EDUCACIÓN
IPSUMTEC
ISSN: 2594 - 2905

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https://doi.org/10.61117/ipsumtec.v8i2.425

Summary – In the field of software development, full stack web application architecture has become very popular due to its ability to work on all three layers of a web application, both on the client side (front-end) and the server side (back-end): user interface, business logic, and data storage, THE BRIDGE (1). In addition, the hybrid management methodology is a smart combination (SCRUM and CASCADE projects) for management, allowing for simultaneous planning and execution in a single project, FlexiProject (2). The purpose of this manuscript is to show the development of a public sector information system based on full stack web application architecture and hybrid management methodology.

Keywords: hybrid, scrum, cascade, front-end, back-end, web.

Abstract -- In the field of software development, full stack web application architecture has become very popular due to its ability to work in the three layers of a web application, both on the client side (front-end) and the server side (back-end): User interface, business logic, and data storage, THE BRIDGE (1). In addition, the hybrid management methodology is an intelligent combination (SCRUM and CASCADE projects) for management, in a single project it is possible to plan and execute at the same time, FlexiProject (2). The present manuscript aims to show the development of a public sector information system based on full stack web application architecture and hybrid management methodology.

Key words **–** hybrid, scrum, waterfall, front-end, back-end, web.

INTRODUCTION

The MEDIUM website (3) defines the key components of Full Stack architecture as layers integrated by HTML, JS, and CSS technologies, mainly directed by their nature to the FrontEnd; for the BackEnd, languages such as Python and Ruby. Node.js and other similar frameworks; the inclusion of relational database managers such as PostgreSQL and MySQL, non-relational ones such as MongoDB, and finally, DevOps, which encompasses best practices for integrating software development and operations, as stated by RedHat (4).

Nowadays, applying only traditional software development methodologies is not enough. To achieve better profitability in the process of creating a web system, it is recommended to combine more than one with a flexible and structured approach.

Due to its characteristics, the waterfall methodology offers a linear approach to project management, for example, it requires advance planning, sequential progression, and complete documentation. In addition, it provides a clear structure and predictability that is easy to understand and manage, as is the case with 6Sigma (5).

Unlike the Agile methodology, it allows for flexibility and feedback from the development team members. "Agile project management is an incremental and iterative approach to managing a software development project." It leaves room for necessary changes, according to the PROOFHUB portal (6).

In the current context of the Federal Electricity Commission (CFE), ensuring the continuity and availability of information systems is essential for efficiently coordinating operations in the national electricity transmission network. The Puebla-Tlaxcala Transmission Operation Zone remotely manages

Receipt: October 14, 2025 | Acceptance: November 22, 2025 | Publication: December 18, 2025

remotely the operating license requests necessary for the execution of maneuvers and maintenance on high-voltage lines and substations. In this zone, the policies, procedures, guidelines, and operating strategies of the National Transmission Network are also applied under normal, emergency, and restoration conditions, with criteria of continuity and quality. However, any interruption in the main registration system, whether due to hardware failures, network outages, or technical contingencies, compromises the traceability of requests and can lead to operational delays, data inconsistencies, and risks to the safety of maneuvers.

This project proposes the design and implementation of an alternate web log: a parallel system that functions as an electronic backup for the registration of license and maneuver requests. When the primary system becomes unavailable, the alternate log will immediately and securely capture all requests from operational personnel, storing them in an independent database. Once the connection to the main system is restored, the data stored in the log will be synchronized, ensuring that there is no loss of information or duplication of records.

Throughout this work, the following main activities will be addressed:

• Diagnosis and analysis of critical points of failure in the existing logging infrastructure.

• Design of the software architecture and database for the alternate log, taking into account scalability and security.

• Development and implementation of the web application (frontend and backend), with authentication controls and data encryption.

• Simulation testing of failure scenarios to validate the integrity and availability of the alternate system.

• Deployment in a production environment and training of local staff to ensure proper adoption of the tool.

With this approach, the project contributes to strengthening the operational resilience of the Puebla-Tlaxcala Transmission Zone, aligning processes with best practices in system reliability, and complying with the regulatory requirements for information recording and storage established by CENACE and CFE's internal regulations. It also lays the foundation for future improvements in license management, such as the generation of automatic reports and the integration of real-time analytics. *Problem statement*

In any information management system, the integrity and availability of data

data are essential to ensure operational continuity and informed decision-making. However, primary systems can face unexpected failures due to technical errors, hardware failures, cyberattacks, or connectivity issues, which can lead to the loss of critical information and process delays.

Given this problem, an alternate log system is required to serve as a backup that can be activated immediately in the event of a primary system failure. This secondary system must ensure the continuity of activity logging, secure data storage, and efficient synchronization with the primary system once it is restored.

Currently, the lack of an effective backup mechanism in many organizations leads to significant operational risks, such as loss of process traceability, inconsistencies in information, and difficulties in recovering critical data. Implementing an alternative log would mitigate these risks by providing a secure and accessible backup that allows for continuity of workflow without major interruptions.

General objective

Create an alternate web log for recording applications and licenses within the Puebla-Tlaxcala transmission operating area.

Specific objectives

• Design the front-end of the web system.

• Implement the back-end and scalability of the application.

• Perform performance and functionality testing.

• Keep electronic records of license applications and maneuvers necessary to perform preventive and corrective maintenance on electrical equipment within the Puebla-Tlaxcala operating area.

Justification

In accordance with the provisions of the nation's official gazette in the operational coordination manual in section "1.2.2" on the delivery, storage, compatibility, and confidentiality of information, subsections "A," "B," and "C."

Currently, the main license management system faces potential operational risks, such as technical failures, data loss, or possible emerging failures, which can compromise the efficiency of the process and affect applicants. Therefore, the alternate web log system is justified as an alternative solution to possible technical failures of the main system. *Importance of the Project*

• Guarantee of operational continuity: In the event of failures in the main system, the alternate web log will allow key information to be recovered.

• Security and transparency: Inconsistencies in records will be avoided through a secure monitoring and storage system.

• Regulatory compliance: It facilitates accountability and ensures compliance with regulations in license management.

The implementation of this system will improve the efficiency and reliability of the licensing process, benefiting both regulatory agencies and applicants for operating licenses.

Scope

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Continuous Event Logging: The system will store all relevant activities and events, ensuring that information is not lost in the event of a main system failure.
Web Operation Mode: The alternate log will operate independently when the primary system is unavailable.
Synchronization with the Main System: When the main system is restored, the data stored in the backup system will be available, ensuring that no relevant data or information is lost at any time.
Access Control and Security: Implementation of user authentication and permission levels to protect data integrity.
Notifications and Alerts: Generation of alerts when the alternate system is activated and when the primary system is back up and running.
Cloud Availability: The system can be hosted on cloud servers, depending on the organization's requirements.
Intuitive and Easy-to-Use Interface: Development of a user-friendly interface that allows efficient use of the system without the need for advanced training.
Limitations
High availability and majority backups in the cloud.
Improve interface and add more fields to the web system.
Use of the system in different plants in other states.
Include real-time graphs on authorized license usage.
A design with more fields and use by larger volumes of users.
Direct reports in Excel on the granting of licenses, showing detailed data on permissions and application times.
Better customization and adaptation to user needs.
Incorporation of artificial intelligence or automation to improve internal processes.
State of the art.
Degree thesis at the University of La Laguna, located on the island of Tenerife, Spain (7), creating a web system to manage the academic activities calendar using the Full Stack methodology. A hexagonal architecture is implemented to separate the application into layers, facilitating the reuse of its components. The front end is built with TypeScript and Vue, importing the VuetiFy and Pinia libraries. Spring Boot, which uses Java to create large-scale microservices, is selected for the back end. MongoDB is chosen for the database structure to handle unstructured data. This allows for the successful application of Full Stack.
Another project implemented with Full Stack (8) in the modular system to efficiently manage digital files, ensuring an architecture for high availability and scalability microservices. It implements Spring Boot in the backend and Nuxt.js in the frontend layer to manage user information related to their electronic signatures and documents. JWT and PostgreSQL were chosen for storage in the security layer. The unique SCRUM methodology facilitated its agile development. In other words, no combination was used to enhance its performance, yet the results were as expected.
Work published as "Full-stack application for the creation and execution of workflows" by Hernández Alayón (9), implemented with hexagonal architecture and layers with modern tools to ensure full-stack development. MongoDB as the database manager, Oracle, Java, and Spring Boot in the backend. Frontend with TypeScript, Vue.js, VuetiFy, and vueFlow. Finally, Docker Compose is used to coordinate and deploy the multi-container architecture, simplifying system development.
Falcón Casanova (10) shows the creation of a mobile application for storing and consulting information on food products. It uses the React Native framework in the backend and the management layer with MongoDB; TypeScript is chosen for the frontend, all of which provide the tools for full stack implementation in the resulting apps.
Work entitled "Design and implementation of a full stack web application for team organization and management," Herrero Romero (11). In it, a web application is designed and developed that saves time and improves organization and production. The full stack methodology involves two collateral objectives: on the one hand, the server side with the use of Angular 10+ tools for Front End and, on the other, the interface with Spring 5 and Java 8 in Back End, which will allow the user to interact easily with the application.
These successfully implemented projects demonstrate the importance of the advantages of applying Full Stack development.

DEVELOPMENT

Methodological approach. Type of research: Applied with a focus on technological development

This project is classified as applied research, as its main objective is to solve a practical and specific problem within the Federal Electricity Commission (CFE). The focus is on technological development, which means that the main result is not only theoretical knowledge, but a functional and validated software solution.

- Nature: It focuses on the design, development, and implementation of a tangible technological solution to solve a specific and real problem in CFE's operational processes.
- Scope: It is descriptive and proactive in nature. First, it describes and analyzes the current logbook processes to identify deficiencies (diagnosis). Then, it proposes and implements a technological solution (the web application) to overcome these deficiencies.
- Modality: It takes the form of a technological project, whose effectiveness and relevance will be verified through empirical validation with end users.

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Development paradigm: Hybrid methodology (Agile-Waterfall)

To optimize resources and adapt to the nature of the project, a hybrid development paradigm has been chosen. This approach combines the robustness and planning of the Waterfall model with the flexibility and speed of the Agile model, taking advantage of the best of both worlds:

• Analysis Phase (Waterfall): In the initial stage, where the fundamental requirements of the system must be clear and stable, a traditional approach will be used. This ensures a solid definition of the requirements, architecture, and scope of the project before writing the first line of code.

• Development Phase (Agile): For software construction, an Agile methodology will be adopted, specifically an adapted Scrum framework. This allows for iterative and incremental development, facilitating adaptation to changes, continuous user feedback, and value delivery in short cycles.

• Validation Phase (Empirical): Final validation of the product will be carried out using an empirical approach, interacting directly with end users to measure usability, functionality, and satisfaction, ensuring that the solution truly meets their needs.

Software development methodology

Development model: Adapted Agile

The choice of Adaptive Agile Development is not accidental, but responds to the inherent needs of a project that requires high user interaction and adjustability.

Justification:

• Rapid adaptation: It allows for the incorporation of adjustments and new ideas that may arise during development, which is crucial in corporate environments.

• Early Feedback: Short cycles (sprints) with functional deliverables allow users to validate progress and provide feedback early on, avoiding costly deviations.

• Risk Reduction: By delivering value incrementally, the risks associated with long projects are mitigated. If a sprint fails or a feature is not accepted, the impact is contained and can be corrected in the next iteration.

Development Phases

The process is divided into three major phases, each with clear activities and objectives.

Phase 1: Analysis and Planning (Traditional Approach)

• Activities: A comprehensive survey of functional requirements (what the system must do) and non-functional requirements (how it must work, e.g., performance, security) will be conducted. Technical and economic feasibility will be studied, the base architecture will be defined, and the general schedule and initial sprints will be planned.

• Techniques: To gather this information, interviews with CFE staff, documentary analysis of current processes, data modeling (ERD), and the drafting of use cases and user stories to translate needs into technical requirements**.**

Phase 2: System Design

• Activities: Requirements will be translated into a concrete technical design. This includes designing the frontend/backend architecture, designing the user interface (UI) and user experience (UX) to ensure it is intuitive, and designing the database and APIs that will connect the entire system.

• Tools: Lucidchart will be used for visual prototypes (mockups), UML diagrams for architecture modeling, and design software to develop flowcharts.

Phase 3: The system will be built following an adapted agile working methodology, organized into 10 sprints or development cycles. Each sprint has clear objectives and generates tangible progress that adds up to complete the final system. Below is a table with the detailed schedule for Phase 3 to better understand the structure and order of development.

System development schedule

Phase 3: Iterative Development - Adapted Agile

Methodology Project: Alternate Log

Methodology: Adapted Agile Methodology Date: 2025

Total Duration: 10 Weeks

10 sprints × 1 week each. See Tables 1 and 2.

Table 1. *Detailed Schedule Module 1.*

Sprint	Semana	Objetivo Principal	Actividades y Entregables
Sprints 1-2 Autenticación	Semana 1	Módulo de autenticación	• Desarrollo del sistema de login •Implementación de registro de usuarios • Configuración de sesiones
	Semana 2	Gestión de perfiles de usuario	• Creación de perfiles de usuario • Implementación de roles y permisos • Validación de accesos
Sprints 3-4 Formularios	Semana 3	Desarrollo de formularios principales	• Diseño de formularios de captura • Validación de campos • Interfaz de usuario
	Semana 4	Operaciones CRUD básicas	• Crear registros • Leer y consultar datos • Actualizar y borrar información
Sprints 5-6 Integración	Semana 5	Integración con base de datos	• Conexión con Supabase • Configuración de esquemas • Pruebas de conectividad
	Semana 6	Lógica de validación de datos	• Validaciones de negocio • Reglas de integridad • Manejo de errores

Source: *Own elaboration* (2025).

Table 2. *Detailed Schedule Module 2.*

Sprint	Semana	Objetivo Principal	Actividades y Entregables
Sprints 7-8 Avanzadas	Semana 7	Funcionalidades avanzadas	• Sistema de búsquedas • Generación de reportes • Filtros avanzados
	Semana 8	Optimización de rendimiento	• Optimización de consultas • Mejora de tiempos de respuesta • Cacheo de datos

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Sprints 9-10 Finalización	Semana 9	Pruebas integrales	• Pruebas de sistema • Pruebas de usuario • Corrección de errores
	Semana 10	Refinamiento y documentación	• Ajustes finales de interfaz • Documentación técnica • Manual de usuario

Source: *Own elaboration* (2025).

Table 3. *Agile Practices Implemented*.

Práctica	Descripción	Frecuencia
Daily Standups	Reuniones alrededor de 30 minutos a 1 hora aproximadamente para revisar el progreso y identificar impedimentos.	2 veces por semana
Sprint Planning	Reunión al inicio de cada sprint para definir el objetivo, seleccionar tareas del backlog y planificar el trabajo.	Inicio de cada sprint
Sprint Review	Demostración del incremento funcional al final del sprint a los stakeholders para obtener feedback.	Final de cada sprint
Retrospectiva	Reunión interna para analizar qué funcionó, qué no funcionó y cómo mejorar en el siguiente sprint.	Final de cada sprint

Source: *Prepared by the author* (2025).

Development Schedule - CFE Transmission and Operation Puebla – Tlaxcala

Agile Methodology - Scrum | Duration: 10 weeks

Developed by: Jesús Iván Islas Vázquez ***Development Architecture (Technology Stack)***

The selection of technologies is based on modernity, efficiency, scalability, and the robust support community they offer.

• Frontend (Client):

• React 18: Leading library for building interactive, componentized user interfaces.

• Bootstrap 5: CSS framework for fast, responsive, and professional design.

• Backend (Server and Database):

• Supabase: Backend-as-a-Service (BaaS) platform that provides a PostgreSQL database, authentication, file storage, and auto-generated APIs. This choice dramatically speeds up development by outsourcing backend infrastructure management.

• Node.js / Express.js (if necessary): For complex business logic or custom APIs not covered by Supabase.

• Infrastructure and Deployment (DevOps):

• Supabase Auth & Storage: Integrated services to manage user authentication (JWT) and file storage (e.g., attachments).

• Vercel/Netlify: Continuous deployment (CI/CD) platforms that facilitate the publication and updating of the web application by connecting directly to the code repository.

Research Methodology

To validate the relevance and quality of the developed solution, a mixed research methodology will be applied.

Population and sample

• Target population: CFE technical and operational staff who interact directly or indirectly with the processes that the log seeks to digitize.

• Sample: A sample of three key users from the technical support area will be selected. Intentional sampling will be used for convenience and expertise, as these users have in-depth knowledge of current processes and their weaknesses, which guarantees high-quality and relevant feedback.

Data collection techniques

Qualitative and quantitative techniques will be combined to obtain a comprehensive view.

1. Qualitative:

• Semi-structured interviews: To thoroughly understand the needs, expectations, and context of use of the system.

• Participant observation: To analyze actual workflows and identify "pain points" or inefficiencies that users may not verbalize.

2. Quantitative:

• Satisfaction survey: Using a Likert scale of 1 to 5, perceptions of usability, functionality, and performance will be measured.

• System Metrics: Objective data such as response times, error rates, and frequency of use of different functions will be collected to evaluate technical performance.

Validation Process

Validation will be carried out on two fronts: technical and with the end user.

Technical validation

• Comprehensive tests will be performed to ensure the quality and robustness of the code.

• Unit tests: To verify the correct functioning of individual components (React).

• Integration Tests: To ensure that communication between the frontend, APIs, and database is correct.

• Security Tests: To validate that authentication and authorization mechanisms are secure and protect data.

End-user validation

• A structured process will be followed to evaluate the user experience.

• Training (30 min): An introductory session to familiarize the user with the interface and key features.

• Supervised Use (1 hour): The user performs specific tasks with the guidance of the researcher to resolve questions in real time.

• Independent Use (1 week): The user uses the application in their actual work environment without supervision.

• Final Evaluation: A satisfaction survey and final interview are conducted to gather impressions and suggestions.

Acceptance Criteria

The success of the project will be measured against the following quantifiable criteria:

• Overall Satisfaction: Average score ≥4.0/5.0.

• Ease of Use (Usability): Average score ≥4.0/5.0.

• Functional Compliance: 100% of the defined functional requirements must be implemented and operational.

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• Learning Time: The user must be able to operate the system independently after ≤2 hours of total use.

Data Analysis

• Quantitative Analysis: Descriptive statistics (mean, standard deviation, frequency distributions) will be used to analyze survey results and system metrics, presenting findings in graphs and tables.

• Qualitative Analysis: Content analysis will be used to categorize interview comments and open-ended feedback. This will allow us to identify recurring themes , behavioral patterns of behavior, and suggestions for improvement. *Ethical Considerations*

The project will adhere to strict ethical principles in both development and research. The privacy and security of CFE data will be guaranteed. For the research phase, informed consent will be obtained from all participants, ensuring the confidentiality of their responses and their voluntary participation.

Significant Steps in Development

1. Establishment of the Core (Sprints 1-12): This is the technical heart of the project. At the end of week 12, we will have a functional system with the essential pillars: users who can register, log in, and perform basic operations (CRUD) on a secure and well-structured database. This is the "skeleton" on which everything else will be built. See image 1.

Image 1. *Individual table management and standard CRUD functionalities*.

Source: *Own elaboration* (2025).

2. Delivering Value to Users (Sprints 13-14): Here, the system goes from being a simple data warehouse to an intelligent tool. The search and dynamic filter functions directly save users time and effort, representing the first major tangible "win" for them. See image 2.

Image 2. Module for locating and navigating records using primary key identifiers.

Source: *Own elaboration* (2025).

3. The Moment of Truth (Sprints 17-20 and Validation Phase): This is the most critical milestone. It is when the technological solution faces the reality of the end user. Comprehensive testing and validation with the user sample will determine whether the project meets its objectives. The feedback obtained here is pure gold. See image 3.

Image 3. *Navigation bars*.

Source: *Own creation* (2025).

Web management system with navigation bar between tables, guided selection of entities, and extended validations in data capture.

4. Analysis and Quantification of Success (Section 3.5): The final step is not the delivery of the software, but the analysis of the validation data. By comparing the results of the surveys and metrics with your acceptance criteria (e.g., satisfaction ≥ 4.0/5.0), you will be able to objectively demonstrate the success of the project and justify the return on investment, if applicable.

Scaling, technological projection, and scaling of technological contribution

The "CFE Alternate Log" not only digitizes an operational process; it positions itself as a base platform with the capacity to scale up to a comprehensive operations management system and an intelligent platform. Current technological benefits have already been identified, but the system is ready to incorporate key future functions. The technological potential is significant for the following reasons:

1. Modular and Componentized Architecture

• React allows new modules to be developed (e.g., inventory control, internal notifications, equipment traceability, scheduled maintenance management) without affecting the core.

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• The decoupled nature of the stack (frontend + BaaS + CI/CD) allows for the integration of external services (REST/GraphQL APIs), whether internal to CFE or third-party.

2. Horizontal Scalability

• Supabase and PostgreSQL allow horizontal scaling through read replicas, load balancing, and partitioning policies. In the future, this will facilitate the expansion of the system to different CFE operating regions without sacrificing performance.

3. Multi-Tenant Architecture (Future Projection)

• The model can evolve towards a multi-tenant architecture so that different divisions (southern zone, northern zone, etc.) can manage their information in an isolated but centralized manner on a single platform.

4. Automatic Report Generation (Power BI or embedded Metabase)

• Tools such as Metabase can be integrated so that supervisors can generate monthly/weekly reports without technical intervention.

• This professionalizes decision-making based on real-time operational metrics.

5. Automated Alerts and Notifications

• Notifications via email, Telegram, or internal messaging when critical failures, pending validation records, or anomalous patterns occur in the system.

• Implementation of Webhooks or event queues to manage alerts without affecting performance.

6. Support for Digital Signatures (Legaltech)

• Using tools such as DocuSign or cryptographic signature solutions, key log entries could be validated with legal traceability. This would have a direct impact on internal regulatory compliance.

7. Offline-First Support (PWA)

• In areas without connectivity, a Progressive Web App version could allow temporary captures and automatic synchronization when the network is restored.

8. GIS Integration (Georeferencing)

• Location of records on maps using Leaflet or Mapbox to geographically visualize incidents, routes, or critical points.

DISCUSSION AND ANALYSIS OF RESULTS

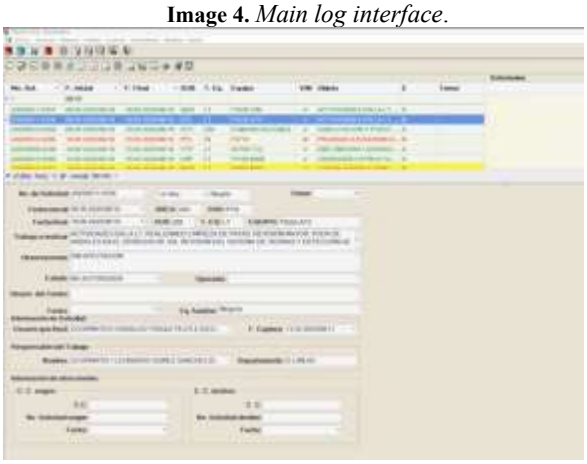
Results achieved - Alternate Log

The implemented system achieved a 50% reduction in capture times, improved the complete traceability of operational activities, and eliminated the loss of critical information. The modern and user-friendly interface facilitated adoption by technical staff, reducing the learning curve and minimizing capture errors.

Among the most notable benefits is the comprehensive document management capability, allowing plans, diagrams, photographs, and PDF documents to be attached, viewed, and consulted directly from the system. This has significantly improved technical decision-making and optimized preventive and corrective maintenance processes.

The system is also available 24/7 from anywhere as long as the server is turned on, since it works remotely, requiring only an internet connection to perform queries on any time. This has significantly increased operational flexibility and allowed technical staff to access critical information without location or time restrictions, improving operational efficiency and contingency response. Interfaces resulting from the successful implementation of the web application. See images 4 and 5**.**

Image 4. *Main log interface*.



Source: *CFE Puebla-Tlaxcala Transmission Zone* (2025).

Image 5. *Alternate log interface*.

Source: *Own work* (2025).

Comparison of overviews of the primary and secondary forms (see image 6).

Table 4. *Comparative table of CFE logs for the Puebla–Tlaxcala operating area*.

ASPECTO	BITACORA PRINCIPAL	BITACORA ALTERNA
DISEÑO VISUAL	Diseño tradicional tipo aplicación de escritorio con colores neutros y estilo clásico.	Diseño web moderno con interfaz limpia, colores actuales y estética contemporánea.
NAVEGACION	Navegación básica con barra de herramientas superior estática	Navegación intuitiva con menú lateral organizado por categorías y fácil acceso.
INTERFAZ	Interfaz densa con múltiples campos y ventanas, aspecto más técnico.	Interfaz amigable y espaciosa con formularios bien organizados y elementos visuales claros.
USABILIDAD	Requiere conocimiento técnico, curva de aprendizaje más pronunciada.	Más intuitivo para usuarios nuevos, diseño pensado en la experiencia del usuario.

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BUSQUEDA	Funciones de búsqueda básicas integradas en la barra superior.	Buscador prominente y accesible en la parte superior derecha.
ORGANIZACION	Información concentrada en una sola vista con múltiples secciones.	Información bien estructurada con separación clara entre secciones y tablas.
MODERNIDAD	Aspecto más antiguo, similar a software de escritorio tradicional.	Aspecto actual que sigue tendencias modernas de diseño web.
FACILIDAD DE USO	Orientado a usuarios técnicos con experiencia en sistemas similares.	Más accesible para todo tipo de usuarios, interfaz autoexplicativa.
GESTION DE ARCHIVOS	Sin capacidad de visualización o gestión de archivos, solo texto.	Permite consultar, subir y visualizar archivos (PDF, imágenes, diagramas, etc.).

Source: *Own elaboration* (2025).

Executive Summary

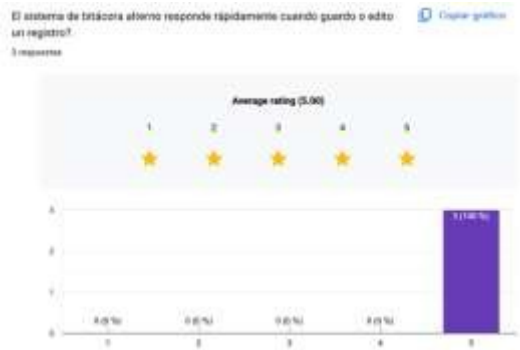
The Main Log represents the traditional system currently in use, characterized by its functional design but with limitations in terms of modern usability and digital file management. See images 5 and table 1.

The Alternate Log offers a modern alternative that significantly improves the user experience, incorporating multimedia capabilities and a more intuitive design that facilitates the daily work of operational personnel.

Evaluation of computational performance according to the user.

100% of operating and transmission personnel confirm that the current functions of the alternate log system fully meet the needs of the main log. This perfect rating (5.00/5.0) validates that the alternate system is a complete functional replacement. As shown in the following graph in image 6.

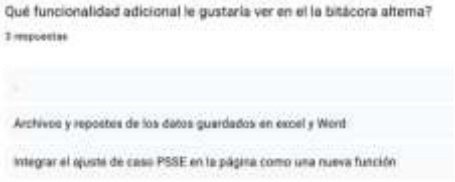
Image 6. *Satisfaction with the performance of the alternate log interface*.



Source: *Own elaboration* (2025).

100% of operations and transmission personnel are satisfied with the functionality of the Alternate Log, with an average rating of 4.67/5.0. The total absence of negative ratings confirms that the system satisfactorily meets the functional needs of the technical team and represents a successful comprehensive solution. See Figure 7.

Image 7. *Performance satisfaction with the alternate log interface*.



Source: *Own elaboration* (2025).

Support staff identify two specific areas for improvement: exporting data to standard office formats and integrating specialized technical tools. These suggestions indicate that the current system meets basic needs but could benefit from additional reporting functionalities and specific technical tools.

Discussion

The development tools used to implement this web application are in line with those that have become highly sought after by software developers today.

The EMPMonitor portal (12) states that the trend in the modern world toward hybrid project management is real and irreversible because it achieves a balance between two realities: structure and flexibility. The intention is to integrate both strengths. As a result, the current world will be transformed by the dynamic needs of companies and users.

Experts on LinkedIn (13) assure that it does not detract from the performance metrics of projects created through the combination of hybrid project management. According to studies, they reveal that the approach did not influence the results obtained.

BitCot (14) states that new technologies favorable to Full Stack come equipped with modules and object-oriented programming, which leave tools such as PhotoShop and Ajax behind.

CONCLUSIONS

Conclusion Methodological and Technological Contribution

The adoption of a hybrid methodology, combining the structured and sequential approach of Waterfall with the principles of Agile methodology, implemented through the Scrum framework, was key to the successful development of the system. This strategy allowed not only for orderly execution based on rigorous planning, but also for continuous and adaptable validation of technical decisions in real scenarios, ensuring their relevance and operational applicability.

Its main advantages include:

• Clear planning from the outset (Waterfall): this allowed technical objectives to be aligned with CFE's institutional requirements, reducing the risk of deviations and ensuring a robust design.

• Adaptability and incremental delivery (Agile/Scrum): facilitated the continuous delivery of value, allowing functional results to be shown from early stages and development to be adjusted according to direct user feedback.

Receipt: October 14, 2025 | Acceptance: November 22, 2025 | Publication: December 18, 2025

• More effective risk management: by dividing the project into weekly sprints, any deviations or failures could be detected and corrected quickly, without compromising overall progress.
• Active collaboration: the Scrum approach encouraged fluid communication between the developer and users, making the end user an active participant in the system improvement process.

This methodological approach not only optimized project execution, but also enhanced its technological quality by allowing development hypotheses to be tested in real environments and quickly adjusted based on operational response.

The use of modern, maintainable, and scalable technologies such as React for the frontend, Supabase for backend and database management, and Render as a continuous deployment platform ensures that the system is not only functional in the present but also prepared to evolve with new institutional needs or technological advances. Platforms such as Render enable fast, sustainable, and agile deployments, reinforcing the principle of continuous value delivery in the agile approach.

What began as an operational digital log has demonstrated its potential to scale up to a true operational intelligence center, where data is not only stored but also analyzed and transformed into continuous improvement strategies. Technological tools are no longer simple recording instruments but have become sustainable institutional capabilities, aligned with a vision of intelligent, progressive digital transformation focused on public value.

Future work

The evolution of web systems goes hand in hand with the various opportunities to combine software development methodologies. It is a path of no return.

With regard to the Full Stack methodology, it can be enhanced by integrating:

- AI for image and voice recognition, and predictions based on historical data, among others
- serverless architectures,
- Progressive Web Applications (PWA) with behaviors similar to APPS
- multi-platform development priority
- and others.

According to experts at CLARUSWAY (15).

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Receipt: October 14, 2025 | Acceptance: November 22, 2025 | Publication: December 18, 2025