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Article

Business intelligence for decision-making in royalties project management

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Abstract: This article highlights the critical role of specialized digital tools in enhancing project management and monitoring in Colombia's public sector, it showcases how Microsoft Office 365 and Power Platform have been effectively utilized to optimize royalty-funded initiatives, automating processes and improving decision-making through advanced data análisis. These tools enable process optimization, task automation, and enhanced data analysis, significantly improving the administration of resources and facilitating timely, well-informed decision-making. The methodology is quantitative and complementary information is taken from the technical and legal opinions of the participating professionals. For its execution, a combined approach had to be followed: a PMBOK methodology that gave a clear roadmap and an agile SCRUM methodology capable of highly prioritizing schedule management to provide effective results. In this process, the tools used are Power BI, Power Apps, and Power Automate; these are used to automate tasks and improve operational efficiency by addressing specific issues and contributing to project management and project optimization. Through this project, a proper technological infrastructure has been built for senior management strategic management, planning team tactical management, and operative monitoring to implement BI systems successfully. The project is structured in several phases: initial preparation and planning; implementation; and personnel training, emphasizing continuous training and personnel adaptation to manage resistance to change. Implementing BI and digital tools facilitates teams to work closely together, with noticeable improvements in coordination and operational efficiency. This paper deals with the optimization of monitoring project management of the SGR in the Office of the Attorney General of the Nation, and this experience seeks to be an example to other entities and to inspire them to walk these paths toward a culture of innovation and permanent improvement within the public sector in Colombia. These Microsoft tools are available to most national public servants and contractors, so generating the solution does not imply additional costs. The experience is well documented in the present work and provides a replicable model that can adapt to multiple contexts, promoting greater efficacy and efficiency in public administration.

1. Introduction

The practice of effective project management is a serious challenge in the public sector; the lack of specialized software tools for projects and administration further aggravates this. The lack of digital management tools indicates that coordination and supervision of projects depend on individual skills and on the collaborative effort of team members to manage tasks and oversee strategic information important for decision-making effectively.

In the Colombian context, the public administration scenario constantly changes for the worse. This is due to introduction of new regulations, public policies, resolutions, goals, and objectives which must be managed and adopted by the human resources of every municipality and department. Such a dynamic nature translates into added challenges related to the maintainability and updating of the mechanisms for project control and monitoring since in fact, each change of the regulation can require specific adaptations in the applications used. Although these adjustments will remain invisible to the final user and other stakeholders, they represent fundamental modifications from the point of view of the optimization of processes and effective programming: these tasks are especially critical since most of the governmental projects dealt with are time-constrained and have exact deadlines.

According to statistics made public by the Ministry of Labor, at the close of 2022, the Colombian state workforce had almost 910,000 contractors [1]. Frequent turnover among different entities occurs because the district or state administrations change after elections, thus causing an interruption in the leadership of the projects that affect strategic vision and decision-making, impacting the normal continuity of the operation and consequently, the end users.

High turnover in key contractor positions may result in loss of institutional knowledge and interruptions in services that rely on persons, affecting operational efficiency until new employees get well adapted. Additionally, responsibilities can be handed over with no planned transition, thus bringing disorganization, which in turn brings about errors and delays in both administrative and operational procedures. These inevitable challenges should be faced with responsibility and determination. In such a case, therefore, there should be complete preparation and commitment to continuous adaptation and improvement by leaders and staff at all levels. Taking such challenges with responsibility will ensure an opportunity for strengthening institutional resilience and capacity, with the personnel appropriately prepared and capable of effectively managing transitions and changes—more importantly, through ongoing training and support systems that facilitate knowledge transfer and effective management of organizational change for Industry 4.0 [2–4].

In our project, we aim at possibilities associated with Office 365 tools such as Outlook, Excel, Forms, OneDrive, SharePoint, Word, Access, and Teams. This can be promptly and efficiently implemented in everyday common project supervision situations, due to their support for process management and operations monitoring and accessibility to all officials, given that the suite from Microsoft is the one assigned to most of the branches of the Public Sector. The different functionalities and add-ins are not standard for each type of license purchased, but in general, the most precise financial overview from a license cost perspective is possible to view in ColombiaCompra.gov.co, where they oscillate between 80,000 and 150,000 Colombian pesos (40USD) per person per month, therefore offering a range for the

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calculation of the cost of the opportunity. An example can be observed in purchase order 109158 of 2023 which can be viewed on the public information page "Colombia Compra" [4].

The organizational structure of operational teams usually includes operational personnel, coordinators, team leaders, or managers (according to the number of persons in every team). Very often, an executive group is implemented that manages about 90% of the personnel and executive decisions. Additionally, there is a transversal team that is responsible for the collection and transformation of data into strategic and descriptive information. In these cases, Business Intelligence (BI) presents itself as a strategic tool where analysis of data, data mining, visualization, and support tools to make decisions based on data are combined, eliminating inefficiencies and quickly adapting to changes in ICT investment projects [5]. This is feasible due to the incorporation of programs such as Power BI, Power Apps, Power Automate, and Power Agents, which provide even more strength to project management. Recent studies have confirmed the efficiency of Business Intelligence in optimizing resource allocation and use, reducing costs, and significantly improving operational efficiency in various areas of government. The approach of BI adoption has had a considerable positive impact on organizational management, especially in small and medium-sized enterprises (SMEs). Research conducted by Bhatiasevi and Naglis (2020) in Thailand states that compatibility, technological readiness, top management support, and competitive pressure are necessary for the adoption of Business Intelligence. Based on the Technology-Organization-Environment (TOE) framework and the BSC approach, this research confirms that the adoption of BI not only enhances the processes within but also fosters learning and growth within organizations. These findings are very pertinent to our project, showing that to reach the successful implementation of BI systems in the management of royalties' projects, adequate technological infrastructure and support from top management are needed. The General Royalties System (SGR) is regulated by Legislative Act No. 5 of 2011, and its main objective of being implemented in Colombia is to distribute the income obtained from the exploitation of non-renewable natural resources among all territorial entities that exist in the nation. This system will encourage the principles of efficiency and rationality in terms of public spending that should be conducted within governmental agencies to guarantee sustainable economic development, avoiding phenomena like "Dutch disease" " [6]. Concerning managing royalties projects, the SGR contributes a legal and financial framework for proper resource administration by fostering transparency and accountability in the use of public funds (Ley 2056 de 2020).

This project can also motivate other officials since the case is applied to an entity at the national level, and it will establish a methodological framework that can be adapted and replicated in other institutions and similar contexts to reach institutional objectives more effectively and efficiently, through a detailed and scalable model for the implementation of Project Management and BI technologies, the project looks to catalyze substantial improvements in public management through more rigorous planning, precise execution, and thorough supervision. On the other hand, the implementation of BI systems in small and medium-sized enterprises has become one of the key factors that can enhance competitiveness and strategic decision-making. Recent research by Alsibhawi, Yahaya, and Mohamed (2023) proposed a conceptual model centered on the TAM and UTAUT models, emphasizing such critical success factors as change management, knowledge sharing, information quality, and IT project management, which are relevant for this paper insofar as it highlights the fact that these variables are fundamental to the successful adoption of BI to properly manage projects within the Attorney General's Office of the Nation; the deployment of a BI system that takes into account these elements can significantly improve the decision-making process and the increase in operating efficiency, which at the end of the day allows public administrations to attain greater transparency and accountability. [7], in this paper you will find how the correct use of digital tools not only facilitates the information and management of the processes but also allows greater transparency and accountability, two elements of vital importance in the public administration of our country, the integration

of such systems allows closer collaboration between the teams and collaborators with greater coordination and communication in the public sector.

In this paper, some challenges involved in implementing new technologies—namely resistance to change, the need for clear data governance policies, and the importance of data security and privacy in the governmental setting: Information security is at the core of BI solutions' implementation; in particular, small and medium-sized enterprises (SMEs) are emphasized [8]. Points out that the lack of an IT department inside SMEs and the common outsourcing of technology projects lead to frequent abandonment of implemented projects together with the absence of basic security measures; these result in leaving critical information assets, many times vital for the company's survival, under exposed conditions against cyberattacks and other hazards, the implementation of standards such as ISO/IEC 27001:2022 is vital in the assurance of the confidentiality, integrity, and availability of information, through which a framework can be established in the effective management of information security in BI solutions [10], recommendations will be made in overcoming them and ensuring that the adoption of digital solutions is as smooth and efficient as possible; the core center of the project lies in automation and process enhancement through tools like Power BI, Power Apps, and Microsoft Automate, which resulted in a significant migration from manual-based processes to digital integrated solutions, as with other cases, this transformation has not only improved how fast projects are executed but has also enabled more effective management and a considerable reduction in process times [9], the use of Microsoft Power Apps offers different benefits and makes the development and construction of applications possible; according to Laaksonen (2024), best practices in using Power Apps include user-centered design, effective data management, security and compliance, and maximizing performance and scalability, the mentioned components are paramount in ensuring that developed applications are efficient and secure and able to develop with the changing needs of productive environments, the developed use of Power Apps enables quick development and deployment of applications to assist in the achievement of digital transformation and the acceleration of operational productivity [10].

Lastly, it is important to emphasize the application of Business Intelligence principles and the use of advanced digital tools that already exist to identify opportunities for continuous improvement and thus achieve a positive impact on the efficiency and results of public administration; in doing so, set a precedent to encourage other organizations to follow these same approaches to nurture a tradition of innovation and perpetual evolution in the public sector of the nation. The review conducted by Baron Ramirez, Garcia Estrella, and Sanchez Garate (2021) reveals that among the different methodologies available, empirical studies are the most commonly used in implementing solutions with Business Intelligence (BI) and data analytics in areas ranging from health, education, technology, to tourism; it is also useful to propose the design of a BI solution in various operational and administrative areas, for example, the construction sector, one might infer that there are fewer applications of opportunities for BI, but this really can change the way companies manage and analyze information. According to Sarango Rubio (2024), the validation done on the application of methodologies such as CRISP-DM and data mining tools makes easy consolidation of information rapidly, so that quick decisions can be taken. Other additional applications of these solutions in the construction sector ensure the optimization of resources and increase competitiveness in the market regarding the issue of project management accuracy and effectiveness. [11], such a finding comprises support for our project because the use of an empirical methodology has proven to be a successful context for implementing BI for project management. Another advantage or benefit derived from this method concerning our context is the adaptability of the empirical methodologies in fulfilling organizational needs and increasing the strategic capacity for decision-making [12], Based on these findings, the proposed procedures will guarantee the efficacy and sustainability of the use of BI solutions in our project management.

2. Methodology

This study adopts a mixed-methods approach, integrating both quantitative and qualitative methodologies, the quantitative aspect focuses on analyzing various datasets to generate descriptive and prescriptive insights, while the qualitative component involves collecting expert opinions from technical and legal domains, these perspectives were systematically categorized, with data triangulation applied to uphold validity and reliability, offering a thorough evaluation of the project's impact, moreover, data triangulation methods were utilized to enhance the reliability and validity of the outcomes, integrating various data sources and viewpoints to furnish a holistic understanding of the project's effects, similarly, the methodological approach used in this project combines rational procedures that provide a solid structure based on PMBOK [13], and is complemented by the flexibility and agility of the SCRUM methodology [14], this combination facilitates having a clear guide and the ability to adjust parameters to improve and adapt solutions according to the project's needs.

In this context, the exploratory case study embraces a data triangulation approach and integrates both quantitative and qualitative investigation methods, the guiding research question for this study is: How can resources available in Microsoft 365 and Power Platform be utilized to develop a tool that facilitates the monitoring and management of projects using business intelligence processes for analyzing and managing royalty projects by the Special Monitoring Group of the Office of the Attorney General of the Nation? This approach emphasizes methodological rigor by combining quantitative evidence with qualitative feedback from stakeholders to address the research question effectively, this question is directly associated with the general objective of the study, which is to design and implement a business intelligence initiative to improve the management of the Special Monitoring Group of the Office of the Attorney General of the Nation through the collection, analysis, and visualization of relevant data from projects funded by royalties, facilitating informed decision-making and the identification of action opportunities.

This documentation of the case serves as a replicable and adaptable model for other similar contexts. The project followed a methodological structure based on PMI's PMBOK, complemented by agile process management through SCRUM, data collection methodologies included structured forms in Microsoft Forms and Power Apps, designed to capture both quantitative metrics and qualitative feedback, structured data informed key performance indicators (KPIs) and dashboards, while qualitative feedback from open-ended questions provided additional insights, these written responses were categorized and analyzed separately from quantitative metrics, ensuring that subjective user opinions supplemented, rather than replaced, the analytical framework, this information is then used for the creation of KPIs, dashboards, and operational analyses, the implementation of Microsoft PowerApps as an alternative solution for application development presents significant benefits, according to Palmer (2020), PowerApps allows users without programming knowledge to create efficient and customized business solutions, this no-code development approach facilitates the creation and deployment of applications in less time and at a lower cost compared to traditional methods, additionally, native integration with other Microsoft services, such as SharePoint and Power BI, enhances data management and report generation, providing a robust and adaptable solution for business needs [15].

He use of low-code development environments, such as Microsoft PowerApps used for this project, has proven effective for teaching agile methodology in educational settings, a study conducted by Lebens and Finnegan (2021) at Metropolitan State University showed that students perceived a greater understanding and comfort with the agile methodology when using PowerApps instead of learning to program in traditional languages, this approach allowed students to focus on Agile practices and roles without the additional burden of learning a new programming language, the findings suggest that low-code platforms not only facilitate the teaching of agile methodologies but also better prepare students for the current job market, where agility and adaptability are essential [16], These results are particularly relevant to our project, as

they demonstrate that using tools like PowerApps can improve efficiency and effectiveness in project management by implementing agile methodologies and using accessible technologies, if students can learn to use these tools, the profiles occupying jobs in public entities can also adapt and eventually learn or hire a profile that is easier to find, the tools used include Office 365 and Power Platform applications, encompassing Power BI, Power Apps, and Power Automate, all tools are officially licensed, ensuring their validity, reliability, and security, these licenses are included in purchase orders and future needs of the entity, ensuring their continuous and effective use, the adoption of Power Platform tools in Bancolombia has proven to be a transformative tool for managing contact center and BPO services (see Figure 1). Jiménez (2024) highlights that implementing applications in PowerApps using agile methodologies like SCRUM has optimized and streamlined the organization's processes, similarly, integrating Power BI and SharePoint opens up the possibility of providing real-time information and enabling decision-making based on up-to-date and efficient information, improving operational efficiency and aligning with Bancolombia's commitment to sustainable development and technological innovation [17].

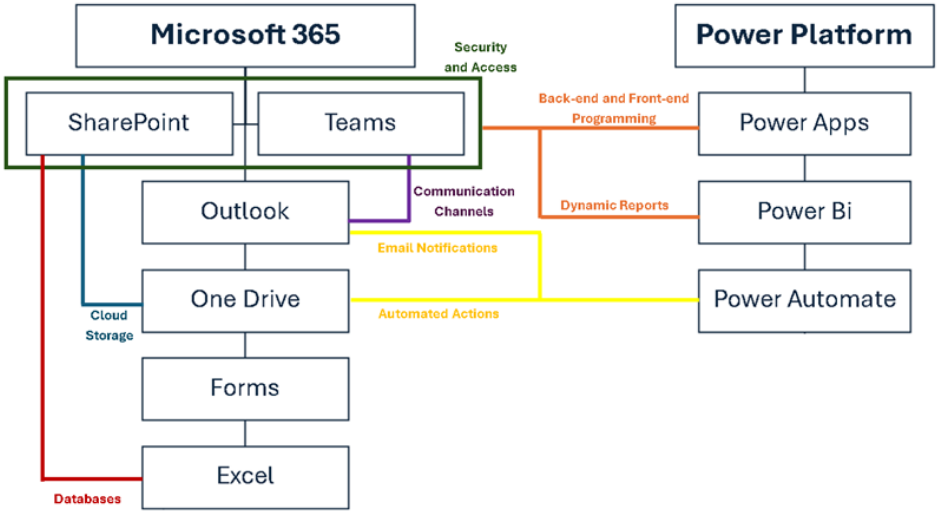

Figure 1. Operational connectivity and integrated functionality between Microsoft 365 and Power Platform.

The Microsoft 365 ecosystem integrates its applications seamlessly, delivering efficient process management, strengthened security, and improved team collaboration, at the heart of this system lies SharePoint, which serves as the first layer of security by requiring user authorization through email inclusion, likewise, Microsoft Teams enforces access control by mandating that users be added to specific teams to access the associated application hosted within designated channels. Together, these measures ensure that only authorized users can interact with the application and its data. For real-time communication, Microsoft Teams and Outlook provide versatile solutions. They enable video calls, text messaging, and audio conversations, supporting both individual and group interactions. This flexibility fosters smooth coordination and adapts to diverse communication needs, data management is efficiently handled using SharePoint Lists, which securely store recorded information and metadata, these lists can be exported to Excel for advanced data analysis or offline reporting, for dynamic online reporting, Power BI creates and publishes interactive visualizations, delivering up-to-date insights for stakeholders. The team's application is built with Power Apps and deployed directly within a Microsoft Teams channel, this integration simplifies access, enabling team members to operate within Teams without relying on external tools, thereby streamlining workflows and centralizing operations. Cloud storage ensures that all generated and

processed data is securely stored in locations like SharePoint folders or OneDrive, access controls are configured based on roles and profiles, protecting sensitive data while ensuring it remains accessible to the appropriate personnel. Process automation is a key efficiency driver, achieved through Power Automate, this tool automates repetitive tasks such as monitoring database changes, creating records, uploading files, or triggering actions on specific dates, these streamlined workflows reduce manual effort and enhance productivity.

The application designed to consolidate the operational management of the GES team benefits all project participants, including operational staff, coordinators, management personnel, and Colombian citizens, the data analysis methods used include descriptive and prescriptive analysis, processed and analyzed with Excel, Access, and DAX language in Power BI, at the end of the information pathway, everything is cataloged and included in an informational monitoring dashboard or Balanced Scorecard (BSC) designed with access for specific profiles, this type of tool has become a key strategic management tool in various industries, according to Osorio (2021), the BSC allows an organization's vision and strategy to be translated into a coherent set of objectives and performance indicators distributed across four perspectives: financial, customer, internal processes, and learning and growth, this methodology facilitates the alignment of business activities with long-term strategy, improving operational efficiency and the ability to adapt to changes in the competitive environment, the implementation of the BSC in the area of engineering, projects, and thermo-mechanical installations demonstrates its effectiveness in achieving more precise and results-oriented management [18].

2.1. Development and Implementation Program for the Tool

The successful implementation of the project will represent a significant change in how the team manages its information and makes strategic decisions, detailed planning and structured execution of the proposed activities are fundamental to ensuring alignment with objectives and effective adoption by officials and contractors, as shown in Table 1 a clear methodology is provided for the execution of this BI project, encompassing five initial phases, focusing on tool development, data preparation, modeling and development, and implementation.

Table 1. Development and Implementation of the Tool.

Phase	Activities
Initial Preparation and Planning	**1. Identification of Involved Areas:** • Identify key areas and departments within the organization that will benefit from the BI project. • Establish contacts with the leaders and managers of these areas to understand their needs and expectations. **2. Definition of Objectives:** • Establish the objectives of the BI project in terms of business improvements and strategic decisions. **3. Project Plan Development:** • Create and detail a plan that includes necessary resources, schedule, project milestones, and estimated budget.

Phase	Activities
Analysis and Design	**4. Information Flow Assessment:** • Analyze the information flow within the organization to identify relevant data sources and integration points. **5. Creation of Use Cases and User Stories:** • Define use cases and user stories that represent functional requirements and end-user needs.
Data Preparation	**6. Data Integration, Cleaning, and Standardization:** • Integrate various available data sources into a single repository. • Understand historical data and adapt it to the new structure. • Clean and standardize the data to ensure its quality and consistency.
Modeling and Development	**7. Database Modeling:** • Design the data model that reflects the structure and relationships between data elements necessary for analysis. • Design data security measures to protect confidential information and ensure compliance with regulations and internal policies. **8. Implementation:** • Develop and configure BI solutions, including the creation of reports, panels, and dashboards. • Develop the necessary ETL processes to extract, transform, and load data into the data warehouse.
Implementation	**9. Implementation and Rollout:** • Implement BI solutions in the organization's production environment. • Conduct user acceptance testing and make final adjustments. • Perform performance testing to evaluate the solution's scalability under different workloads. • Compare the results with previous exercises and additional analyses. • Build custom report proposals tailored to each stakeholder.

2.2. Training and Staff Adaptation

This phase is a crucial stage in the implementation of the information system, ensuring that employees understand and feel comfortable using the new tools and developments, and facilitating a smooth and efficient transition to the new operational processes, adequate training helps minimize resistance to change and maximizes the effectiveness of the implementation, as shown in Table 2, two phases include activities such as the development of training materials, management of training sessions, instruction in the use of BI tools, and training evaluation.

Table 2. Training and Staff Adaptation.

Training	**10. Staff Training:** Development of Training Materials. Management of the Training Session Schedule. Train personnel in the use of BI tools and data interpretation. Training Evaluation.
Adaptation	Develop a change management plan to facilitate access and adoption of the new development by end users and minimize resistance to change

2.3. Optimization of Internal Processes

To ensure the long-term sustainability and effectiveness of the implemented solutions, continuous procedures are established to guarantee the proper functioning of the system, this includes detailed documentation of manuals and guides for users and administrators, and the implementation of continuous monitoring and evaluation systems, Table 3 shows the activities designed to maintain the system's quality and ensure that users can use the tools efficiently and effectively (see Table 3).

Table 3. Optimization of Internal Processes.

Monitoring and Maintenance	**11. Ongoing Maintenance and Support:** Establish preventive and corrective maintenance procedures to ensure the proper functioning of BI solutions. **12. Documentation of Manuals and Procedures:** Document user manuals, procedure guides, and technical documentation to facilitate the use and administration of the system. **13. Continuous Monitoring and Evaluation:** Establish continuous monitoring and evaluation systems to closely track the performance and utilization of BI solutions and adjust as needed.

2.4. Establishment of Management Indicators

To evaluate performance and ensure the alignment of operational activities with the strategic objectives of the entity, key performance indicators (KPIs) will be projected, these KPIs will enable the objective and quantifiable measurement of progress towards established goals, this phase involves the definition of specific indicators, the implementation of a continuous monitoring process, as evidenced in Table 4.

Table 4. Management Indicators.

Indicadores KPI	**14. Definition of KPIs** Formulate specific KPIs that reflect critical performance aspects in each identified area. **15. Implementation of a Continuous Monitoring Process** Design a regular procedure to review and adjust the KPIs based on changes in the operational or strategic environment. **16. Review and Adjustment of KPIs** Collect data related to each KPI from the BI tool and other relevant systems to analyze current performance compared to established objectives. Identify areas where KPIs require adjustments, whether in definition, performance thresholds, or data collection methods.

The project is divided into several phases, beginning with preparation and planning, where the involved areas are identified and objectives are defined, this is followed by analysis and design, which includes the creation of use cases and data preparation, subsequently, data modeling and the implementation of the BI tool are carried out, culminating in its rollout, once the tool is implemented, the focus shifts to training personnel to ensure understanding and effective use of the BI solution, the adaptation of personnel is critical to managing resistance to change, additionally, internal processes are optimized to improve efficiency, and finally, KPIs are established to measure performance and align operations with strategic objectives.

In terms of ethical considerations, information security is guaranteed by Microsoft's policies, and confidentiality and consent are managed according to national and OTIC policies, the methodological limitations encountered included contractual instability and staff turnover, which affected adoption by participants, these limitations were addressed through working groups and tests conducted over two weeks prior to production deployment, confirming and adjusting the information flow to ensure its accuracy and effectiveness in managing projects funded by royalties, the implementation of cloud-based productivity solutions, such as Microsoft Office 365, can be a key strategy for improving operational efficiency and reducing costs, Chandorkar and Patil (2018) highlight that Office 365 not only provides secure remote access to documents and applications but also integrates powerful tools like Power BI for data analysis and interactive visualization, these features allow project managers to monitor progress, identify risks, and make informed decisions more effectively [19], By using Office 365, organizations can significantly improve project coordination and monitoring, ensuring that resources are used optimally.

To train participants and evaluate the impact and achievement of the project's objectives, a socialization event will be organized, accompanied by satisfaction surveys, this event will be carefully planned, starting with a clear definition of its objectives and the meticulous selection of the audience, which will include members of the special monitoring group, among other key stakeholders, a structured presentation will be prepared with well-defined sections: introduction, methodology, results, conclusions, and a Q&A session, to support the presentation, tools such as Power BI will be used to create engaging data visualizations, along with supporting documents like executive summaries.

The satisfaction surveys will be designed to include both closed and open-ended questions, incorporating the use of the Likert scale, a psychometric tool commonly used in social research to measure attitudes and perceptions on a scale of 1 to 5 [20], This allows for a comprehensive evaluation of the clarity of the presentation, the relevance of the results, and the perception of the achievement of the stated objectives, during the presentation, the project will be contextualized by explaining its purpose, specific objectives, and the methodology used, it will be highlighted how task automation and process optimization significantly improve the efficiency and monitoring of projects, additionally, it will be demonstrated how access to up-to-date data has facilitated strategic decisions and agile adjustments, and how data analysis has enabled more accurate project reviews and strategy adaptations.

To illustrate the findings, bar charts, timelines, flow diagrams, or comparative tables will be used, and, if possible, an interactive dashboard will be presented, in the results and conclusions, the achievements of the specific objectives will be highlighted, the potential impact of the implemented improvements on the management of royalty projects will be described, and future practices and possible extensions of the project will be suggested.

Once the event is concluded, the satisfaction surveys will be collected and analyzed, with this information, a detailed report will be prepared, including the main conclusions and additional comments, this report will serve to identify areas for improvement and plan specific actions for future versions of the project, finally, the report will be shared with attendees and other interested parties, thus closing the feedback loop and ensuring the continuity and refinement of the proposed improvements.

3. Results

The project has delivered notable improvements in managing and monitoring royalty-funded initiatives within the Office of the Attorney General. Through the adoption of business intelligence tools, processes were automated, tasks streamlined, and decision-making became more agile and informed (see Figure 2). These advancements underscore the transformative impact of integrating Microsoft 365 and Power Platform solutions. Bringing Microsoft 365 and Power Platform tools together created a powerful system that took project tracking and management to the next level, here's what made the difference:

- **Power BI Dashboards:** Real-time updates on KPIs and project statuses meant less time spent on manual reporting and more time focusing on the bigger picture.
- **Power Automate:** Task assignments and notifications got a major upgrade—everything flowed more smoothly, cutting down on delays and improving communication.
- **Power Apps:** A user-friendly interface made data entry and retrieval super easy, even for folks who aren't tech-savvy.
- **SharePoint and Teams:** These tools centralized everything—documents, collaboration, you name it—so teams could stay coordinated and transparent.

Figure 2. Designed SharePoint Site. Integrates Microsoft 365 and Power Platform Tools.

Together, these tools completely transformed how projects were managed. The takeaway? Microsoft 365 and Power Platform aren't just techy buzzwords they're scalable solutions that can tackle even the toughest challenges, especially in the public sector., the adoption of Microsoft Office 365 in project management demonstrates that it can offer a range of significant benefits, especially in terms of productivity and efficiency, according to Chandorkar and Patil (2018), Office 365 allows organizations to access their applications and documents from anywhere, facilitating collaboration and file sharing among team members, furthermore, the integration of tools such as SharePoint Online, OneDrive, and Microsoft Teams optimizes information management and improves internal communication, which is crucial for effective project oversight [19]. In Figure 3, we can see the SharePoint site established for the project's completion, consolidating various multimedia resources in an organized manner, this site can allow access and real-time collaboration, which can significantly reduce response times and improve strategic decision-making.

In terms of improving the efficiency and monitoring of projects, five dashboards in Power BI were designed and are periodically updated, these tools stand out as an effective solution to support decision-making in various entities, organizations, or individuals at both national and international levels, according to Díaz Vásquez et al. (2022), Power BI allows for the efficient restructuring of organizations by improving data management, which helps hierarchical levels obtain accurate and updated information to base their strategic decisions, the methodology of Ralph Kimball applied in the design of the data architecture ensures that the processed information is of high quality and reliable, which is essential for responding to the needs of managers in real-time, improving the overall productivity of the company [21]. In Figure 3, we can see the design and focus of these dashboards that provide strategic information and allow coordinators and operational staff to access real-time reports and panels with relevant strategic information, the automation of repetitive tasks through Power Automate and data integration in Power BI significantly reduced the time dedicated to administrative tasks, freeing up resources for more strategic activities and improving the coordination and efficiency of the operational team, to integrate interactive maps in Power BI, the Power Map functionality can be used, allowing for the interactive and dynamic visualization of geospatial data.

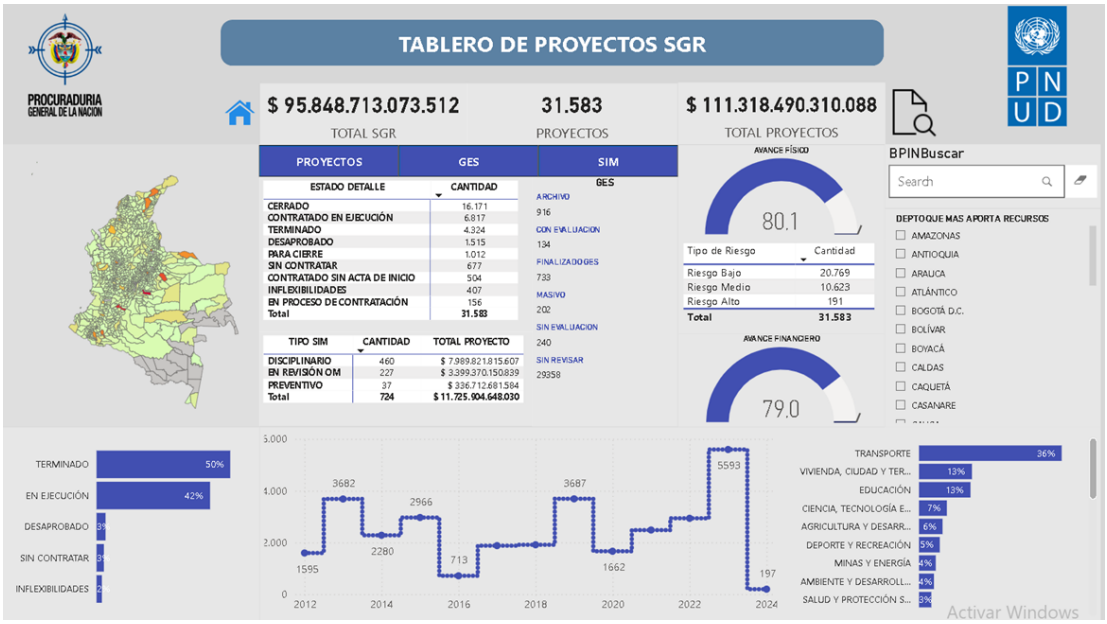

Figure 3. Information and Monitoring Dashboards - Designed in Power BI.

To integrate interactive maps in Power BI (see Figure 4), the Power Map functionality can be used, which allows for the interactive and dynamic visualization of geospatial data, Power BI facilitates the creation of detailed maps at the country, department, city, or even exact coordinate level, which is ideal for these projects, interactive maps allow users to explore and analyze geographical data intuitively, improving the understanding of regional investment and demographic dynamics based on location, additionally, filters and additional layers can be used to highlight different aspects of the data, providing a deeper and more personalized view of the presented information [22].

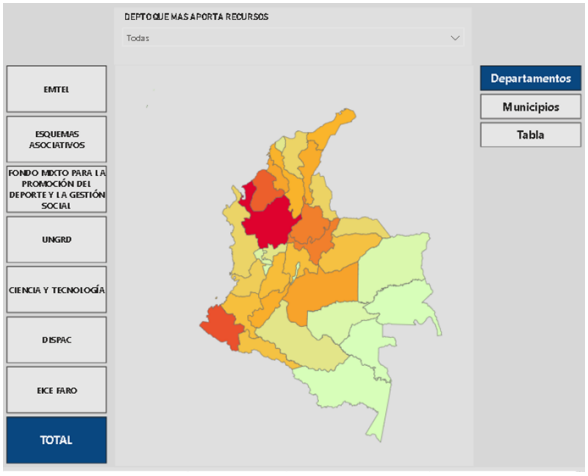

Figure 4. Information and Monitoring Maps - Designed in Power BI.

The implementation of Power BI in SMEs facilitates the analysis and visualization of large volumes of data intuitively and efficiently (see Figure 5). Meseguer Barrionuevo (2016) notes that Power BI allows organizations to manage their data more effectively and obtain valuable insights that previously required IT specialists, with integrated tools like Power Query, Power Pivot, and Power View, Power BI transforms raw data into interactive visual reports that help companies make strategic decisions based on accurate and up-to-date information [23].

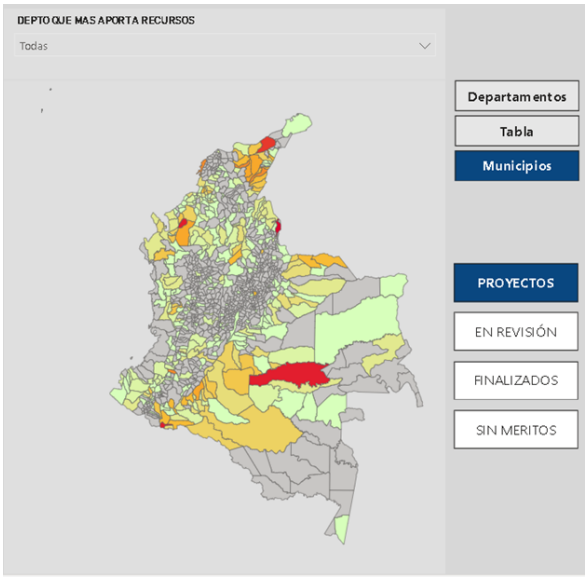

Figure 5. Heat Map by Municipalities of SGR Projects.

To optimize decision-making through updated data, two-phased actions were implemented that improved the reporting of each collaborator's management, initially, a form was designed in Microsoft Forms, as shown in Figure 6. This form included restrictions and logical branching that allowed for the reporting of management information from anywhere with internet access, the second step focused on developing a tool in Power Apps that served the same purpose of receiving and storing management information, in this tool, information flows and work trays were applied, thereby enhancing the ability of managers to quickly assess the status of projects and make informed decisions based on accurate and up-to-date data.

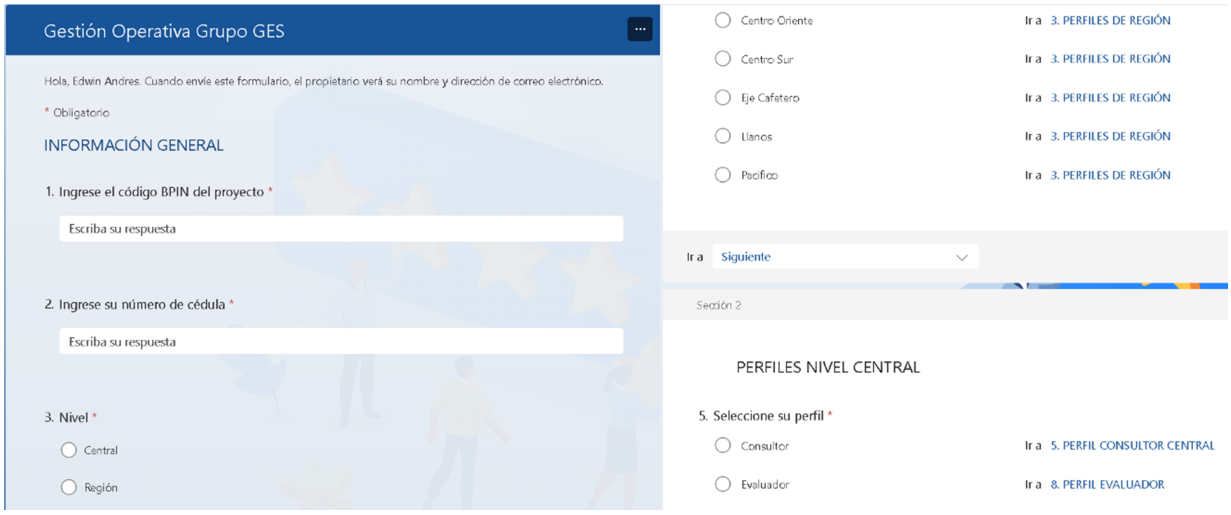

Figure 6. Form with Implemented Branching and Restrictions.

The use of work trays allows collaborators to view and manage the projects assigned to them, those returned to them, and those pending management, this list is accompanied by data such as the assignment date, the type of document assigned, or the management details, enabling the user to decide or set priorities in the operational schedule, these work trays are accessed from Power Automate to send reminders or alerts to the persons in charge, this helps motivate action and collaborate with key information for indicators.

Regarding the monitoring and review of royalty projects, information from other entities impacting these projects was consolidated, this allowed for the creation of monitoring, classification, and information retrieval model for each of the more than 30,000 projects funded with royalty resources, the analysis of these data using business intelligence tools facilitated the identification of trends and patterns, enabling better risk management associated with the projects and greater transparency in resource utilization, similarly, information dashboards were created in Excel, as shown in Figure 7, for the management group, this provides an opportunity for them to conduct their analysis using tables, charts, filters, and data from each report, the development of dashboards in Excel for data analysis offers an accessible and powerful solution for business intelligence in the management of royalty projects. Rodríguez-Rivas (2022) highlights that, although Excel has limitations in the number of rows it can handle, the use of add-ons like Power Query allows for working with large datasets and generating accurate reports, Excel's ability to handle large volumes of data and its integration with other tools make this platform a viable and effective option for improving operational efficiency and precision in project management [24].

The project has proven to be beneficial for all participants involved, from operational staff to Colombian citizens who benefit from optimal management of public resources, the use of Microsoft Power Automate and PowerApps in the development of customized applications allows for the automation of workflows and improved data management. Bharadwaj and Pavithra (2022) describe how these tools were used to create an e-invoicing system that automates the creation of invoices, sends notifications to users, and ensures the

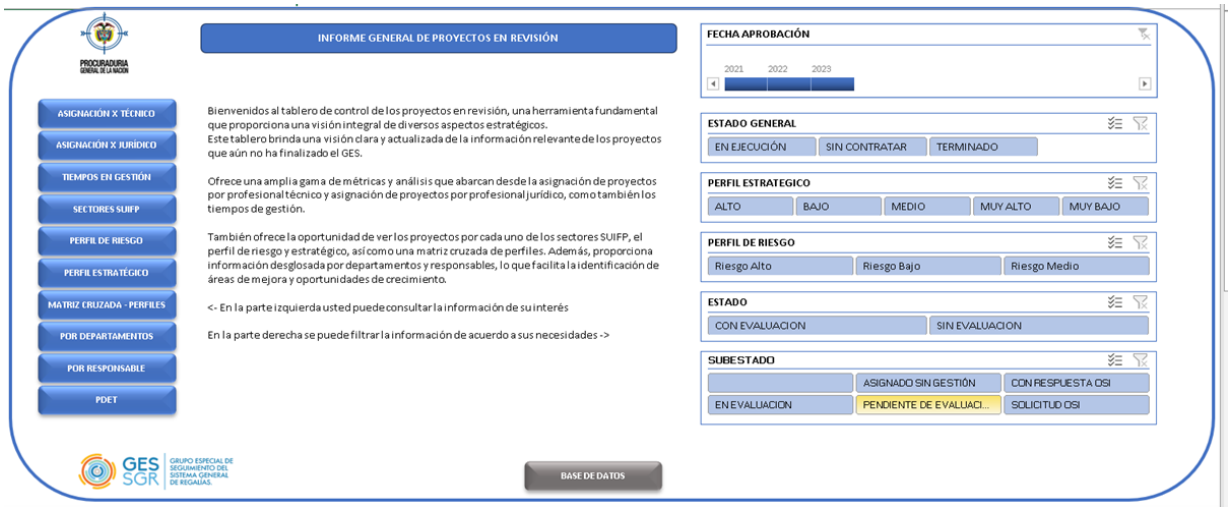

Figure 7. Monitoring and Information Dashboards in Excel Format.

integrity of data stored in SharePoint, the integration of these technologies in project management can optimize administrative processes, ensure data accuracy, and improve strategic decision-making [25] this integration can be seen in Figure 8, which provides evidence of the application developed in Power Apps within the MS Teams environment, along with all the integration options that this tool offers.

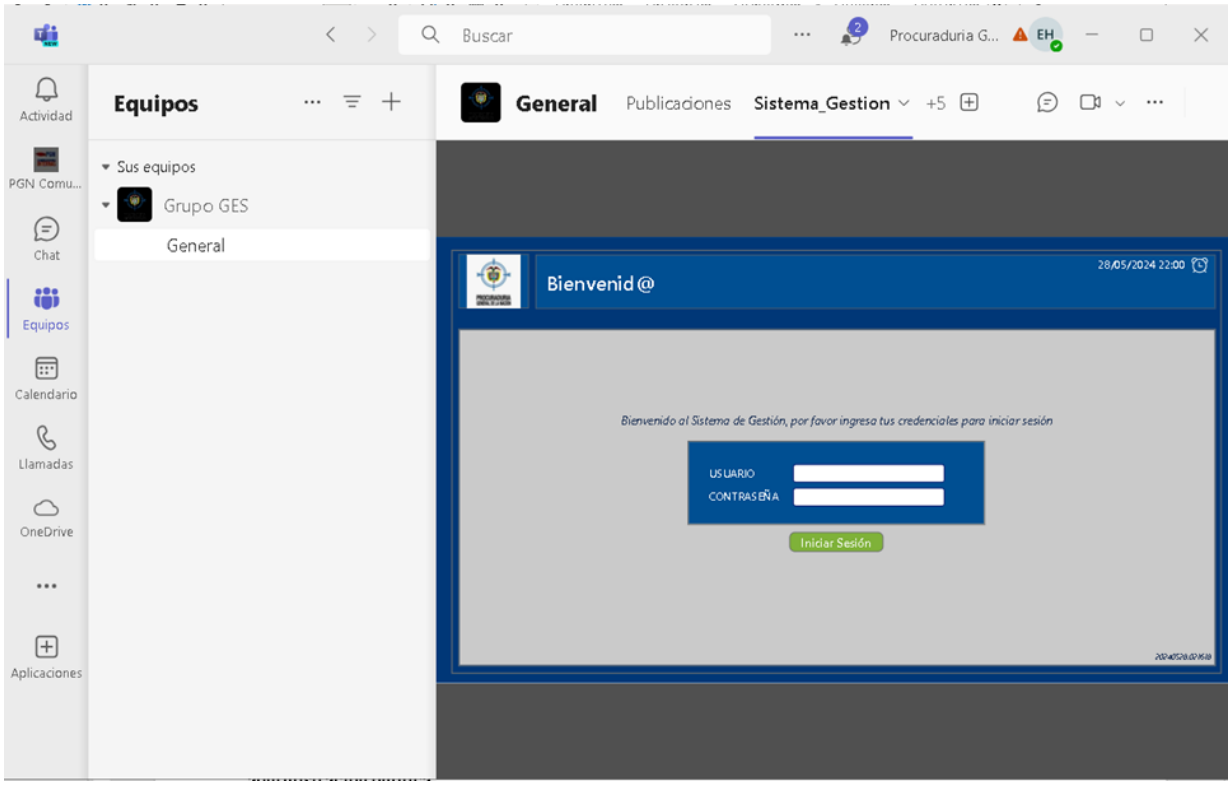

Figure 8. Integration of Solutions in Microsoft Teams.

The ability to report and maintain an accurate record of pending work has improved the coordination and efficiency of the operational team, coordinators can better scale their operations and make agile decisions

based on consolidated information, while management has access to a set of key indicators that allow them to monitor the overall status of projects and make strategic adjustments in real time, the results of this project highlight the importance and effectiveness of Microsoft 365 tools, the implementation of business intelligence, and agile methodologies in project management in the public sector, the digital transformation at Telefónica Colombia, specifically in the Core Operations and Platforms Management, is based on a comprehensive infoknowledge management approach, according to Olaya Leguizamón and Alfonso Vanegas (2022), this transformation is crucial to addressing operational challenges and improving productivity, implementing a knowledge management procedure that uses advanced technologies achieves greater efficiency in information management and facilitates the flow of knowledge within the organization, this model ensures that the company can quickly adapt to changes and maintain its competitiveness in the market [26].

The implementation of these solutions has improved operational efficiency and decision-making and has increased transparency and accountability in the management of public resources; by documenting these experiences and recommendations, a replicable model is provided that can inspire other institutions to adopt similar approaches, promoting a traditional of innovation and continuous improvement in public administration (see Figure 9).

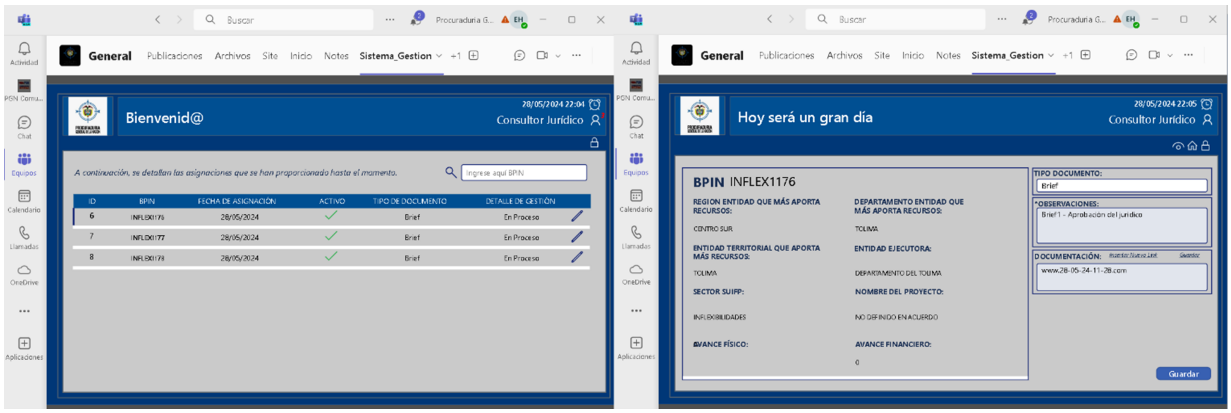

Figure 9. Management Trays and Visualization of the Technological Solution.

To measure the impact of the new management system, a satisfaction survey was conducted targeting the system users, this survey was designed to collect data on various aspects of the user experience, aiming to evaluate the system's usability, functionality, performance, compatibility, and security, to ensure the representativeness and accuracy of the results, the optimal sample size was determined using stratified random sampling with proportional allocation, this method was chosen for its ability to ensure that all subgroups within the total population are adequately represented, minimizing potential biases and providing a high level of confidence in the results, in determining the sample size, it was considered that the total population for this survey consisted of 42 people, it was determined that to achieve a 95% confidence level, 38 surveys were necessary, this calculation was performed using the formula for sample size in finite populations, with the results shown in Tables 6 and 7:

$$n = \frac{N \cdot Z^2 \cdot p \cdot (1-p)}{E^2 \cdot (N-1) + Z^2 \cdot p \cdot (1-p)} \tag{1}$$

The constants were:

- n: Sample Size.
- N: Population Size (42 people).

- Z: Corresponding to the confidence level (1.96 for 95% confidence).
- p: Expected proportion of the characteristic to be measured (0.5 in this case).
- E: Acceptable margin of error.

The population was divided into four strata based on job profile, proportional allocation was applied to assign surveys to each stratum in proportion to their relative size within the total population, this approach ensures that each stratum is represented in the sample according to its weight in the total population, thereby improving the accuracy and representativeness of the results, the satisfaction survey included questions designed to evaluate various aspects of the management system, divided into the following categories: usability, functionality, performance, compatibility, security, and user satisfaction, as shown in Table 5.

Additionally, open-ended questions were included to obtain detailed feedback on positive aspects, areas for improvement, difficulties encountered, and an overall assessment of the experience.

Table 5. Survey questions – Management system.

Usability	Did you find it easy to navigate the user interface and locate the necessary functions?	Ease of Use and Navigation
	Did you find the user interface intuitive and allow for smooth use without additional training?	User Interface Intuitiveness
	Was the time it took you to complete the assigned tasks using the tool adequate?	Efficiency in Task Completion
Functionality	Are all the advertised functionalities operational and working correctly?	Functional Coverage
	Are the results generated by the tool accurate and meeting your expectations?	Accuracy of Results
Performance	Was the response time of the tool adequate during your use?	Response Speed
	Does the tool manage data efficiently with appropriate performance?	Data Handling Capacity
Compatibility	Does the tool work correctly on different devices and browsers?	Multi-Device Operability
	Does the tool integrate effectively with other Office 365 tools?	Integration with Office 365
Security	Does the tool adequately manage access and permissions according to user roles?	Access and Permissions Management
	Does the tool ensure the protection of sensitive data by complying with security regulations?	Sensitive Data Protection
User satisfaction	Please rate your overall opinion of the tool after using it, on a scale from 1 to 5.	Overall Opinion
Open-ended questions	What features or functionalities of the tool did you like the most and why?	Positive Aspects
	What aspects of the tool do you think could be improved and how?	Areas for Improvement
	Did you experience any specific difficulties while using the tool? Please describe.	Difficulties Encountered
	How would you describe your overall experience using the tool in terms of usability, functionality, and performance?	Overall Experience Assessment
	Would you recommend this tool to other users? Why or why not?	Recommendation

By applying this formula and adjusting for each of the strata through proportional allocation, it was determined that 38 surveys were necessary to obtain representative results with a 95% confidence level (see Table 6 and 7).

Table 6. Sample size calculation.

Calculation of the Optimal Sample Size	
Maximum Admitted Margin of Error	5%
Population Size	42
Size for a 95% Confidence Level	38

Table 7. Samples and proportions per profile.

Stratified Random Sampling with Proportional Allocation				
Stratum	**Profile**	**N° of Subjects in the Stratum**	**Proportion**	**Sample from the Stratum**
1	Legal consultant	19	45%	17
2	Technical consultant	21	50%	19
3	Legal coordinator	1	2%	1
4	Technical coordinator	1	2%	1

After tabulating and analyzing the survey responses, we divided the results into two parts, initially, we analyzed the quantitative information and then conducted a special analysis of the open-ended questions to obtain a general overview of the responses, in Table 8, the overall results of the responses can be seen using a Likert scale of 1 to 5, where 1 represents "Strongly Disagree" and 5 represents "Strongly Agree." The responses from all profiles to all questions are shown, and it can be observed how the responses tend to align towards the right, indicating most ratings with a value of 5. This suggests that respondents agree with the questions asked (see Table 8).

Table 8. General Results - Satisfaction Surveys.

Profile	**%1**	**%2**	**%3**	**%4**	**%5**
Legal consultant	0%	2%	8%	27%	63%
Technical consultant	0%	1%	9%	35%	54%
Legal coordinator	0%	0%	0%	33%	67%
Technical coordinator	0%	0%	0%	50%	50%
Total	0%	1%	4%	36%	58%

As previously mentioned, the satisfaction survey was designed to measure specific aspects of the tool and the perception regarding these, in this regard, the results of each of the objective aspects measured are segmented in Tables 9 to 14.

In terms of usability, 94% of the total responses are grouped in ratings 4 and 5, with 48% and 46% respectively of the total responses, regarding functionality, there is also a positive response with a higher average rating of 5 compared to the previous aspect, similarly, the sum of ratings 4 and 5 accounts for 93% of all responses for this aspect, in the aspect measuring performance, general satisfaction is evident, however, it is the only aspect that received ratings of 1 in some responses, which could indicate a point or opportunity for improvement that is not commonly evaluated, on the other hand, in the aspect of

compatibility, we can recognize and evidence the highest ratings from the technical consultant profile, indicating satisfaction from this profile in terms of compatibility and integration with other Microsoft Office 365 tools (see Tables 9 to 11).

Table 9. Question results - Usability.

Profile	%1	%2	%3	%4	%5
Legal consultant	0%	2%	8%	25%	65%
Technical consultant	0%	4%	7%	35%	54%
Legal coordinator	0%	0%	0%	33%	67%
Technical coordinator	0%	0%	0%	100%	0%
Total	0%	1%	4%	48%	46%

Table 10. Question results - Functionality.

Profile	%1	%2	%3	%4	%5
Legal consultant	0%	0%	21%	18%	62%
Technical consultant	0%	0%	8%	34%	58%
Legal coordinator	0%	0%	0%	50%	50%
Technical coordinator	0%	0%	0%	50%	50%
Total	0%	0%	7%	38%	55%

Table 11. Question Results - Performance.

Profile	%1	%2	%3	%4	%5
Legal consultant	0%	3%	3%	32%	62%
Technical consultant	3%	3%	16%	39%	39%
Legal coordinator	0%	0%	0%	100%	100%
Technical coordinator	0%	0%	0%	0%	100%
Total	1%	1%	5%	18%	75%

We can observe that for the technical consultant profiles, the aspect of compatibility in Table 12 received the most ratings of 5 compared to the other aspects and profiles, with 63% of the total ratings for this profile being 5. Similarly, the aspect of security in Table 13 was the highest rated by the legal consultant profile, accumulating 68% of the total ratings for this profile as 5. Thus, it is concluded that the aspects of compatibility and security are the best rated by the operational team.

Table 12. Question results - Compatibility.

Profile	%1	%2	%3	%4	%5
Legal consultant	0%	6%	6%	26%	62%
Technical consultant	0%	0%	8%	29%	63%
Legal coordinator	0%	0%	0%	0%	100%
Technical coordinator	0%	0%	0%	50%	50%
Total	0%	1%	3%	26%	69%

Table 13. Question results - Security.

Profile	%1	%2	%3	%4	%5
Legal consultant	0%	0%	3%	29%	68%
Technical consultant	0%	0%	11%	32%	58%
Legal coordinator	0%	0%	0%	50%	50%
Technical coordinator	0%	0%	0%	50%	50%
Total	0%	0%	3%	40%	56%

Table 14. Question results - Overall Satisfaction.

Profile	%1	%2	%3	%4	%5
Legal consultant	0%	0%	6%	35%	59%
Technical consultant	0%	0%	5%	47%	47%
Legal coordinator	0%	0%	0%	100%	0%
Technical coordinator	0%	0%	0%	0%	100%
Total	0%	0%	3%	46%	52%

Finally, we have tabulated the results of the overall satisfaction rating, the responses with ratings of 4 and 5 are evenly divided, indicating general satisfaction with 97% of the responses grouped in ratings 4 and 5.

The survey included open-ended questions aimed at gathering qualitative user feedback, with quantitative metrics focusing on assessing key performance indicators (KPIs) of the tool. Feedback from open-ended responses was analyzed using thematic coding, revealing common insights such as functional strengths and weaknesses, thematic coding systematically categorized feedback into predefined themes, including usability, functionality, and performance, adhering to recognized qualitative analysis standards for accurate classification of user insights, multiple coding iterations were performed to ensure consistency across themes, enhancing the reliability of the findings, it was observed that the tool achieved high acceptance, with over 80% positive responses across various measured aspects, users particularly emphasized the tool's usability, functionality, compatibility, and security. However, performance was identified as an area for improvement, suggesting that while the tool is well-received, further optimization could enhance the user experience.

For the open-ended questions, sentiment analysis will be conducted that captures the character strings provided by the users to identify the most frequently used words or those most commonly mentioned in the responses to the open-ended questions, typically, monosyllabic words that are frequently used in paragraphs, so the following words are omitted in the exercise: "the," "of," "that," "is," "it," "in," "if," "and," "or," "me," "a," "an," "to," "for," "with," "without," "as," and "on."

The obtained result is illustrated in an image that contains the words identified as the most used, depending on the frequency of their repetition, the size of the word increases, such that the most frequently used words are the quickest to identify and are larger in size, below are the results after applying the described process to each of the five open-ended questions asked of the users:

What features or functionalities of the tool did you like the most and why?

For this question, it is observed that in the word cloud resulting from user responses, the words "Tener" and "Caso" stand out, this suggests that what users liked the most was having (new functionalities,

integrating functionalities they wanted, or aspects they needed), similarly, a notable word is "pendientes," which can be associated with the inbox designed to accurately track pending tasks (see Figure 10).

Figure 10. Word Cloud - Question Best Features.

What aspects of the tool do you think could be improved and how?

Regarding the aspects that users believe could be improved, words like "Tiempo" (time), "internet," and "información" (information) are evident, this can be associated with response time, filling out forms when there is no internet, and data or details that can be displayed but are not yet present in the current tool (see Figure 11).

Figure 11. Word Cloud - Improvement aspects.

Did you experience any specific difficulties while using the tool? Please describe.

In the results for this question, it is evident that the word "ninguna" (none) is one of the most used, omitting this information, it can be inferred that the difficulties were associated with issues such as slowness and internet connectivity (see Figure 12).

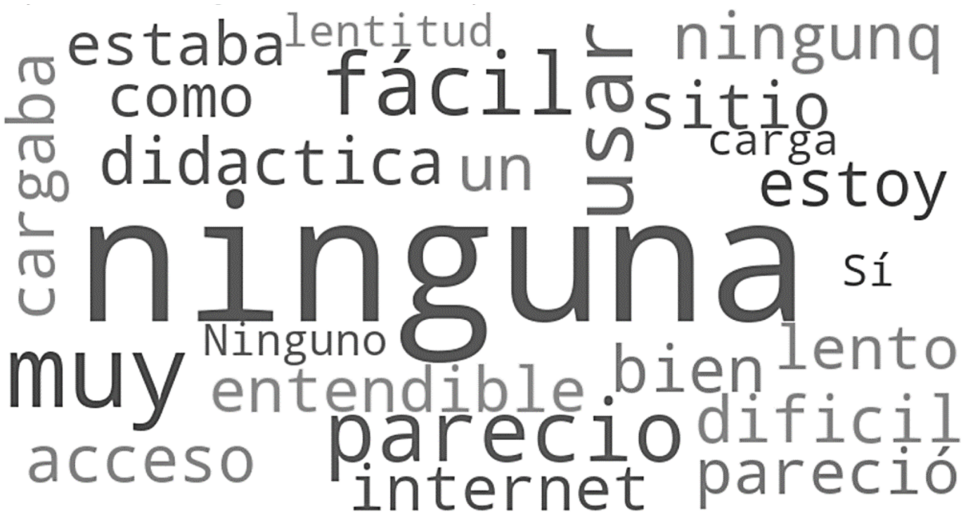

Figure 12. Word Cloud – Difficulties.

How would you describe your overall experience using the tool in terms of usability, functionality, and performance?

The most used words when responding to the question about the experience with the tool in terms of usability, functionality, and performance include positive words such as "bien" (good), "buena" (good), "gusto" (like), "Excelente" (excellent), and "function" (works), this indicates that the development aligned with the operational needs and desires (see Figure 13).

Figure 13. Word Cloud - Experience (Usability, functionality, and performance).

Would you recommend this tool to other users? Why or why not?

In the final question, we sought to obtain users' opinions and the reasons why other people might need this type of solution, in this context, words such as "gestión" (management), "organizer" (organize), and "poder" (ability) can be observed, indicating an interest or recommendation to people who need new functionalities in their work processes, as these were integrated into the tool (see Figure 14).

Figure 14. Word Cloud - Recommendation to other users.

4. Conclusions

The programming of triggers in Power Automate to send notifications and auto-emails when projects are assigned or returned for review, thereby improving internal communication and significantly reducing response time at each stage of the project management process, which is consistent with the objective of this system: "improving project efficiency and monitoring through business intelligence by automating tasks and optimizing processes for effective management." Web forms are associated with Excel databases in such a way that data consumption is executed in real-time, hence optimizing the accuracy and speed of awareness and decision-making; this has also been effected in the case of creating lists that act like relational tables, and thereby, the automation of the information flow and assurance that all relevant data is updated and accessible to the users in time. Finally, the system has enabled the incorporation of active/inactive fields to manage pending tasks, thereby affording an effective tool for streamlining and monitoring tasks, ensuring effective and efficient management of the projects. One of the general solutions that can help in achieving the goal "to optimize decision-making by updated data to determine the strategic initiative and agile adjustments" was the development of updatable reports. The latter was developed given the possibility of updating quickly and effectively, which enables information relevant only to the interested and authorized persons to be confidential and proper usage of the data. It was also necessary for the active participants holding a current strategic profile to take part in making the tables and visualizations as the information displayed must be well explained and make the maximum impact on the success of the project. Due to this joint work, not only could the use of adequate visualizations for strategic decision-making be provided, but also the staff got acquainted with new tools. Given these efforts, an information system was set up that allows exact and efficient monitoring of projects, facilitating the great improvement in administration and optimization of operational processes. Due to this, the objective "follow up on the review of projects related to royalties through data analysis and business intelligence, with development and implementation of a tool programmed in Power Apps" can be said to have been effectively met. This is proven because the functioning flow established by the programmed tool, which permits the availability of real-time reports on the reviewed cases, has given clear and exact visibility on the status of each of the projects and, with this, the supervision and monitoring of pending activities for each collaborator within an inbox has been made possible. The information system has been optimized for the capacity to monitor and manage projects, as well as to improve accuracy and transparency in task distribution so that every collaborator can keep an

exact account of their pending tasks. Operational efficiency and individual accountability have increased significantly.

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