

# Application of business intelligence to improve decision-making in the marketing of hardware companies in Peru

José Antonio Ogosi Auqui, Magister<sup>1</sup>, Victor Hugo Guadalupe Mori, Magister<sup>2</sup>, Luis Antonio Usquiano Cárdenas, Magister<sup>3</sup>, Ruben Alejandro Rayme Serrano, Doctor<sup>4</sup>, Valeria Camila Avalos Quispe, Bachiller<sup>5</sup> and Jorge Lira Camargo, Doctor<sup>6</sup>

<sup>1</sup>Universidad Tecnológica del Perú, Perú, c18793@utp.edu.pe

<sup>2,3,4,5</sup>Universidad Privada San Juan Bautista, Perú, victor.guadalupe@upsjb.edu.pe, luis.usquiano@upsjb.edu.pe, ruben.rayme@upsjb.edu.pe, valeria.avalos@upsjb.edu.pe

<sup>6</sup>Universidad Nacional Federico Villarreal, Perú, jlira@unfv.edu.pe

**Abstract**– *The objective of this research article is to make a proposal to support decision-making within the sales area in hardware companies. The company La Libertad S.R.L. was taken as a case study, applying the use of the business intelligence tool as an effective and efficient solution. For this article, points in the design of the DataMart have been considered, such as the management and analysis in a strategic way in the operational part of the company's sales area based on the types of products with the highest valuation and / or sale. Currently in the company La Libertad S.R.L., in the sales area, it has a transactional system that performs processes such as the registration of categories, customers, districts, employees, orders, suppliers, stores. This system that goes hand in hand with the database is feasible for the company, however there is no form of visibility of complete movements for the manager of the sales area, either from the current year or from previous years, which is of important interest. for the planning of future projects, and in case of wanting to carry out a project, they must handle visible data to support the marketing and production area. The article aims to develop a DataMart as a business intelligence tool which is a decision support service for Peruvian hardware companies that need to plan their activities and in turn reduce the time it takes to generate reports.*

**Keywords**-- *DataMart, Business Intelligence, Decision Making.*

## I. INTRODUCTION

The company needs the data integration process because in this process the creation of reports is done, which in the case of the company La Libertad S.R.L. are shown through printed Excel sheets, which causes less information input for the sales area, which means that no contributions or improvements are made within the company.

The company also focuses on making choices, which is why it places a lot of trust in the decisions made by the company in commercial events and being attentive to the market, which is very changeable due to the competition, so that an incorrect decision can seriously affect the company.

Over the years the era of information technology is becoming more frequently present in companies that need to

improve the effectiveness with which the reports of each area are smooth and complete. To do this, the person in charge of the company's management has needed more support from these tools to manage the organization's data in a suitable way for proper decision making, which are vital to properly manage the information that has a common purpose which is to generate reports that help implement new ideas within the company.

The company wants to understand the value of their daily data to make better decisions. By collecting this data, they can better analyze and report the results. This helps them better understand the importance of their systems and the data they collect [1].

In the company there is a systems department in which a tool must be considered to make it easier to obtain the data and be able to provide solutions, and reports must be generated to be able to see the data from various perspectives.

The tools that can better understand the data of an organization are related to the latest IT tools mentioned above. One such tool is Cloud Data Analytics; it allows organizations to manipulate their data and discover why they perform in a certain way. This is because better understanding is achieved through data manipulation, leading to better decisions [2].

Hardware entities are one of those companies that do not want to be left behind in the use of these new technologies, so it requires a data integration that is reliable to use so that they can understand the specific performance they are going through.

## II. BACKGROUND

During the development process of this research project, in the national aspect.

From 2020 to the date of this research, COVID19 caused significant economic damage to all businesses. The tourism sector had its maximum revenue drop of 98% from 98% in May 2020. Also, facing this economic factor, it tries to apply answers in a technological way that contribute to the tourism

area to understand the emerging requirements and to be ready for the demands before the users or visitors in POS COVID19.

Hoteles Rado of Grupo RER Peru S.A.C., is no exception to this problem, the company is affected by the hotel occupancy rate and the fall in its profits. And because of the demand and competition for lower costs, an analysis tool is required to help make rate management decisions; and thus meet the demand of users now and in the future [3].

An Integration Services model was developed in the company so that now there are savings in reporting information that is big. The time required could be reduced by up to 98.7%, which made it possible for the sales department to receive the quarterly sales reports significantly faster. On the other hand, in the survey conducted as a key user, we estimated the percentage of errors that occurred in the manual calculation of the indicators, which complies with the implementation of the Datamart to eliminate this error, the in the Function Testing Chapter [4].

In the international aspect

This project aims to support business decision-making processes. Furthermore, this information will reduce the time required to receive data. The datamart provides many benefits to the sales department. These include reduced waiting times for reports and queries because these reports can be created by programmers and systems analysts. In addition, the data provided by a datamart can be examined from different perspectives and interpreted according to each department's criteria. This ensures that departments make the most informed decision possible.

The project benefits AMEVET CIA, a tax agency that LTDA assists with reports and historical sales data. LTDA's expertise also allows them to make predictions about future events to help beneficiaries make the best decision [5].

## II. METHODOLOGY AND METHODS

For the realization of the response to the implementation of business intelligence as a proposal, an analysis of the method known as Hephaestus was carried out. The activities and tasks are shown in Table 1.

TABLE I  
PHASES OF THE HEPHAESTUS METHODOLOGY

Phases	Activities	Author
Requirements Analysis	<ul style="list-style-type: none"> <li>Identify the questions within the hardware company.</li> <li>Identify indicators and perspectives.</li> <li>Design the Data Warehouse conceptual model.</li> </ul>	Bernabeu R. Dario

OLTP analysis	<ul style="list-style-type: none"> <li>Forming indicators.</li> <li>Establish correspondence between the resources obtained from the company and the data warehouse.</li> <li>Identify the granularity index.</li> <li>Design the extended conceptual model of the Data Warehouse.</li> </ul>	(Bernabeu, 2010; García Mattio Mariano, 2013)
Data Warehouse Logic Model	<ul style="list-style-type: none"> <li>Design logical model of Data Warehouse</li> <li>Design dimension tables</li> <li>Design fact table</li> <li>Perform joins in the tables</li> </ul>	
	<ul style="list-style-type: none"> <li></li> </ul>	
Data integration	<ul style="list-style-type: none"> <li>Initial loading of data by applying data cleansing and information quality techniques, ETL procedure.</li> <li>Declare policies and guidelines for their respective update.</li> </ul>	

The following outline details the processes that took place during our research, which are explained in depth below.

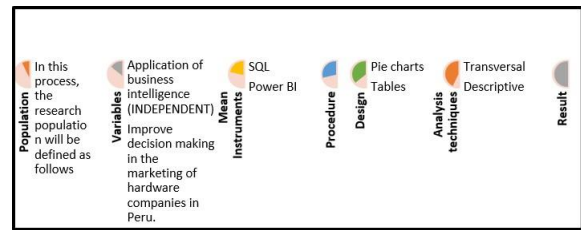


Fig. 1 Detailed process diagram.

### A. Population and Sample

The population will be made up of all the people in charge of making decisions, since the future of the company depends on them.

For this purpose, we will take into account both the distribution area and the sales area, the head of management and the head of sales.

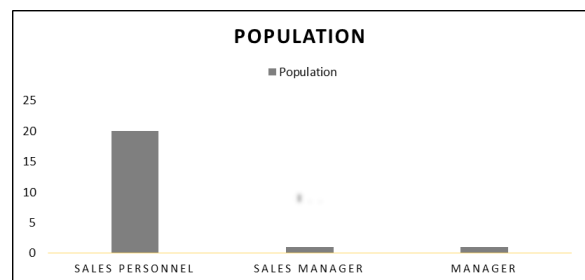


Fig. 2 Detailed process diagram

### B. Procedure

After an exhaustive request for information to the owner of the company La Libertad SAC, we were able to obtain key information to proceed with the requested information reports. In this case, we obtained Excel with

information on monthly sales, personnel data, company clients, products and suppliers, as well as a transactional and a dimensional database. With this, we proceeded to differentiate key points that serve the company and the processes that need the reports to be delivered.

#### IV. PROPOSAL DEVELOPMENT

##### A. Programming languages used

To carry out this project we have programming languages that will support us to perform the integration of SQL Server to Visual Studio to make the data transfer. These are the following:

##### Visual Studio

Microsoft Visual Studio uses the programmable language C++ and Csharp. By means of which we will connect to the SQL Server to be able to make the ETL and the Cube.

One of the most relevant advantages is the facilitation to the programmer to visualize all the updates in real time through the IDE after the compilation of the code, there is no need to exit the IDE and must start the application separately, the User only has to drag the content of the Window while the software makes all the arrangements automatically. Visual Studio turns out to be a very useful tool to elaborate excellent software designs, having finished the design, each component must be programmed. On the other hand, one of the most outstanding advantages of the tool is that it can be very complex for beginners, and one must get used to the interface. Another disadvantage is that, although the program receives constant updates, it still presents errors, especially when developing a complex application, it must be always saved after a major coding change has been made [6].

##### SQL Server

Microsoft SQL Server is a database management system manufactured by Microsoft. Its main query language is TransactSQL, which is an implementation of the ANSI/ISO structured query language standard used by both Sybase and Microsoft SQL Server [7].

#### BUSINESS INTELLIGENCE

BI analytics and applications. Descriptive and predictive data analysis tools are classified at this level. These include OLAP viewers, dashboards, reports and ad hoc queries, data mining. These applications are classified into two parts: decision support systems and executive information systems [8].

#### IV. RESULTS

The application of business intelligence in hardware

companies allowed a better management in the control of the company that was designed according to the needs of the general manager to contribute to the decision-making process.

The development of the cube was taken as the basis:

We used the dimensional database to make the OLAP cube, we are going to use the dimcliente table to be able to make reports and reports of the clients that go to the hardware store to later be implemented.

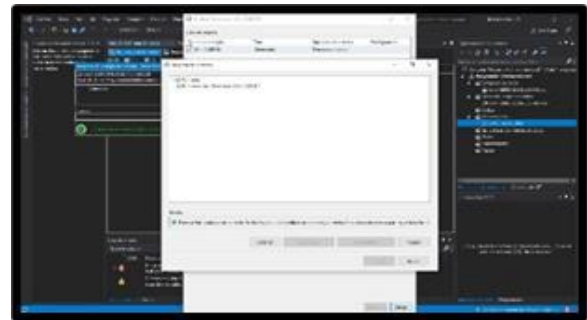


Fig. 3 First OLAP cube execution process

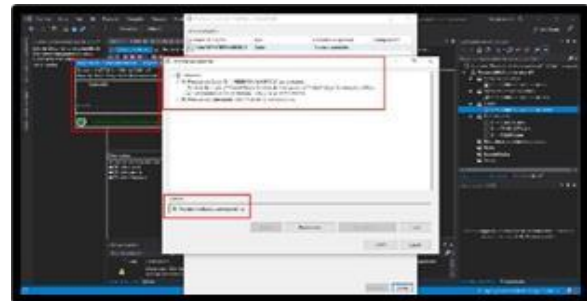


Fig. 4 Second OLAP cube execution process

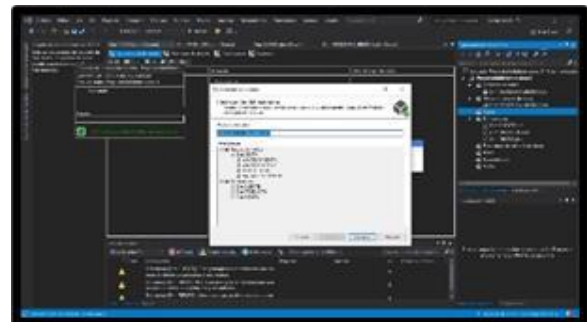


Fig. 5 Third OLAP cube execution process

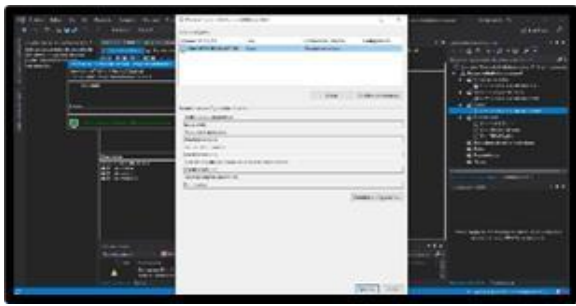


Fig. 6 Fourth OLAP cube execution process

With the cube already done, we can generate multiple reports without having knowledge of SQL Server, this will be useful for the company to have the information in order.

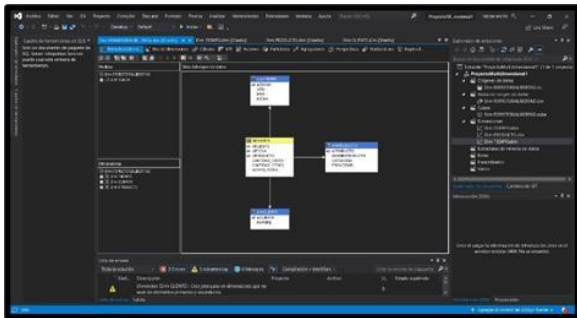


Fig. 7 OLAP cube executed 1.

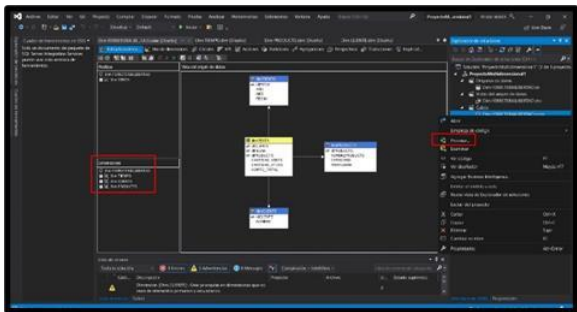


Fig. 8 OLAP cube executed 2.

After the execution of the cube, we proceeded to send the processed information to the PowerBI program in which we obtained dashboards results based on the requirements requested by the management of La Libertad S.R.L. company.

- Se desea conocer monto y cantidad totales de cada producto que fueron vendidos por cada sucursal según nombre del producto o categoría en un determinado tiempo.
  - **Monto Total de ventas y Unidades vendidas de cada producto o categoría según la sucursal en un tiempo determinado.**
- Se desea conocer cuántas unidades de cada producto hay en almacén por sucursal según el producto o categoría que pertenece.
  - **Cantidad total de productos en almacén según producto o categoría de cada sucursal.**
- Se desea conocer el monto y cantidad totales de ventas de cada empleado por cada sucursal.
  - **Monto total de venta y Unidades vendidas de cada empleado por sucursal**
- Se desea conocer cuántas unidades de cada producto fueron vendidas a sus clientes en un periodo determinado.
  - **Unidades vendidas de cada producto a cada cliente en un tiempo determinado.**

Fig. 9 Request for requirements

The dashboards obtained from the PowerBI application are shown below. Figure 9 shows the total sales amounts and quantities per branch by product or category.



Fig. 10 Dashboards obtained from PowerBI

Figure 10 shows the quantities of products registered in the warehouse of each branch according to the product or category in the company.



Fig. 11 Quantities of products registered in each branch warehouse

Figure 11 shows the total amounts and quantities of sales per employee by branch.



Fig. 12 Total amounts and quantities of sales per employee by branch office

Figure 12 shows the total amounts and quantities of sales for each customer at a given time.



Fig. 12 Total amounts and quantities of sales by each customer in each time.

## VI. DISCUSSION

According to the results we have obtained, it is demonstrated that implementing DATAMART in hardware companies shows a significant change in the effectiveness of decision making in the sales sector, since it makes it easier to visualize the periodic analysis needed.

In previous studies, we visualized similarities and differences with respect to research reflected in the theoretical background mentioned in this article, which is detailed below:

According to Sosa (2021) in his thesis "Implementation of a Data Mart for the administration area of Rado Hotels of the company PER Peru S.A.C - Trujillo group" uses PMS technology or also known as Property Management System in transactions daily [3].

Similarities: By implementing the Data mart in the thesis mentioned above, it focuses on optimizing the decision making of the tariff administration because we take as a reference to focus our research work on productive solutions towards making in choices within the sales sector in hardware companies.

Differences: The project uses the Project Management System, or PMS, as a management platform that helps hotels manage tasks such as check-in, check-out, room

**Digital Object Identifier:** (only for full papers, inserted by LACCEI).  
**ISSN, ISBN:** (to be inserted by LACCEI).  
**DO NOT REMOVE**

assignment and front desk. The PMS also serves as a management platform for rate management. This hotel company uses it for rate management. In contrast to our project that uses Analysis Services to provide us with analysis data that contribute to decision making.

According to Castillo (2016) in his article "Implementation of a Datamart for decision making for container sales in the commercial area in the company spacewise Peru" uses the Integration Services model to reduce the time to generate reports [4].

Similarities: The implementation of the Integration Services model in the Spacewise Peru entity is focused on improving productivity in generating fast quarterly reports and thus obtaining a solution to the company's problems. This points we take as a reference to perform the OLAP cube and ETL for hardware companies.

According to Toainga (2014) in his thesis "Construction of a sales oriented Datamart for decision making in the company Amevet CIA. LTDA" uses DataMart in the decision-making process of the sales department [5].

Similarity: The application of the Datamart in the sales department to reduce work for programmers or systems analysts of the company Amevet we take as a reference these points by applying it in the sales areas of hardware companies that are the main source of income.

Difference: In the mentioned thesis it takes Datamart as a tool for decision making, which although it is a support tool, it is only applied in one area, which is sales, while the basic support tool in the decision making process in the ferretares entities is the use of PowerBI and Visual Studio, which helps to perform the ETL and the OLAP cube, besides using SQL Server as a database manager.

## VI. CONCLUSIONS

Business intelligence gives the results that prove that it improves the tasks in the administrative area. This is shown by analyzing the data collected. The figures show that the use of business intelligence improves administrative tasks, as evidenced by the fact that these were measured. The business intelligence of Empresa La Libertad S.R. directly influences the administrative work of the company.

Reports generated through Business Intelligence applications are usually generated faster than reports generated without it. This helps commercial companies improve performance by collecting data stored in their systems daily. Once the data is collected, it can be analyzed and presented to the business in a meaningful way. This helps the business to better understand the importance of their data and make better decisions.

participles, such as, “Using (1), the potential was calculated.” Write instead, “The potential was calculated using (1),” or “Using (1), we calculated the potential.”

Use a zero before decimal points: “0.25,” not “.25.” Use “cm<sup>3</sup>,” not “cc.” Do not mix complete spellings and abbreviations of units: “Wb/m<sup>2</sup>” or “webers per square meter,” not “webers/m<sup>2</sup>.” Spell units when they appear in text: “...a few henries,” not “...a few H.” If your native language is not English, try to get a native English-speaking colleague to proofread your paper.

#### ACKNOWLEDGMENT

We would like to thank the work team for providing us with their knowledge and support during the research presented, as well as their guidance in each step of the project until we obtained the result we expected. Finally, we would like to thank our families.

#### REFERENCES

- [1] Rico, B. C. (2011). DESARROLLO DE UNA SOLUCIÓN BUSINESS INTELLIGENCE EN UNA EMPRESA DEL SECTOR DE ALIMENTACIÓN. Valencia: Universidad Politécnica Valencia.
- [2] Sosa, García (2021). IMPLEMENTACIÓN DE UN DATA MART PARA EL ÁREA DE ADMINISTRACIÓN DE RADO HOTELES DE LA EMPRESA GRUPO RER PERÚ S.A.C. – TRUJILLO. Trujillo: Universidad Católica Los Ángeles de Chimbote.
- [3] D. Bernabeu y M. Garcia, “HEFESTO DATA WAREHOUSING: GUÍA COMPLETA DE APLICACIÓN TEÓRICA PRÁCTICA; METODOLOGÍA DE DATA WAREHOUSE”. 2017.
- [4] Elena, Castillo (2016). IMPLEMENTACIÓN DE UN DATAMART PARA LA TOMA DE DECISIONES PARA LAS VENTAS DE CONTENEDORES EN EL ÁREA COMERCIAL EN LA EMPRESA SPACEWISE PERÚ. Lima: Universidad San Martin de Porres
- [5] Toinga, M. P. (2014). CONSTRUCCIÓN DE UN DATAMART ORIENTADO A LAS VENTAS PARA LA TOMA DE DECISIONES EN LA EMPRESA AMEVET CIA. LTDA. Ambato, Ecuador: Universidad Técnica de Ambato.
- [6] T. Popescu and T. Costache, "DESIGNING A WINDOWS PROGRAM FOR CONTROLLING DC-MOTORS USING MICROSOFT VISUAL STUDIO AND ARDUINO IDE," Journal of Industrial Design and Engineering Graphics, vol. 14, (2), pp. 29-34, 2019. Available: <https://www.proquest.com/scholarly-journals/designing-windows-program-controlling-dc-motors/docview/2367733886/se-2>
- [7] Jose Santamaría y Javier Hernández (2015). SQL SERVER VS MySQL.
- [8] Ghosh, 2015; Gounder, Iyer, Professor-ccis, Mazyad, & Prof (2016); A Marinheiro & Bernardino, 2015; Vassell, Apperson, Calyam, Gillis, & Ahmad (2016)