

Data Visualization in Business Intelligence: A Comparison Between Power BI and Qlik Cloud Analytics

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The visualization component within Business Intelligence (BI) systems plays an essential role in transforming operational data into actionable insights for the decision-making process. BI tools facilitate data interpretation and the formulation of evidence-based conclusions, supporting organizations in monitoring performance through clear metrics and adapting rapidly to changes in the competitive environment, including in low-latency information contexts. From this perspective, the article presents general BI concepts and proposes a comparative analysis of two representative platforms, Microsoft Power BI and Qlik Cloud Analytics, highlighting their capabilities and limitations based on relevant evaluation criteria.

Keywords: Business Intelligence, Microsoft Power BI, Qlik Cloud Analytics, Analytics and Reporting Platforms, BI Architecture, Data Warehouse, Data Mart, Comparative Analysis

1 Introduction

In the current business environment, companies are undergoing an accelerated digitalization process, recognizing that data represents one of the most valuable available resources. This reality is reflected by a significant increase in data volume and a diversification of sources, which amplifies the need for efficient integration and analysis mechanisms. Consequently, the adoption of Business Intelligence systems becomes a necessity and a strategic factor, as it allows for leveraging data and supports real-time decision-making [3].

Data visualization is an essential element in transforming raw data into aggregated and easily interpretable information. Tools oriented towards graphical representations offer a high degree of interactivity and have, over time, integrated user-oriented functionalities, such as multi-criteria filtering and exploring data from different perspectives. By analyzing the trends of key performance indicators (KPIs) and identifying patterns (evolutions, stagnations, or deviations), organizations can formulate conclusions that contribute to understanding market dynamics and customer behav-

ior, as well as to identifying opportunities and risks.

In this sense, BI solution developers do not just build isolated visualizations, but structure the information in a narrative approach, which facilitates the interpretation and communication of results. This approach can contribute to the consolidation of a data-driven organizational culture, in which decisions are based on accurate and consistent information, with the potential to generate competitive advantages [4].

In fields of activity such as energy, finance, and education, the choice and implementation of a visualization platform go beyond the technological dimension, becoming an organizational decision that influences processes and working methods. Since the market offers a wide range of alternative platforms, each with benefits and limitations, there is no universally suitable solution; the selection depends on the specific requirements and the operational context of each organization.

Annually, Gartner, an IT consulting and research company, publishes evaluations regarding Analytics and Business Intelligence platform providers. Through the Gartner Magic Quadrant methodology,

providers are positioned in a synthetic representation that reflects both the ability to execute and the completeness of vision. In this paper, the Magic Quadrant is used for orientation purposes, to contextualize the

market, without being treated as a complete validation for all implementation scenarios [10, 11, 12].



Fig. 1 Magic Quadrant for Analytics and Business Intelligence Platforms

In the following chapters, the theoretical foundations associated with the traditional BI architecture are presented, in order to familiarize the reader with the concept and understand how it integrates with the system architecture. Subsequently, the characteristics of two representative technologies, namely Microsoft Power BI and Qlik Cloud Analytics, are detailed. Both the benefits and the constraints of each platform are highlighted, and in the final stage, a comparative analysis is performed based on a set of relevant evaluation criteria.

2 The BI Architectural Model

The concept of Business Intelligence can be structured into three main components: data extraction and integration, data stor-

age, and data access, analysis, and visualization. The BI flow can be described as a sequential process, from information collection to analytical consumption [1].

In the first stage, organizations use internal sources, originating from operational systems (for example, SAP or Salesforce), as well as external sources, such as public data from the Internet or information provided by partners and agencies. These datasets are processed through ETL (Extract, Transform, Load) or ELT (Extract, Load, Transform) processes, within which cleaning and standardization operations are applied, with the aim of ensuring data quality.

The second component, storage, is achieved by loading the data into the Data

Warehouse. At this level, different Data Marts oriented towards specific functional areas can be defined (for example, individual Data Marts can be created for the finance, retail, and logistics departments). Through this logical separation, organizations can adapt the data structure to particular analytical requirements and improve query performance through aggregations and dedicated models [1, 5].

In the final stage, data is leveraged through the development of dashboards and re-

ports, through detailed exploratory analyses, as well as through data mining and machine learning techniques, these representing just a few of the usual methods of analytical consumption. By integrating these capabilities, BI solutions contribute to the transformation of data into analytical conclusions that substantiate organizational decisions [2].

Next, this conceptual structure is illustrated through a traditional BI architecture, which highlights the data flow:

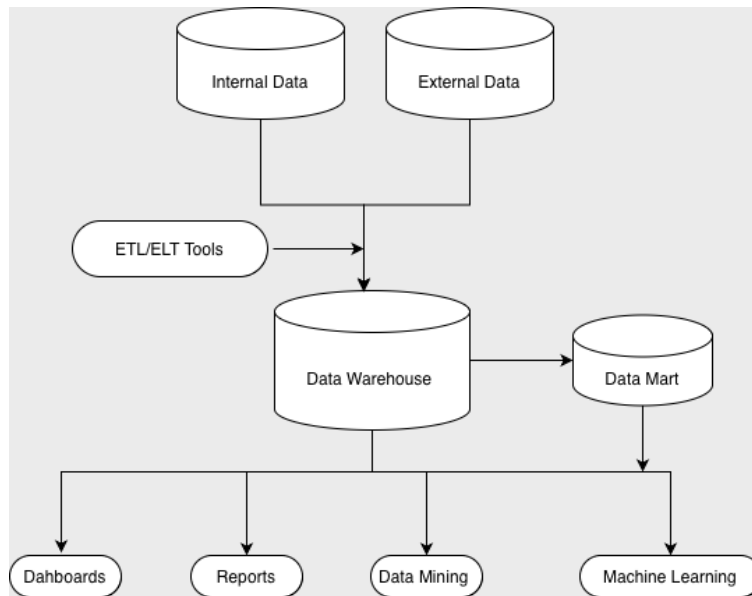


Fig. 2 Architecture of a BI System

3 Overview of the Analyzed BI Platforms: Microsoft Power BI and Qlik Cloud Analytics

Microsoft Power BI, initially launched in 2013, represents a Business Intelligence platform integrated into the Microsoft ecosystem and available within the Microsoft 365 suite. The solution is noted for a high degree of flexibility in use and a relatively low learning curve for users who already have experience with tools such as Microsoft Excel. From the perspective of its components, Power BI includes a cloud-based part, called Power BI Service, used for publishing, sharing, and administering analytical content, as well as a local component, Power BI Desktop, intended for the development of data models and reports [14].

Regarding connectivity, Power BI offers an extensive range of integration options with heterogeneous data sources, including enterprise applications (such as CRM/ERP), relational databases, on-premises sources, files (for example, Excel), and other types of specific connectors. This diversity supports the use of the platform in varied organizational scenarios, where data originates from multiple systems and formats.

For data processing and modeling, Power BI provides a set of established components: Power Query (for extraction and transformation), Power Pivot (for tabular modeling), and the DAX language – Data Analysis Expressions (for defining measures and calculations). Together, these elements allow both the preparation of data and the construction of a semantic model that can support advanced analytical calculations [2, 6].

From the perspective of user perception, the specialized literature highlights favorable evaluations for Power BI in organizational contexts. The study conducted by Kumaresan and Shalu, oriented towards understanding the perspective of organizations that have adopted Power BI across different industries, reports a high level of satisfaction from the respondents. Accord-

ing to the authors, over 75% of the evaluations were positive in each of the three analyzed areas: efficiency in reporting and visualization, impact on business decisions, and real-time analysis capabilities [6].

Ease of development and accessibility for non-technical users represent a primary advantage of the platform. Power BI offers a relatively easy-to-use drag-and-drop interface that allows both BI developers and business users to explore data and build visualizations. Furthermore, a significant portion of the configurations, such as models, visuals, and interactions, can be achieved through interface options, reducing the need for complex code-level interventions [5]. Another strength consists of its high capabilities for collaboration and distribution of analytical content. The platform provides flexible mechanisms for publishing and sharing reports, with the possibility of controlling data access based on the user's role. In this way, teams can work on the same reports and use a common set of indicators. The integration with the Microsoft 365 ecosystem, including Microsoft Teams, facilitates access to reports in collaborative contexts like meetings, conversations, and workspaces [6].

Regarding the challenges, scalability emerges as a primary concern. For large-sized organizations characterized by a high number of sources and significant data volumes, scalability becomes a relevant issue. The increase in data complexity and volume can lead to performance degradation, particularly concerning the update times of dashboards. This aspect represents an important limitation in contexts where the real-time availability of information is required [5, 6].

Additionally, governance and the consistency of indicators in a self-service environment pose significant challenges. The flexibility of Power BI can lead to duplicated reports and non-uniform definitions of KPIs if a common semantic model and clear rules for development and publishing are not established.

Qlik Cloud Analytics is a Business Intelligence and analytics platform offered by Qlik in a SaaS (Software as a Service) model, being hosted and managed by the provider. The solution is positioned in the "modern data stack" area, as it covers an end-to-end flow, from connecting and integrating data sets to analysis and visualization, with an emphasis on interactive and exploratory consumption [13].

A distinctive element of the platform is the use of the Qlik Associative Engine, an associativity-oriented engine that allows data exploration from multiple perspectives by highlighting the relationships between entities and contextual filtering. In this model, data is loaded and processed in memory, which facilitates fast queries and dynamic recalculations during user interaction. As a result, users can perform exploratory analyses with high granularity, quickly identifying relevant correlations, exceptions, or patterns as they modify selections and filters [7].

Unlike strictly SQL-based query approaches (joins) where the analytical context is often limited to explicitly defined relationships, the Qlik associative model allows navigating through data in a more flexible way, maintaining visibility over elements correlated and uncorrelated with the current selection.

At the interface level, after each selection, the platform instantly updates the context and highlights the possible states of the data (for example: selected values, values compatible with the selection, and incompatible values). This mechanism facilitates what-if analysis and supports the rapid formulation of additional analytical questions, as well as the identification of opportunities or risks in the data [7].

Regarding connectivity, Qlik Cloud Analytics provides support for a varied range of sources, including SaaS applications, databases, web APIs (REST), and cloud storage systems (for example, AWS S3 or Azure).

From the perspective of data preparation, the platform includes integration and trans-

formation functionalities that can be used directly within the development environment, including through the Load Editor area, where loading and transformation flows can be defined, thus integrating ETL/ELT type components in the process of building the analytical application.

Low-latency interactive analysis represents a major strength of the platform. The associative engine allows for the dynamic recalculation of visualizations after each selection, immediately highlighting data relationships through association states (selected values, compatible values, and incompatible values).

This mechanism supports the rapid exploration of data and the identification of correlations or exceptions during analysis [7]. Furthermore, scalability and suitability for complex data models constitute another significant advantage. Qlik Cloud Analytics is well-suited for scenarios involving large data volumes and complex relationships between entities, enabling multidimensional and exploratory analysis without imposing a rigid data navigation flow.

Regarding the challenges, the complexity of development and the learning curve are notable. Development in Qlik requires familiarization with platform-specific concepts and mechanisms, including the load script and the expressions used in the interface. Consequently, the learning curve can be steeper for users without prior experience in Qlik. Additionally, constraints regarding data modeling and association control can arise. The associative model inherently relies on associating fields with the same name across tables.

This characteristic can become a limitation in situations where names are not harmonized or when there are multiple relationships between the same entities, in which case script-level interventions are necessary to avoid ambiguities and unexpected results in the analysis.

4 Comparative Analysis: Power BI vs. Qlik Cloud Analytics

To obtain a more comprehensive perspective on the two solutions presented in the previous chapter, Microsoft Power BI and Qlik Cloud Analytics, this section proposes a multidimensional comparative analysis, tracking relevant capabilities across the entire BI flow: data integration and preparation, modeling, data exploration, and creating visualizations.

From the perspective of data integration and transformation processes, Qlik Cloud Analytics offers an efficient in-app processing mechanism, particularly through the use of QVD files (Qlik native format) and the possibility of organizing the load script modularly for reuse. In Qlik's technical literature, it is mentioned that reading from QVD files is typically 10 to 100 times faster than reading from other sources, which can significantly reduce load times in certain scenarios [9]. In Power BI, the main component for data integration and preparation is Power Query, which allows applying transformations through sequential steps. This approach is advantageous due to the transparency of the transformations (step history) and accessibility for non-technical users, who can perform many operations directly from the interface.

An important difference between the two technologies is the way the data model is built. In Power BI, relationships between tables can be automatically detected and subsequently reviewed and configured manually, including choosing the filtering direction. This platform has a predominantly visual approach, and relationships are defined interactively in the Model View area. In Qlik, the associative model is based on the implicit association of fields with the same name across tables; the control of these associations is mainly achieved through scripts (for example, renaming, loading rules), not by manually adjusting relationships in the model, as seen in Power BI. In this context, the notion of the

Synthetic Key also appears, which is formed when there are multiple common fields with the same names between tables in Qlik Analytics, generating ambiguities that must be resolved through remodeling, such as clarifying keys or restructuring links [15].

In the stage of validating loaded data, the tools offer different approaches. In Power BI, the user has dedicated areas for examining the model and the data, such as viewing the model in the Model View area and tabular viewing in the Table View area, which facilitates quick checks (sorting, filtering, inspecting values) and adjustments through transformations or calculated columns. In Qlik, verification is usually done by viewing the model, previews available in the load area, and often by building a control sheet (for example, simple tables) to validate content and associations. Additionally, both platforms offer data profiling functionalities at the column level, providing descriptive statistics, which are useful for quickly identifying anomalies and evaluating data quality before the visualization stage.

From the perspective of languages, Power BI uses M in the Power Query area for transformations and DAX for analytical measures and calculations. In Qlik, data preparation is performed through Qlik Script, and the analytical logic in visualizations is expressed through specific expressions in the Set Analysis section. Typically, for users without technical experience, Power BI may seem more accessible at first due to the high number of operations that can be performed through the interface; in Qlik, for advanced scenarios, the need to use scripts arises more quickly, which can steepen the learning curve [4].

At the visualization level, both platforms offer an extensive portfolio of charts and configuration options. Regarding page arrangement, Qlik uses a grid layout, which facilitates the alignment of visualizations, while Power BI offers

greater freedom of positioning on the canvas. From the perspective of style customization, Power BI generally has greater control over formatting elements, such as fonts and design details. In Qlik, colors can be selected from palettes or set through expressions and themes; there is control, but the level of customization depends on the type of visualization and the chosen approach.

From the perspective of end-users' interaction with reports, the number of actions required to complete a task directly influences the efficiency of exploratory analysis. In this regard, the BARC Benchmark comparatively evaluates Power BI and Qlik in usual scenarios, reporting differences in productivity and stability. The communications associated with the benchmark mention that Qlik requires fewer interactions (clicks) per task, contributing to higher productivity during tests: on average, a Power BI user would need approximately 1.3 times ($\approx 30\%$) more interactions to accomplish the same

task compared to Qlik [8]. A practical explanation relates to how each platform exposes the filtering context. In Qlik, the associative mechanism immediately highlights the state of the values (selected, possible, impossible), and the user sees the active selections at the top and can quickly remove a selection or reset the context through a "clear all selections" action, which shortens the exploration cycle. In Power BI, filters are mainly managed through the Filters pane, with filters existing at the visual, page, and report levels; the user can inspect the filters, but their visibility and management depend on how the report is configured and the filtering interface (pane or slicers), which can lead to a higher number of steps in exploration, especially in complex scenarios.

To summarize the information described in this chapter, the most important evaluation criteria have been grouped below, offering a conclusion for each of the two analyzed technologies.

Table 1. Summary of the comparison between Power BI and Qlik Analytics

Evaluation Criterion	Microsoft Power BI	Qlik Cloud Analytics
Data Integration and Preparation	Power Query (M) + step-by-step transformations; accessible approach, many operations available via the interface.	Load script + QVD; efficient for in-app processing and reuse.
Data Modeling	Visual modeling; manually configurable relationships (cardinality, cross-filter direction).	Associative model; implicit associations based on common field names, primarily controlled via script.
Exploration and Interactivity	Filter/slicer-based exploration; highly dependent on report design.	Associative exploration (selected/possible/excluded); highly suitable for exploratory analysis.
Exploration and Interactivity	High degree of freedom in arrangement and formatting; detailed customization.	Grid layout for alignment; good customization, but more dependent on palettes, themes, and expressions.
Languages and Learning Curve	M + DAX; easier initially for users familiar with Excel.	Qlik Script; steeper learning curve for advanced scenarios.

Given the points presented above, a comprehensive overview of the similarities and differences between the two platforms

can be outlined. However, to ensure their efficient use and achieve adequate performance in an organizational context,

it is necessary to consider complementary factors, such as the infrastructure and the way the platform is integrated into the organization's existing processes and systems, the design of robust and secure data flows capable of providing real-time data according to operational requirements, the definition and application of clear data governance policies, increasing the level of data literacy for users who utilize reports and dashboards, and consolidating the skills of development teams (BI developers and analysts) to leverage existing capabilities and adopt new platform functionalities [3].

5 Conclusion

In conclusion, Business Intelligence tools play an essential role in supporting organizational decisions by transforming data from heterogeneous sources into relevant, synthetic, and easily interpretable information. In the current context, characterized by accelerated digitalization, increasing data volumes, and the diversification of sources, BI becomes a strategic factor that supports both performance monitoring through key performance indicators (KPIs) and the identification of trends, patterns, and deviations impacting the competitive environment.

The paper framed this issue by presenting the traditional BI architecture, structured into three main components: data integration and preparation (extraction, transformation), storage (Data Warehouse and, where applicable, Data Marts), and analytical consumption (reporting, exploratory analysis, and advanced methods). This framework highlights the fact that the value of BI is not derived exclusively from visualizations, but from the entire chain that ensures data quality, consistency, and availability for analysis, including in scenarios with low-latency requirements.

Based on this foundation, the comparison between Power BI and Qlik Cloud Analytics indicates that both platforms are well-established and widely used, yet they differ

in their approach and in the way they support data development and exploration. Power BI stands out through its integration into the Microsoft ecosystem, its initial accessibility, and its visual modeling of relationships, making it suitable for scenarios where rapid development, standardization, and easy distribution of reports are prioritized. In contrast, Qlik Cloud differentiates itself through its associative model and interactive exploration mechanisms, which facilitate exploratory analysis and the highlighting of data relationships, particularly in contexts with complex models and iterative analytical questions.

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