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Integrated Multi-Income Stream Performance Dashboard: a Japanese Corporate Banking Case

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ABSTRACT

In response to the complex operational challenges faced by Japanese Corporate Banking (JCB), arising from the coexistence of disparate core banking systems post-merger, this study aims to address inherent issues affecting marketing performance monitoring. The existing condition at JCB is characterized by data inconsistency, limited system interoperability, and fragmented income tracking through multiple Excel reports and management systems. Recognizing the gaps in the current setup, the research question revolves around how to enhance marketing performance monitoring effectively. The research objectives, therefore, encompass the development and implementation of a tailored integrated report utilizing the CRISP-DM methodology. This innovative performance dashboard harmoniously consolidates data from diverse sources, presenting a cohesive representation crucial for comprehensive marketing performance assessment. Leveraging advanced methodologies like data normalization and cross-platform integration, the research approach ensures streamlined income tracking, mitigating existing limitations. The data, drawn from various product applications, undergoes meticulous processing to facilitate a unified view on the integrated dashboard. The anticipated result is a significant improvement in monitoring efficiency, heightened data accuracy, and an empowered decision-making process within JCB's operations. The business implication of this initiative is the tangible enhancement of the bank's ability to comprehensively assess income performance, thereby elevating the quality of strategic decision-making and reinforcing JCB's competitive positioning in the banking sector.

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1. INTRODUCTION

In the highly competitive and dynamic banking sector, the need for agility and real-time operational insights is paramount [1]–[3]. Performance dashboards tailored to the banking environment have become indispensable, merging critical metrics like customer onboarding statistics, loan disbursement rates, and regulatory compliance into one clear and cohesive format. This consolidation is not only critical for swift and informed decision-making but also plays a vital role in resource optimization, productivity enhancement, and maintaining a competitive edge [4].

Performance dashboards are critical in maintaining a continuous cycle of monitoring, measuring, and managing essential organizational activities, ensuring alignment with objectives. This process, as outlined by experts like Eckerson [5] and Van Grembergen & Amelinckx [6],

includes the stages of monitoring, measuring, and managing, which together form a comprehensive approach to business performance optimization.

[5] highlights the transformative impact of performance dashboards in enabling organizations to measure, monitor, and manage their performance with increased precision and effectiveness. Rooted in business intelligence and integrated data infrastructure principles, these dashboards are now fundamental to modern business strategy and operations. Eckerson's approach to developing these dashboards involves a structured methodology, focusing on pivotal questions to refine their architecture. His insights have significantly influenced both academic and practical business, emphasizing the crucial role of performance dashboards in the contemporary data-driven business environment.

This study endeavors to create a unified platform for performance reporting, specifically tailored to address the complex operational challenges faced by the Japanese Corporate Bank (JCB). The overarching goal is to streamline numerous processes within JCB by deriving a comprehensive performance report from its existing dual core banking systems. The focus lies in identifying crucial business streams and metrics essential for effective performance monitoring. The unique context of JCB, with two distinct core banking systems post-merger, presents specific operational challenges that impede seamless performance monitoring. These challenges manifest in fragmented data representation and hindered decision-making processes, ultimately resulting in siloed information. This fragmentation obstructs JCB's ability to gain a holistic view of its operations, leading to delayed responses to market demands and impacting overall competitiveness. The pressing need for a unified platform arises from the imperative to bridge this operational gap and empower JCB with a cohesive, comprehensive system for efficient performance tracking. This study serves as a direct response to the identified challenges, offering insights into the development of a performance dashboard that not only addresses the specific pain points resulting from the merger but also contributes novel solutions to optimize banking performance.

2. RELATED LITERATURE

2.1 Business Intelligence

Business Intelligence (BI) encompasses a comprehensive framework integrating various strategies, processes, applications, and technologies. It aims to streamline the gathering, analysis, visualization, and dissemination of key business insights [7]. BI tools offer a holistic view of business trajectories, covering past trends, current operations, and predictive analytics, and support a wide range of decision-making processes. They are instrumental in merging data from internal and external sources, transforming raw data into intelligible insights for optimized decision-making [8], [9].

2.2 Business Analytics

Business Analytics is the systematic process of using data, statistical analysis, and information technology to analyze corporate data and provide insights for better business decision-making. This process involves several key steps: Data Collection, where data is gathered from various sources like sales systems, social media, customer surveys, and more, in both structured and unstructured forms [10]. Data Cleaning and Processing, which involves cleaning data from errors, duplications, or inconsistencies to ensure accurate analysis and transforming it into a suitable format. Data Analysis, where statistical methods and machine learning techniques are used to discover patterns and relationships within the data [11], [12]. This analysis can be descriptive (explaining what has happened), predictive (forecasting what will happen), or prescriptive (suggesting actions to take). Data Visualization then presents the analysis results in a clear and understandable manner using graphs, charts, and other visual tools, making it easier for stakeholders to see key findings and make data-informed decisions. Finally, Decision-Making Based on Data involves using insights from the analysis to support strategic business decisions, such as identifying new opportunities, optimizing processes, improving efficiency, and mitigating risks. With Business Analytics, companies can make more informed and strategic decisions, driving growth and improving overall performance [13].

Integrating a performance dashboard into the Japanese Corporate Bank's Business Analytics framework significantly elevates its decision-making process. The real-time monitoring feature of the dashboard provides an up-to-the-minute view of operations, aligning with the descriptive analysis

to ensure that decisions are based on the latest data, a critical factor in the fast-paced financial environment [14], [15]. Visualization tools transform complex predictive models and analyses into understandable charts and graphs, making it easier for stakeholders to grasp and act on actionable insights. This visual representation is crucial for interpreting the nuanced patterns and trends that predictive analytics reveal. Moreover, the customization capability of the dashboard ensures that it serves not as a standalone tool but as an integral component of a data-driven decision-making framework [16]. It allows the dashboard to meet the unique needs of different bank departments, enhancing the prescriptive analytics by providing relevant, actionable insights tailored to each sector's focus. This synergy between the dashboard's features and Business Analytics' outcomes ensures that the bank doesn't just respond to current trends but anticipates future shifts, maintaining a competitive edge through informed, strategic decisions [17], [18].

2.3 Performance Dashboard

A Performance Dashboard is an essential visual tool that presents key performance indicators (KPIs), metrics, and other vital data points for an organization, department, or process. Designed for real-time monitoring, it connects directly to data sources to provide the most up-to-date information, allowing users to observe operations as they happen and swiftly identify any issues or opportunities [19], [20]. The heart of a dashboard lies in its KPIs, which are the primary metrics selected to gauge the health and performance of a specific area. These are depicted using various visualization tools like charts, graphs, and gauges, making complex data more accessible and understandable at a glance.

Customization and interactivity are key features of modern dashboards, enabling users to focus on the metrics that matter most and interact with the data for deeper analysis. They are designed to be user-friendly and accessible, making them a valuable resource for stakeholders at all levels, regardless of technical expertise.

3. METHOD

This study applies the Cross Industry Standard Process for Data Mining (CRISP-DM) as a predominant methodology in the realm of business analytics design [21], [22]. This structured methodology unfolds in six distinct phases, ensuring an organized and transparent approach to project execution (Figure 1). It begins with the Business Understanding phase, focusing on thoroughly comprehending business objectives and then transitions into Data Understanding through data collection and exploration. Following this, the Data Preparation phase involves rigorous cleansing and formatting of data, setting the stage for the subsequent Modeling phase where data models are constructed and tested against business objectives in the Evaluation phase. Finally, the Deployment phase, which includes planning, execution, monitoring, and review, marks the culmination of the process. [23]. Figure 1 shows the overview of this study’s research framework.

3.1 Domain Understanding

JCB grapples with the intricate responsibility of overseeing business performance across multiple operational domains of income, encompassing financing, funding, foreign exchange, and fee-based income, resulting in a wealth of diverse data. Recognizing the criticality of efficient data management and analysis, the researcher embarked on a comprehensive domain understanding process. This involved navigating the extensive data generated by JCB's operations to convert it into actionable insights, forming the bedrock for crafting corporate performance reports. These reports play a pivotal role in facilitating real-time, interactive analysis and decision-making, shaping the overarching business strategy of the bank. Post-merger, JCB faces the unique challenge of managing two core banking systems within distinct environments, each serving different customer segments. The processors inherited from ex-bank 1 cater to retail and some corporate customers, offering a suite of products. Meanwhile, processors from ex-bank 2 predominantly handle corporate customer data, including that of JCB clients, across various banking services. In the pursuit of integrating and analyzing data from these disparate systems, the researcher navigated through challenges arising from varied report layouts and platforms. Recognizing the imperative of a cohesive and unified reporting system, the researcher took steps to streamline operations, aiming to enhance the efficiency and effectiveness of JCB's decision-making processes.

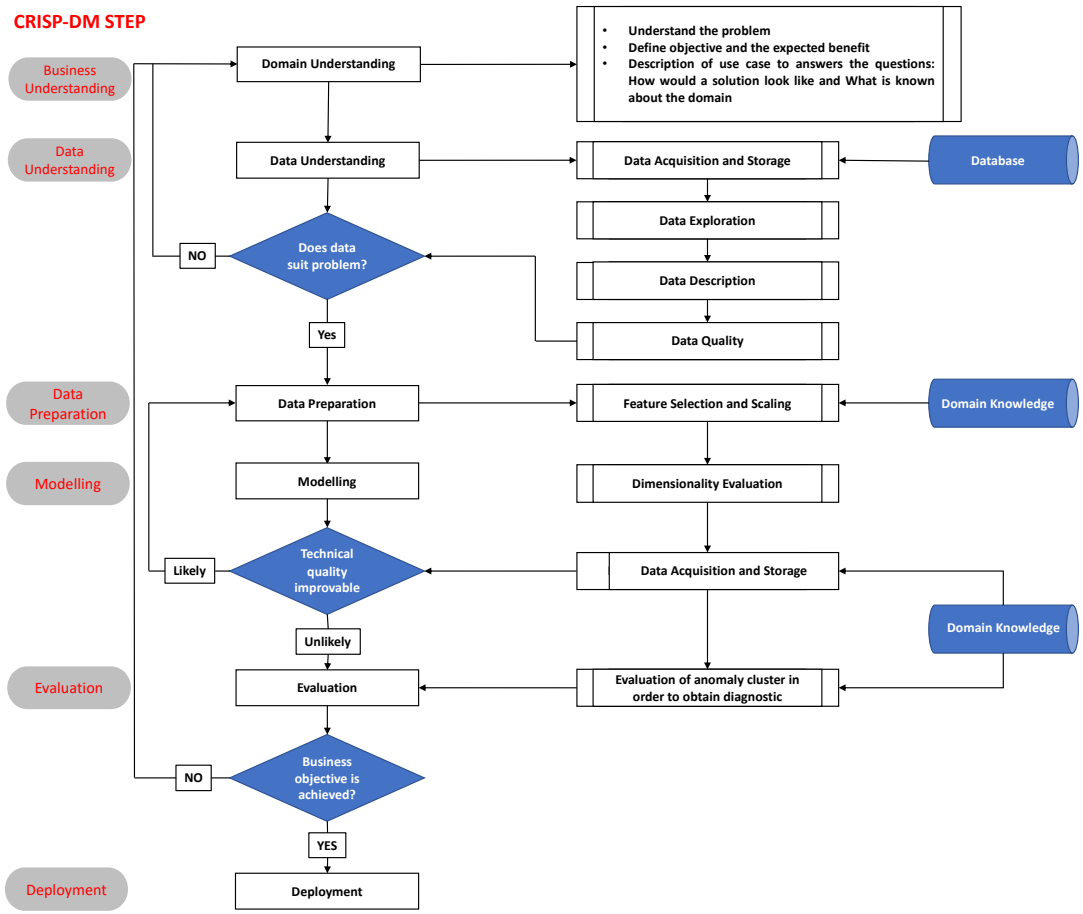

Figure. 1 Research Framework

3.2 Data Understanding

The Data Understanding stage in CRISP-DM is pivotal, bridging raw data collection to actionable intelligence, laying the foundation for a successful data-centric project. Analysts collect data from diverse sources, employing descriptive statistical analyses and visualization tools to comprehend central tendencies and dispersion measures, ensuring a reliable basis for subsequent analysis. Quality assurance is critical, addressing discrepancies and rectifying issues early on to maintain stakeholder confidence. The stage not only involves familiarization with the data but ensures its readiness for subsequent steps. Challenges arise due to the vast and complex nature of modern data, including missing elements or inconsistencies. Time constraints impact the depth of this phase. As part of the bank's strategy to implement a new core banking system, a migration plan is in place to consolidate disparate systems, involving multiple streams of product data. Components like Liquidity Adjustment and Special Rate will be managed manually through periodic MFT uploads, ensuring a unified approach to data management in the new system.

Aligned with the CRISP-DM (Cross-Industry Standard Process for Data Mining) framework, the study unfolds through distinct phases, each carefully linked to its corresponding CRISP-DM counterpart. The "Data Understanding" stage in this study involves a comprehensive analysis of JCB's existing core banking systems, identifying the data sources, and understanding the intricacies of the available data. This aligns seamlessly with the CRISP-DM "Data Understanding" phase, emphasizing the need to become familiar with the data characteristics, quality, and potential issues.

3.3 Data Preparation

The creation of a robust dataset for modeling is a multifaceted endeavor that rigorously validates the quality and relevance of data for use in predictive analytics and data mining. The journey begins with a deep dive into the dataset to grasp its intrinsic properties and to unearth insights related to its structure and attributes. This initial stage, known as Data Understanding, is critical for detecting

anomalies or gaps that could compromise the study's integrity. It is followed by Data Cleaning, a meticulous process aimed at rectifying errors, filling missing values, and removing outliers to purify the dataset, thereby laying a solid foundation for trustworthy analysis and robust model development.

Subsequent stages include Data Transformation, where data is refined and reformatted through techniques like normalization and categorization to numerical formats, enabling more sophisticated analyses. Data Reduction techniques, like Principal Component Analysis (PCA), streamline complex datasets while preserving vital information. Data Integration then amalgamates disparate data sources, harmonizing varying scales and types to produce a holistic dataset. Before modeling, Data Partitioning splits the data into training and testing sets to prevent overfitting and to validate the model's predictive prowess in real-world scenarios. Each step is integral to constructing a dataset that is not only accurate and reliable but also richly structured and reflective of real-world complexity, thereby empowering insightful decision-making and strategic planning.

3.4 Modeling

In response to a merger, Japanese Corporate Banking (JCB) tackled the challenge of consolidating data operations through a multi-layered architectural design. This approach unified essential banking systems, such as FUNDING and LOAN, and incorporated specialized systems for Trade Finance and FOREX, transcending a fragmented data environment. To ensure seamless interconnectivity, JCB utilized Outsystems as a flexible middleware layer, implemented Apache Airflow for data workflow orchestration, and leveraged Apache Spark's in-memory techniques for processing. Data was organized into a Hive Operational Data Store (ODS), reinforced by AtScale for OLAP analysis and Microsoft SQL Server for robust storage. Tableau was chosen for front-end data visualization, transforming complex datasets into accessible information. This comprehensive solution addresses current post-merger data needs while positioning JCB for future growth. In the modeling stage of Tableau Dashboard development, a meticulous process transforms raw data into a structured format. Modelers align significant performance indicators with strategic objectives, ensuring an intuitive and user-friendly interface for efficient data interpretation, supporting informed decision-making in JCB's dynamic financial sector.

In the data modeling stage, the researcher embarked on a transformation journey, converting clean raw data into structured tables tailored to match Tableau dashboard requirements. The process involved two essential transformations: first into staging tables and then into dimension and fact tables. Staging tables facilitated the alignment of data for efficient integration, while dimension tables were structured to represent the report field structure, ensuring a coherent narrative for end-users. Simultaneously, fact tables were crafted to capture and organize quantitative information, especially amounts and key performance metrics. This dual transformation process laid the foundation for the seamless integration of complex datasets into Tableau, optimizing the dashboard's backend analytics capabilities. The dimension and fact tables not only enhance the data structure but also enable a more intuitive and insightful user experience when interacting with the final Tableau Dashboard. This meticulous data transformation ensures that the dashboard not only meets the current reporting needs but is also adaptable to evolving requirements in the dynamic financial sector.

3.5 Evaluation Deployment

The Evaluation and Deployment phase involves rigorous testing through User Acceptability Tests (UAT) and survey to ensure the dashboard meets the users' needs across the bank, including relationship managers and business planners. It emphasizes the importance of stakeholder feedback and training in the successful rollout of the new system. This phase underscores the need for continuous assessment and iterative improvement, ensuring the dashboard remains relevant and effective.

Table 1. Stakeholders

No	Stakeholder Groups	Stakeholder Position	Engagement Phase	Role/Function	Expectation
1	Japanese Corporate Banking	Relationship Officer	Tester	Dashboard User	All income well presented

		Relationship Manager	Tester	Dashboard User	All income well presented
		JCB Team Head	Tester	Dashboard User	All income well presented
		JCB Division Head	Tester	Dashboard User	All income well presented
		Business Planning	Dashboard Designer, Tester	Dashboard User	All income well presented
2	Finance Directorate	Corporate Business Finance & Business Planning	Tester	MFT data source upload	Data presented as source

The Evaluation and Deployment phase marks a critical transition of the prototype dashboard into a fully operational tool within the banking environment. This phase calls for meticulous testing and validation, involving a spectrum of stakeholders from sales/relationship managers to division heads and financial planners, ensuring that the dashboard meets diverse operational and strategic needs. User Acceptability Tests (UAT) and survey are conducted to assess the dashboard's functionality, accuracy of data representation, and user interaction effectiveness (Table 1). Such thorough scrutiny, incorporating feedback from various bank divisions, is essential to fine-tune the dashboard before its final rollout (Table 2).

One crucial UAT scenario involves evaluating the dashboard's performance in handling real-time data updates. Users will simulate scenarios where the underlying data undergoes rapid changes, mimicking different period of the performance. This will assess the dashboard's responsiveness and reliability in providing all of the products income figures. Another pivotal UAT scenario focuses on the dashboard's adaptability across different user roles. Various stakeholders, including relationship managers, team heads, and division heads, will navigate the dashboard to validate its ability to cater to diverse information layer needs. Testing the dashboard's scalability constitutes yet another scenario, involving the simulation of a substantial increase in data volume to ensure its efficient performance under varying workloads. Additionally, UAT will scrutinize the dashboard's accessibility across multiple devices and screen sizes, guaranteeing a consistent user experience. By proactively engaging in these UAT scenarios, the research team aims to fine-tune the dashboard to meet the specific needs of JCB's users, fostering a user-friendly and performance-driven tool for strategic decision-making.

During the thorough User Acceptability Testing (UAT) process conducted before deployment, any notable challenges or feedback received were meticulously documented and analyzed. The engagement of stakeholders, including relationship managers, team heads, and division heads, revealed valuable insights into the dashboard's performance format and layout. While the dashboard received high ratings for delivering key performance indicators and its responsiveness, challenges were identified, particularly in terms of navigational ease and cross-device compatibility. These feedback points are instrumental in refining the dashboard's design to enhance user experience and address potential usability concerns. By transparently discussing challenges and incorporating constructive feedback, the research team is committed to continuous improvement, ensuring that the developed dashboard evolves to meet user expectations and serves as an invaluable tool for informed decision-making at JCB.

Table 2. Survey Question

Question	Rating Scale (1-5)
How would you rate the overall ease of navigating and finding information on the dashboard?	1 - Very difficult, 10- Very easy
To what extent does the dashboard provide the necessary key performance indicators (KPIs) for your decision-making?	1 - Not at all, 10 - Extremely well
How responsive and quick is the dashboard in generating and displaying data visualizations?	1 - Very slow and unresponsive, 10 - Very fast and responsive
How comprehensive do you find the data presented on the dashboard in addressing your business needs?	1 - Incomplete and insufficient, 10 - Extremely comprehensive and relevant
How intuitive are the dashboard's functionalities for customizing views or exploring data further?	1 - Very unintuitive and complex, 10 - Very intuitive and user-friendly

How accurate and reliable do you perceive the data provided by the dashboard to be?	1 - Highly inaccurate and unreliable, 10 - Highly accurate and reliable
To what extent does the dashboard facilitate collaboration and sharing insights across your team or department?	1 - Not at all collaborative or helpful, 10 - Highly collaborative and beneficial
How effectively does the dashboard adapt to different devices or screen sizes for accessibility?	1 - Poor adaptation and usability, 10 - Excellent adaptation and usability
How frequently do you rely on the dashboard to make critical decisions or drive strategic initiatives?	1 - Rarely or never, 10 - Very frequently and consistently
How likely are you to recommend this dashboard to colleagues or other departments based on your experience?	1 - Highly unlikely to recommend, 10 - Highly likely to recommend

The deployment strategy emphasizes a structured approach, including setting up the necessary technological infrastructure, data security measures, and ongoing maintenance protocols. Comprehensive training ensures that all end-users are adept at using the dashboard to its full potential, enhancing their decision-making efficiency from the get-go. Post-launch, the strategy includes a framework for continuous evaluation and iterative improvements, incorporating user feedback to adapt to the ever-evolving business landscape. This approach underscores the commitment to maintaining the dashboard's relevance and utility as a dynamic decision-making tool.

3.6 Deployment

The Evaluation and Deployment phase, integral to the CRISP-DM framework applied in dashboard development, marks the transition from prototype to a fully functional business tool. Extensive stakeholder verification, including feedback from sales/relationship managers and financial planners, ensures alignment with practical and strategic business needs. User Acceptability Tests (UAT) rigorously assess performance, data accuracy, and interactivity, aligning with CRISP-DM's model evaluation step. Meticulous planning encompasses technological setup, data security, and support system implementation. Training programs for end-users are pivotal for effective utilization. A continuous improvement framework, aligned with CRISP-DM's iterative approach, ensures post-launch evaluation and enhancement to adapt to evolving business needs and feedback, ensuring ongoing relevance and effectiveness in decision-making.

In our study's deployment phase, we focus on transitioning the dashboard from prototype to a fully functional tool in a real-world banking setting. This involves strategic selection and integration of industry-leading tools tailored to JCB's infrastructure, ensuring seamless integration and optimal performance. Robust data security measures, including encryption protocols and access controls, are paramount to safeguard sensitive information. Implementation of comprehensive support systems ensures a smooth operational transition, while meticulously designed training programs emphasize effective dashboard utilization from the outset. We establish a continuous improvement framework, in line with CRISP-DM's iterative approach, facilitating post-launch evaluation and enhancement to proactively adapt to evolving business needs and user feedback. This ensures the dashboard's ongoing relevance and effectiveness as a dynamic decision-making tool in the banking sector's ever-changing landscape.

4. RESULT

4.1 Domain Understanding

Post-merger, Bank ABCD grappled with scattered data systems, a common issue in such scenarios (Figure 2). The study proposed a strategic solution—a consolidated platform to streamline diverse data streams from merging entities. This platform created a centralized repository, harmonizing information across departments and ensuring standardized formats and protocols for consistency. The system enhanced reporting, facilitating more effective performance tracking and strategic decision-making. Integrated CRM played a vital role in unified customer data management, contributing to enhanced engagement and a competitive edge. Bank ABCD's creation of this integrated platform strategically addressed post-merger challenges, positioning the bank for success in a competitive financial landscape.

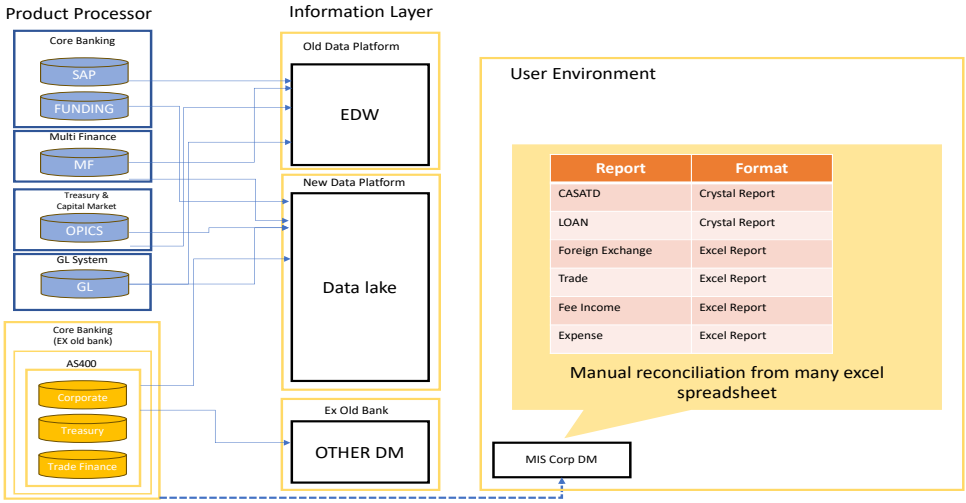

Figure 2. Data integration and analytics workflow showcasing the transition from source systems.

4.2 Data Understanding

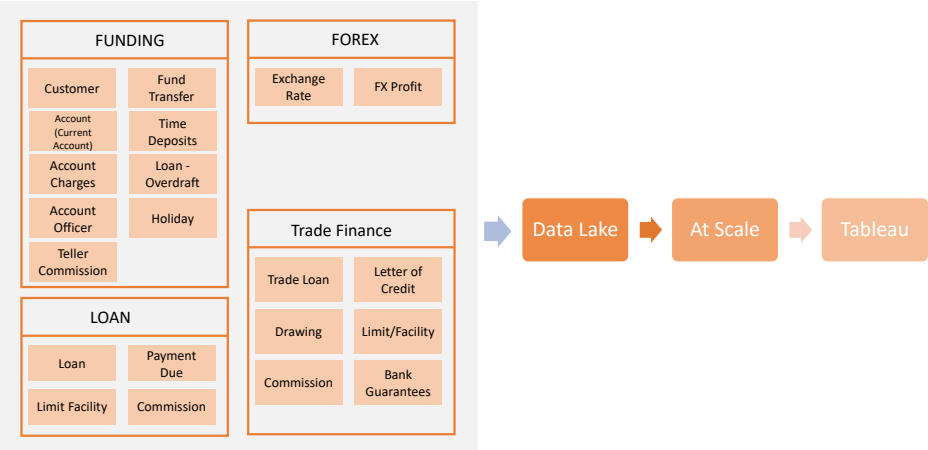

Figure 3. Data integration and analytics workflow showcasing the transition from source systems.

The diagram provided (Figure 3) appears to illustrate a data flow architecture, detailing the journey of data from various banking systems to a final dashboard visualization [24]. Data originates from several core banking systems, each with its specific data categories. For instance, the FUNDING system includes data categories such as Customer, Account (Current Account), Account Charges, Account Officer, Teller, Fund Transfer, Deposits, Loan-Overdraft, and Holiday. The LOAN system holds information regarding Loans, Payment Due, Limits, and Commissions. Similarly, FOREX system tracks Exchange Rate and FX Profit, while the Trade Finance system manages data concerning Trade Loans, Letters of Credit, Drawing, Limit/Facility, Commission, and Guarantees.

From these individual systems, the data is then channeled into a Data Lake, which acts as a centralized repository designed to store vast amounts of raw data in its native format. The Data Lake enables the aggregation of data from disparate sources and formats, making it accessible for further processing and analysis.

The next stage in the flow is the AtScale platform, which likely refers to a data processing or analytics tool that enables scalable and efficient handling of the data ingested into the Data Lake. At Scale may be responsible for organizing, optimizing, and preparing the data for analysis, perhaps acting as an OLAP (Online Analytical Processing) layer that allows for more sophisticated data queries and computations.

Finally, the processed data is pushed to Tableau, a powerful data visualization tool, which enables the creation of interactive and shareable dashboards. These dashboards translate complex data sets into intuitive graphical representations, making it easier for end-users to analyze and derive actionable insights. In the context of the banking data flow, this means that bank executives and managers can monitor and analyze various aspects of banking operations, from customer activity and loan management to foreign exchange profitability and trade finance operations, all through an accessible and user-friendly interface.

4.3 Data Preparation

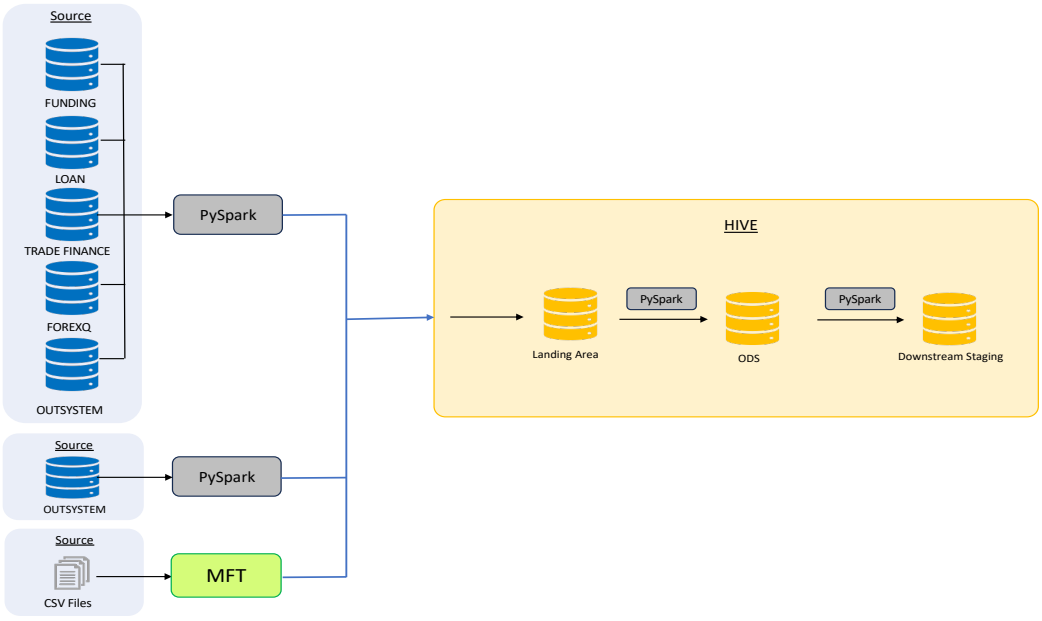

Figure 4. Data Preparation

The intricate data processing architecture depicted in this workflow tackles the challenges encountered during the data preparation phase, notably when dealing with data from multiple Excel reports and applications. To address data quality issues and integration challenges, the workflow begins by ingesting data from various banking systems, including FUNDING, LOAN, TRADE FINANCE, FOREX, and OUTSYSTEM. Apache PySpark is employed for its robust in-memory computation and large-scale data processing capabilities, forming the initial processing stage. After this, the data undergoes consolidation into a Hive 'Landing Area,' establishing a preliminary structured format for the raw data.

Recognizing the need for a comprehensive solution, subsequent processing stages in Hive, facilitated by PySpark, refine the data into an Operational Data Store (ODS). This ODS serves as an intermediate step before progressing to a 'Downstream Staging' area, revealing a tiered approach to data preparation and staging for final use. Throughout this process, the challenges posed by diverse data sources and varied formats, including multiple Excel reports, are meticulously addressed.

Moreover, the workflow integrates data seamlessly from an OUTSYSTEM source and CSV files via Managed File Transfer (MFT), showcasing the system's adaptability to handle various data formats and ingestion methods. This integration is a strategic solution to the challenges posed by diverse data sources and ensures a cohesive and efficient pipeline for transforming raw, disparate data into a structured and query-ready format. By elaborating on the challenges and providing systematic solutions, this streamlined pipeline stands as a robust foundation, readying the data for insightful analytics and reporting within a cohesive data ecosystem.

4.4 Modeling

The diagram illustrates a data modeling workflow within a business intelligence environment. Initially, data is sourced from various banking systems represented by FUNDING, LOAN, Trade

Finance, FOREX, an Outsystem, and an old existing MIS (Management Information System) Data Mart [25], [26]. This data undergoes a transformation and consolidation process. The first stage of this process is the 'Landing' area, where raw data from different sources is initially gathered. The 'Landing' stage acts as a collection point for raw, unprocessed data which may include various formats and structures. Next, the data moves to the 'ODS' (Operational Data Store), which organizes and provides a cleansed, consolidated view of the data, typically structured for query performance and operational reporting. The ODS is designed to integrate data from multiple sources and to provide a comprehensive view of business operations.

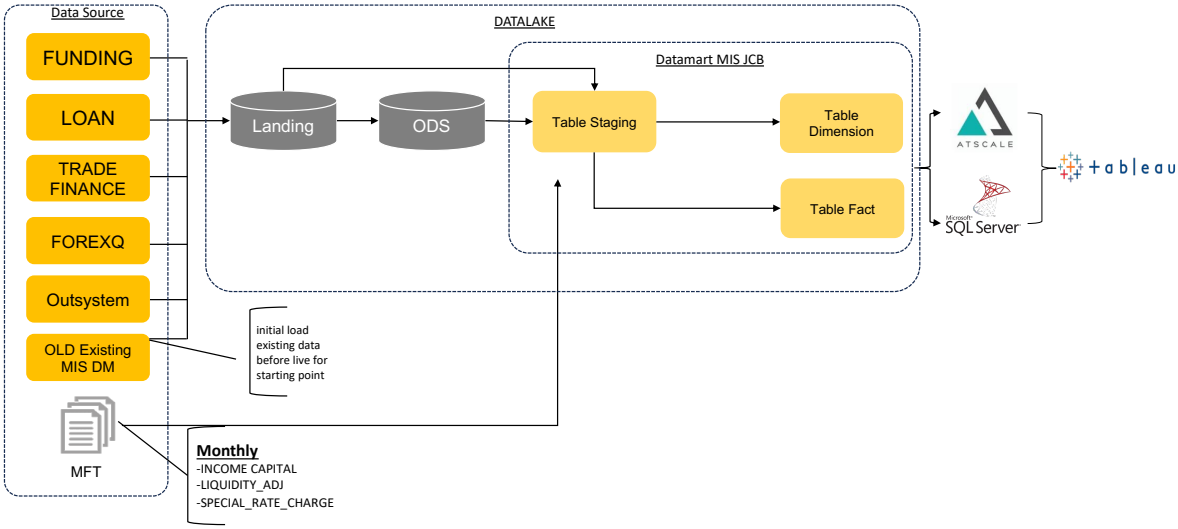

Figure 4. Modeling of end-to-end Data Flow

From the ODS, data is further refined into 'Table Staging', which indicates an intermediary step where data is staged before being divided into 'Table Dimension' and 'Table Fact'. The 'Table Dimension' refers to dimension tables in a star schema, which usually contain descriptive attributes related to dimensions of the business, such as time, geography, or product. 'Table Fact' refers to fact tables that contain the metrics or measurements of the business processes. This structured data is then ready for use within analytics and business intelligence tools. In this workflow, 'ATSCALE' is incorporated, which suggests the use of an OLAP (Online Analytical Processing) cube to facilitate multi-dimensional analysis. Finally, the data is visualized in 'Tableau', a popular data visualization tool, which would allow end-users to interact with and draw insights from the processed data.

The inclusion of 'ATSCALE' and 'Tableau' logos in the diagram emphasizes the tools' roles in the modeling process: 'ATSCALE' for providing scalable analytics and 'Tableau' for presenting the data in an interactive, visual format to the end-user. The overall data modeling process depicted is critical for transforming raw data into meaningful information that can drive strategic business decisions.

In the JCB dashboard application architecture (figure 5), the foundational layer is the Data Source Layer. This stratum comprises various product processor applications adept at collecting and managing data from diverse sources, each dataset serving unique organizational purposes. Directly connected to this layer is the Data Ingestion Layer, acting as a conduit funneling data streams into our centralized Data Lake. Here, raw, unprocessed data is meticulously stored in its native format, primed for future accessibility and utilization [14], [15].

Upon entry into JCB system, data undergoes a comprehensive transformation within the Data Integration Layer. Here, it undergoes refinement and structuring, finding its place within the organized framework of the JCB Data Warehouse. This warehouse stands as the central repository, housing integrated and processed data, ensuring effortless accessibility and streamlined analysis.

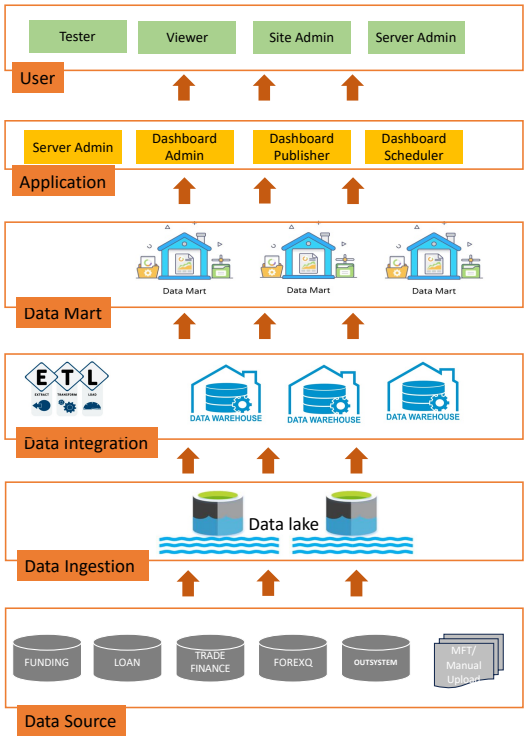

Figure 5. JCB Performance Dashboard Architecture

Expanding from the Data Warehouse are multiple specialized Data Mart Server Layers, each tailored to cater to specific business units or functionalities. These specialized servers house datasets customized to meet distinct user needs, facilitating efficient retrieval and analysis. Above this structured data framework, our Application Layer operates, comprising modules and services dedicated to data processing, analytics, and visualization. This layer utilizes aggregated data to generate meaningful insights, presenting them through our intuitive dashboard interface. At the apex of our architecture resides the User Layer, housing the dashboard application. This layer serves as the user-friendly interface, offering intuitive tools and interactive visualizations that empower users to explore, interpret, and leverage insights from the comprehensive data within the system, ultimately driving informed decision-making across the organization.

4.5 Evaluation

The diagram (figure 6) presents an organizational structure chart, mapping out the hierarchical layout of a company's divisions and teams, leading up to the director level [27], [28]. At the top of the hierarchy is the Director, who oversees the entire structure. Under the Director are five divisions, each divided into two teams, labeled as Team 1 and Team 2. These teams represent the operational segments within each division that carry out the company's core functions and objectives. Beneath the team level, we see individual roles labeled as 'RM' and 'RO', which likely stand for 'Relationship Manager' and 'Relationship Officer' respectively. Relationship Managers and Officers are responsible for maintaining and developing customer relationships, a common structure in sales or client service-oriented departments. On the far right of the diagram, there's a separate but related branch labeled 'Planning', which includes a 'Business Planning Team'. This suggests that the Planning division has a specific focus, possibly on strategic business planning, forecasting, or resource allocation, which supports the broader organizational objectives overseen by the Director.

The users of the JCB Dashboard will be only strict to JCB member of employees starting from: RO: Relationship Officer, RM: Relationship Manager, Team leader: Head of Department, Division Head: Head of Division, Finance Planning Team

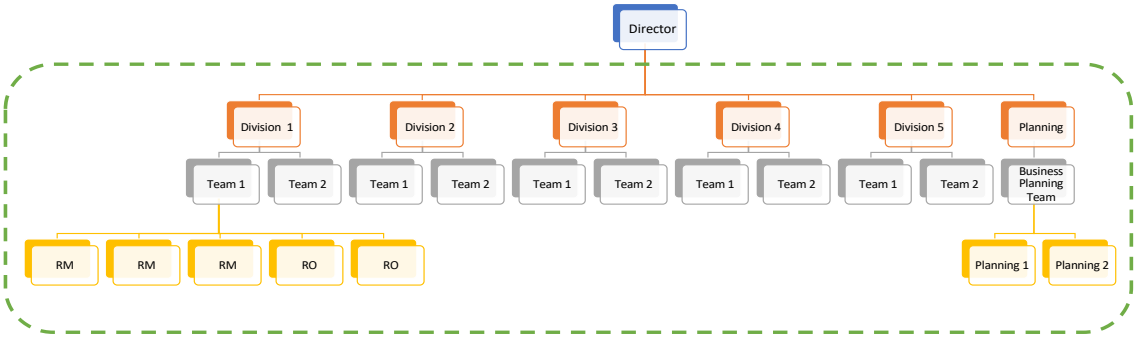

Figure 6. JCB Organizational Structure

Upon analysing the assessment data from different user roles, significant conclusions about the performance format and structure of the dashboard are evident. The dashboard consistently obtains excellent reviews, with an average score of 9.38 out of 10, for its ability to effectively provide the essential key performance indicators (KPIs) used for personal performance evaluation. This suggests that the dashboard excels in delivering pertinent data for customers to evaluate and improve their performance. Furthermore, the dashboard receives widespread acclaim for its high level of responsiveness, as seen by its impressive average rating of 7.63. This rating reflects its exceptional capability to promptly generate and present information, which is a vital aspect of its everyday usability. Moreover, the dashboard has been positively regarded for its ability to enhance collaboration and knowledge sharing across team members or departments, as indicated by an average rating of 8.13. Nevertheless, several elements require careful consideration. The ease of navigation, which has an average rating of 7.13, might be enhanced. Similarly, the accessibility across various devices and screen sizes, with an average rating of 6.63, still has potential for improvement. To summarise, although the dashboard is highly effective in presenting key performance indicators (KPIs) and being responsive, improving its ease of navigation and compatibility across different devices will further improve its usability and user happiness. This will result in significant insights for developers of the dashboard. Upon analysing the assessment data gathered from users in different positions, significant results about the performance format and structure of the dashboard have been identified.

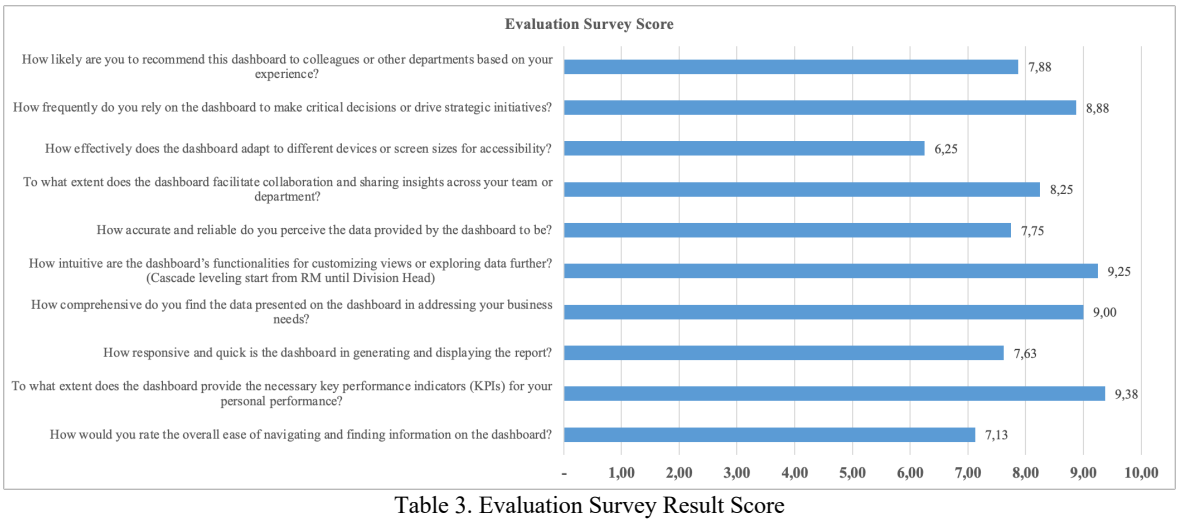

Table 3. Evaluation Survey Result Score

4.6 Deployment

The deployment phase in a data analytics project is a critical transition from development to production, entailing the release of data models, reports, or dashboards for end-user application [29], [30]. It involves rigorous final testing to ensure the product's performance aligns with expectations in a real-world environment. Simultaneously, users are trained on utilizing and interpreting the tool

to inform their decision-making effectively. This phase also includes the integration of the product with live data sources, guaranteeing access to current and pertinent data. The rollout process is executed, which may be staged, starting with a pilot group before extending to the broader organization. Post-deployment, the product is continuously monitored for issues, with a robust support system in place to resolve any user challenges promptly. Feedback mechanisms are established to capture user insights, driving iterative improvements and ensuring the product remains responsive to business needs. Maintenance is an ongoing process, with regular updates to adapt to new data sources, evolving business requirements, or technological advancements, thus maintaining the product's relevance and utility in aiding strategic business decisions.

Furthermore, the deployment of the dashboard within the organization followed a systematic process to ensure a smooth transition from development to production. User training played a crucial role, facilitating comprehensive sessions to familiarize stakeholders, including relationship managers, team heads, and division heads, with the functionalities and interpretation of the tool. This was complemented by detailed documentation and user guides, enhancing the accessibility of the dashboard. Challenges faced during deployment, such as potential resistance to change and varied technology proficiency among users, were addressed through personalized training modules and dedicated support channels. Rigorous testing was conducted to guarantee the dashboard's seamless integration with live data sources, ensuring users had access to timedly information. The rollout process was executed in stages, commencing with a pilot group and gradually extending to the broader organization, allowing for incremental adjustments based on user feedback. Post-deployment, continuous monitoring and a robust support system were implemented to promptly resolve any challenges encountered by users. Feedback mechanisms were established to capture user insights, enabling iterative improvements. The maintenance process involved regular updates to adapt to new data sources, evolving business requirements, or technological advancements, ensuring the sustained relevance and utility of the dashboard in aiding strategic business decisions.

The user feedback on the dashboard implementation was invaluable, revealing key insights to enhance its functionality. Firstly, stakeholders emphasized the need for mobile accessibility, particularly for Relationship Managers (RMs) visiting customers. The demand for on-the-go access underscores the importance of flexibility in the tool's usage. Secondly, users expressed the preference for daily figures availability in the morning, aligning with an early daily scheduler. This real-time update ensures timely decision-making based on the most recent data. Thirdly, the request for the ability to export data in spreadsheet format indicates a desire for seamless integration with MS Excel, facilitating further data processing. Lastly, additional feedback included suggestions for enhanced data visualization features and intuitive navigation, demonstrating a user-driven approach to continuously refine the dashboard for optimal usability and effectiveness.

5. DISCUSSION

The JCB Performance Dashboard is a complex system, customized engineered to integrate data from various sources into a single, centralized data warehouse. This consolidation is strategic, allowing segmentation into specialized data marts for different areas of the company, such as the JCB data mart and the MIS data mart [14], [15]. These marts are crucial as they provide the data for specialized reports, enhancing decision-making precision and efficacy by enabling users to access data most relevant to their operational needs.

In the design phase, user roles and access levels are carefully delineated to ensure data security and efficient decision-making. For example, the tiered access system not only enhances data security by ensuring sensitive financial information is only accessible to authorized personnel but also streamlines decision-making by providing users with the specific data they need. Admins and Division Managers have Full Access, Team Leaders and Relationship Managers have Limited Access, and Analysts have View Only access. This system ensures not just the security, but the relevance of data distributed, with each user accessing information pertinent to their role and responsibilities. Customization is key, with parameters allowing users to filter data based on Year, Division, Relationship Manager, and Customer [17], [18]. This flexibility means a Division Head can focus on data specific to their division, or a Relationship Manager can track the performance of their sales personnel, enhancing the dashboard's utility and relevance to different stakeholders.

The financial tracking tools within the dashboard are tailored to provide specific benefits to various user roles. For instance, 'Deposit Profit' and 'Loan Profit' sections help monitor profitability and are crucial for financial analysts and managers overseeing these products. The 'Guarantee Fee' and 'Trade Finance Fee' sections are vital for teams managing guarantees and trade finance services, offering them detailed insights into their operations. Moreover, data governance practices ensure the integrity of the centralized data repository. Validation processes and quality checks are in place to guarantee the accuracy and reliability of the data accessed by users, thus supporting sound decision-making [31]. The implementation plan is linked to key performance indicators (KPIs) to measure the dashboard's success in meeting organizational goals. Anticipated success metrics might include improved decision-making efficiency, cost savings, or enhanced customer service. Recognizing potential challenges like data integration complexities and user training, the plan includes mitigation strategies to ensure smooth deployment and adoption [32], [33].

Quantifiable improvements in decision-making efficiency and other key metrics will highlight its success. It's designed for adaptability, ready to incorporate future data sources and technological advancements. User feedback and iterative improvements demonstrate the bank's commitment to continuous enhancement. The dashboard not only aligns with industry trends but sets new benchmarks for excellence, reflecting the collaborative efforts of multiple teams. As a cornerstone of JCB's commitment to innovation in data management and analytics, the dashboard is a testament to the bank's forward-looking approach and aspiration to remain at the forefront of the banking sector's data-driven practices.

6. CONCLUSION

The development and deployment of the JCB Performance Dashboard stand as a testament to the strategic foresight of Bank ABCD in the wake of its merger. The centralized data warehouse and its segmented data marts, including the JCB and MIS data marts, are quintessential in providing a unified, comprehensive view of the organization's data, thereby bolstering department-specific decision-making. The dashboard’s design ingeniously reflects the organizational hierarchy, granting tiered access to financial metrics, from Full Access for Admins and Division Managers to View Only for Analysts, thus ensuring data security and integrity. The study successfully developed and implemented a unified platform for performance reporting in the Japanese Corporate Bank (JCB), addressing the challenges posed by the coexistence of two distinct core banking systems. The adoption of the CRISP-DM methodology, coupled with Tableau as the reporting tool, yielded transformative outcomes. Key findings and contributions include:

1. Unified Reporting Solution: The implementation of CRISP-DM facilitated the creation of a unified and integrated performance dashboard using Tableau. This platform effectively consolidated data from diverse sources, providing a comprehensive view of multi-stream business performance.
2. Enhanced Business Performance Monitoring: The performance dashboard, driven by Tableau's capabilities, allowed for efficient tracking of crucial business indicators, including funding business profit, financing/loan business profit, trade finance business profit, foreign exchange business profit, bank guarantee fees, remittance fees, and other fees profit. This consolidated view enhances JCB's ability to monitor and strategize across various income streams.
3. User Feedback and Usability: User feedback indicated high satisfaction with the dashboard's effectiveness in delivering key performance indicators. However, insights highlighted areas for improvement, particularly in navigational ease and cross-device compatibility. This feedback contributes to ongoing efforts to enhance usability and user satisfaction.
4. Operational Efficiency and Decision-Making: The dashboard's versatility, offering customizable views based on parameters such as year, division, customer group level, relationship manager (RM) level, and customer level, empowers users at different managerial levels. This adaptability supports more informed and efficient decision-making processes across the organization.

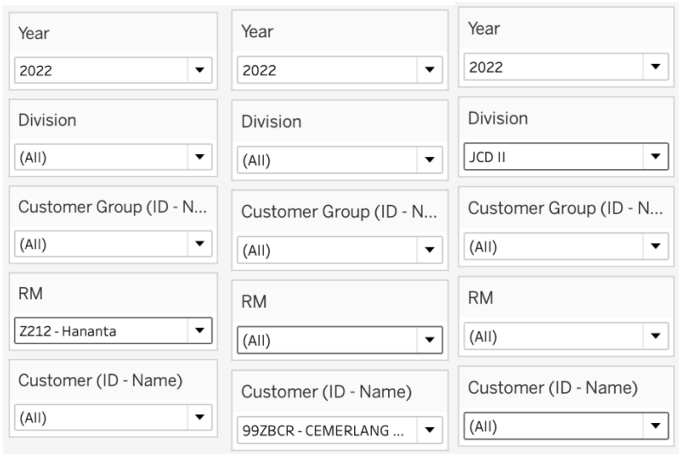

Figure 7. JCB Performance Dashboard Parameter

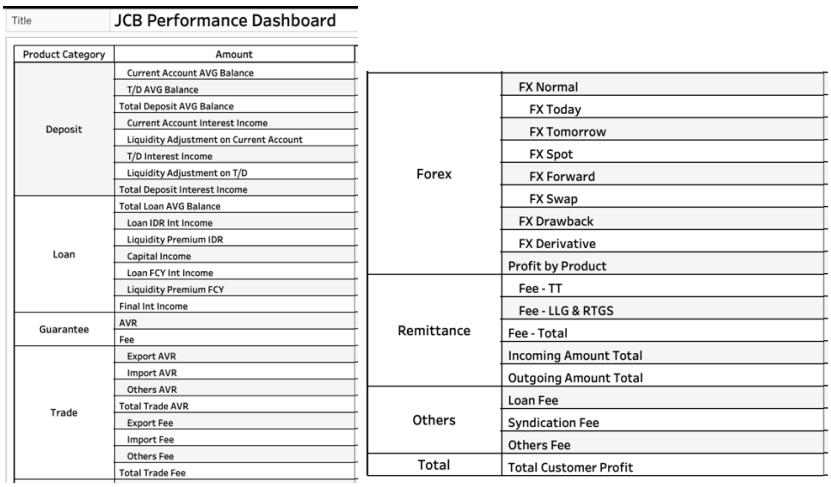

Figure 8. Mockup JCB Performance Dashboard View

Furthermore, the methodical implementation plan for the dashboard, spanning a 12-month period, showcases a commitment to a phased, well-structured approach that encompasses everything from the project kick-off to post-deployment support and performance reviews. This approach not only facilitates a smooth transition and adoption of the dashboard across the organization but also underscores the bank's dedication to maintaining an agile, data-driven, and customer-centric operation in a competitive digital banking landscape. Ultimately, the success of the JCB Performance Dashboard is a reflection of the bank's ability to effectively navigate post-merger complexities, harnessing the power of data consolidation and advanced analytics to emerge as a formidable player in the banking sector.

7. LIMITATION AND FURTHER RESEARCH

The limitations of the JCB Performance Dashboard post-merger study are quantifiable and varied, with specific focus on the impact of data quality issues and user resistance to change. Data inaccuracies might have skewed analyses, leading to potentially less informed decision-making; for instance, a 10% discrepancy in loan profitability reports could have led to misguided strategies. User resistance was identified through surveys and anecdotal feedback during deployment, with department heads noting hesitance in adopting the new system. Mitigation strategies were implemented: rigorous data validation checks for quality issues, and comprehensive training sessions coupled with interactive workshops to overcome resistance. Future research could involve longitudinal studies to monitor key variables like user adoption rates and decision-making accuracy over time, offering a dynamic understanding of the dashboard's long-term impact. Integrating machine learning could enhance predictive capabilities, while specific metrics like user satisfaction scores and frequency of use could measure engagement and guide interface improvements.

Addressing cybersecurity as the system scales is crucial, with potential exploration into blockchain technology for its immutability and security features.

In conclusion, the study's limitations prompt further research for optimization and next-gen enhancements. Future studies could delve into advanced analytics and machine learning to bolster the dashboard's capabilities and explore human factors more deeply to understand user engagement comprehensively. Technical inquiries into cybersecurity, particularly with system growth, and the integration of technologies like blockchain, are vital avenues for ensuring robust security. Summarizing potential optimization strategies is key; regular technology upgrades, process improvements, and additional features like predictive analytics would address current limitations and propel the JCB Performance Dashboard toward becoming a transformative analytical and strategic tool for the bank. These strategies would not only address the limitations identified but also reinforce the dashboard's position as a critical asset in the bank's decision-making and strategic planning processes.

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