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Web system to enhance technical supervision of incidents at the hydrocarbons regulatory institution in Lima–2023

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ABSTRACT

In this article, the implementation of a web system was carried out to improve the process of technical supervision of incidents of a hydrocarbon regulatory company because time was lost in carrying out each process; this research was developed using the SCRUM methodology as it is an agile methodology and adapted to our research. Using the process, events and artifact, it was possible to design the prototypes of the system, architecture, and database. Finally, the implementation was carried out among other important points obtained as results; the average level of optimization of the incident assignment process, derived from the observations, is 91.05% efficiency in assigning incidents to specialists. Regarding the 95% confidence interval for this indicator, it is between 88.98% and 93.11% efficiency, representing two standard deviations with respect to the mean. Regarding the average response time to incidents in all states, obtained from observations, it is 15 days. The 95% confidence interval for this indicator ranges between 14 and 18 days, which represents two standard deviations from the mean. The system is intuitive and not complex. With the implementation of the web system, processes are automated and end user satisfaction is obtained.

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1. INTRODUCTION

After reviewing several articles referring to this type of investigation, the lack of adequate tools and technologies to efficiently manage and supervise incidents within the hydrocarbon regulatory institution has been found. Where the supervision and control process depend on manual methods and obsolete systems, making it difficult to collect, classify and analyze data in real time. This lack of appropriate technology leads to delays in decision-making, lack of effective communication, and limitations in monitoring and control capacity.

It is important that technical supervision maintains compliance with rules and regulations, detection and prevention of incidents, and timely response to emergencies. These tasks require a comprehensive and efficient approach to ensure safety and quality standards are met at all stages of the process. Faced with the problem in this investigation, a web system was implemented that allows improving the process of technical supervision of incidents of the hydrocarbon regulatory institution. In this context, having the problem identified, we made the decision to carry out an investigation that improves the supervision process, implementing a web system that helps generate supervision tasks such as assigning responsibilities and tracking incidents, showing the ability to response of this implementation within the city of Lima. For its development, external technological tools and software will be used to help obtain positive results.

The choice of the agile SCRUM methodology for the development of this project is supported in part by important results obtained in previous research. For example, Sanchez *et al.* [1] successfully applied this methodology in the design of a web system. Another example of the effectiveness of SCRUM is found in the development of a web system with radio frequency identification (RFID), to optimize time, reduce costs and improve internal control [2]. Likewise, an important work related to electronic commerce stands out, where the buying and selling of products online was promoted through the implementation of a mobile application in a Peruvian company [3].

Optimizing the incident management process lies in better service and minimizing response times in companies, thus. Martell *et al.* [4] focuses on designing and implementing two monitoring, control and data collection (SCADA) systems, to automate the production process in the CIGB, which is applicable to monitoring the technological parameters of the facilities. auxiliary equipment and systems in certain areas of the CIGB and the monitoring of the parameters of the fermentation bench and agitators in certain areas of the CIGB fermentation process. The results of the study indicate that both systems are designed on the Siemens SIMATIC WinCC and Windows operating systems and are based on Microsoft OPC and ActiveX technology. The system intended for monitoring technological parameters also includes: i) fire extinguishing system (SADI); ii) locking system; and iii) electrical parameter distribution system.

Throughout history, different research works have been carried out with the aim of saving resources and time invested in carrying out the traditional method in the processes, innovative tools have been proposed and implemented. Nowadays, companies are focusing on the automation of their internal processes, as mentioned by according to Serrano *et al.* [5]. The research aimed to propose a solution that minimizes incident response time in scenarios with a large number of incidents, using quantum computing to obtain solutions in constant time. The study uses an experimental approach to validate the applicability and efficiency of the proposal. Quantum programming techniques were applied to real cases to evaluate performance. Applied research, focused on the practical implementation of advanced technologies to improve incident management and proved to be efficient in reducing incident response time, maintaining a constant time regardless of the number of incidents handled.

On the other hand [6], the objective was to evaluate a web-based incident reporting system in Taiwan, focusing on user satisfaction and the impact of using the system. The study is quantitative and comparative, as it analyzes and compares survey data and incident reports between two different systems. The new system seeks to improve the incident management process by meeting the requirements and being compatible with the latest versions of widely used web browsers. The previous system presented challenges due to its incompatibility with modern browsers and outdated technology on both the frontend and backend. It is noted that the user offices could not effectively use the incident registration system, which limited their ability to adequately address the needs of the institution. To overcome these obstacles, new software was implemented that meets the requirements of the information technology area. The choice of this solution was based on its ability to run smoothly on the latest versions of popular browsers such as Chrome and Mozilla. This ensured that user offices could record their incidents and requirements effectively.

After the successful implementation of the new web system, notable improvements were observed in the amount of care provided to user areas. Eliminating incompatibility issues and modernizing the system enabled a smoother, more efficient process for recording and addressing issues. As a result, the user areas were able to use the system effectively, which improved the quality and speed of the service provided by the information technology area.

The incident area performs functions and processes manually using resources such as paper and filing cabinets, which generates an accumulation of documents and disorder when locating important documentation for the area. The implemented web system reduces the average incident resolution time, optimizes the incident assignment process and improves the level of user satisfaction. That is why implementation of a web system was implemented to improve the process of technical supervision in the incidents of the hydrocarbons regulatory institution in the city of Lima-2023.

2. LITERATURE REVIEW

Throughout history, different research works have been carried out to save resources and time invested in carrying out the traditional method in the processes, innovative tools have been proposed and implemented. Nowadays companies are focusing on the automation of their internal processes, as mentioned by according to according to Serrano *et al*. [5]. The research aimed to propose a solution that minimizes incident response time in scenarios with a large number of incidents, using quantum computing to obtain solutions in constant time. The study uses an experimental approach to validate the applicability and efficiency of the proposal. Quantum programming techniques were applied to real cases to evaluate performance. Applied research, focused on the practical implementation of advanced technologies to improve incident management and proved to be efficient in reducing incident response time, maintaining a constant time regardless of the number of incidents handled. On the other hand, [6] the objective was to evaluate a web-based incident reporting system in Taiwan, focusing on user satisfaction and the impact of using the system. The study is quantitative and comparative, as it analyzes and compares survey data and incident reports between two different systems. The new system seeks to improve the incident management process by meeting the requirements and being compatible with the latest versions of the most used web browsers. The previous system presented challenges due to its incompatibility with modern browsers and outdated technology on both the frontend and backend. It is observed that the user offices were not able to make effective use of the incident registration system, which limited their ability to adequately address the needs of the institution. To overcome these obstacles, new software was implemented that meets the requirements of the information technology area. The choice of this solution was based on its ability to work smoothly on the latest versions of popular browsers such as Chrome and Mozilla. This ensured that user offices could record their incidents and requirements effectively.

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Gallardo and Rodríguez [8] focused on the development of a web system for the incident management process in the First Accounting R&P company with the main objective of improving incident management in the company. Likewise, the specific objectives focus on determining the influence of this web system on the level of attention and the level of deadline compliance in incident management in the First Accounting R&P company. To do this, they used the C# programming language with ASP.NET under the Visual Studio 2019 development environment. The database manager used was SQL Server 2017. In addition, they applied information technology infrastructure library (ITIL) concepts to Incident management in web development. They concluded that the web system had a positive impact on incident management. An increase of 6.75% is observed in the level of incident attention. In addition, a significant increase was achieved in the deadline compliance indicator, with an increase of 8.62%. These results show that the implementation of the web system effectively improved both incident attention and compliance with deadlines in incident management in the company.

Condor [9] in his research whose main objective was to determine the influence of the implementation of a web platform in the company for the development of incident management. It seeks to improve the management and prioritization of events in the company through the implementation of practices based on ITIL V3. The investigation identified several deficiencies in the company, such as a lack of order in the prioritization, referral, escalation, resolution and closure of incidents. These deficiencies affected the overall incident management process and led to the need for a more structured approach. To address these shortcomings, he implemented an investigation plan based on ITIL V3, which served as a basis for minimizing problems in incident management. The research followed a pre-experimental design of an applied experimental type. The study population included 71 incidents, obtained from records carried out during a period of 4 weeks. The specific objectives focused on defining the influence on the prioritization and event resolution ratio when implementing a web platform based on ITIL V3 in the company Corporación La Sirena S.A.C. For the development of the web platform, the SCRUM methodology was used due to its adaptable and flexible nature. Various programming styles were used, such as PHP and JavaScript, along with libraries such as Bootstrap and FPDF. The database used was MySQL. They concluded that the application of the web platform was successful, based on ITIL V3 and developed using the SCRUM methodology, it allowed improving incident management in the company Corporación La Sirena S.A.C. The event prioritization and resolution indicators were positively influenced by this implementation.

Gavidia and Perugachi [10] identify the main objective was to identify the automation of processes, monitoring and documentation of incidents, as well as the optimization of the management and use of information through a web-based system. The project was developed using the SCRUM methodology, and the requirements were gathered through interviews as a research method. The system was programmed in Java, using the model-view-controller (MVC) architectural pattern. The application has automated processes for the management of critical incidents, allowing the generation and recovery of information in real time, with implementation within the company. Decision making has been delegated to maintenance employees. Then Tomarema [11] reinforces what was said above, indicating that automated processes focused on companies have acquired vital importance since they provide us with the facilities in the administration of information, now that they are recorded and saved, they are finally reflected in established reports.

Similarly, Aballay *et al*. [12] proposed that companies should consider data as a raw material that is stored, processed and transformed to obtain information as a final product. This is because current information management systems focus on generating large volumes of information, whose relevance for business growth and productivity must be seen as a priority. The methodologies used in the surveys were implemented based on variables of the SCRUM methodology, which contributed to the improvement and development of project processes, including hardware coding, good software and other similar processes that are reflected in the development and implementation of the same. Process control is understood as helping the systematic organization in monitoring these processes, by automating, to the extent possible, tasks such as data analysis, error detection, diagnosis, decision-making. decisions or the recommendation of specific actions using, to do so, all the available information. In this sense, the SCADA system was used to replace the control stations, as well as the tools used, and the results obtained must always be based on the available knowledge and the behavior of the process (the relationship between symptoms and errors). According to Colomer *et al.* [13] several tools are used. SCADA is a set of software applications that access the factory, through digital communication with devices and controllers, and graphical user-level interfaces.

Lou *et al.* [14] utlines an approach to managing incidents in online services through software analytics. The authors present a framework that includes task definition, data preparation, analytical technology development, and deployment. This approach enhances efficiency and security in incident management, providing a systematic, data-driven solution to operational issues. Gibadullin and Nikonorov [15] this article discusses the development of an automated incident management system using open-source software, aiming to streamline the information security incident process and reduce response times. It analyzes SOAR solutions and implements a fault-tolerant, centralized management system with a distributed architecture. The research confirms that SOAR solutions can effectively reduce incident response times and the need for specialists' way coincides with the authors Lou *et al*. [16] as online services grow, incident management becomes crucial to minimize downtime and ensure service quality. This involves analyzing vast amounts of runtime monitoring data, facing challenges like data scale and complexity. To address this, 2-year research developed the service analysis studio (SAS) for Microsoft, enhancing incident management through novel data-driven techniques.

3. METHOD

For the development of implementation of a web system to improve the process of technical supervision in the incidents of the hydrocarbons regulatory institution in the city of Lima-2023 the following steps were considered:

- The choice of an appropriate development methodology according to the research, an analysis of different traditional and agile methodologies was carried out, it was decided to use the SCRUM reference framework.
- The definition of the work team (SCRUM master, product owner, development team) was carried out.
- Information was recorded through the user list.
- The database was created, and the MySQL software was used as it is manager.
- The hexagonal service architecture was chosen because it better adjusts to application programming interface (API) queries.
- The prototypes of the implemented system were carried out, the statistical validation of the system was carried out using Cronbach's Alpha to measure the level of PostTest incidents.

This research will be based on the SCRUM methodological approach, a framework widely used in agile projects. It is broken down into several phases, starting with preparation in the "Start" phase and moving on to detailed planning in the "Planning phase". Then, the "Implementation and results" will guide the execution and follow-up. continuo del proyecto, seguido of a "Review and retrospective" to analyze the results and draw lessons. Finally, the "Launch phase" marks the conclusion of the project. These phases will be executed iteratively, allowing flexible and high-quality management of research [17]. SCRUM is an agile project management methodology that is characterized by its iterative approach and continuous interaction between the development team and project stakeholders. This methodology is based on development cycles called "Sprints," each of which is composed of a series of phases aimed at creating the product, addressing different aspects in each iteration. Throughout a sprint, several fundamental activities are carried out that contribute to the success of the project, see Figure 1.

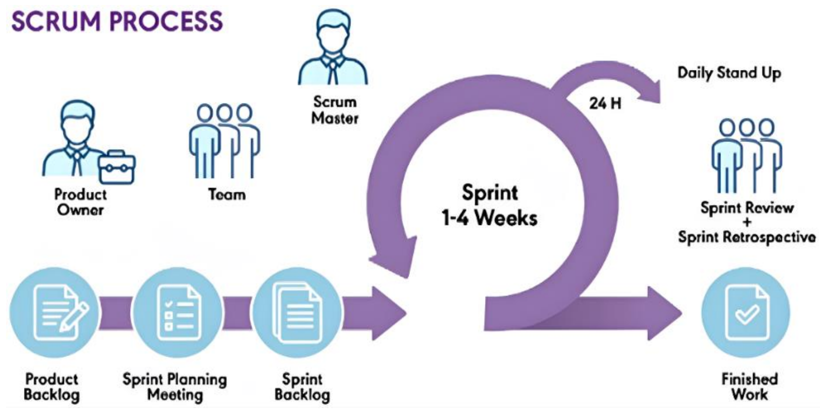

Figure 1. SCRUM process

In this study, it was proposed to address the problem in the process of technical supervision in incidents of the hydrocarbon regulatory institution where it plays a fundamental role to ensure compliance with regulations, prevent incidents and guarantee the quality of the services. Their effectiveness and efficiency are crucial to maintaining worker safety, protecting the environment and building consumer confidence. Improving the technical supervision process through a web system has a significant impact within the regulatory institution and society in general.

In this context, the objective of this research is to implement a web system that will improve the technical supervision process in incidents of the hydrocarbon regulatory institution. This web system will allow more efficient management and effective monitoring of incidents, streamlining supervision processes and improving communication between those involved. The aim is to optimize the efficiency of technical supervision and guarantee quality and safety in the hydrocarbon industry.

Therefore, this web system will bring with it more effective and efficient technical supervision. It will allow better management and monitoring of incidents, facilitating the quick detection and resolution of problems. In addition, it will improve communication between the actors involved, ensuring fluid and timely interaction. This improvement in the technical supervision process is expected to contribute to the reduction of incidents, compliance with regulations and the strengthening of the hydrocarbon industry in terms of safety and quality. The definitions of the SCRUM team, SCRUM events, SCRUM artifacts, and development tools are described in subsection.

3.1. SCRUM team

The SCRUM team is made up of the product owner, development team and team leader as Table 1. A SCRUM team has as main characteristics the self-organization and collaboration of it is time and information when developing the project [18]. The group of people who make up the team have experience in their task to develop and hardly need any external help. Responsible for managing the progress of each sprint with the SCRUM team, verifying that the functional and non-functional requirements of the web system are met.

Table 1. The SCRUM team

SCRUM team	Description
Product owner	It is the one in charge of giving maximum importance to the product within the work of the SCRUM team. It is responsible for managing the accumulation of products in a total product. The product owner does not have the management authority in the SCRUM team; however, the product owner remains responsible. Maintains direct communication with the user area, capturing the requirements and needs of all end users who will use the web system.
SCRUM master	The primary responsibility of the SCRUM master is to ensure that all members of the SCRUM core team, including the product owner, apply the SCRUM process correctly. The SCRUM master has the responsibility to steer the project smoothly and that the participants of the SCRUM team have everything they need to do their job [1].
Development team	A SCRUM tea mis made up of professional who work to deliver increments of “ready” products that can go into production at the end of each sprint. Those who participate in the development team are allowed to participate in the definition of steps [1].

3.2. SCRUM events

This section develops the activities of the SCRUM reference framework, which are detailed in Table 2. These events are designed in blocks of time to analyze, develop the retrospective if necessary, in order to develop the deliverables in the time frame established.

Table 2. SCRUM events

SCRUM event	Description
Sprint	SCRUM is based on a sprint, which is a time box, from four weeks to two weeks, where an increment of a "finished" product is developed and can be put into production. It is more beneficial that the sprint time is the same throughout the development. The beginning of a new sprint is after the previous sprint is completed [19].
Sprint planning	During the sprint, the work to be done on the sprint timeline is planned. The program was created with the cooperation of the entire SCRUM team. The maximum sprint planning duration for a sprint planning month is 8 hours. For shorter sprints, events are usually shorter. The SCRUM teacher makes sure that the event takes place and that the participants understand the objective [20].
Sprint goal	Sprint goals are defined goals for a sprint and can be developed by implementing the product Backlog. Provide guidance to development teams on why they are building steps. It is born in the creation of the sprint plan. Sprint Goals support the development team with the flexibility to implement features in a Sprint.
Daily SCRUM	A daily SCRUM is a regular 15-minute time that the development team has. The daily SCRUM is held every day of the sprint. Your role is to plan your work for the next 24 hours. It assists in information sharing and team performance by checking work progress and managing the same meeting time and space to reduce complexity.
Sprint review	When the sprint is finished, a validation of the sprint is done to check the progress and adjust the set of products. From the time it takes to review the Sprint, the SCRUM Team and all stakeholders collaborate on the work done on the sprint. Based on this and in the event of any changes in the product portfolio in the sprint, members help determine what can be done next to optimize value.
Sprint retrospective	The sprint retrospective is a process that allows the SCRUM team to look back on the just-concluded sprint, identify areas for improvement, and plan changes for the next sprint. This meeting occurs after the sprint and before the next planning. It is duration may vary depending on the length of the sprint. The SCRUM master facilitates the meeting to help participants progress and better understand the event.

3.3. SCRUM artifacts

SCRUM artifacts are used to manage and visualize work progress in a project, ensuring transparency and enhancing team collaboration (Table 3). They include the product Backlog, sprint Backlog, and the increment.

Table 3. SCRUM artifacts

SCRUM artifacts	Description
Product Backlog	The product list orders all the changes, corrections, problems, and improvements found, which modify the following versions of the product. Inventory items have description, order, estimate, and value as attributes. Product portfolio items often include test descriptions that will demonstrate the integrity of the completed items [21].
Sprint Backlog	Sprint Backlog is a stack of pending products, selected for the Sprint in conjunction with planning, to drive product growth while meeting the sprint goals. The sprint Backlog allows us to project different strategies and functionalities for the next phase of spring development.
Increment	The increment is the overall addition of the list of finished goods in the sprint and the sum of all previous sprints. The final phase of the sprint, the new growth must be "completed", and then the definition of "completion" of the SCRUM team can be used and executed. At the end of the sprint, there is incremental and testable work that supports the empirical work. The increase is a part towards the completion of the goal, see Figures 2 and 3.

Figure 2. SCRUM events

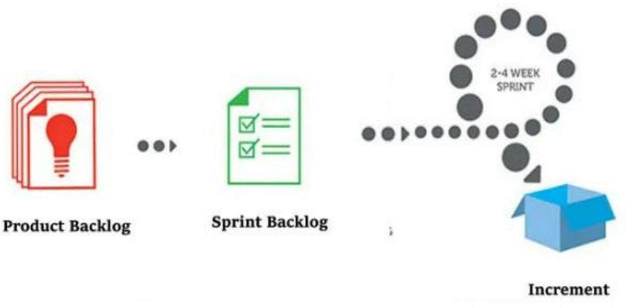

Figure 3. Artefacts SCRUM

3.4. Development tools

Development tools facilitate the creation and management of software, improving work efficiency and quality (Table 4). They help developers write, test, and maintain code effectively.

Table 4. Develoment tools

Develoments tools	Description
Net.js	It is a web development framework that relies on Node.js and makes use of TypeScript to offer a robust and highly scalable programming structure. Its design is inspired by other widely recognized development frameworks, such as angular and spring. Nest's architecture.js features a structural approach that closely resembles Angular's structure, simplifying adaptation for developers familiar with the latter [22].
Modules	In Nest.js, each app is structured into modules, which are sets of components, controllers, and related services that help perform specific tasks.
Drivers	Handlers are classes that handle HTTP requests and provide responses. Each handler is assigned to a specific path and will only process requests that match that path.
Services	Services are classes that contain business logic and can be injected into controllers or other service classes. They are widely used for interaction with databases and other tasks that are not directly related to presentation logic.
JavaScript	JavaScript is a high-level programming language that is mainly used in web development to add interactivity and dynamism to web pages. Unlike Java, JavaScript is not related to the Java programming language. JavaScript runs in the user's web browser and allows developers to create interactive web applications, control web page behavior, and communicate with the web server to load or send data without having to reload the page [23].
API	API refers to a formal specification that describes how different software components communicate and interact with each other. In essence, an API establishes a set of commands, functions, and protocols that allow software developers to create specific applications for certain operating systems or platforms. These interfaces simplify the development process by providing a series of predefined and well-documented functions that programmers [24].
DataBase MySQL	It is a database development engine, which handles two licenses, public and commercial, being developed with the open-source base, is the most used in database development [25].
Hexagonal architecture	Hexagonal architecture, also known as ports and adapters, is a software design pattern that has become increasingly important in modern application development. This architecture is based on the principle of separation of concerns and focuses on creating highly maintainable and scalable systems, see Figure 4.

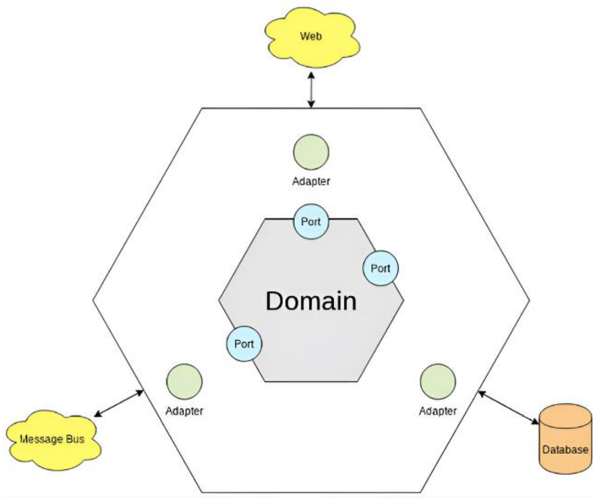

Figure 4. Architecture hexagonal

3.5. Method development

To develop this research, we will be guided by the phases, events and artifacts of the SCRUM methodology. This reference framework was chosen because it fits the research, it presents partial results through sprints which are functional, that is, processes completed as part of the total implementation.

3.5.1. Team SCRUM

In the context of this project, specific roles are assigned to team members. Dr. Miguel Cano Lengua assumes the role of SCRUM Master due to his extensive experience in the management and coordination of teams, as well as in the generation of ideas for the improvement of projects. Fredy Rosas Culcos, will play the role of product owner due to his experience in capturing project requirements and his ability to maintain effective communication with users. Cynthia Caceres Sanchez along with Luis Diburga will be part of the development team due to their vast experience in the design and development of web pages, as can be seen in the Figure 5.

Figure 5. Team SCRUM

3.5.2. User type

According to the information obtained during the interview with the general supervisor, the various user profiles that will interact with the system were established. These users will be responsible for the management of the web system. Each of them has specific roles and tasks, and the administrator has the final authority to designate who will occupy these roles. These user profiles are detailed in Table 5 for better understanding and organization.

Table 5. Defining user type

User type	Description
Supervisor	Personnel in charge of carrying out the management, control and monitoring of the activities of the processs.
Specialists	Personnel in charge of carrying out the activities of regulation and survey of incidents.
Support	Personnel in charge of carrying out the registration and documentary control of the regulated incidents.

3.5.3. System requirements

To carry out project development effectively, it is essential to have an accurate understanding of the functional and non-functional requirements of the system, which are specified in Tables 6 and 7. These should include details about the restrictions, limitations and applications related to the operation of the project.

Table 6. Functional requirements

Code	Functional requirement
RF01	User registration by role
RF02	User login
RF03	Menu display
RF04	Pending incident visualizations
RF05	Mapping interface
RF06	Notification of assigned incidents
RF07	Reception of incidents
RF08	File upload
RF09	Incident status interface
RF10	Report interface

Table 7. Non-functional requirements

Code	Non-functional requirement
RFN01	Functionality
RFN02	Safety
RFN03	Time
RFN04	Quality
RFN05	Control

3.5.4. Creating product Backlog

This list will help us identify our properties to perform product deliveries as our project objective to define with priorities and estimates and approximate deliverables. Below is the Table 8 of stories with their priorities and estimates.

Table 8. Product Backlog

Code	Requirement	Priority	Estimate
HU-1	User registration by role	High	5
HU-2	User login	High	5
HU-3	Menu display	High	5
HU-4	Pending incident visualizations	High	4
HU-5	Mapping interface	Half	5
HU-6	Notification of assigned incidents	Half	3
HU-7	Reception of incidents	Half	3
HU-8	File upload	Half	4
HU-9	Incident status interface	Low	2
HU-10	Report interface	Low	4

3.5.5. User stories

User stories give the full detail of the functionalities of the given system or software from a customer's perspective. The purpose of a user story is to illustrate how a work item provides specific value to the customer. This project has been interviewed to gather requirements for user stories. In this case, the owner of the product will become the supervisor of the area based on a hydrocarbon regulatory company, and the interested parties are employees who will manage the incident, the latter will have a greater participation, since they will use the web. For the following research we have considered 10 user stories, see Tables 9-18.

Table 9. UH1

UH
ID: HU01 **Name**: user record by role **Priority**: high **Time estimate**: 5 days **Description**: As a new user, I want to be able to register on the platform and be assigned to a specific role according to my functions to access the corresponding functionalities. **Acceptance criteria**: A registration interface must exist. The system must validate that the mail is unique.

Table 10. UH2

UH
ID: HU02 **Name**: user login with email and password. **Priority**: high **Time estimate**: 5 days **Description:** As a registered user, I want to be able to log in to the platform using my email and password to access the functionalities of my role. **Acceptance criteria**: There must be a login page. There must be fields to enter email and password. The system must validate the credentials and allow access if they are correct.

Table 11. UH3

UH
ID: HU03 **Name**: menu display for supervisors. **Priority**: high **Time estimate**: 5 days **Description:** As a supervisor, I need to be able to display a menu screen that provides me with options such as assigning incidents, consulting incidents, modifying information, accessing reports, and managing my profile. **Acceptance criteria**: There must be a login page. There must be fields to enter email and password. The system must validate the credentials and allow access if they are correct.

Table 12. UH4

UH
ID: HU04 **Name**: visualization of pending incidents for supervisors. **Priority**: high **Time estimate**: 4 days **Description:** As a supervisor, I want to have the ability to visualize an interface with query options to review pending issues and take necessary actions. **Acceptance criteria**: There must be a clear and accessible query interface. The interface should show all pending issues.

Table 13. UH5

UH
ID: HU05 **Name**: assignment interface for supervisors. **Priority**: half **Time estimate**: 5 days **Description:** As a supervisor, I need to be able to visualize an interface that allows me to assign incidents to the corresponding managers, providing relevant information about the incident. **Acceptance criteria**: There must be a clear incident assignment interface. The interface should show all pending issues. It should be possible to select an issue to view more details.

Table 14. UH6

UH
ID: HU06 **Name**: notification of incidents assigned by mail. **Priority**: half **Time estimate**: 3 days **Description:** As a supervisor, I want to have the ability to notify managers (analysts or specialists) about assigned incidents via emails to keep them informed. **Acceptance criteria**: There must be an email notification feature. Mailings should be generated automatically after assignment.

Table 15. UH7

UH
ID: HU07 **Name**: reception of incidents for analysts. **Priority**: half **Time estimate**: 3 days **Description:** As an analyst, I want to be able to receive designated issues and access an interface that allows me to modify and update the incident information. **Acceptance criteria**: There must be a clear interface for analysts. Analysts should receive assigned incidents. There must be buttons to save the changes you make.

Table 16. UH8

UH
ID: HU08 **Name**: file upload for analysts and specialists. **Priority**: half **Time estimate**: 4 days **Description:** As an analyst or specialist, I need to be able to upload relevant files related to the incident being handled and access an interface that allows me to modify, update, and query information related to the incident. **Acceptance criteria**: There must be a file upload function. Users should be able to attach files related to the incident. After uploading a file, they should be able to make changes to the incident.

Table 17. UH9

UH
ID: HU09 **Name**: incident status interface for supervisors. **Priority**: Low **Time estimate**: 2 days **Description:** As a supervisor, I need an interface that allows me to view the status of all incidents to identify their progress in resolution. **Acceptance criteria**: There must be a clear and accessible incident status interface. The interface must display all incidents with their status. It should be possible to filter incidents by name, date, and status.

Table 18. UH10

UH
ID: HU10 **Name**: reporting interface for supervisors. **Priority**: low **Time estimate**: 4 days **Description:** As a supervisor, I need an interface that allows me to generate reports and obtain information about incidents, as well as the option to download relevant files. **Acceptance criteria**: There must be a clear and user-friendly reporting interface. It should be possible to filter incidents by name, date, and status. There should be an option to generate reports and download files related to incidents.

4. RESULTS

4.1. Sprint

The development of each sprint has been focused on documenting the distribution of each user story to track the proposed timelines. This will also allow us to verify the achievement of the set objectives [2]. Table 19 will display the distribution of each sprint with their respective user stories.

Table 19. Sprint

Sprint	User stories	Days
Sprint 1	HU01-HU02-HU03	15
Sprint 2	HU04-HU05-HU06	12
Sprint 3	HU07-HU08	7
Sprint 4	HU09-HU10	6

4.2. Sprint 1

User stories H01, H02, and H03 are completed based on the estimated times and their high priority. They will be carried out in the appropriate order. To achieve this, the user must register with the corresponding role, proceed to log in with the appropriate credentials, and if the user logs in with the supervisor profile, they should see the menu screen with the options to assign, query, modify, and report, as shown in Figures 6-8. The retrospective evaluation is displayed in the Table 20.

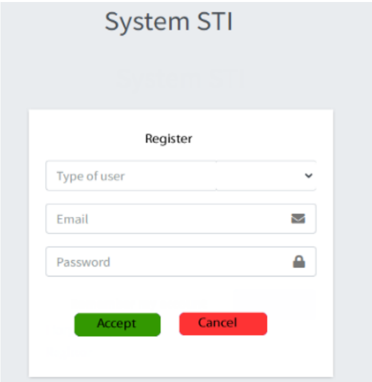

Figure 6. User registration according to role

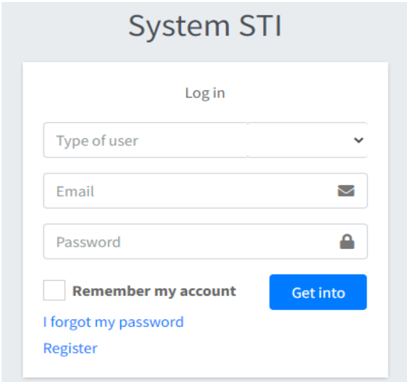

Figure 7. User login with your email and password role

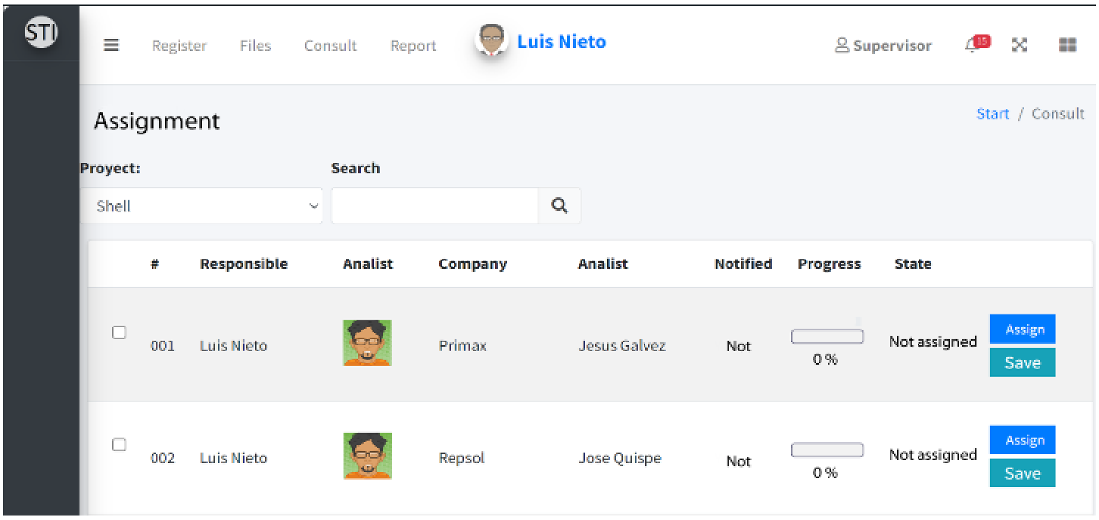

Figure 8. Menu display for supervisors

Table 20. Sprint retrospect

Successes	Errors	Continuous improvement
We obtained approval for the HTML prototypes of user stories 1, 2, and 3.	Observations are made regarding the meaning of the user role	Training sessions regarding the meaning of the user role will be coordinated.

4.3. Sprint 2

User stories H04, H05, and H06 will be completed based on the estimated times, with high and medium priority, in the corresponding order. For this, a user with the role of supervisor should be able to view an interface with options such as “consult” to review the details of pending incidents. In the “assign” interface, the supervisor will complete the data for the incident’s responsible party, and if the supervisor assigns the incident to an analyst specialist, they should notify the analyst specialist by email. This is depicted in Figures 9-11. The retrospective evaluation is displayed in the Table 21.

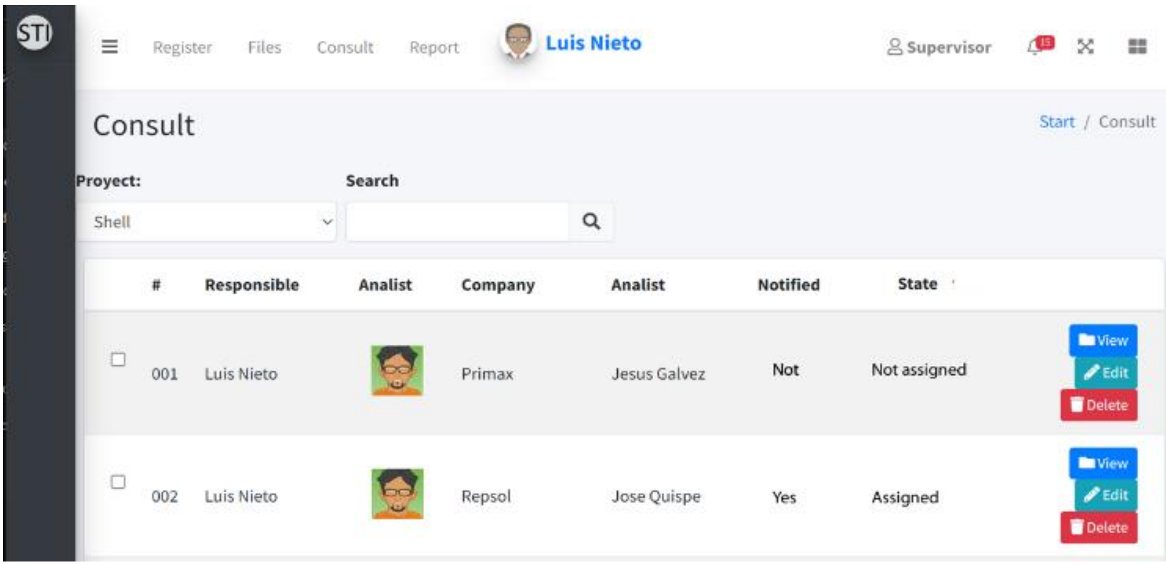

Figure 9. Viewing pending incidents for supervisors

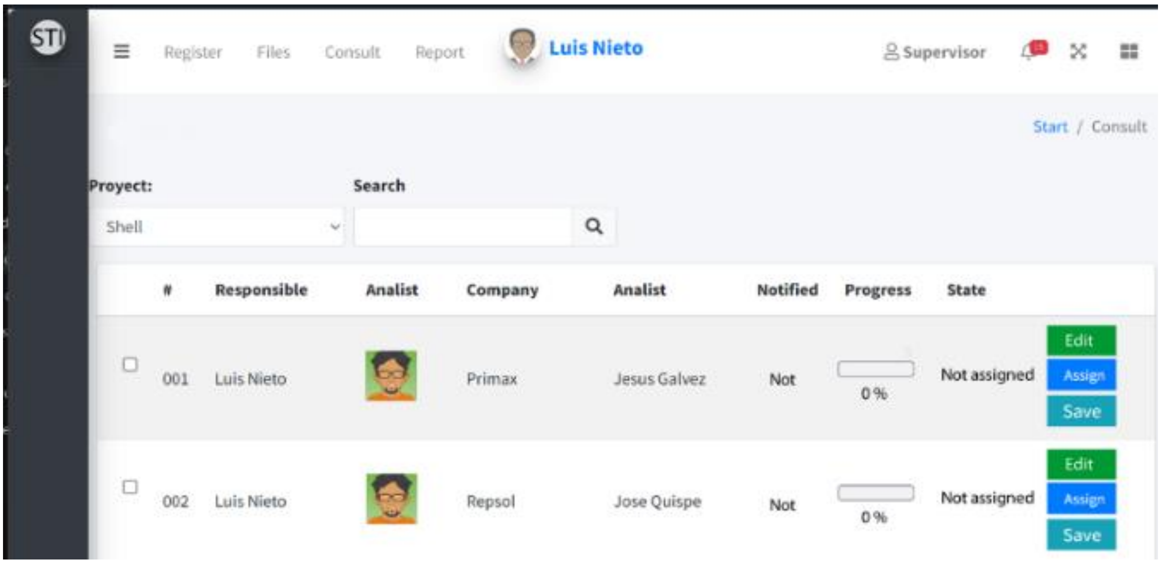

Figure 10. Assigment interface for supervisors

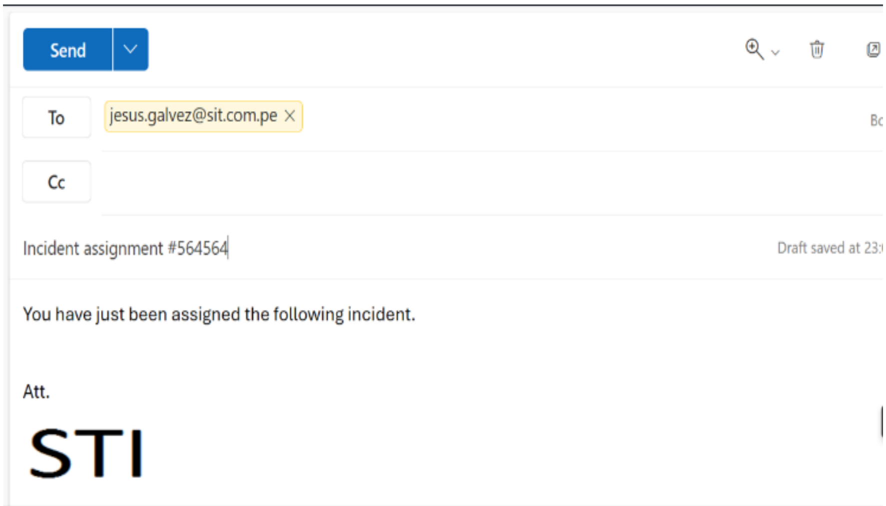

Figure 11. Notification of assigned incidents by email

Table 21. Sprint 2 retrospect

Successes	Errors	Continuous improvement
We obtained approval for the HTML prototypes of user stories 4, 5, and 6.	Queries are made regarding the sending of emails by the supervisor.	Meetings will be scheduled with the supervisor to explain the process of sending email notifications for assigned incidents.

4.4. Sprint 3

User stories H07 and H08 will be completed based on the estimated times and their medium priority, in the corresponding order. For this, with the role of analyst, they will receive the assigned incident. The interface will allow them to edit and update the incident to add or modify information about it is content. They will also be able to attach files and change the incident's status. Upon completion of the incident, they will inform the supervisor through a notification by email. This is depicted in Figures 12 and 13. The retrospective evaluation is displayed in the Table 22.

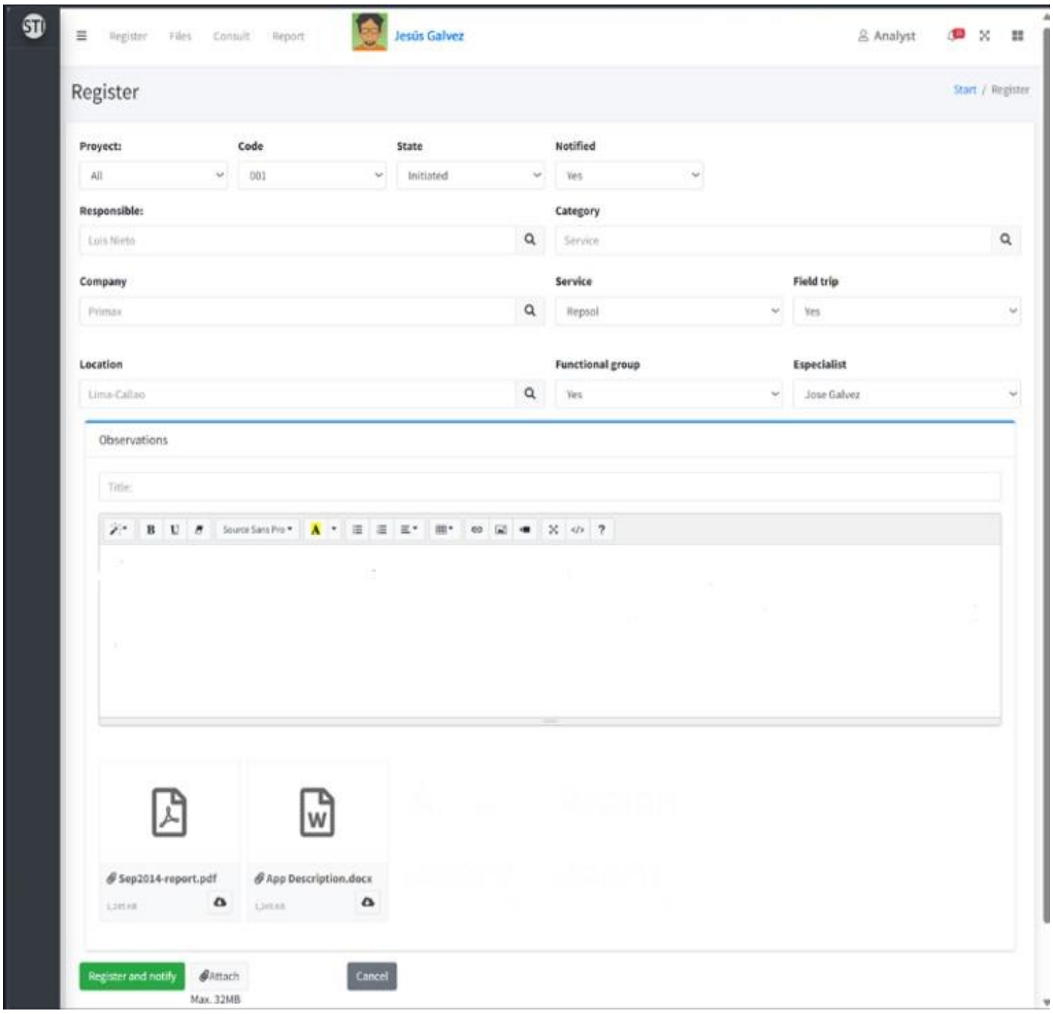

Figure 12. Reception of incidents for analysts

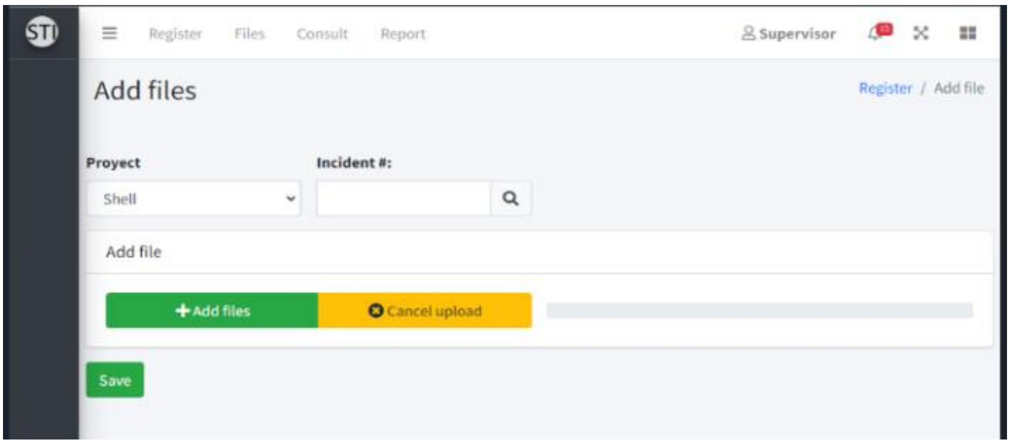

Figure 13. File upload for analysts and specialists

Table 22. Sprint 3 retrospect

Successes	Errors	Continuous improvement
We obtained approval for the HTML prototypes of user stories 7 and 8	Observations are made regarding the incident statuses	Training sessions regarding the flow of incident statuses will be coordinated.

4.5. Sprint 4

User stories H09 and H10 will be completed based on the estimated times and their low priority, in the corresponding order. For this, a user with the role of supervisor will be able to view the incident statuses in the interface to keep track of their progress until they are resolved. Additionally, they will have access to an interface where the report is displayed, and with specific filters, they will be able to download the desired information. These are depicted in Figures 14 and 15. The retrospective evaluation is displayed in the Table 23.

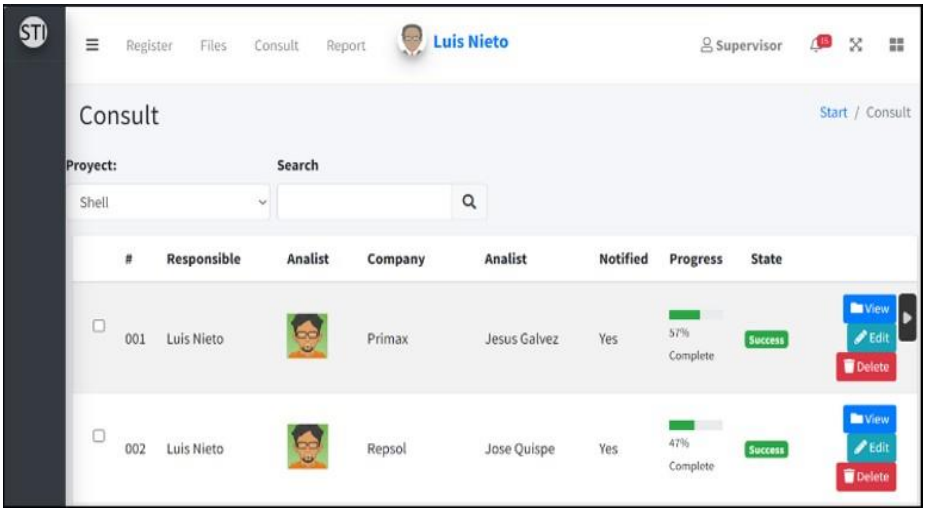

Figure 14. Incident status interface for supervisors

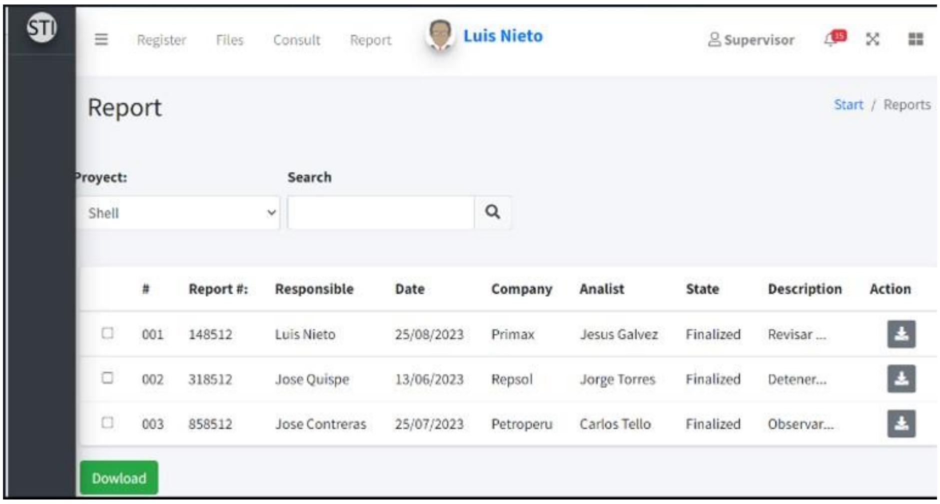

Figure 15. Reporting interface for supervisors

Table 23. Sprint 4 retrospect

Successes	Errors	Continuous improvement
We obtained approval for the HTML prototypes of user stories 9 and 10	It was not considered when the user manual will be delivered	The overall project schedule will be modified, and the date for delivering the user manual will be adjusted

4.6. Storage structure

The data storage structure is dependent on the use of the AWS server, which is a highly scalable and flexible cloud platform that provides a wide range of computing and storage services. This enables businesses to develop, deploy, and manage applications and services efficiently and cost-effectively. This can be schematized in Figure 16.

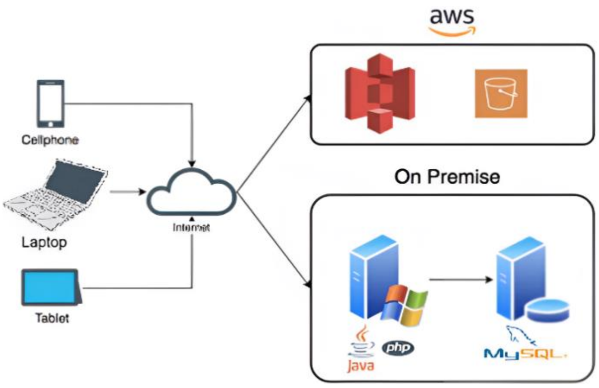

Figure 16. Structure AWS

4.7. Statistical validation

In Table 24 reveals a P value of 0.118, exceeding the 0.05 threshold. This finding suggests normal behavior in the data, supporting the reliability of the observed interval. The average level of optimization of the incident assignment process, derived from the observations, is 91.05% efficiency in assigning incidents to specialists. Regarding the 95% confidence interval for this indicator, it is between 88.98% and 93.11% efficiency, representing two standard deviations with respect to the mean. Additional details indicate that the first quartile (Q1) indicates that 25% of the level of optimization of incident assignment is equal to or less than 87.6% effectiveness, while the third quartile (Q3) highlights that 75% of this level. It is equal to or below 94.8% effectiveness. For more information see Figure 17.

Table 24. Incident assignment indicator

N	Half	Stand. dev.	P. value	Q1	Q3	Conf. inter.
30	91.05	5.52	0.118	87.61	94.80	95%

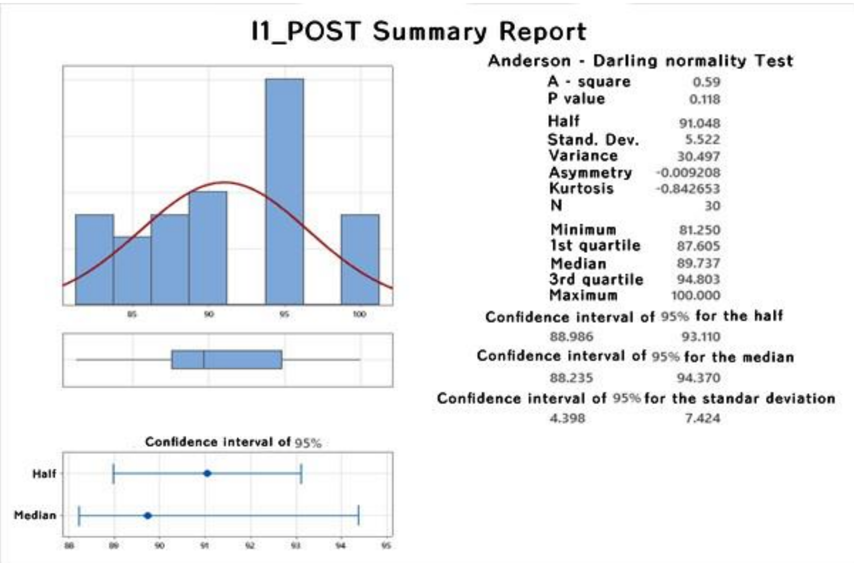

Figure 17. KPI 1_Post_Test

Table 25 reveals a P value of 0.516, higher than the significance threshold of 0.05. This finding suggests normal behavior in the data, supporting the reliability of the observed intervals. The average incident response time in all states, obtained from observations, is 15 days. The 95% confidence interval for this indicator ranges from 14 to 18 days, which represents two standard deviations from the mean. Furthermore, the first quartile (Q1) indicates that 25% of the incidents have a response time equal to or less than 12 days, while the third quartile (Q3) indicates that 75% of the incidents are resolved within the same period. or less than 20 days. For more information see Figure 18.

Table 25. Incident assignment indicator

N	Half	Stand. dev.	P. value	Q1	Q3	Conf. inter.
30	15.64	5.66	0.516	11.90	27.40	95%

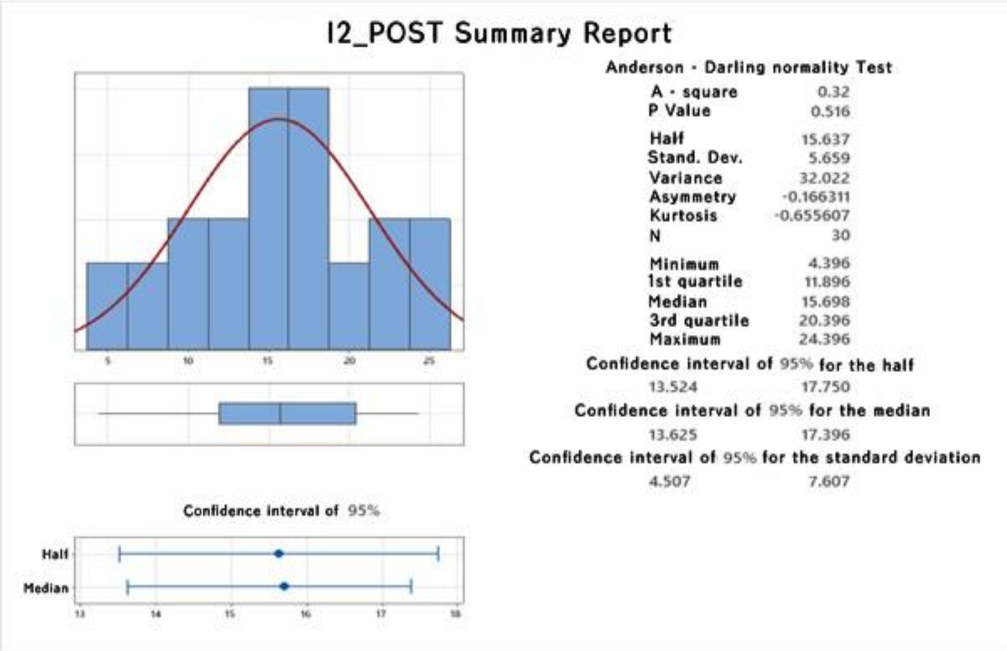

Figure 18. KPI 2_Post_Test

4.8. Survey validation

For the development of the system, a survey consisting of 14 questions was carried out with 50 users belonging to the technical supervision department of the hydrocarbon regulatory authority. The survey was carried out using Google Forms and was subsequently processed with the SPSS statistical tool, version 28. Initially, the data obtained from the surveys were standardized to work with them in the SPSS statistical software, where the Cronbach's Alpha coefficient was calculated to measure the confiability. of the survey questions. The results show a Cronbach's Alpha coefficient of 0.910, which indicates excellent reliability of the questions.

5. DISCUSSION

The present study entitled "Implementation of a web system to improve the technical supervision process in incidents of the hydrocarbon regulatory institution", where the main objective is to implement a web system to improve the technical supervision process of the institution's incidents. hydrocarbon regulator in the city of Lima. It was based on the use of the SCRUM methodological tool for the development of the system taking into account the appropriate requirements. In this sense, this research seeks to implement systematized technology that improves a process of monitoring the activities of those responsible for the incident supervision area. It has been the object of interest in various recent investigations, reflecting the evolution towards a more efficient and automated management of processes. business. In this sense, several studies have highlighted the positive impacts of these implementations in various organizations. Condor [9] point out the successful use of react technology in the management of computer incidents, observing quantifiable improvements in operational efficiency. They point out that the implemented web system had a positive impact and it is evident that through the use of the web system, the percentage of incidents managed within the specified period (PIGE) increased from 51.82% to 61.43%. In addition, a decrease in the labor productivity index was observed in an incidence (TII) from 45.04% to 33.82%. Also, like Gavidia and Perugachi [10], they highlight how the migration of obsolete systems to modern web platforms has generated notable improvements in incident response, providing more compatible and agile solutions for user demands in public entities. This transition has allowed user offices to register and address incidents more effectively, thus improving the quality of service.

Furthermore, research such as that of Tomarema [11] in GMD and the Banco Continental BBVA project show how the implementation of web systems has achieved positive impacts in incident management where he points out that the web system managed to reduce the number of reopened incidents by 75% to 20%. Likewise, the rate of attended incidents increased from 50% to 90%. These conclusive results indicate that the web system has significantly improved incident management within the GMD company, particularly in the Banco Continental BBVA project. These projects have managed to improve incident response and compliance with deadlines, which indicates that the implementation of web systems has been successful in improving the quality and speed of service in different organizational contexts.

Process automation, as demonstrated by Hinostroza in his study, has been a key strategy in optimizing incident management. By implementing practices based on ITIL V3 and agile methodologies such as SCRUM, improvements have been observed in the prioritization and resolution of events, which underlines the relevance of adapting specific methodologies to the business context to obtain optimal results. Gallardo and Rodríguez [8] mention that the web system had a positive impact on incident management. They also observed an increase of 6.75% in the level of attention to incidents. In addition, a significant increase was achieved in the deadline compliance indicator, with an increase of 8.62%. These works have not only demonstrated the positive impact of the implementation of web systems in incident management, but have also highlighted the importance of technological updating and the adaptation of specific methodologies to optimize business processes, which demonstrates the relevance of these research in the current context of the digital transformation of companies.

6. CONCLUSION

It is concluded that in this work the implementation of a web-based system was successfully achieved to improve the process of technical supervision of incidents in the hydrocarbon regulatory institution. HTML was used for the development and design of the prototypes, which allowed all the information obtained from the user stories to be represented, thus meeting the needs of the end user. Regarding the architecture that was used, it allows us to work in layers, providing better organization as there is a clear separation of where each type of logic goes. This architecture facilitates the maintenance and scalability of the web system. Regarding the methodology used for the design of the project, SCRUM was used due to the short term, allowing us to comply with all the defined user story sprints. At the end of each sprint, a sprint retrospective was held, which provided us with insights and observations that needed to be addressed before the start of the next sprint. There is efficiency in assigning incidents, an efficiency of 91.05% is revealed in assigning incidents to specialists, demonstrating a significant improvement in this process. The confidence interval supports this efficiency, showing consistency between 88.98% and 93.11%. Furthermore, the quartile analysis highlights that 75% of the allocations are made with an efficiency of up to 94.8%. Likewise, with respect to the indicator of reduction in resolution times, the web system influenced the reduction in average time, showing an average of 15 days, where the confidence interval of 14 to 18 days confirms this improvement. It stands out that 75% of incidents are resolved within a period of up to 20 days, and 25% within a period equal to or less than 12 days, where these data indicate notable agility in problem resolution. In the future, we anticipate the development and implementation of a version of the mobile application, which will allow the hydrocarbon regulatory institution to optimally and efficiently manage incidents as they arise.

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