JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2025, VOL 8, NO S7

Functional Architecture Of Business Intelligence Platforms In Accounting Contexts Based On Contaweb-BI

David Antonio Franco Borré[1] , Raúl José Martelo Gómez[2] , Pedro Juan Guerrero Muñoz[3]

[1] Specialist in University Teaching. Master in Computer Science. Systems Engineer, Tenured Research Professor of the Systems Engineering Program at the Universidad de Cartagena. Leader of the GIMATICA Research Group. Cartagena de Indias, Colombia. Email: dfrancob@unicartagena.edu.co. ORCID: https://orcid.org/0000-0001-7500-0206
[2]Specialist in Networks and Telecommunications; Master in Computer Science. Systems Engineer. Tenured Research Professor of the Systems Engineering Program at the Universidad de Cartagena. Leader of the INGESINFO Research Group. Cartagena de Indias, Colombia. E-mail: rmartelog1@unicartagena.edu.co ORCID: https://orcid.org/0000-0002-4951-0752.
[3]Systems Engineer, Universidad de Cartagena; Software Developer; CVLAC: https://scienti.minciencias.gov.co/cvlac/visualizador/generarCurriculoCv.do?cod_rh=0001923048; Email: pjgm181818@gmail.com

Abstract

The functional structure of business intelligence (BI) platforms plays a fundamental role in the potential generation of value in specialized environments such as accounting. This article aims to develop a technical and structural study of the ContaWeb-BI platform, specifically applied to the accounting contexts of small and medium-sized organizations, as well as public organizations. To carry out the study, a direct functional analysis is proposed applied to a real-life context of development and use of the solution, allowing a review of its main modules, workflows, interaction logic, and analytical capacity. The results reflect a highly adapted modular architecture, with functionalities that allow for structured data uploading, sales and purchase projections, supplier groupings, and automatic detection of accounting anomalies, among others. The user-friendly interface and hierarchical segmentation by entities reinforce its applicability in organizational environments with decentralized work structures. ContaWeb-BI, compared to general BI platforms, presents a greater degree of alignment with the functioning of the accounting logic. Finally, it is concluded that its design represents a replicable model of specialized BI architecture and is valuable for digital transformation in medium-sized contexts, recommending its use as a model for the development of contextualized analytical solutions.

Keywords: business intelligence; accounting platforms; predictive analytics; operational segmentation; information systems; ContaWeb-BI; financial analytics.

Introduction

In recent years, the advancement of business intelligence (BI) platforms has changed the way organizations access, process, and use accounting information to support strategic decision-making (Olszak, 2022). These tools are no longer exclusively used by large corporations but have become a fundamental component in companies of all sizes, enabling the conversion of large volumes of data into structured and usable knowledge (Grabova et al., 2010). In this sense, the functional architecture of BI platforms is a key element for their effectiveness, as it determines how input, processing, analysis, and visualization components are integrated, as well as their adaptation to different domains, including accounting (Caserio, 2018).

Despite the advances made in this area, the literature indicates that most of the BI platforms currently available on the market have generic architectures and a focus on multiple sectors of activity, but without any specific optimization for accounting processes (Ereth & Baars, 2020), which is also reflected in the works carried out by Lasca (2024) and Genotiva (2025), who point out that BI systems that are not developed with an explicit accounting logic limit the ability of non-technical users to interpret financial information.

Consequently, it is necessary to advance in the design of platforms that accept the integration of technical components (ETL, storage, dashboards, analytical models) with functional structures that are representative of the operating logic of accounting, including control, segmentation, anomaly detection and financial planning functions. This need has been evidenced by recent works such as those of Martins et al. (2024), Lasca (2024) and Trigo et al. (2014), which highlight the importance of adapting BI architectures to a real workflow in areas such as financial accounting and internal auditing.

Considering the current situation, there is a gap in the literature related to the technical and functional analysis of BI platforms created for the accounting field. Most of the studies available have focused on measuring operational impacts (such as KPIs), while few have documented and delved into the explanation of how BI platforms are architecturally structured. This gap is especially relevant in emerging economies, where many small and medium-sized businesses require systems that are not only technically efficient but also functionally understandable and adapted to their actual accounting conditions.

Therefore, this research aims to analyze the functional architecture of the ContaWeb-BI platform, a technological solution developed in the context of a joint project between the University of Cartagena (Universidad de Cartagena) and Colciencias, which is functionally oriented toward accounting management. Based on direct observation of the platform in its operating environment, a study is conducted of its components, information flows, analysis modules, and the logic of their interaction. The objective is to establish a reference model that serves to document good functional design practices in BI platforms for accounting, while also highlighting strengths and weaknesses and indicating opportunities for improvement that can be replicated in other environments.

This analysis is justified for several reasons. The main one is that it enhances the existing knowledge on intelligent accounting systems from a technical-functional perspective, a dimension underexplored by the existing literature. The second reason relates to the empirical evidence provided by a working tool, which allows for going beyond theoretical models of intelligent accounting systems and offering practical design criteria. The third reason is associated with the need for BI solutions that are

interoperable, modular, and integrate with the operational flows of accounting systems, going beyond the simple visualization of indicators.

Among the contributions this study can offer is the characterization of the functioning of the modular architecture of ContaWeb-BI, which shows the functionalities that integrate user and company administration, structured data uploading, predictive purchasing analysis, sales projection, supplier segmentation, and financial anomaly detection. It also highlights the way these functions are organized within a user-friendly interface with visual structures optimized for accounting users without advanced technical training. Finally, the article proposes a series of recommendations applicable to the design of new business intelligence platforms for accounting, based on the principles of modularity and usability and their functional alignment.

Methodology

This research corresponds to a qualitative and exploratory technical case study (Sánchez & Murillo, 2021), aimed at describing the functional architecture of a BI platform designed for accounting environments. This approach was chosen because it allows an in-depth understanding of the structural, operational, and logical configuration of a real system, rather than measuring quantifiable effects (Herrera, 2017). In this sense, for Stake (1995), qualitative case studies aim to describe and understand complex phenomena in their natural contexts, in this case related to the search for how systems or processes that cannot be fragmented without losing their operational meaning are functionally organized.

The methodological design is descriptive and functional-structural, which implies that it is not intended to verify causal hypotheses, but rather to document and analyze in detail the components, flows, relations and functionalities that make up the architecture of the analyzed system. According to Yin (2017), this design is appropriate for research that explains the internal logic of complex systems in real-world situations, as occurs in software design (management platforms), where technological phenomena are considered in an integral manner.

The study was conducted by analyzing the ContaWeb-BI platform in its real-world environment. To obtain this analysis, all access requirements for using the platform's functionalities were available from an authorized operating environment. This analysis was developed through the following phases:

1. Functional exploration: comprehensive navigation through all existing modules (business management, branches management, user management, data uploading, analytics, fraud detection, prediction, among others) in order to carry out a complete inventory of components and operations.

2. Architectural characterization: recognition of logical layers (interface, processing, storage, analytics) and design of functionalities based on modular design criteria, interoperability, adaptability, data integration, and user experience.

3. Structural and operational assessment: categorization of components according to their role in the functional architecture, describing the flow of internal processes, the relation between modules, information inputs and outputs, and user interaction logic.

The analytical coding was organized around five key dimensions: system organizational structure, functional hierarchy and modularity, user interface and experience (UX), predictive and prescriptive analytics capability, and alignment with operational accounting needs. Screenshots taken directly from the platform's live environment were used to visually illustrate the modules and processes, serving as empirical evidence for the structural analysis.

This study does not involve the participation of human subjects, nor does it use personal, financial, or sensitive data. All analysis was conducted through functional access to the technological platform in a non-production environment, so no intervention, opinion collection, or manipulation of real-world processes was involved. Consequently, the research does not require approval from an ethics committee, in accordance with the guidelines established in the Declaration of Helsinki (WMA, 2014) and international frameworks on ethics in research with technologies (IEEE, 2022). Neither intellectual property nor platform usage rights have been violated, as institutional permissions for controlled access to the system were granted. The images used are for illustrative purposes and do not include third-party data.

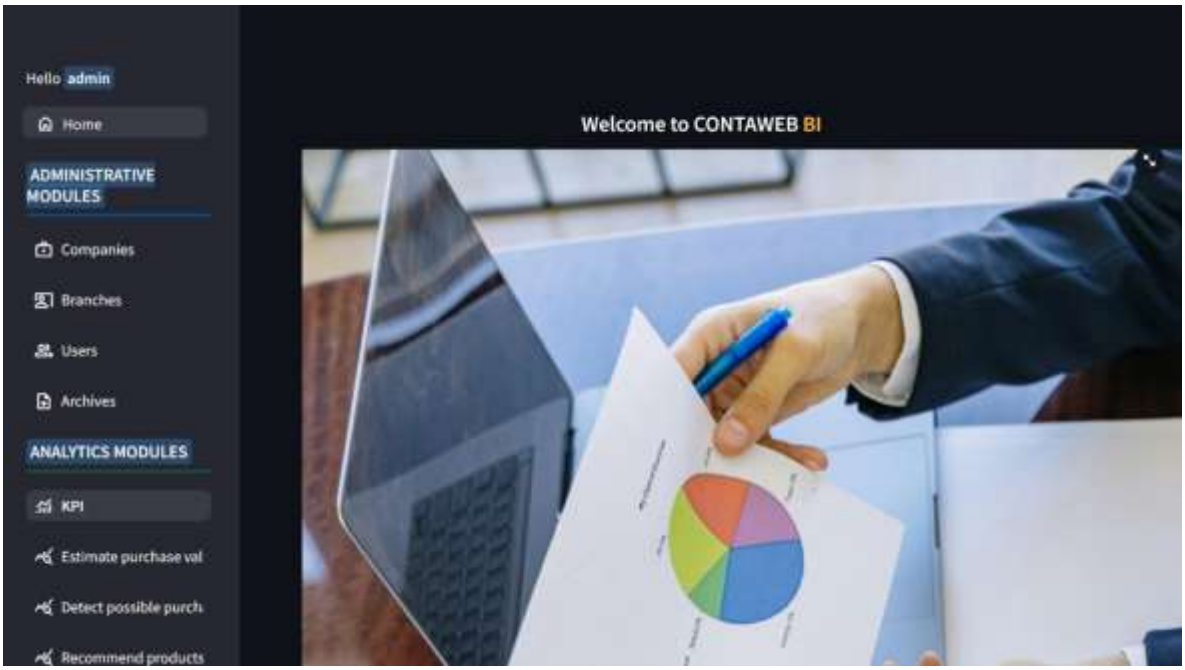
Among the main limitations of the study are the fact that the focus is on a single system, which, while allowing for in-depth analysis, limits the generalization of the findings to other accounting BI platforms that operate with different logics. Furthermore, there is a lack of external comparative analysis, since a direct comparison with other BI architectures (such as SAP Business One, Odoo, or Tableau) was not included, so a relative functional hierarchy cannot be established. Technical performance (response times, computational efficiency) was not evaluated, since the objective was documentation and structural analysis, not operational performance assessment. However, these limitations are inherent to a technical-descriptive case study and do not affect the validity of the main objective of the work, which is to analyze the functional architecture of a real platform oriented to accounting contexts.

Results

The functional analysis of ContaWeb-BI reveals a modular architecture built on principles of scalability, operational segmentation, and automated accounting processes. The platform is organized into four main functional layers: (i) entity management (companies, branches, and users), (ii) transactional data processing through structured document uploading, (iii) automated analysis of financial and accounting behavior, and (iv) dynamic visualization through interactive dashboards. Each module responds to an independent logic, but is interconnected through a unified interface that guides the user through sequential and intuitive flows.

Figure 1 shows the administration panel, the general access point to the platform's various modules. This centralized structure allows the user to select specific actions based on their role (administrator, company, or branch), ensuring segmentation and access control. This modular organization facilitates system governance while simplifying the navigation experience for non-technical users.

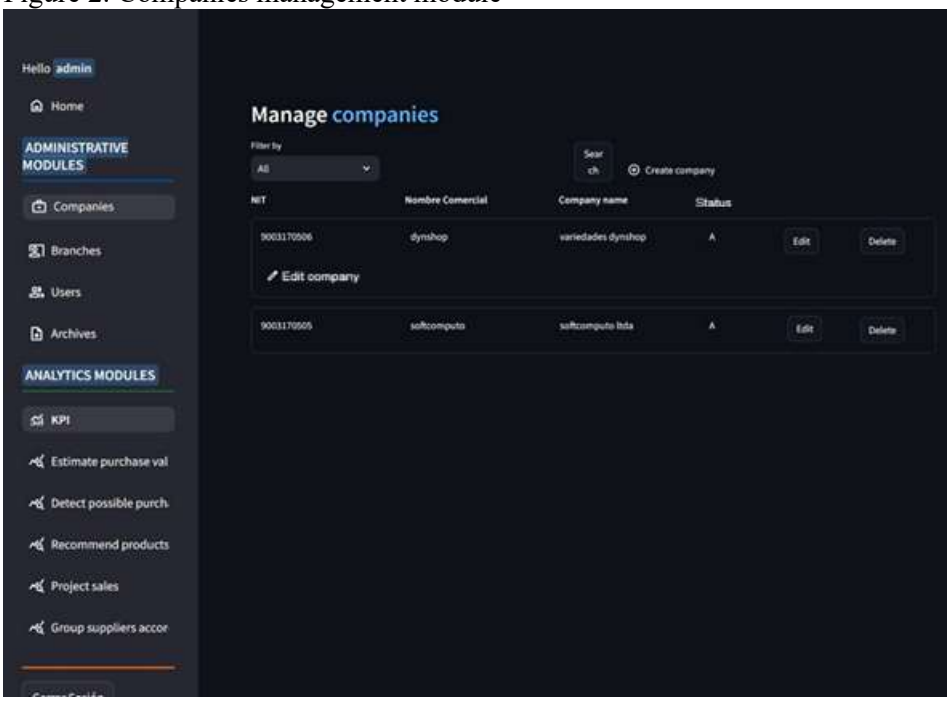
Figure 1. ContaWeb-BI general administration panel



Source: Direct capture of functional environment

The company management module, represented in Figure 2, allows for the registration, editing, and location of accounting entities through customized filters. This subsystem constitutes the organizational backbone of the platform, since each registered company becomes an independent analytical unit. Relational logic links each company to distinct offices, users, and accounting files.

Figure 2. Companies management module

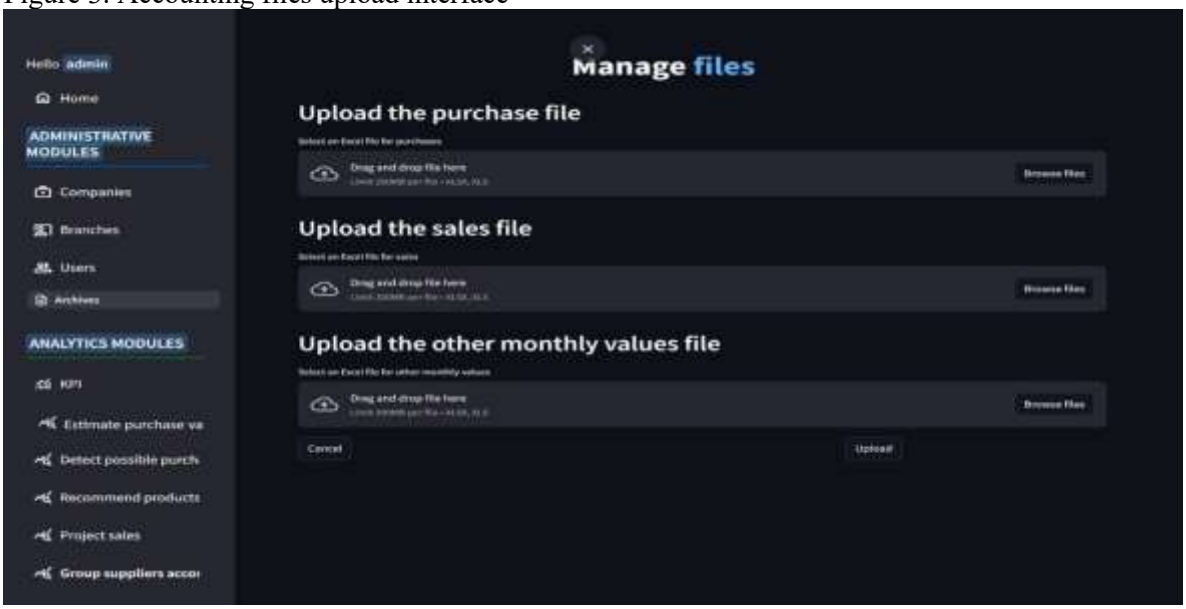


Source: Direct capture of functional environment

One of the essential functionalities offered by the ContaWeb-BI functional architecture, as seen in Figure 3, is the acquisition of information through document processing, specifically structured files.

Through this functionality, the user can upload sales and purchase files in Excel format, which are automatically processed to load the information into the different analysis modules. This operation eliminates the need to manually enter information, thus ensuring, on the one hand, the standardization of the source information and, on the other hand, enabling a faster and more fluid cycle for obtaining information in each of the analysis modules, which represents the main entry point to the analytical ecosystem.

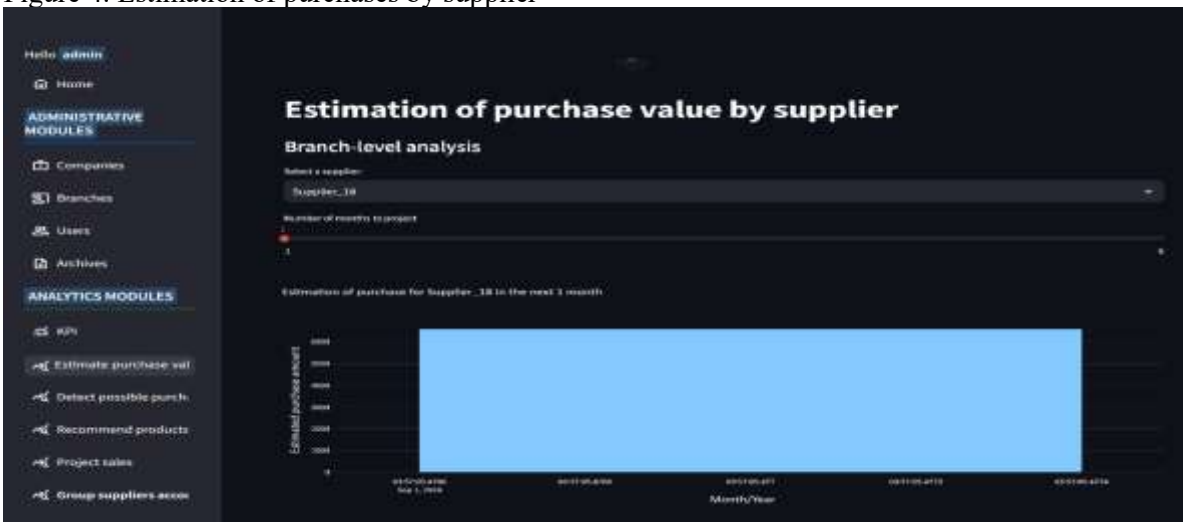
Figure 3. Accounting files upload interface



Source: Direct capture of functional environment

Once data is loaded, the system offers a set of analytical tools. Figure 4 shows, for example, the estimation of purchase value based on algorithms that predict expected spending behavior by supplier. The visual design of this feature allows for assessing the performance of a specific supplier by selecting them from a drop-down list and defining the projection time horizon using a slider. This approach facilitates financial planning, anticipating supply needs, and managing future liquidity scenarios.

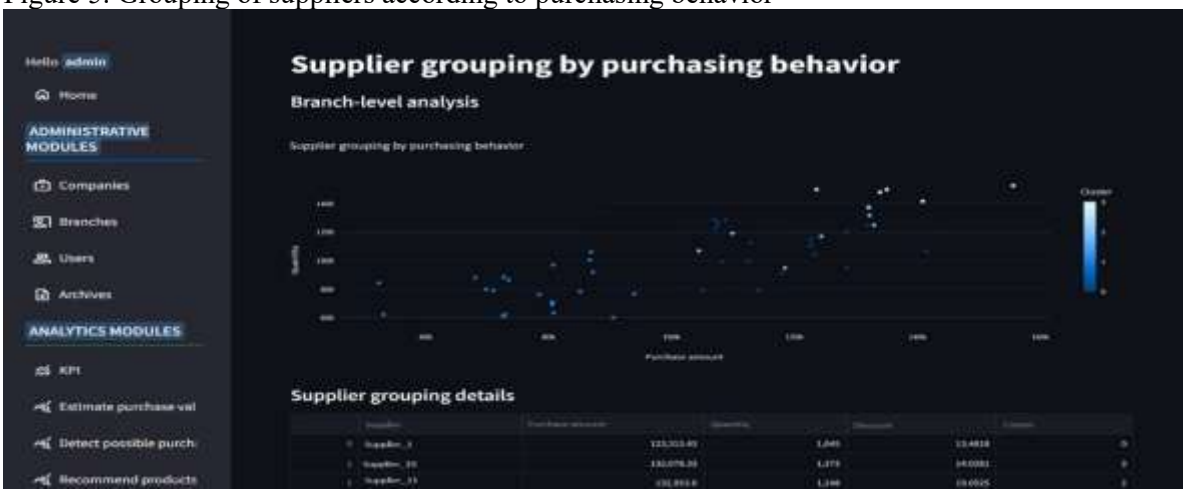
Figure 4. Estimation of purchases by supplier



Source: Direct capture of functional environment

Another feature is supplier analysis, which, as shown in Figure 5, integrates grouping capabilities based on transactional behavior through the use of variables such as purchase amount, frequency, and payment type. This results in automatic groupings that allow the company to classify its suppliers according to their strategic level. This grouping helps strengthen the procurement process, renegotiate terms, and diversify business relationships.

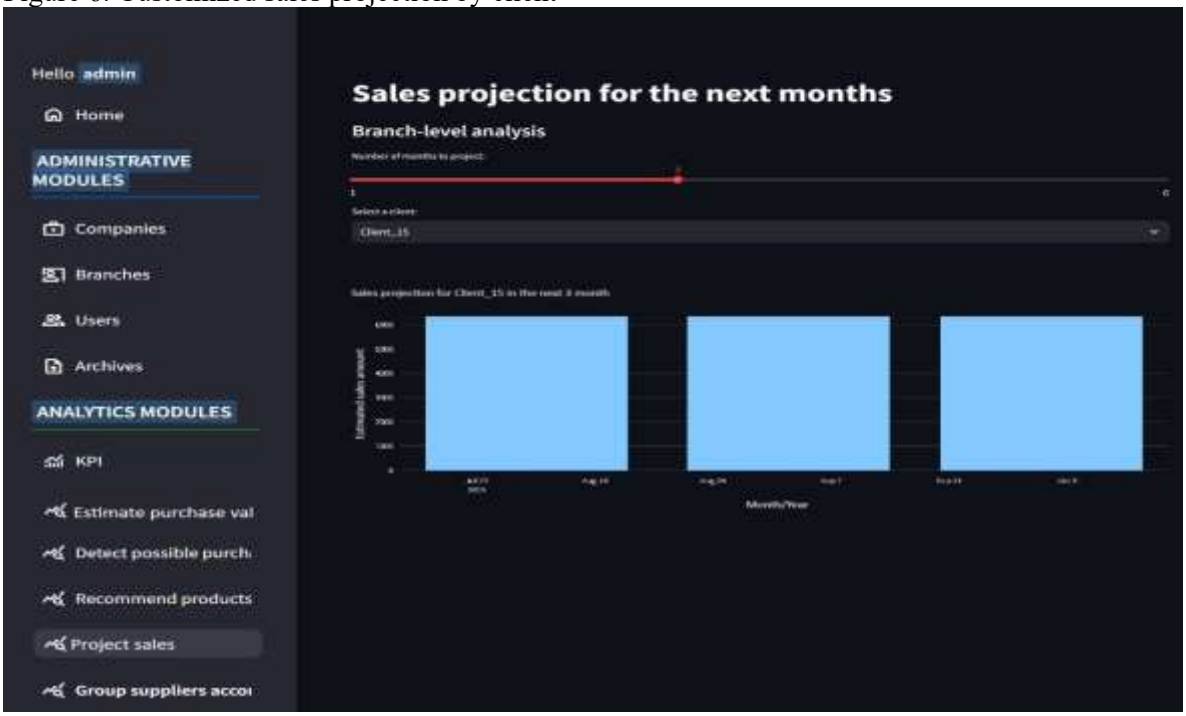
Figure 5. Grouping of suppliers according to purchasing behavior



Source: Direct capture of functional environment

Similarly, the system has the ability to project sales by client, which allows estimating future sales using historical patterns, as can be seen in Figure 6. This functionality also makes it possible to adjust sales campaigns, predict future stock levels and anticipate future income, helping the company in operational and financial planning in seasonal or changing cycles.

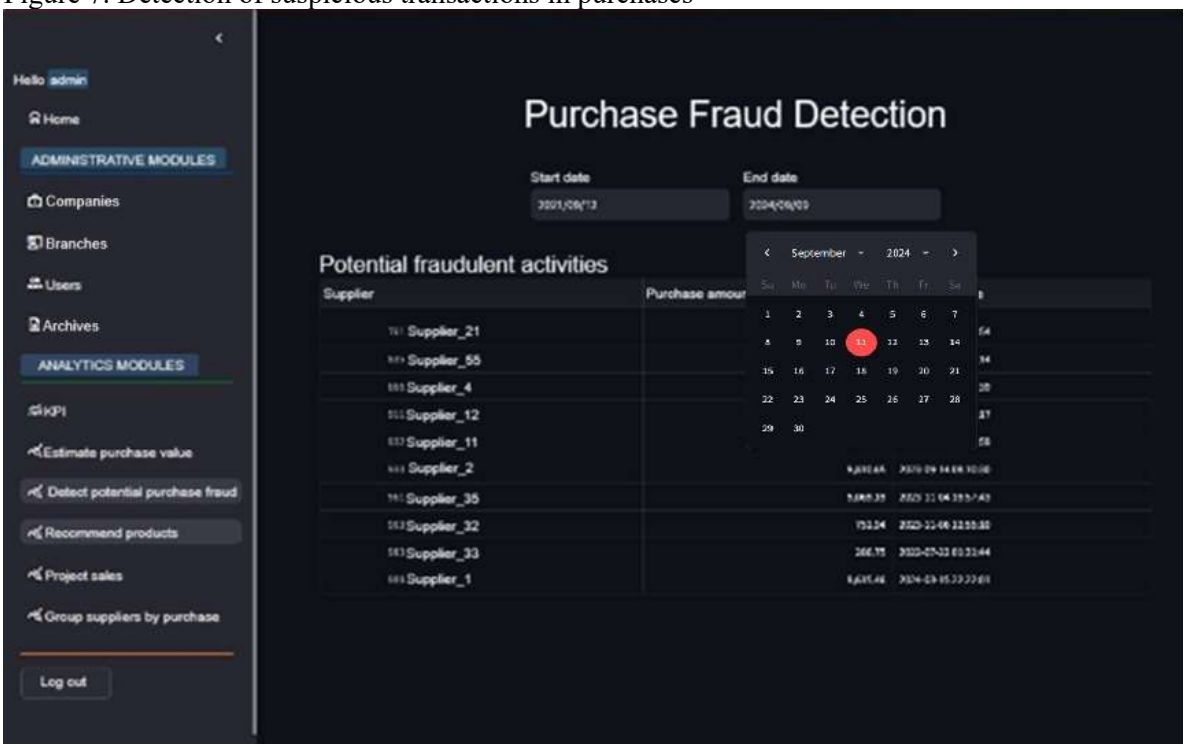
Figure 6. Customized sales projection by client



Source: Direct capture of functional environment

Finally, Figure 7 illustrates the anomaly detection module, which focuses on identifying potential fraud attempts in the purchasing process. The system analyzes transaction series and identifies patterns that contrast with the usual purchase indications, such as anomalous amounts or unjustified repetitions. In this way, ContaWeb-BI becomes a solution that is not only an accounting dashboard, but also functions as an automated monitoring system for financial flows.

Figure 7. Detection of suspicious transactions in purchases



Source: Direct capture of functional environment

Taken together, the analysis results show that ContaWeb-BI presents a functional architecture highly adapted to the needs of the accounting environment. Its modular structure allows for layered implementation; while the automation of operations and user-friendly visual representation allow these systems to be adopted by untrained or specialized users. The model that emerges from this platform is considered replicable in the design and development of BI solutions in accounting domains, especially in emerging business environments where simplicity, scalability, and functional specialization become key factors in the digital transformation process of companies.

Furthermore, to complement the precise functional analysis of ContaWeb-BI, a structured comparison has been carried out between this platform and other BI solutions available on the market, with the aim of highlighting their architectural features and their degree of accounting specialization. This comparative exercise provides an idea of the technical and functional scope of ContaWeb-BI in relation to larger, general-purpose systems such as Power BI, SAP Business One, and Zoho Analytics.

Below is a summary of the key elements that make up an effective functional architecture for accounting-oriented BI platforms, based on specialized literature. Tables 1 and 2 simplify these aspects, allowing for visualizing the strengths, strategic alignments, and differentiating contributions of ContaWeb-BI compared to conventional solutions.

Table 1. Functional comparison between ContaWeb-BI and commercial BI platforms

Criterion	ContaWeb-BI	Power BI	SAP Business One	Zoho Analytics
Functional approach	Accounting and financial management	General (visualization)	General financial ERP	General BI
Modularity	High (uploading, analysis, detection)	Medium (requires configuration)	High (integrated with ERP)	Medium-high
Target users	SMEs and public accounting sectors	Broad business users	Large companies	SMEs and startups
User-friendly interface	Yes, designed for non-technical users	Requires a learning curve	Technical, with prior training	User-friendly visual interface
Supplier segmentation	Yes (automated grouping)	Limited (requires external modeling)	Yes, but integrated with the ERP	Partial
Purchase/sales projections	Integrated, by supplier or client	Requires custom models	With additional modules	Limited to reporting
Fraud detection	Yes, based on atypical patterns	Not native	With advanced modules (extra cost)	Not integrated
Cost and access	Free with academic authorization	Per-user license	Expensive (full ERP)	Freemium
Accounting alignment	High (structure designed for accounting processes)	Low (requires customization)	Medium-high (within ERP)	Medium

Source: Authors

Table 2. Key elements in the functional architecture of accounting-oriented BI platforms

Dimension	Recommendation according to literature	Implementation in ContaWeb-BI	Suggested source
Modularity	Separation by functional domains	High: independent modules	Turban et al. (2008); Vo et al. (2017)
Uploading and processing	Data automation and standardization	Upload by structured file	Tantawy & Ismail (2021)
Visualization	Dashboards accessible to non-technical users	Interface with blocks, sliders and filters	Heang & Mohan (2017)
Predictive Analytics	Projections based on historical data	Projected sales and purchases by client/supplier	Bussa (2023)
Operational Segmentation	Automated classification of accounting relationships	Supplier grouping	Achhaiba & Omari (2022)
Governance and Scalability	Control of users, locations, and companies	Structured separation by entity	Al-Aqrabi et al. (2019)
Anomaly Detection	Algorithms to identify fraud or irregular transactions	Pivot table with unusual patterns	Han el al. (2024)

Source: Authors

Taken together, the results provided demonstrate that the ContaWeb-BI tool is more than just a simple accounting analysis tool, as it incorporates a functional architecture specifically designed to meet the operational, strategic, and analytical needs of the accounting environment. Its modular structure, adaptability to different user profiles, and integration of predictive and control functionalities demonstrate an approach geared toward informational efficiency and user autonomy when making decisions.

Entity segmentation, data flow automation, and the availability of advanced tools such as supplier grouping and anomaly detection allow this tool to overcome the typical limitations of generic BI systems, facilitating an analytical ecosystem that can be effectively applied to medium-sized companies or public institutions with specific accounting needs. The comparisons made reinforce the idea of considering ContaWeb-BI as a solid, contextual, and replicable alternative to internationally applicable alternatives, albeit with a lower degree of functional specialization.

This set of results supports the idea that the functional design of BI platforms must evolve around architectural models focused on the application domain, which not only improves the user experience but also increases the strategic value of accounting information in environments where digital transformation is still faced with the limitations of organizational structures.

Discussions

An analysis of the functional architecture of ContaWeb BI reveals a modular design that is in line with the principles valid for specialized BI platforms, coinciding with some of the conclusions derived from studies in the field of BI and information systems. First, the layered architecture, interface, processing, storage, and visualization support the classic BI model defined by Turban et al. (2008) and Abrarov and Khudaybergenov (2024), which summarizes that a layered structure facilitates both system maintenance and the incorporation of advanced modules such as OLAP and data mining.

Modularity, observed in the separation of components such as document uploading, segmentation by company and branch, and predictive functionality, corresponds to the recommendations of Vo et al. (2017), who highlight that the trend in new BI architectures is moving toward operational, situational, and self-service models, with independent but interoperable modules. ContaWeb BI reflects this evolution by integrating modules with predictive intelligence such as purchase estimation and sales projection, which act more as autonomous pieces within a coherent ecosystem.

Compared with implementation cases in sectors such as retail or finance, where it is seen that the adoption of BI provides rapid access to reports, improves the quality of information and eliminates dependence on human operators as found in Tantawy and Ismail (2021), ContaWeb BI complements these benefits with a broader approach, not only optimizing processes, but also deepening analytical support with anomaly detection and predictive variables, aligning with emerging practices in BI that combine reporting and advanced analytics.

A relevant aspect is the frictionless integration between technical components (ETL, storage, OLAP) and functional components (users, companies, offices). Achhaiba and Omari (2022) highlight that, to impact management accounting, BI systems must interact effectively with the organization's ERPs and other databases, providing not only reports but also analyses that enrich decision-making. ContaWeb BI offers this integration, as it allows the user to move from file uploading to the detection of anomalous behavior without changing platforms, which reflects this systemic alignment.

The value of the interface and user experience is an aspect that should not be underestimated. Heang & Mohan (2017) note that the adoption and effectiveness of BI are typically determined by its scope for non-technical users, ease of use, data quality, and connectivity with existing systems. In the case

of ContaWeb BI, an interface with sliders, filters, and drop-down lists reflects a design geared toward accounting profiles without specific technical skills, thus facilitating its adoption.

However, as Al-Aqrabi et al. (2019) mention, expanding the capabilities of a BI system to the cloud or to the capacity to store large volumes of data requires scalable architectures that can increase the complexity of the situation. Although ContaWeb BI has modularity and a robust architecture, the study did not evaluate scalability or performance with high concurrency, which opens a future line of technical analysis work such as load testing, parallel optimization, cloud hosting, among other aspects.

Finally, at a strategic level, studies such as the one carried out by Williams et al. (2023), within the framework of BI as a scientific discipline, consider that there is indeed a gap between BI theory and its practice, especially in medium-sized or emerging companies. ContaWeb BI closes part of this gap by being a local development that incorporated predictive and governance functionalities adapted to real accounting scenarios, which validates the viability of developing contextualized BI solutions without relying exclusively on global commercial platforms.

Conclusions

The research conducted allowed for a thorough analysis of the functional architecture of the ContaWeb-BI platform, which demonstrates that a modular design oriented toward the accounting domain can constitute an alternative, effective, and, above all, replicable solution in private and public environments with financial management requirements. In contrast to various commercial BI solutions, which offer generic structures poorly adapted to accounting logic, ContaWeb-BI connects its components according to the real needs of the financial-operational environment, thereby facilitating access, understanding, and use of analytical tools by non-IT users.

Among the most significant findings are that the administrative management, document uploading, predictive analysis, supplier segmentation, and anomaly control modules are well organized and maintain a coherent thematic relation within an intuitive and responsive interface. This layout allows for the automation of routine processes, financial planning, and increased scope of accounting control from a single platform. Furthermore, the use of interactive dashboards, adaptability to different types of users, and the structural configuration by company and branch are key elements for its applicability in decentralized organizations.

From a technological perspective, this platform demonstrates that it is possible to build BI systems with a specific focus, without sacrificing flexibility, interoperability, and scalability. Comparing ContaWeb-BI with widely used international tools (Power BI, SAP Business One, or Zoho Analytics, to name just the most well-known) shows that its accounting capabilities and modular operating logic provide useful differential features in terms of functional alignment, ease of adoption, and analytical relevance.

From a scientific perspective, this paper presents a detailed characterization of a functional platform, which represents a relevant methodological and technical contribution to studies on the design and implementation of BI systems. It also raises the need to advance in the construction of functional architecture models that begin with the analysis of the domain's own processes, rather than adapting general solutions, especially in sectors such as accounting, where traceability, accuracy, and control are structural components.

Finally, this study opens new lines of research related to the evaluation of the technical performance of this type of platforms in high-concurrency environments, scalability in the cloud or adaptation with existing accounting systems (ERP, tax software, among others), as well as other lines of research

related to the adoption experience, the impact on the organization or the value perceived by users, which would allow complementing the functional model with socio-technical dimensions.

Acknowledgments

The authors thank the Publindex institution, the Universidad de Cartagena, and the Softcomputo company for their support and for making this study possible.

References

1. Abrarov, R., & Khudaybergenov, T. (2024). Using OLAP Cubes as Dataset for Neural Networks: Integrating Business Intelligence and Artificial Intelligence. In 2024 IEEE 3rd International Conference on Problems of Informatics, Electronics and Radio Engineering (PIERE). IEEE, 1600-1604.
2. Achhaiba, M., & Omari, L. (2022). The Impact of Business Intelligence Systems on Management Accounting in Companies: Literature Review. Revue du Contrôle, de la Comptabilité et de l'Audit, 6(1).
3. Al-Aqrabi, H., Liu, L., Hill, R., & Antonopoulos, N. (2019). Cloud BI: Future of Business Intelligence in the Cloud. . arXiv preprint arXiv:1901.08151.
4. Bussa, S. (2023). Enhancing BI tools for improved data visualization and insights. International Journal of Computer Science and Mobile Computing, 12(2), 70-92.
5. Caserio, C., Trucco, S., Caserio, C., & Trucco, S. (2018). Business intelligence systems. In: Enterprise Resource Planning and Business Intelligence Systems for Information Quality. Contributions to Management Science. . Springer, Cham., 43-73.
6. Ereth, J., & Baars, H. (2020). A Capability Approach for Designing Business Intelligence and Analytics Architectures. . In HICSS, 1-10.
7. Genotiva, K. (2025). Enhancing Financial Visibility: A Proposal to Implement Power BI for Group Accounting Analysis and Reporting. Metropolia.
8. Grabova, O., Darmont, J., Chauchat, J., & Zolotaryova, I. (2010). Business intelligence for small and middle-sized entreprises. ACM SIGMOD Record, 39(2), 39-50.
9. Han, X., Xiao, S., Sheng, J., & Zhang, G. (2024). Enhancing efficiency and decision-making in higher education through intelligent commercial integration: Leveraging artificial intelligence. Journal of the Knowledge Economy, 1-37.
10. Heang, R., & Mohan, R. (2017). Literature review of business intelligence. Diiva.
11. Herrera, J. (2017). La investigación cualitativa. UDGVirtua. Retrieved from http://biblioteca.udgvirtual.udg.mx/jspui/handle/123456789/1167
12. IEEE. (2022). Ethics in Action in Autonomous and Intelligent Systems. IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems.
13. Lasca, W. (2024). Business Intelligence and Analytics Systems in Management Accounting Contexts: A "Journey" Through Enablers, Barriers, and Organizational Dynamics. IRIS. Retrieved from https://hdl.handle.net/11566/326883
14. Martins, A., Bianchi de Aguiar, M., Sambento, M., & Branco, M. (2024). Business intelligence system adoption and the leveraging of reporting process capabilities. . Journal of Accounting & Organizational Change.
15. Olszak, C. (2022). Business intelligence systems for innovative development of organizations. . Procedia Computer Science, 207, 1754-1762.
16. Sánchez, A., & Murillo, A. (2021). Enfoques metodológicos en la investigación histórica: cuantitativa, cualitativa y comparativa. . Debates por la Historia, 9(2), 147-181.
17. Stake, R. (1995). Case study research. Cham: Springer.

18. Tantawy, A., & Ismail, M. (2021). A Case Study on the Implementation of Business Intelligence in a Retail Company. American journal of business and operations Research (AJBOR), 107-115. doi:https://doi.org/10.54216/AJBOR.030204
19. Trigo, A., Belfo, F., & Estébanez, R. (2014). Accounting information systems: The challenge of the real-time reporting. Procedia Technology, 16, 118-127.
20. Turban, E., Sharda, R., Aronson, J., & King, D. (2008). Business intelligence: A managerial approach. Upper Saddle River, NJ: Pearson Prentice Hall.
21. Vo, Q., Thomas, J., Cho, S., De, P., Choi, B., & Sael, L. (2017). Next generation business intelligence and analytics: a survey. . arXiv preprint.
22. Williams, R., Duman, G., Kongar, E., & Tenney, D. (2023). Understanding Business Intelligence Implementation Failure from Technology, Organization, and Process Perspectives. . IEEE Engineering Management Review, 52(1), 151-176.
23. WMA. (2014). World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. The Journal of the American College of Dentists, 81(3), 14-18.
24. Yin, R. (2017). Case study research and applications: Design and methods. Sage publications.