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**TOPIC:**

**"ANALYSIS AND IMPROVEMENT PROCESS OF INVENTORY MANAGEMENT THROUGH TECHNICAL BUSINESS INTELLIGENCE, TOOL APPLYING THE ORACLE BUSINESS INTELLIGENCE OBI"**

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**ANALYSIS AND IMPROVEMENT OF THE INVENTORY  
MANAGEMENT PROCESS THROUGH BUSINESS INTELLIGENCE  
TECHNIQUES, USING THE ORACLE BUSINESS INTELLIGENCE  
TOOL OBI.**

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*Abstract—This paper summarizes the thesis project "Analysis and improvement of the inventory management process through business intelligence techniques, using the Oracle Business Intelligence OBI tool." It includes the development of a Data Mart Inventory, following the steps suggested in the Kimball methodology in accordance with the project. Finally, it presents the conclusions and recommendations of the research product.*

*Indexed terms— Data Mart, Inteligencia de Negocios, OBIEE, Metodología Kimball.*

### I. INTRODUCTION

Inventory management is a common process in all types of business and is practically equal anywhere in the world. Differences to implement an inventory process are: the size of the company, the number of products, number of customers and suppliers, the cost and size of the product and the form of distribution, retail or distributors.

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Inventory Management, you must solve three fundamental problems: balancing inventory levels, reduce operational costs



*Illustration 1 Inventory Management*

Source: Own.

This allows you to maximize time and reduce costs; fulfill, without delay, the customer demand; reduce costs when making production and distribution at a steady pace, according to the seasonality of sales; negotiate with suppliers under better conditions; improve cash flow; maximize the stock; reduce freight costs and control the quality of products.

Most companies have computerized inventory systems connected OLTP transactional database, which produce large amounts of data daily and are operationally oriented. These systems are optimized for common tasks of writing and reading, the history information is limited to recent data, do not allow analytical processes of information, analyze trends, obtaining patterns or represent information in interactive, simple and intuitive way, from different perspectives and levels of summary of the historical data of the inventory process.

In this context, companies have created strategies that have enabled them to increase their performance and competitiveness by improving processes and using IT solutions that analyze historical information thereof, which supports decision-making. This is a basic concept of business intelligence.

## II. BASIC CONCEPTS

### A. Business Intelligence.

Forrester (2015) “Defines business intelligence as a set of methodologies, processes, architectures and technologies that transform data into meaningful and useful information used to enable better tactical strategies, points of view and operational decision making.”

Complementing the above definition, business intelligence must be assumed at management levels of organizations. It also allows to have quality information and detailed summarized; centralizing data from different enterprise applications, databases and files; in this way it helps to gain competitive advantages and risks identified in relation to competition.

### B. BI Architecture

The general architecture of a business intelligence solution has the following components:

*Resource:* are all sources of data which feeds the DataWarehouse, these include: operational systems, flat files, spreadsheets, among others.

*ETL Tools* (Extraction, Transformation and Load), these tools allow you to extract data sources, defining fields and

transformations or process (mapping), and finally load the data clean your destination or data repository.

*DataWarehouse:* represented in multidimensional models. Interacting with DataWarehouse process is the OLAP (On-Line Analytical Processing) that allow graphically represent the DataWarehouse, this representation is called CUBE, consisting of dimensions and fact tables.

*Access tools:* allow the end user to interact with the data, make reports and allowing analysis of data, in graphic and dashboards.



Illustration 2 Architecture Business Intelligence

Source: Oracle.

[http://www.oracle.com/ocom/groups/public/@otn/documents/webcontent/317529\\_esa.pdf](http://www.oracle.com/ocom/groups/public/@otn/documents/webcontent/317529_esa.pdf)

### C. Kimball Methodology

According to Ralph Kimball, a data warehouse is a copy of transaction data specifically structured for query and analysis.

For the construction of DWH proposes a methodology called up BUTTOM UP uniting departmental data mart of an entity. This methodology is based on the Life

Cycle Dimensional Business, the same that is based on the following principles:

- Focus on business: identifying the most important business requirements and its associated value.
- *Building an adequate information infrastructure*: Designing a database of unique information, integrated, easy to use, high performance, where is reflects a wide range of business requirements identified in the company.
- *Make deliveries in significant increases*: Create the data warehouse (DWH) in terms of deliverables increases in 6-12 months.
- *Provide a complete solution*: deliver a solid data warehouse, well designed, with proven quality and accessible that meets user requirements. We must also provide query tools to display information.

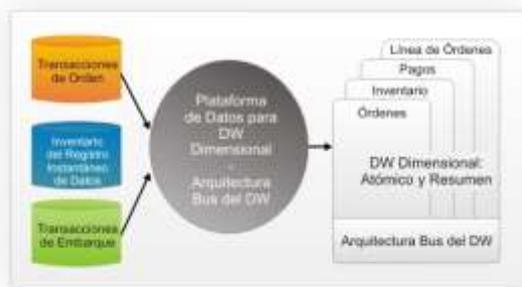


Illustration 3 Methodology Kimball scheme. Fuente:

<https://churriwifi.files.wordpress.com/2010/04/enfoque-inmon.jpg>

5) *Design and implementation subsystem Extraction, Transformation and Load (ETL).*

This methodology is one of the most popular, the structure proposed for the construction of a Data Mart, this methodology proposes the following steps:

- 1) *Project Planning*: define specific objectives, scope, risk, that is an approach to the needs of the information.
- 2) *Definition and analysis requirements*: here the success of the project is determined, here are interpreted the requirements at all different levels and types of users, then it is guided through the central path of the diagram.
- 3) *Dimensional Modeling*: it is a dynamic and interactive process, which contains 4 steps:
  - Choose the business process, that is choose the modeling area..
  - Establish the level of granularity, specify the highest level of detail possible..
  - Choose the dimensions..
  - Identify measures and fact tables.
- 4) *Physical Desing*: it focuses on the selection of the structures required to support the logical design. For example BDD, partitioning and naming standards.
- 6) *Implementation*: the final application is accessible from the user's desktop.
- 7) *Maintenance and growth DW*: development of a DW should always think to the future, and plan to measure their success, and always communicate with the end user, to establish the flow of feedback.

In the bottom of the diagram, are the tasks associated with Business Intelligence area.

- 8) *Specification BI Applications:* Applications are the same Business Intelligence, which Kimball proposed in two divisions.
- Standard reports

➤ Analytical Applications

- 9) *Technical Architecture Design:* is integrated by three factors, business requirements, existing technical environments and strategic technical guidelines for establishing future DW architecture.

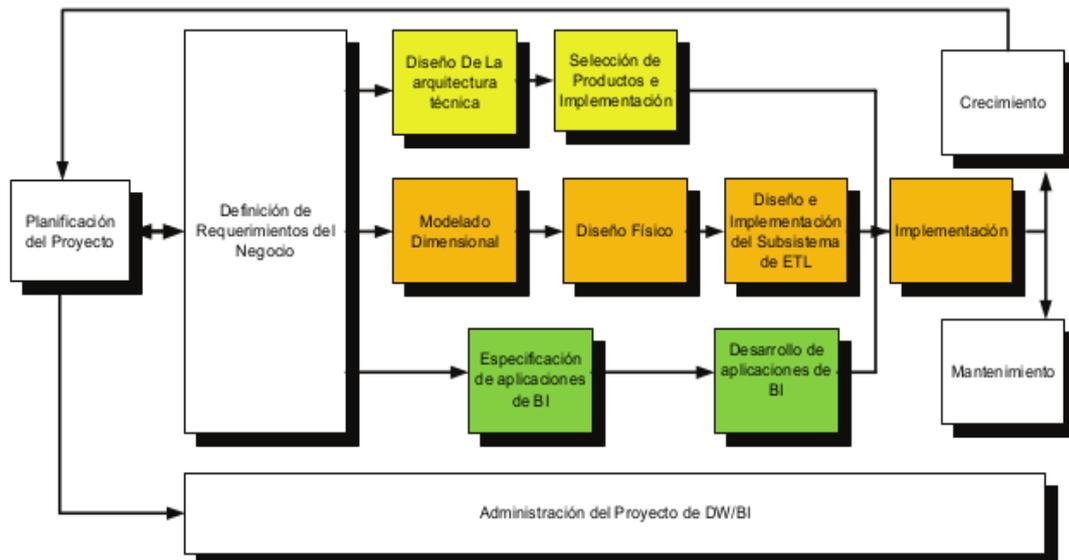


Illustration 4 Kimball  
Tasks Dimensional Life Cycle

Source: <http://inteligenciadenegociosval.blogspot.com/2014/01/metodologia-de-kimball.html>

D. Classification BI components.

Benefits based on their implementation of business intelligence systems has become a strategic factor for companies as it provides optimum and precise information to solve business problems. But to carry out all its processes has a variety of products which are divided into three groups:

- *Dashboard or Scorecard:* are aimed primarily at the strategic level of companies that is for use by managers, this tool allows you to set and monitor the objectives of a company.
- *Decision Support Systems:* Primarily focuses on data analysis, which aims to exploit the information resident in the DWH, solving many of the limitations of management programs. It is focused on all levels of the company.
- *Executive Information Systems:* These systems are based on previous support systems, its goal is to provide managers easy access to information, provide

reports and listings areas of the company with a visual and intuitive graphical interface.

#### *E. Datawarehouse(DWH)*

For Kiumars Farkisch, a DWH integrates information from many different sources in a database optimized for decision making. A data warehouse is a subject-oriented, integrated, nonvolatile and variant chronological collection of data to support management decisions.

*Integrated:* the information stored in the DWH should be integrated into a consistent and uniform structure, so that existing inconsistencies between different operating systems or sources must be eliminated. The information is often also structured in different levels of detail to suit different user needs.

*Thematic:* to classify information on specific topics, for easier access and understanding by the end user that is must pass only the data necessary for the process of knowledge generation.

*Variant time:* In a DWH time is implicit part of the information it contains. The information stored in the data warehouse is used to perform trend analysis with different values of a variable in the time.

*Non Volatile:* The information store of a DWH there to be read, but not modified. The information is therefore permanent, meaning DWH update incorporating the latest values taking the variables contained

in it without any action on what already existed.

#### *F. Data Mart*

The DataMart is also considered as a data store, as the DWH stores information, but a specific topic or area of a business. A DataMart is a subset of data from a DWH (DataMart dependents), o directly from data sources (DataMart Independents)

Among the various objectives to be met DataMart to be effective the following described:

- Optimize the processes performed in a specific area.
- Eliminate long times analysis to obtain information.
- Provide agility to navigate and understand the information contained.
- The design and construction time should be shorter than that of a DWH.
- It is aimed to handle a limited amount of data is therefore a less historical significance.
- Provide optimum data structure to analyze the data in detail, from all perspectives that affect the processes of a certain department.

The mart can be constructed from various data sources and depending on its origin are classified:

**DATAMART OLAP:** These are supported by a structure such as OLAP cubes, which contain dimensions and measures required for the area that is worked.

**DATAMART OLTP:** Estos en cambio se basan en un simple extracto del DWH, pero se suele incluir operaciones como

agregaciones y filtrados, orientados a las características particulares de cada área.

### G. OLAP and OLTP

OLTP for its acronym in English (Online Transaction Processing) these systems are designed to handle many concurrent requests on relational databases, where users can add, modify, delete and search the data. Each transaction or operation works with a set of rows, offering a quick response. The relational databases are usually highly normalized, where data integrity is important and comply with the properties: atomicity, consistency, isolation and durability.

OLAP systems are a set of tools that allow answers to queries return large amounts of data quickly; allow to carry out the analytical process the information online, that is to say, instantly; they offer a view of the data oriented analysis from different perspectives and flexible navigation of the same; the data history is long term, access to the data is typically read only and OLAP systems are often fed information from existing operational systems through ETL processes.

E. F. Codd in 1993 establishes parameters for OLAP systems described below the main:

- You must have a multidimensional view of data
- The manipulation of the data must be intuitive and simple, aimed at analysts and top executives of the companies
- The OLAP engine should provide end applications: dashboards, scorecards, financial analytical applications, etc..

- Access to relational databases and multidimensional
- Modeling based on OLAP
- Client Server Architecture
- Transparency for end users
- Multi-user access to applications and concurrently
- Create reports
- Aggregation levels and hierarchies

### H. Multidimensional Databases OLAP Cubes.

An OLAP cube is characterized by a multidimensional structure where data are arranged hierarchically, allowing the analysis of large data volumes faster. A multidimensional database can contain multiple cubes.

The multidimensional databases are mainly used to create OLAP applications and it can be seen as databases from a single table, its peculiarity is that each dimension has a field and another field for each metric or fact.

To store information using a structure based on tables, known as facts and dimensions.

*Facts tables:* is the main table in a dimensional model, is where are stored numerical measurements that represent the needs of the company, by example Sales Net. These measurements are known as facts that are the object of analysis, and incorporate this table the primary keys of the dimension tables. They are usually denormalized and may include different aggregations as maximum, minimum, etc..

*Dimensions Tables:* It joins the fact table and contains descriptions of a specific business area. Each dimension has a unique primary key and also are denormalized. In these tables if the information needs to have

several levels of granularity hierarchies are created with dimensions. By example date hierarchy would month – week – day. The hierarchies of the dimensions have relationships n-1 so that a value of a level can be grouped by only a single value for each next higher level in the hierarchy.

There are two options multidimensional modeling: star and snowflake.

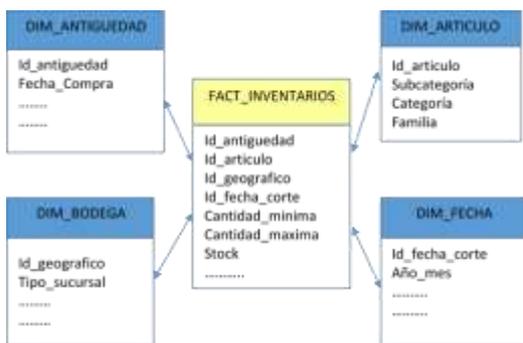


Illustration 5 Star scheme

Source: Own

### I. ETL Process

ETL, English Extract-Transform-Load, works on the source information from any data source. Its main objective is to organize the flow of data, reformat, clean and load them into a data repository.

The different phases or sequences of an ETL process are:

- Data **extraction** from one or more source systems.
- **Transformation** of this data, ability to reformat and clean these data when necessary.
- **Load** the data elsewhere or database a data mart or DWH, in order to analyze or support a business process.

Advantages of ETL processes

- Facilitates the creation of a standardized central repository for all organizational data.

- Allows managers to make strategic decisions based on the analysis of data in the new bases loaded and updated.

- Facilitate the transformation of data: data type conversion, string manipulation or simple calculations, aggregations, among others.

- Recovery of data models from data sources, data mapping, among others besides allowing to interact with other tools.

## III. INVENTORY DESIGN DATA MART USING THE METHODOLOGY KIMBALL.

### A. Definition of requirements.

At this stage is collected all available information to determine dimensions and measures that are necessary to comply with the scope of this project.

### B. Identification Resource

Identifying resources is described the process of inventory of the company object of this study.

According to the process of inventory, you can set the variables that identify the dimensions and measures that should be analyzed to present required reports for the area inventories, these variables lead to perform analysis relating to:

**PRODUCTS:** Variables that describe each product.

**BODEGA:** Data describing each existing bodega

PROVIDER: Descriptive information for each provider

TIME: for analyzing each variable in function of time.

They are considered as dimensions.

### C. Dimensional Modeling.

This phase is one of the most important in the development of the project, as here defined steps to build the logical design from which works to build the DataMart.

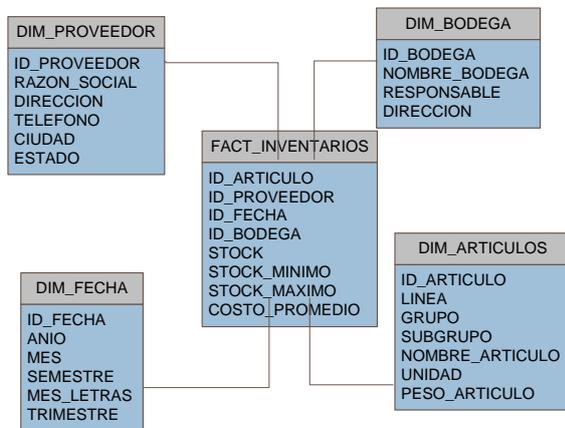


Illustration 6: Data Model  
Source: Own

### D. Physical Design.

In this part is performed the construction of the multidimensional database that supports the logical design, made in the previous step, the same that serving as data repository where the transformed information obtained from the transaction database is stored, for construction of the database is used database engine SQL Server 2014

Finally, the relational data model is shown bellow

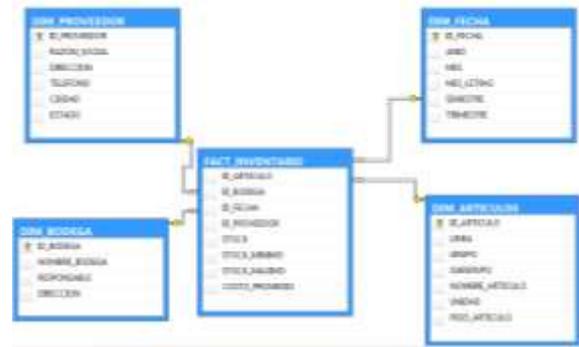


Illustration 7: Database diagram  
Source: Own

### E. Design and construction of ETL Processes.

At this stage the aim is to build the ETL processes that transform and consolidate information obtained from the sources to be deposited into the data warehouse created in the previous step.

To continuation is described the data corresponding for the Dimension DIM\_FECHA

NOMBRE TABLA O VISTA ORIGEN	CAMPO	TIPO DATO	CAMPO	TIPO DATO
V_INV_TIEMPO	ID_FECHA	VARCHAR 2(80)	ID_FECHA	NUMERIC(18,0)
V_INV_TIEMPO	ANIO	NUMBER (4)	ANIO	INT
V_INV_TIEMPO	MES	NUMBER	MES	INT
V_INV_TIEMPO	SEMESTRE	NUMBER	SEMESTRE	INT
V_INV_TIEMPO	TRIMESTRE	NUMBER	TRIMESTRE	INT
V_INV_TIEMPO	MES_LETRAS	VARCHAR2(40)	MES_LETRAS	VARCHAR(50)

Illustration 8: Corresponding Dimensión Data  
Source: Own

### F. Creating ETL Processes

Once you defined the ETL process, it is necessary to use Microsoft SQL Server Integration Services, SSIS tool; describing the figure below:



*Ilustración 9: Processing task  
Source: Own*

**F. Application Specification.**

At this stage is realized the construction of reports and data analysis, for which as proposed in the objectives of this project, the OBIEE tool is used.

*Construction of the Physical Layer*

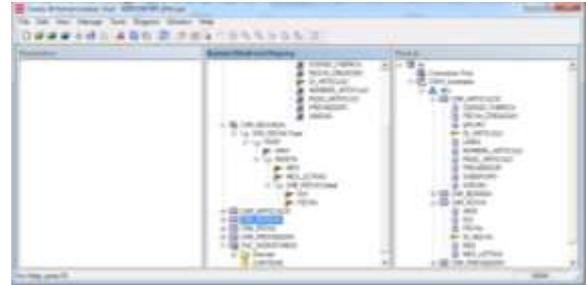
The following screen shows the main view of a Repository. Physical Layer is in the right panel, intermediate panel contains the business layer and the layer of the left contains the presentation layer.



*Ilustración 10: Step 2 Creating a new repository  
Source: Own*

*Construction of the Business Layer.*

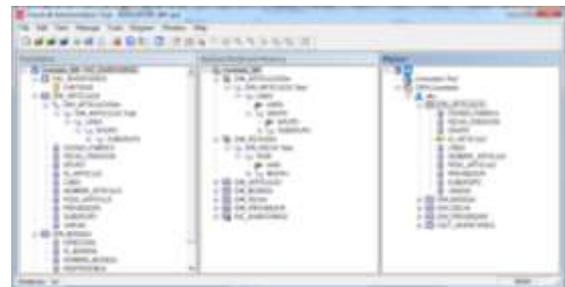
In this layer are constructed the levels and hierarchies of the dimensions; are summarized the metrics of the fact table. The following image shows the creation of the business layer.



*Ilustración 11: Step 1 creating business layer  
Source: Own*

*Construction of the Presentation Layer.*

In this layer is customize the view of the business model for end users. This includes renaming objects without affecting the physical and logical names that will be used to generate queries.



*Ilustración 12: Step 3 Creating Presentation Layer  
Source: Own*

**G. Report Creation**

Using the tools of OBIEE 11g, we can deploy reports used to analyze data, as shown by the following figures:



*Illustration 13 : Stock Edited by Products Report  
Source: Own*



*Illustration 14: Stock and Average Cost Report  
Source: Own*

- The importance of using business intelligence tools for decision making in the department of inventories is of utmost importance to directly solving the problems in this area, as is the proper management of inventories.
- Other benefits of implementing solutions for business intelligence, you can set the ease with which the end user can access the information independently, as it requires no request reports of the department tics, eliminating long analysis and programming in that department, and you can also model their own reports according to their needs.
- Using the Kimball methodology for the construction of this project is a guide important as followeth adequate and organized construction DataMart inventory as it goes along the growth that can have the department feedback provided information requirements.

#### IV. CONCLUSIONS

The end result of this thesis project entitled "Analysis and improvement of the process of inventory management through business intelligence techniques, using the Oracle Business Intelligence OBIEE 11g Enterprise Edition tool" and then the development of applications that have enabled it to meet the objectives has reached the following conclusions:

- The tool used OBIEE is very versatile for connection to any source, that is to say, it has proven connectivity of the tool with the data source raised in the architecture of this project, as it is the engine of SQL database Server 2014.

#### V. RECOMMENDATIONS

Based on the experience gained in the development of this project can suggest the following recommendations:

- When deciding the tools to use, it is suggested where possible choice for the whole construction process of the solution of business intelligence a single tool, that has a comprehensive solution that will give yourself the ETL processes to building frames control, as it is OBIEE (Oracle Business Intelligence OBIEE 11g Enterprise Edition).
- It is recommended before starting with the construction phase of the business intelligence solution, a study and

understanding of all processes modeling since this depends on the final result is appropriate and meets the requirements of the end user.

- Is recommended monitoring and adequate training for end users, in the use of business intelligence solution, for to acquire increasing skill in making decisions, because many users by not adequately understand tool not understand the true potential that this represents for their business.
- It is recommended for further study, the research depth (Enterprise Edition Oracle Business Intelligence OBIEE 11g) OBIEE tool as it is a very powerful tool and has powerful components for business intelligence solutions.

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## Mauricio Rea



I was born in the city of Otavalo in 1976. Do my initial studies in this city at the school Aug. 10 and at the Colegio San Luis. His superiors studies conducted in the city of Ibarra at the Technical University of the North (Computer Systems Engineering) and the Pontifical Catholic University of Ecuador (Master in Computer Management). Linked to major companies in the public and private sector as a Systems Analyst, Software Architect and Project Management Technology. He bears his profession University Teaching for several years at the Technical University of the North, supporting the educational process in the Race Computer Systems Engineering.



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