Data Mart Design to Increase Transactional Flow of Debit and Credit Card in Peruvian Bodegas

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Abstract—The objective of this research is to design a Data Mart to identify tactical actions and increase the use of POS (points of sale) in the bodega business sector of Lima, Peru. A quantitative approach, using transaction history data, is applied using the Kimball methodology. This involves the ETL (Extract, Transform, Load) process to create a dimensional model and to develop a dashboard to visualize key indicators using Power BI. This solution is expected to improve the detection and analysis of transactional errors, categorized by geographic location and business sector while enhancing decision-making processes. This research improves the transactional flow and digital payment adoption in small businesses, fostering greater financial inclusion in the Peruvian market. Therefore, the methodology and tools to be applied in this research offer a framework as a model for similar contexts, especially in emerging markets, which will allow closing gaps in digital payment adoption and financial inclusion.

Keywords—*Business intelligence; Extract; Transform; Load (ETL); dashboard; data mart; Point of Sale (POS)*

I. INTRODUCTION

Every year, there is a higher penetration of digitalization in business areas, which allows not only for the increase in sales, but also makes it possible to reach financial inclusion, which could solve the growth necessities of businesses in Peru. A clear example of this is Yape [1], a digital wallet through which users can send and receive money with enough speed to acquire products in physical establishments, transfer money to family members, or pay for services. Bodegas are not foreign to this development, since, through Yape, they not only increase their sales (increasing their digital demand) but also have better odds of credit access, since banks can visualize their money flow.

While it is well known that Peruvians are increasingly making more purchases through digital means [2] (either digital wallets, credit or debit cards, use of QR codes, among others), the main use of these methods is still low when compared to the rest of Latin American countries. According to the financial inclusion index published by Credicorp, the use of cash in 2024 is still the main means through which citizens' money flows [3]. This represents a big opportunity not only for digitalization but also for bankization.

This is how companies in the digital payment sector aim to incentivize sales through points of sale (POS). POSs are tools that allow users to make payments with not only credit or debit cards, but also through digital wallets, and offer a range of value-added services which bring access to banking financial services, a key part of financial inclusion.

The specific objectives set for this paper are the following:

- Identifying the main transactional errors in the bodega sector associated with POS usage.

- Finding where the transactional errors are present in terms of geographic location and business sector.

- Comparing the bodega sector and the restaurant sector to measure the average ticket sales.

- Verifying if there is an increase or decrease in transactional errors every month.

- Validating if the number of active businesses using POS solutions is steady or if it suffers notable variations.

With this article, we introduce the reader to the use of digital payment methods, mainly points of sale (POS), in the context of Peru, and how the process of digitalization still has a long way to go in this country. We then examine the existing literature, which grants significant insights to the digital payment sector. Subsequently, we review relevant concepts regarding the methodology used, as well as important products, challenges and difficulties within the sector, and present our proposal based on Business Intelligence and the Data Mart architecture in order to create a model and, with it, a dashboard which will allow companies within the digital payment sector to make smart, data-based decisions in order to increase their presence and the transactional flow in Peruvian bodegas, where cash is still the main payment method. Finally, we discuss our findings, focusing on the advantages and benefits of our proposal.

II. LITERATURE REVIEW

In this section, we present a literature review of research relevant to the proposal described in this paper. It contains topics such as the use of digital payment methods and their benefits for clients, the challenges to adopting these methods, the differences between the users who are taking advantage of them and the ones who are not, and important aspects of the use of digital payment methods, among others.

According to Muhtasim, D. A., Yee Tan, S., Hassan, A., Pavel, M. I., and Susmit, S. (2022), security aspects such as authentication, encryption mechanisms and information

provided to clients are strictly related to the improvement of customer experience. Other security-related aspects that should not be excluded are the speed of transactions, software performance, and the privacy of the user's data [4]. It is important to keep all of this in mind to reduce the weak points of companies since maintaining good customer experience is a key task in doing so.

While security is a crucial factor for users to be more welcoming towards the use of digital payments, Alabdan, R. and Sulphey, M. M. (2020) indicate that there are key factors belonging to payment platforms which are important for their acceptance, such as ease of use, utility (how easy they are to set up, where they are accepted, etc.) and user awareness (how well they understand payment options or how to use the services). In addition to this, they found a small difference in the acceptance of mobile payments between men and women, obtaining an average value a bit higher in men [5]. This helps in focusing on the target sector that needs to be worked on.

We can complement this data to the findings of Aurazo, J., & Vega, M. (2021), who explain that the population using digital payments is usually between the age range of 25 to 40 years old, they're usually people with higher education, formal jobs, and are often located in urban areas with Internet access [6]. Their findings further help in narrowing down the potential target sector that digital payment companies should focus on.

Another study, conducted by Ünver, Ş., & Alkan, Ö. (2021), supports these characteristics and mentions that as users age, their odds of participating in e-commerce decrease. Similarly, as their income increases, they're more likely to participate in e-commerce. Furthermore, they found that users who are active in social media and online banking are more likely to use e-commerce [7]. This information represents a significant opportunity for financial inclusion within the digital payment sector, as a target segment has been identified that can be leveraged, not only to drive revenue growth, but also to benefit the broader communities. This is crucial, as noted by de Moraes, C. O., Roquete, R. M., and Gawryszewski, G. (2023), who found that access to finance, in general, has a direct relationship with income inequality in the population, but the impact is even greater regarding digital finance specifically. [8]

It has been demonstrated that e-commerce models can increase client acquisition, sale goals, and overall revenue, as indicated by Hafiz Yusoff, M., Alomari, M. A., Adilah, N., Latiff, A., and Alomari, M. S. (2019). [9] This means that expanding the reach of digital payment methods can generate a positive impact on the population, not to mention the effect that digital platforms have on businesses.

However, the challenges that users may face must be considered when wanting to implement digital payment platforms. Widayani, A., Fiernaningsih, N., and Herijanto, P. (2022) explain that there is a set of barriers that complicate the adoption of said platforms, such as the tradition barrier, which refers to innovative changes that clash with user's routines or traditions; the use barrier, which represents the incompatibility of user's habits with technological innovation or the psychological barrier, defined by user behavior such as mistrust, anxiety, lack of control of discomfort [10]. Identifying and knowing how to deal with these barriers is crucial to face

the challenge of digital transformation and reach users more efficiently.

We can complement this with the research by Hermenegildo-Chávez, Martín-Ruiz, and Rondán-Cataluña (2023), who found that, in Peru, client loyalty on sale channels is influenced by the environment, more specifically, online and offline environments [11]. Clients have a better feeling of security for offline sales, and this is related to their trust and loyalty to the seller. This factor represents another of the challenges of implementing digital transformation, especially in the context of developing countries.

One way to counteract this is to improve the interoperability between electronic systems, as stated by Libaque-Saenz, C. F., Ortega, C., Rodriguez-Serra, M., Chong, M., and Lopez-Puente-de-la-Vega, S. (2024). Digital wallets from different providers need to communicate between themselves easily. Additionally, providers must focus on keeping scalable systems to generate future benefits for their customers in the long term [1]. This is important because any way to make customers feel comfortable using these platforms will help in dealing with the previously mentioned barriers.

The authors Alkan, O.; Küçükoğlu H. and Tutar, G., (2021) add that, considering age, gender, education level, and monthly income have an impact on online shopping, it would be beneficial if the providers of these services use this data to develop adequate marketing strategies to reach the necessary users. Additionally, they state that complaints, suggestions, or user requests may be received directly using field studies to determine the factors of user preferences and keep them in mind to personalize and improve their experience with the service [12]. These findings give us an idea of how companies in the digital payment sector can expand their reach and improve their relationship with their customers.

While these related works bring us valuable information and insights, they do not present practical proposals that take advantage of such insights. Our proposal consists of a solution for companies in the digital payment sector to visualize not only their general performance, but also to bring light to the gaps in this market, allowing them to focus on unattended parts of the sector, such as different types of businesses, as well as provinces or districts where digital payment methods are barely present, if at all.

This solution will also allow its users to find and manage errors, issues or problems with more efficiency and precision, so that they can work in improving their clients' experience and continue to provide them with a steady and reliable service.

III. BUSINESS INTELLIGENCE METHODOLOGY

Before determining the methodology to be used in this research, we will review the concepts of data warehouse, data mart, and the most known business intelligence methodologies today.

A data warehouse is defined as a collection of data that helps in the decision-making process of the entity in which it is used. A data warehouse stores copious amounts of data coming from diverse sources, which must have a coherent format for their

later exploitation (analyses, reports, etc.) by the organization [13].

It is also important to know how to differentiate a data warehouse from a data mart. While the first holds the entirety of the organization's data, data marts hold only a subgroup of it, focusing on a specific business area. They are both key components in the business intelligence architecture.

A. Inmon Methodology

Developed by Bill Inmon and his team in 1980, this methodology is centered on the creation of one centralized and complete data warehouse, which serves as a data source for the whole organization. The Inmon methodology involves designing the data warehouse based on the data sources and the entities and relationships present in them. The normalized data warehouse is then used to feed several data marts which adapt to the specific commercial needs and use cases [14] (Fig. 1).

Key aspects of this methodology include:

- The data warehouse is very flexible to change.
- Business processes can be understood very easily.
- Reports can be handled by different enterprises.
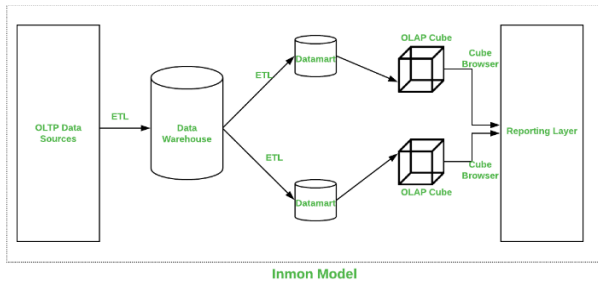- The ETL process is not as error prone.

Fig. 1. Architecture according to the Inmon model. [14]

B. Kimball Methodology

A methodology developed by Ralph Kimball and his team in 1990, the Kimball methodology consists of delivering data to end users in the fastest and most efficient way possible. It implies designing the data warehouse based on business processes and key performance indicators [15].

Kimball's data model follows a down-up approach for the architecture of the data warehouse, in which data marts are formed first, according to the company's commercial requirements [16] (Fig. 2). Characteristics of this methodology include:

- Fast configuration and construction.
- When compared to the multiple-star schema, report generation is highly successful.
- Highly effective database operations.
- Takes up less space in the database.
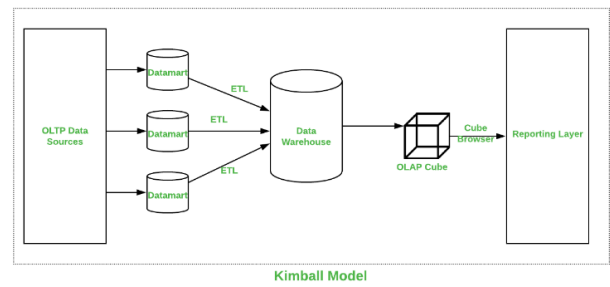- Easy to manage.

Fig. 2. Architecture according to Kimball's model. [15]

C. Data Vault Methodology

Created by Dan Linstedt in 2000, it is based on creating a scalable, agile, and resistant data warehouse. This methodology presents the design of the data warehouse around data history, auditability, and traceability. The data warehouse consists of a 3-layer data model which includes hubs, links, and satellites. This methodology is adequate for organizations that need flexible and adaptable data architecture, a high-performance data load process, and an auditable data history registry [14] (Fig. 3, 4).

Attributes of this methodology include:

- Scalability: Data vaults are highly scalable, which means they can manage large amounts of data and easily add new data sources. This makes it an ideal solution for fast-growing companies.
- Flexibility: The data vault is highly adaptable and can manage changes in data without having to restructure the entire model. This means that in the future, it can be easier and cheaper to make changes.
- Data history: Data vaults keep a complete history of the data, which allows for historic analyses and data comparisons.
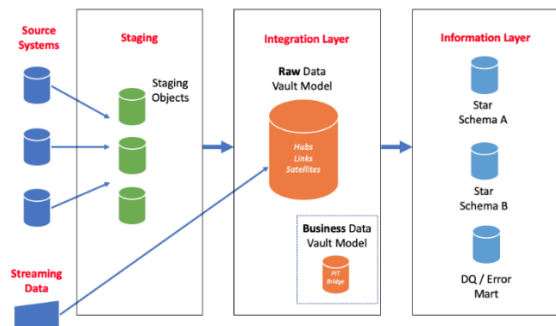
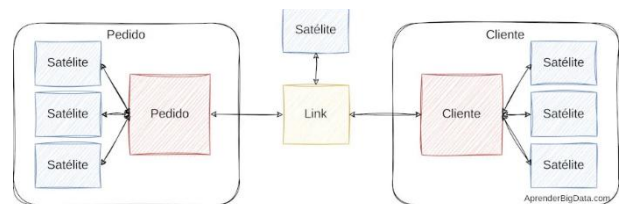Fig. 3. Data Vault model architecture. [17]

Fig. 4. Example of internal components of the Data Vault model. [18]

For this study, Ralph Kimball's methodology was chosen because the model is being proposed for the operative area of companies in the digital payment sector, for which a data mart would be used to measure the desired indicators, and in the future, more data marts or even a more robust data warehouse could be implemented as each company and/or their products grow.

IV. ABOUT THE DIGITAL PAYMENT SECTOR

In Peru, the digital payment sector is playing a key role in the financial inclusion and growth of small businesses. This is what the companies in this sector strive to do – to offer new tools that assist businesses in moving to digital payment systems, thus assisting the businesses in managing their finances and surviving in the competitive market of today and tomorrow. Technology is not the focus; it is about empowering people and creating lasting opportunities [19]. The goals of the digital payment sector include this commitment:

- Putting customers first: Making sure businesses have the tools and support they need to succeed on their financial journey.

- Creating meaningful impact: Developing solutions that enable small businesses and enhance the economic development of communities.

- Fostering growth and adaptability: Always improving to overcome any given challenge and adapt to changing needs.

- Building trust through communication: Keeping open and honest conversations to build up the right connections with clients and stakeholders.

- Investing in talent: Attracting and nurturing talented people to lead the way to innovation and excellent service.

- Championing digital transformation: Using creativity and technology to turn problems into opportunities and provide useful, forward-thinking solutions.

A. Products in the Digital Payment Sector

The digital payment sector provides several innovative solutions for the needs of businesses and consumers. These include.

1) POS Systems: This first product offers a wireless POS, which has contactless payment technology and accepts all Visa and MasterCard debit and credit cards. To use this service, customers don't need to pay monthly, only the POS must be paid for and it has a regular price of S/.425. Commission for national cards is 3.89% + IGV and 4.99% + IGV for international cards.

2) Online payment platforms: This service allows for an easy and fast integration of plugins and APIs. This service also accepts payments from all credit and debit cards, with no monthly costs, which means only successful payments have a cost. It has the following commission values:

a) National cards: 4.20% + $0.30 + IGV

b) International cards: 5.49% + $0.30 + IGV

c) PagoEfectivo (a local online payment platform): 4.20% + $0.30 + IGV

B. Identified Challenges in the Digital Payment Sector

- Experience during the collecting payment process seems stagnant and does not take advantage of current technologies in procedures such as sales counting, order history, and efficiency in balancing.

- Service coverage is and always will be a weak point because payment methods always require an active internet connection for optimal functionality. This also depends on the location of the business. For example, when having a large concentration of customers in the same place, a weaker network hinders customer experience even more.

- Having a complex interface can make it difficult for customers and staff to navigate, operate and customize the software. It can also increase the risk of errors, confusion, and frustration.

- Limited functionality when the software does not have features or integration necessary for the business. For example, it is possible that a client needs software that accepts multiple payment methods.

- Security issues when the software is vulnerable to piracy, malware, or data violations that could compromise the business and/or the client's information.

- Bad customer service when the software provider does not offer support, orientation, or appropriate and timely problem solutions for the customer's issues or questions. Bad customer service can cause frustration, a feeling of helplessness, and dissatisfaction, and it can affect the performance and continuity of the business.

C. Opportunities and Improvements in the Digital Payment Sector

- Better POS payment experience: "Less is more" [20] defines the main needs of businesses in their day-to-day routine. Taking fewer steps to make a sale means more sales will be conducted. This is where the POS industry has a big opportunity: being able to bring more efficient experience in the payment process, reducing the number of steps, and streamlining the interactions between the business, the sale, and the client.

- Better financial inclusion: It is estimated that only 46.1% of the Peruvian population [3] is financially included. Meaning that they know, trust, and can access financial services (also known as credit). However, there's a social development barrier present, since a large part of society doesn't represent a financial benefit in the eyes of banking entities, which is why growth opportunities are lower or almost null for this sector. The insertion of digital payment methods aims to bring banking access to the income and expense flows, so that financial entities gain transparency and trust, and in this

way, make them more willing to bring their services to this population sector.

- Acceleration in digital transformation: The use of cash in Peruvian businesses is still relevant due to the low penetration of banking in society, in general. The increase in the use of digital wallets such as Yape or Plin impulses citizens to not only make digital transactions but also pushes business owners into accepting these payment methods in their establishments. There is a big challenge here since despite this increase in digital wallet use, there is still fear of using them among the population, mainly because of education (or lack thereof) reasons [3].

- Business analytics is a competitive advantage: While sales in the commerce sector increase, new opportunities for business growth arise, such as offering new products or services, making marketing campaigns, and hiring more staff, among others. It is here where competitors emerge and analytics gain relevance, because having metrics and more sector knowledge helps in making better decisions; for example, if a business owner knows that most of his clients pay using DINERS cards, he could make loyalty campaigns with this brand, increasing consumer recurrence.

V. DATA SOURCE ANALYSIS (DATASET)

The dataset used for this research is based on information acquired from the transactional database (Data Lake) of a company in the digital payment sector, but it was slightly modified for confidentiality reasons. It was obtained in Excel format under the following structures:

TABLE I. BUSINESS DATASET

N°	Field	Description
1	Id_comercio	Business unique code
2	Tipo_doc_tributario	Tax document type (RUC20, RUC10, DNI)
3	Departamento	Department where the business is located
4	Provincia	Province where the business is located
5	Distrito	District where the business is located

The first dataset, shown in Table I, contains information regarding many businesses and it includes their unique ID, the document type corresponding to each of them (usually the ID number of the legal representative), and their location, which consists of three fields: department, province and district. The second dataset, shown in Table II, contains much more technical information. It has data related to the errors occurring during transactions, including the denial code, the description of said code and the sum corresponding to the transaction amounts for transactions with errors.

The third dataset is much smaller but still has valuable information. Shown in Table III, it stores the codes and descriptions for the business sectors, and the ID of every business, effectively linking each business to its corresponding sector.

Finally, the fourth dataset, shown in Table IV, is the most important. It holds the data corresponding to the details of the transactions made by each business. It stores the month, the number of transactions made by the business during said month, the values of these transactions, and how many of them were successful.

TABLE II. DETAIL OF POS ERRORS DURING AUTHORIZATION

N°	Field	Description
1	Id_comercio	Business unique code
2	Action_code	Denial code during transaction attempt
3	Desc_respuesta_trx	Error code description
4	GPV	Sum of transaction amounts for failed transactions

TABLE III. COMMERCE SECTOR DETAIL BY BUSINESS

N°	Field	Description
1	Id_comercio	Business unique code
2	Cod_mcc	Commerce sector code
3	Desc_mcc	Description for the commerce sector

TABLE IV. TRANSACTION DETAIL BY BUSINESS

N°	Field	Description
1	Cod_mes	Month code
2	Id_comercio	Business unique code
3	trx	Number of transactions made by the business
4	GPV	Sum of transaction amounts for this business
5	Trx_exitosas	Number of successful transactions for this business

VI. INDICATORS OR BUSINESS METRICS

The following indicators were identified as important for this research:

- Conversion of successful transactions in bodegas using POSs: This is essentially the main indicator for companies in the digital payment sector. Being able to track the number of successful transactions is of utmost importance in this area, as it will help companies assess their performance and key results, and it also facilitates the process of finding errors in any of the systems used throughout the payment processes.

- Use of digital payment methods in bodegas which use POSs: another key metric is how much digital payment methods are being used in bodegas. As stated in the literature review section of this paper, it has been proven that the use of digital payments has positive and noticeable impacts in businesses in general. Because of this, it's important that business owners (especially the older, sometimes more informal parts of the population) learn about these benefits to increase their income. Measuring this can lead to important insights for future works in this sector.

- Number of bodegas with POSs that also have access to financial services (credit, maintenance discounts): tracking this number can lead to insights on how the access to financial products impacts the number of transactions carried out by each business.

- Market share in POSs in the bodega sector in Peru: Keeping track of the market share for POSs can help determine which regions have the biggest growth potential and help companies direct their efforts into entering these regions.

VII. BUSINESS INTELLIGENCE ARCHITECTURE

To apply Business Intelligence (BI) in any environment, an architecture capable of converting a company's operational information into useful information for the strategic and tactical areas of the organization is necessary [21]. The standard transactional model, called OLTP (online transaction processing) which companies use, does not allow adequately efficient access to the information needed to make business decisions. Because of this, BI solutions propose the use of the OLAP (online analytical processing) system (shown in Fig. 5), in which specialized data repositories, called data warehouses or data marts are used, as mentioned previously in this paper. These data repositories allow information queries to be much faster because of the way they structure data, and they are fed by the company's traditional sources of information, which could be databases or spreadsheets, among others.

The use of these repositories will allow users (usually staff in management positions), to visualize the information they need through dashboards adequately and clearly, according to the company's business sector and personal preferences. This will help them make key business decisions. Business Intelligence architectures are usually composed of the following elements/processes:

- Data sources: Any file system, databases, or other sources of information the company uses in its standard model to handle daily transactions. For example: plain text files, Excel files, MySQL or Oracle databases, among others.

- Extraction, transformation, and load (ETL) process: it's the process through which the company's information, which can have several origins, is combined into a single centralized repository, in which it's cleaned and organized according to the company's needs [22].

- Data storage (Data Warehouse/Data Mart): The data repositories that handle the storing of information provided from the data sources. They can store structured, unstructured, or semi-structured information.

- Data exploitation: The final stage of the process, where users can visualize the information they need easily and quickly, through one or more dashboards. This leads to a simpler business decision-making process.
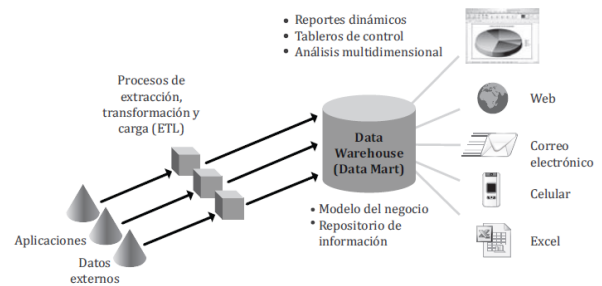

Fig. 5. Architecture of a Business Intelligence Solution [21].

VIII. ETL PROCESS AND DIMENSIONAL MODEL

The objective of the dimensional model is to facilitate information queries for users. For this case, the star model was chosen because, due to the simplicity of the data structures, it was not deemed necessary to go for the snowflake model, which usually consists of more complex relationships between tables. The star model, on the other hand, consists of a main fact table located in the center, which is related to several dimensional tables that are relevant to the business environment. The fact table contains information about transactions, which include the business code, the month and year of the transaction, the number of transactions, the value of the completed sales, error codes and descriptions (if any), and the code and description of the commerce sector. In addition to this table, the following dimensions were presented:

- Dim_Cod_Comercios: Contains information related to the business such as its code, document information, and geographic location, shown in Fig. 7.

- Dim_Cod_Rubros: Contains information related to the codes and names of the possible commerce sectors for each business. For example: transportation services, food sales, clothing sales, and medical services, among many others.

- Dim_Cod_Errores: Contains the codes and names for any errors that could occur when attempting to make a transaction.

- Dim_Tiempo: This dimension is usually considered necessary on any dimensional model. In this case, it contains the values for the transactions' months and years.

As we can see in Fig. 6, and according to what we've described above, the fact table stores the information from the fields of all dimensions. This allows queries to be made efficiently using dimensions as filters. For example, we could visualize all the transactions from August which generated a 116 error (insufficient funds). This ease of query is crucial for the business's continuous improvement, since it can be executed very quickly and allows data to be shown clearly and concisely, as explained in the results section.

Fig. 6.   Proposed dimensional model.

However, before starting with the dimensional modeling, the program Pentaho Data Integration was used as the main tool to conduct the ETL process. First, partial information was extracted from the transactional database to an Excel file (.xlsx). Then, for the transformation stage of the process, the data was ordered, filtered (to remove information with null values), and cleaned to remove any duplicate values, maintaining good data quality for the model. This process was repeated for all the dimensions proposed in the model.

Once the transformations were completed for each dimension, the corresponding transformation to generate the fact table was executed. This consisted of joining the data sources of the transactions, errors, and commerce sectors, as shown in Fig. 8. Then, the data was loaded to Power BI to start with the creation of the dashboard.
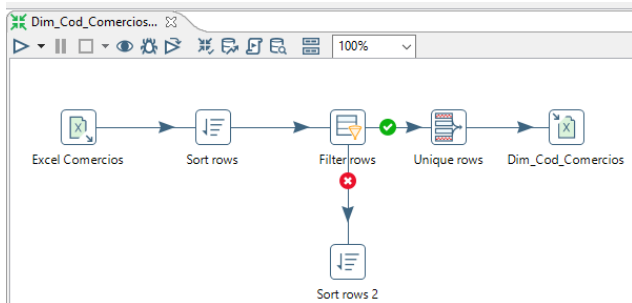

Fig. 7.   ETL process carried out in Pentaho Data Integration for the Dim_Cod_Comercios dimension.
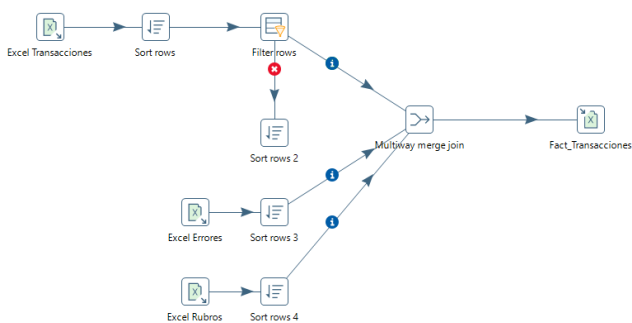

Fig. 8.   Pentaho Data Integration view for the generation of the fact table, Fact_Transacciones.

IX.   RESULTS

Power BI was used as the tool to create a dashboard separated into pages to keep information organized. As shown in Fig. 9, the menu view was generated as the first page, which

consists of a set of buttons that takes the user to the desired page. Each button is labeled with the information shown on each page. All these pages represent the most important metrics for the proposed solution and are the ones that generate the most value to the company's decision-making process.

The dashboard with transaction information shown in Fig. 10 allows users to visualize the business status quickly, as it presents a concise view of the number of transactions carried out to date, how many of them have been successful and how many have had errors, plus the value of sales. All of this is during the selected month in the filter located above.
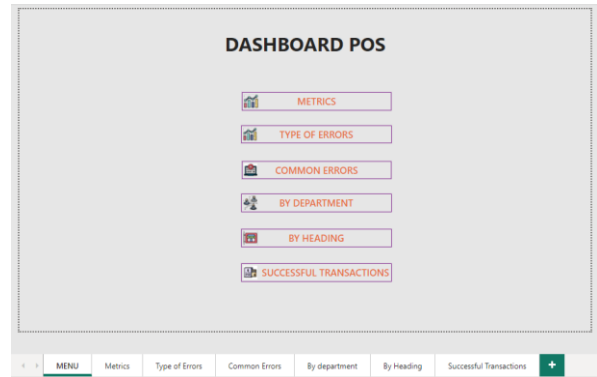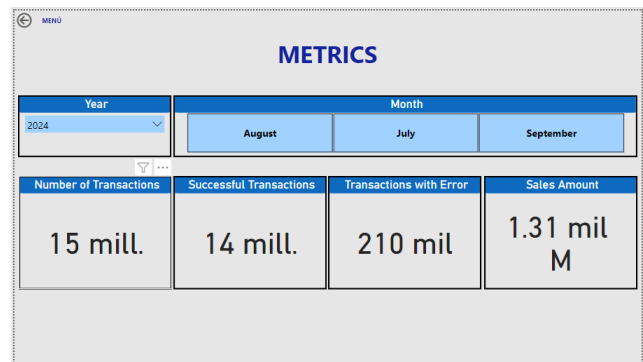

Fig. 9.   Menu view.

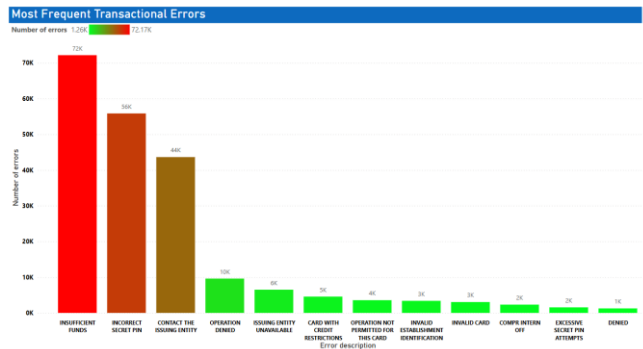Fig. 10. Dashboard with transaction indicators.

Fig. 11. Graphic showing the most frequent errors in transactions.

On the other hand, information about error types has been presented on several graphs. The most frequent errors (shown in Fig. 11), the number of transactions in Lima with errors and which of them, the number of failed transactions by commerce

sector (shown in Fig. 12), the distribution of departments with the highest number of errors (shown in Fig. 13), and a monthly comparison between the number of failed and successful transactions are shown in the dashboard's following pages.
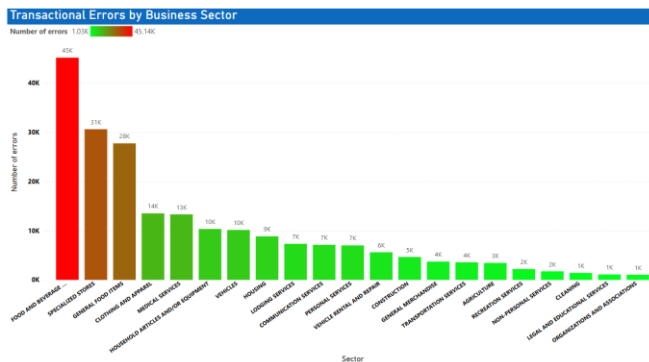

Fig. 12. Graph showing the number of errors by business sector.

These graphs are particularly important because, in the sector of e-commerce, there are many reasons why a transaction can fail, such as connection problems, internal errors in the bank or banks involved in the transaction, or even errors caused by the customer, such as having insufficient funds or incorrectly entering their PIN. Knowing which of these errors is the most common allows the management to determine quickly where to find problems in the business process and how to diagnose them effectively.

In addition to this, being able to visualize the distribution of errors by dimension is important to facilitate diagnostics and give an idea of where to focus efforts to prevent these errors in the future. The information shown must be treated as analytics that will contribute to increasing the company's value.
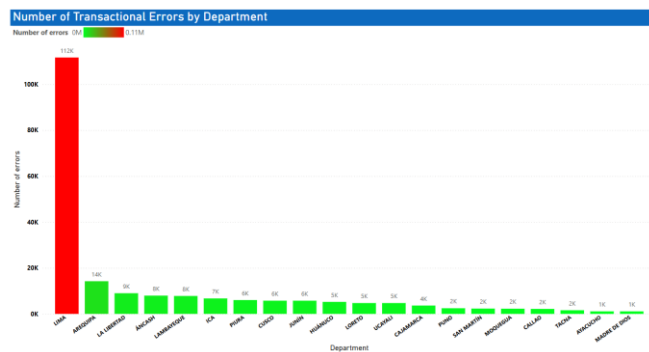

Fig. 13. Distribution of departments by their number of transactions with errors.

In Fig. 14, a comparison between the number of failed transactions and successful ones is shown by month. This information can provide benefits such as:

- Fraud detection: A high number of failed transactions in a certain month could represent fraudulent activity.

- User satisfaction: A high number of successful transactions can be a sign of good system performance and, therefore, a good customer experience. Similarly, a small number of errors can improve customer loyalty.

- Comparative analyses: Transaction data can be compared monthly to observe performance and allow the company to establish realistic goals for determined periods.

- Continuous improvement: Knowing the relation between failed and successful transactions allows management to determine the decisions they will make in the future.
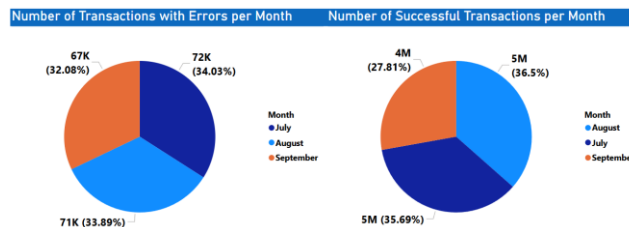

Fig. 14. Difference between the number of successful and failed transactions each month.

X. DISCUSSION

This paper demonstrates the importance of the use of Business Intelligence in the sales sector. Through the identification of the problem, the setting of objectives, the application of the dimensional model, the ETL process, and finally the data visualization in dashboards, business management, and decision-making can be facilitated, since the company's weak points and their causes can be identified quickly.

The proposed Business Intelligence solution can help companies in the payment sector increase their income and improve the user's experience, if the dashboard is constantly monitored, and the proper measures are taken to address problems.

The objectives set at the beginning of the paper were accomplished, since the implementation of the dashboard allows for clear, quick, and concise visualization of the transactional errors, which commerce sectors and locations they occur in, and analyzing how many transactions are being carried out successfully or failing every month, which brings great analytical value to the company. In future work, it would be beneficial to analyze how viable the implementation of a data warehouse is for bigger companies in the digital payment sector, so that they can apply this model to a much larger and scalable volume of data.

Although the proposed solution demonstrates a clear improvement in the decision-making process for the digital payment sector, it is important to acknowledge certain limitations. One of these is the current scope of the Data Mart, which is restricted to specific transactional data from a single company. Expanding this scope to integrate additional data sources, such as customer feedback or competitor analysis, could provide a more comprehensive view of the business landscape. Moreover, while the Kimball methodology was effective in this case, it may not be suitable for all contexts. A future comparative study between Kimball and other methodologies, such as Data Vault or Inmon, could offer valuable insights into the best approach for companies with

similar needs. Additionally, the model's reliance on accurate data collection means that any issues in the ETL process, such as missing or incomplete data, could affect the quality of the analyses. Addressing these limitations and exploring opportunities for further optimization will be crucial to ensuring the long-term success and scalability of the solution. Finally, this study contributes to business intelligence by demonstrating how tactical solutions can drive digital transformation in small businesses, particularly in emerging markets where financial inclusion remains a significant challenge.

Therefore, Business Intelligence in transactional data analysis has proven to be a powerful tool for improving decision-making, particularly in sectors like e-commerce. Recent research has shown how implementing big data analysis models can optimize decision processes by extracting hidden patterns in transactions and enhancing the customer experience [23]. This approach applies to our solution for analyzing transactions in bodegas, where POS systems provide valuable insights into consumer behavior.

Furthermore, studies on the application of machine learning for customer segmentation suggest that combining these analytical approaches with Business Intelligence enables a more precise classification of customers based on their transactional behavior and demographic characteristics [24]. Similar to our research, combining these analytical approaches could lead to increased financial inclusion, allowing companies in the digital payment sector to better customize its services and offer solutions that more effectively meet the needs of bodegas.

Finally, as Bouchra et al. (2019) indicate, including the context in Data Mart design can further personalize BI solutions, adapting the information to the various user profiles [25]. This is particularly relevant to our study, where the bodega sector exhibits very specific characteristics that must be considered in the system's design.

XI. CONCLUSION

The design of the Data Mart presented in this work becomes a key tool to understand and improve the transactional flows in the bodegas of Lima, Peru. Thanks to the implementation of the Kimball methodology, it has been possible to accurately identify the most frequent errors in transactions and categorize them according to their geographic location and commercial sector, allowing more informed decisions to be made and optimizing digital payment operations.

The solution also has an important impact on financial inclusion, as it enables bodegas to adopt digital payment methods that, in addition to increasing their competitiveness, facilitate access to financial services such as credit. This development encourages the transition from cash to digital payments, driving the digitization of one of the most traditional sectors of local commerce.

One of the current limitations of the Data Mart is that it only deals with a single company's transactional data. Adding new data sources like customer feedback or competitive market analysis to a Data Warehouse would provide a more complete perspective and allow for the development of stronger strategies.

Using tools like Power BI has been useful in converting complex data into simple and easily understandable information. The dashboards created contain vital metrics; for example, transaction success and failure rates, and recurring error patterns, thus enabling accurate interventions and constant service enhancement.

The application of Business Intelligence solutions can make a difference in the management of small businesses in emerging markets by converting data into knowledge that creates value. It also provides a new opportunity to investigate technologies such as machine learning for predictive analytics and customer segmentation which may lead to better results.

Therefore, the proposed model is not only useful for improving transactional processes, but also for supporting the progress of the digital transformation of small businesses; this project has the potential to contribute to the development of the business environment and the reduction of barriers to financial inclusion particularly in the Peruvian market which needs such solutions.

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