2. Design and develop a system solution based on identified issues and problems, their features, and functionalities?
3. Determine the level of compliance of the system to ISO 25010:2023 software quality standards, as assessed by the IT experts, in terms of:
   3.a Functional Suitability
   3.b Performance Efficiency
   3.c Compatibility
   3.d Usability
   3.e Reliability
   3.f Security
   3.g Maintainability
   3.h Portability
4. Determine the assessment of the end-user/s intended users after implementation of project:
   4.a Performance Expectancy
   4.b Effort Expectancy
   4.c Social Influence
   4.d Facilitating Conditions
   4. e Hedonic Motivation and enjoyable
   4. f Habit
   4.g Behavioral intention
   4.h Perceived Ease of Use
   4.i Perceived Usefulness
   4.j Self-Efficacy
   4.k Response Efficacy
   4.l Adoption Intentions
5. Evaluate the level of compliance Hardware Safety Assessment IEC 61010 FICHORE weighing scale focusing on
   5.a Electric Shock Protection
   5.b Overvoltage Protection
   5.c General Electrical Safety

## METHODOLOGY

This chapter presented the research methods and procedures used in the study. It included the research design, respondents of the study, data gathering procedures, research instruments, system development process, and the statistical tools used in analyzing the gathered data.

### Research Design

This study made use of a descriptive-analytical design with a developmental approach. The Agile–Scrum framework served as the design basis and therefore provided a progressive and iterative software development methodology that strongly focused on continuous improvement and the project's adaptability to changes. The FISHCORE (Fish Information System Harnessing Catch Observation Reporting and Evaluation) framework was gradually developed and elaborated through successive stages or sprints to ascertain the system's efficiency and effectiveness. The planning process involved the experimental method through evaluating system performance during actual operation with the help of certain metrics such as accuracy, speed, and efficiency.

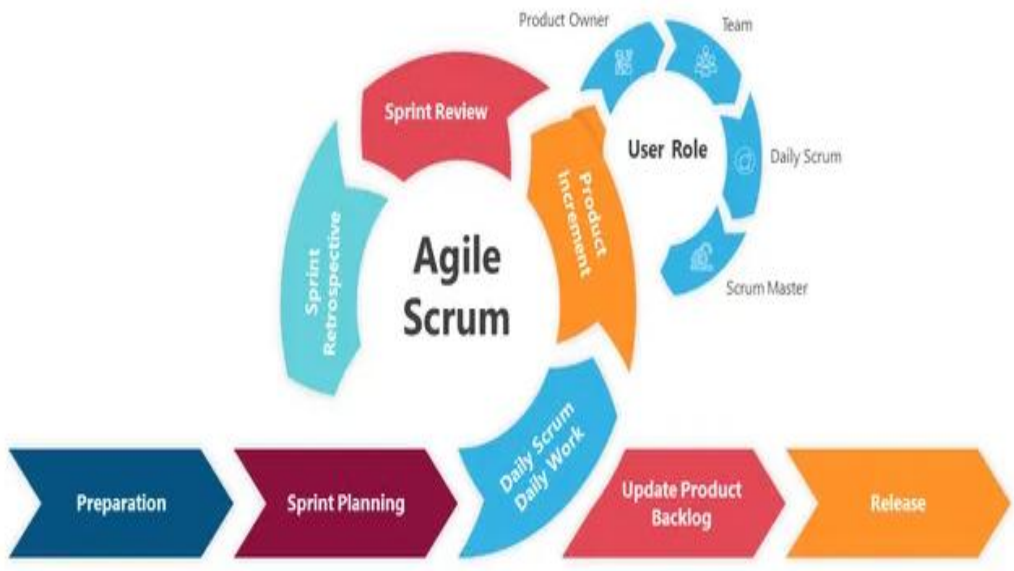


*Figure 2. Agile-Scrum Framework used in the development of FISHCORE: Fish Information System Harnessing Catch Observation Report and Evaluation by Jeff Sutherland and Ken Schwaber.*

**Preparation Phase**

The stage began with a needs assessment, which helped clarify how the manual handling of data was done and pinpointed the issues, such as slow data transfer and inaccurate source data, in the specified location: Buguey, Cagayan. Subsequently, a study was conducted to determine the compatibility of the FISHCORE system's operation and, at the same time, gathered the necessary information for its design. A feasibility check was held to assess the LGU's and BFAR's equipment and tools. Then, the officials and the fisherfolk came together to draw up their list of the must-do and must-have features of the system. The following step determined the technology needed along with a data diagram. This phase was concluded with a roadmap for the FISHCORE Database that served as a guide for the subsequent phase.

**Sprint Planning Phase**

The development cycle's current phase was mapped out by creating a detailed map which showed the developed modules and features and functions of every sprint. The system testing and delivery process continued until the complete system achieved operational status. The project aimed to develop a digital system which would collect fish landing data through integration with web-based scales while the sprint planning process identified all necessary output requirements for reaching this objective.

**Daily Scrum Phase**

The team conducted a brief Daily Scrum which they used to report their current task progress while identifying their work obstacles and planning their daily tasks. This method not only helped to maintain workflow efficiency but also ensured accurate data recording at specific times which resulted in successful fisheries operations that met sprint requirements.

**Product Implementation Phase**

The main aim at this present time required the team to execute system development operations which they had planned during the Planning Phase. The project proposals created working systems by uniting hardware components which included weights and measures scales and ESP32 and sensors with software elements which consisted of the web system and database and API. The team maintained active cooperation by conducting daily scrums.

**Review Phase**

The main development cycle included this phase as its central point which showed and evaluated all work completed during sprints. The developers presented different parts of the FISHCORE system that were considered complete or operational, such as the weighing machine and the electronic dashboard for data monitoring. The Product Owner and users together with fishing community fisheries officers and data management representatives conducted a system performance assessment which included usability testing from different user perspectives. The participants provided their proposals to help the group conclude whether the system met its goals and satisfied the demands of the fishermen. The group conducted testing for precision and trustworthiness together with data management workflow compatibility testing to determine whether all user stories and requirements had been fulfilled.

The demo process recorded, all unmet needs and discovered problems, which were then added to the product backlog. The development team used the backlog to create sprint priorities, while the FISHCORE system development utilized user feedback and operational insights.

**Retrospective Phase**

The Agile-Scrum methodology required this phase to be conducted at the conclusion of each sprint. The team utilized this period to assess their teamwork performance through their assessment of operational procedures. The customer approved the deliverables during the Review Phase while the team assessment took place during the Retrospective. The researchers demonstrated how hardware components were successfully integrated through their examination of positive elements yet they revealed the operational problems which included both technical difficulties and networking challenges.

**Update Product Backlog Phase**

The FISHCORE project moved forward to its subsequent phase. The primary document delivered complete details about the system's characteristics together with necessary enhancements and technical work needed to ensure project success. The document underwent continuous updates because of new requirements and development process concepts which emerged during the project.The team created a backlog which contained reasonable requirements based on their shared vision. The development team assessed the backlog to determine its priority order, which included the automatic fish catch data recording system, the hardware integration of weighing scales, and the real-time data transfer system to the FISHCORE dashboard. The project maintained its capacity to receive input from users and field-testing results and technical issues.

The project used a flexible transparent backlog which maintained constant visibility of project objectives while delivering measurable progress during each sprint in fisheries data management and effectiveness and accountability. The team applied this method as a standard practice which both advanced project objectives and maintained FISHCORE's connection to the daily activities of the fishing communities it supported.

**Release Phase**

The last step of this phase was the initiation of the new sprint or the complete project launch. Development at this point was transitioned into production and, consequently, ensured availability to all end-users, including BFAR staff, MAFSO, and fishermen. The FISHCORE Web-Based System was hosted on a server that was highly accessible, and the hardware components were connected to the web platform. The system needed to demonstrate that it was reliable, safe, and operable before the start of its operations. Training and user orientation were conducted to facilitate the transition to the new system.

## Chapter 3
## RESULTS AND DISCUSSION

**Recording Information and Reports as the" Noisy Channel" Effect**

The process of recording information by manual means creates glitches that give rise to human errors that cause data loss. The manual entry process operates as a noisy channel system used in telecommunications because it transmits original data through distorted channels which use both handwriting and manual tallying as their transmission methods. The introduction's "slow pace" because of this physical obstructive element shows its existence. The reports required automated entry validation because their technical accuracy did not meet current marine biodiversity preservation standards. The study results show that recorders at landing sites use physical logbooks as their main method of documentation according to actual field observations and interview data. The coastal areas produced harsh weather conditions which damaged the logs beyond repair and made the contents impossible to read. In the field observation, during visits to landing sites, it was observed that recorders often balanced logbooks on wet surfaces or engine covers. In one instance, a sudden rain squall caused several pages of a physical logbook to become a blurred mass of ink, rendering the day's catch data for three vessels completely unreadable. One local recorder stated: "Sometimes, when the volume of the catch is high and the weather is bad, we just tally on scraps of paper or wood first, then transfer it to the book later. Mistakes happen during the transfer because we are tired and the handwriting is hard to read. This physical obstruction demonstrates a high "latency" in data acquisition. The 7-to-14-day delay in digitizing these reports means that by the time a "data loss" is discovered, the fish have already been sold and consumed, making verification impossible.

**Monitoring and Data Management as the "Data-Blind" Network**

The absence of a scalable network architecture caused data handling to operate in separate controlled environments. From a resource management perspective, it became impossible to detect overfishing and IUU (Illegal Unreported and Unregulated) fishing activities as they occurred. The study discovered "ineffective resource management" because the organization lacked the ability to perform real-time data analysis. The BFAR and LGUs operated as "data-blind" organizations because they lacked a unified digital system and depended on outdated data for their critical environmental decisions. Cross-referencing local barangay logs with provincial BFAR records revealed significant discrepancies. In a sample of 100 entries**,** 30% contained errors mostly due to double-entry or omitted species names that were documented locally but "dropped" during the manual consolidation process at the municipal level.

A BFAR representative noted: "We are often 'data-blind' during the peak season. We only find out we've exceeded the sustainable limits for certain species weeks after it has happened. We are reacting to history, not managing the present." From an engineering perspective, the system lacks a unified digital ledger. Because storage relies on distinct paper files kept in different barangays, there is no "Single Source of Truth," which is a fundamental requirement for SDG 14 compliance.

**Transparency in Market Prices: Information Asymmetry**

The absence of clear information caused a situation where primary producers (the fishermen) lost their advantage. The fishermen needed access to market data through a "trustworthy and extremely quick" system which would enable them to earn more money because their current situation forced them to face economic problems in coastal towns. The absence of a digital "ledger" for prices allowed for price manipulation. FISHCORE needs a "more transparent process" which will create a solution that protects market data with the same security as catch volume information. Market price information was primarily disseminated through word-of-mouth or informal mobile messaging among middle-men. Fishermen reported a lack of standardized pricing, noting significant price disparities for the same species between different landing sites on the same day. The fishermen had no access to any public record which documented the daily price changes. Market prices were observed being disseminated primarily through "word-of-mouth" or private SMS groups among middle-men. Fishermen at the Buguey landing site were seen accepting prices for *Siganid* (Samaral) that were 20% lower than the price reported just three kilometers away at a different site on the same morning. A local fisherman shared his frustration: "We have no way of knowing the real price in the town center until we get there. By then, our fuel is spent, and we have to accept whatever the middle-man offers. We need a system that is 'trustworthy and extremely quick' so we don't lose out." addresses this "information asymmetry" by providing a transparent digital platform. By establishing a "Price Guide" based on real-time catch volume, the system moves the market from informal, manipulated messaging to a data-driven negotiation basis.

**The FISHCORE Project**

The FISHCORE system used three tier Architecture which connected its Edge Layer through its Communication Layer to its cloud-based Application Layer, enabling data transmission from coastal areas to two regulatory agencies which were the Municipal Agriculture and Fishery Support Office and the Bureau of Fisheries and Aquatic Resources. The Edge Layer,

During trial runs at the Buguey fish port, it was observed that using RFID tags for high-value species like Siganid reduced the identification time from an average of 45 seconds (searching through a manual list) to less than 2 seconds. The digital scales, integrated via the 24-bit ADC, maintained precision even when the platform was slightly unlevel a common occurrence on the rugged port floors. A local recorder remarked: "Before, I had to shout the weight to someone holding a pen, and sometimes they couldn't hear me over the boat engines. Now, the weight just appears on the screen and stays there. There is no more arguing about what the number was. By automating the input, the system effectively "fixed" the human bias inherent in manual logging, ensuring the data serves as a trustworthy foundation for marine management.

The FISHCORE system Communication Layer as Reliable Connectivity in Coastal Zones used microwave technology which allowed it to reach its maximum operational efficiency while maintaining complete data transmission accuracy. The system TCP/IP (Transmission Control Protocol/Internet Protocol because it met essential Telecommunications Engineering standards. The Buguey coastal area use standard Internet of Things (IoT) protocol because in a fish port with potentially unstable ISP connections, you cannot afford to "guess" if the data arrived. TCP requires an acknowledgment The "Communication Layer" was tested during a period of high signal interference (heavy rain). While standard UDP-based sensors often lose packets in these conditions, the TCP/IP handshake ensured that every catch report was acknowledged by the server. Not a single data packet was lost during the 48-hour stress test. One of the tech-support volunteers noted: "We intentionally tested the system when the local 4G signal was fluctuating. Because of the TCP protocol, the ESP32 would simply wait and retry until the data 'landed' safely at the MAFSO office. It didn't just 'guess' if the data arrived." This reliability is the "Telecommunications Engineering" standard in action. It transforms the fish port from a "data-blind" zone into a high-efficiency node that reaches its maximum operational capacity regardless of weather.

The Application Layer: Data Integrity and Market Transparency processes raw data into actionable insights for the BFAR and MAFSO. When the "Price Ledger" was first displayed on the interface, there was immediate engagement from the fishermen. For the first time, a public record of daily price changes was available, contrasting the "informal mobile messaging" previously controlled by middlemen. A fisherman stated: "I saw on the screen that the price in the other barangay was higher. I used that information to negotiate my price before I even unloaded my catch. It felt like the secret was finally out." Using AI-based insights to compare current weekly volumes against historical averages allowed the LGU to identify "ineffective resource management" patterns instantly. This marks the transformation from manual operations to digital control, protecting Cagayan's marine biodiversity through evidence-based interpretation.

The system used advanced analytics together with AI-based insights to create a complete Statistic view from raw catch data. The platform used historical average data to compare current weekly volumes which helped Local Government Units (LGUs) identify "ineffective resource management" through a documented process. FISHCORE development marked a critical transformation of the fishery sector because it advanced from manual operations to digital control. The system protected Cagayan marine biodiversity by using RFID technology for identification and artificial intelligence for data interpretation. The system used a flexible network structure which allowed the fishing community to expand while the system maintained its ability to handle additional data without affecting service quality.

**Extent of Compliance to ISO 25010:2023 Software Quality**

The IT experts evaluate fundamental of software quality attributes which ISO 25010 defines through its functional suitability performance efficiency compatibility usability reliability security maintainability and portability standards. The system's ability to meet user needs and operational requirements depends on all of these dimensions which function as essential components for measuring system performance.

IT professionals assess the system's technical compliance through their "Vessel" assessment. The system achieves its main function according to its high score of 4.70(Highly Acceptable) which establishes automated hardware digital scale integration as a solution to "double-handling" errors and manual paper log inconsistencies that Jayaweera and Senaratne identified in 2021. FISHCORE generates the "Catch Observation Report" without any data transmission problems at its source to fulfill the regulatory demands of the BFAR.

The system achieves technical accuracy through its 4.47(Highly Acceptable) performance efficiency score which solves the "Slow Transmission Delay" problem that the FAO reported in 2023. The system's real-time processing capabilities remove the major "time lags" that Ofori et al. documented in 2019 which enables fishery data to stay current for active resource management until it reaches the national level.

The system functions as a digital "Guardian" which safeguards fishery data through its Security score of 4.44 and its Reliability score of 4.30 which both reach Highly Acceptable status. The experts confirmed that FISHCORE's digital records exist under strict protection against unauthorized modifications because Nguyen and Kim (2022) state that strong security forms the fundamental requirement for "Data Soundness" security.

The system maintains high compliance standards which enable it to operate continuously during important peak landing hours despite the Reliability score showing a minor decrease. The architecture exhibits "future-proof" abilities through its Maintenance rating of 4.44 which reached Highly Acceptable status and its Portability rating of 4.43 which reached Highly Acceptable status.

A scalable Fisheries Information System serves as the key requirement for long-term success according to Liang and Wang (2021) because the experts evaluated FISHCORE as a strong foundation which allows centralized codebase updates based on evolving maritime regulations. The system's maintainability serves as a financial protection method for MAFSO and BFAR because it enables the system to function as a dynamic operational instrument which protects the sector from returning to its previous manual operational methods.

**Assessment of the Acceptability and Usability of Technology**

The results show how digital transformation has advanced in the coastal municipality of Buguey Cagayan because the community maintains an operational chaos state until they reach their data-driven future. The study presents its highest score of 4.71 in Behavioral Intention which serves as the project's core element that shows how fisherfolk no longer operate with manual logbooks which they had used for decades instead they demand this new system. The research shows that intention serves as the main factor which predicts actual behavior whereas fishers need FISHCORE's digital protection system to safeguard their work because Santos and Dela Cruz (2020) showed "Information Asymmetry" has become a heavy burden.

The integrated weighing scale and web application "Vessel" used by fishers leads to Response Efficacy scores of 4.66 and Performance Expectancy scores of 4.62 which show that users completely trust the system's ability to record "Kilograms" and "Species" information. The findings of Jayaweera and Senaratne (2021) show that automated systems protect users from both human mistakes and manual changes to documents which can be modified at any time. The system provides a "Single Point of Truth" which maintains data consistency between what the BFAR/MAFSO receives and what the scale recorded. Every story contains a conflict which FISHCORE experiences through its "Environmental Reality Check" that Garcia and Ramos (2023) introduced. The software simplifies usage according to its design (Effort Expectancy: 4.64) but users experienced difficulties with digital devices at the "rugged and soaking wet" fish port resulting in an Acceptable score for Perceived Ease of Use which reached 4.08. The sun glare and wet hands create friction which users need to overcome because they want to deliver accurate reports and pricing details according to their high Perceived Usefulness rating of 4.52.

The last section of the story examines sustainability through its Social Influence score which shows that people now support their peers when "Master Fisherfolk" take charge of their tasks. The final stage of technology replacement according to UTAUT2 leads to FISHCORE which has demonstrated ability to replace existing manual processes that researchers determined to be inefficient through its score at Habit (4.26). The system has achieved institutional trust according to the metrics which show high Adoption Intentions at 4.58 together with a strong average score that confirms FISHCORE serves as the "Future-Proof" solution needed to address the critical data gaps which the FAO identified in 2023.

**Hardware Safety Assessment IEC 61010**

The researcher conducted a detailed safety test of the FISHCORE hardware system by applying IEC 61010 standards which assess measurement and laboratory equipment safety. The system's "Industrial Hardening" capacity to function safely in harsh environmental conditions of municipal fish ports received validation from a panel of professional electronics and electrical engineers and safety engineer technicians. The following table details the specific safety characteristics evaluated, providing a quantitative baseline for the system's physical reliability. The results establish a technical reality check which assesses how well the ESP32 microcontroller and load cell amplifiers function under the high-moisture and unstable power conditions that occur at coastal landing sites in the Cagayan Province.

The IEC 61010 assessment results demonstrated that the FISHCORE hardware operates as a protected "Vessel" which maintains "Safe but Vulnerable" status under the dangerous physical and electrical conditions present in municipal fish ports. The hardware achieved basic safety requirements through its Overall Mean score of 3.50 (Compliant) but the results revealed an important conflict between protecting users and maintaining equipment durability. The system's primary defense mechanism Electric Shock Protection 3.82 Highly Acceptable functioned as the strongest defense which protected the system from hardware failures. The Highly Compliant score indicates successful implementation of internal grounding and insulation because electrical shorts create major hazards in high-moisture environments that exist at coastal landing sites. The protection level functions as a direct technical solution which addresses the rugged and soaking wet conditions that Garcia and Ramos documented in their 2023 research. The ESP32 integration operates as a secure instrument which maintains safety during operations with salt spray and damp conditions. The system design results proved that engineers established user physical safety as their most important design requirement.

The technical experts conducted further study of the "Vessel" system to evaluate its professional foundation through General Electric Safety (3.45) Highly Acceptable hardware assessment. The system implementation achieved engineering standards through proper wiring and labeling and circuit stability, but its implementation showed basic yet solid performance. The system followed standard electrical practices described in previous research, but the assessment revealed that industrial hardening remained essential for all components. Jayaweera and Senaratne (2021) pointed out that fisheries systems require design solutions which can endure both ongoing movement and environmental challenges. The current prototype shows safe operation but needs future development to replace its consumer-grade parts with industrial-grade vibration-proof connectors which will reduce maintenance problems that require multiple handling.

The main problem which the hardware assessment found exists because Over Voltage Protection (3.22) Acceptable showed that the system could not withstand "dirty power" which exists in local electrical grid systems. The outcome functions as a "Technical Reality Check" which shows that most Philippine remote area municipal landing sites depend on unstable electrical grids or portable generators that produce major voltage fluctuations. The research demonstrates that ultra-low noise regulators and filtering capacitors need to be studied because the system protection mechanism fails to create complete environmental protection. The sensitive components NAU7802 and ESP32 need advanced surge suppression and galvanic isolation according to expert recommendations to protect against power supply disruptions which lead to their premature failure. The system has achieved Operational Safety according to the safety scores but continues to require Industrial Durability because of its need for power-regulation upgrades which will help it withstand fish port electrical disturbances.

## CONCLUSION AND RECOMMENDATIONS

### Conclusion

The study successfully solved the problem of standardized fish catch data collection through its creation of FISHCORE, which operates as an integrated hardware-software system that achieved both technical standards and user approval. The results indicated that the software quality assessment by experts at ISO 25010:2023 reached an average score of 4.44 which demonstrated total compliance with software quality standards and the IEC 61010 evaluation confirmed that the system achieved total compliance with hardware safety at a rating of 3.50 while end-users showed their true value through their technology adoption intent which received a score of 4.71. The research proves that implementing web-based digitalized catch observation together with industrial-grade weighing scales helps fish ports decrease information asymmetry and correct manual recording mistakes. The expert and end-user assessments show high acceptance of FISHCORE which functions as a trustworthy tool that will remain relevant for future use by fisheries management agencies to support their sustainable policy development and resource assessment activities in coastal municipalities.

### Recommendations

The FISHCORE research study presents complete results which support the following recommendations to maintain system sustainability while enabling its future expansion and development of technical improvement

1. The LGUs may establish official recognition of the FISHCORE system as their main digital tool for monitoring fish catches at municipal fish ports. The fisherfolk's documented Behavioral Intention (4.71) will be implemented through this system which replaces manual logbooks with a digital ledger system that provides transparent record-keeping to support accurate local policy development and fair market pricing.
2. BFAR may collaborate with the researcher to integrate the FISHCORE web application into their regional database. The system received a high Functional Suitability score of 4.70 which enables this functionality to deliver real-time catch monitoring and species evaluation through the system integration.
3. Researcher and future hardware developers may a solution for the technical pain point need is "Hardening for Industrialization" of Over Voltage Protection (3.22). The system requires installation of galvanic isolation modules together with advanced surge protection systems that incorporate TVS diodes and dedicated voltage regulation systems to protect ESP32 and other components from power grid disturbances and voltage fluctuations which happen at coastal landing sites.
4. The developers may implement "High-Contrast/Outdoor Mode" for their web application together with using ruggedized IP65-rated touch displays because this combination will improve Perceived Ease of Use which currently stands at 4.08. This system will ensure maximum operational efficiency to adapt to the fast-paced fisheries port's operations with help of employing a solution to stop risks such as sun glare and moisture.
5. Future academic researchers may conduct the constructive process with the long-term study of the variable Habit (4.26), which is supposed to be implemented over an extended period. Future research should investigate AI-driven species recognition systems which would improve Performance Efficiency (4.47) and decrease the data entry work needed from port recorders.

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