Inteligencia de negocios + comercio electrónico = PYMES eficaces

Business intelligence + e-commerce = effective SMEs

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Resumen

El presente artículo es una investigación con una propuesta de solución a la problemática que afecta a las PYMES (pequeñas y medianas empresas) de Colima, relacionada con los sistemas transaccionales que utilizan para la administración de sus operaciones, los cuales generan y almacenan datos diariamente. En 2012, en Colima la Secretaría de Fomento Económico (SEFOME) implantó el proyecto "E-Mall CLQ, una Plataforma de Comercio Electrónico para las Pymes del Estado de Colima", cuyo objetivo principal era desarrollar 200 sitios de comercio electrónico para incrementar los canales de comercialización de los productos y/o servicios ofertados por las PYMES.

Lo anterior se realizó tomando en cuenta que las PYMES no disponen de los recursos suficientes para adquirir herramientas que les ayuden a transformar sus datos transaccionales en información y, posteriormente, en conocimiento. Con el presente

proyecto se pretende contribuir al procesamiento y análisis de los datos y mediante la arquitectura desarrollada hacer más eficiente la toma de decisiones.

Palabras clave: PYMES, Colima, comercio electrónico, inteligencia de negocios, toma de decisiones.

Abstract

This article is a research with a proposal for a solution to the problems affecting SMEs (small and medium-sized enterprises) in Colima, related to transactional systems used for the management of their operations, which generate and stored data daily. In 2012, in Colima the Secretariat of Economic Development (SEFOME) implemented the project "E-Mall CLQ, an Electronic Trading Platform for SMEs in the State of Colima", whose main objective was to develop 200 ecommerce sites to increase the channels of commercialization of the products and/or services offered by SMEs.

The foregoing was carried out taking into account that SMEs do not have sufficient resources to acquire tools that help transform your transactional data in information and, subsequently, knowledge. The present project aims to contribute to the processing and analysis of data and by means of the developed architecture make decision-making more efficient.

Key words: SMEs, Colima, e-commerce, business intelligence, decision-making.

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Introduction

The Institute of statistics and geography (INEGI) mentions that in Mexico there are more than 4 million businesses, of which 95% are SMEs. Of this percentage, 73% use the technologies of the information and only 10% carried out activities related to e-commerce (Moreda, 2013).

E-commerce is the process of purchase, sale or exchange of goods, services or information offered by suppliers in various parts of the world through communication networks. Such trade can be attractive due to the ease which provides for performing marketing (Comunicación, 2011), allowing even the smallest business to reach a global audience with your products or services at a minimal cost.

Currently, according to data collected by the Ministry of Economy, of every 100 new companies established in the country, and the CONDUSEF 65 disappear before their two years of existence on the market (Pentaho, 2015). A high percentage (43%) of SMEs in Mexico fail due to lack of access to information for decision-making in the administrative area (OECD, s.f.).

The data generated by the companies that make use of e-commerce structures remain only as a journalized system, taking into account have not sufficient resources for tools of business intelligence that will help them to improve the process of decision-making in the SMEs. Regardless of the size of any company, the ability to collect, analyze and act on data is the key to success, highlighting the importance of the management of the data generated by the transactions of electronic commerce.

Management and processing of data would help the creation of strategies and the improvement of the decision-making process. The main objective of this research is to design and develop a web platform based on business intelligence for the processing of databases originating from the business activities of electronic commerce in SMEs.

SMEs

In Mexico, the SMEs can be defined as "a type of company with a small number of workers (usually less than 900 employees), and whose turnover is moderate". According to statistics from INEGI, 98% of the companies are SMEs (Moreda, 2013), which have a very great importance in the development of countries.

SMEs, according to INEGI, commonly share the same general characteristics (INEGI, 2014). Below are some.

- They manage an empirical administration.
- The number of workers is always less than 900.
- They are always in process of growth; a small business is growing to medium and then to large.
- Mostly they are subcontracted to carry out services or a larger enterprise operations.
- There are business activities that are most beneficial when they are carried out by SMEs.
- They are usually generated by students or recently graduated, so the experience is usually minimal.
- Focus on individualized non-standardised products as large companies do.
- Those who run the company are often owners themselves.

Today, the environment that handle SMEs is very competitive since they use business models that help to improve and transcend these companies.

Business Model

There are many definitions of business model, some are along the lines of "a narrative of how the company works," others speak of activities and value chain, the most recent focus on elections or answers to key questions (Pentaho, 2015).

The essence of a successful business model is a logical design, covering every one of the limits of the company. A successful business model is one that ensures value creation for all stakeholders while maintaining the focus on the company (Pentaho, 2015).

A business model consists of a set of assets, activities and governance structure of the assets that seeks to build virtuous cycles, while weakening the competitors. The role of a business model is not only increase profits directly affecting the price, volume or cost through the virtuous cycle that generates, but also deteriorate and, if possible, to interrupt cycles of competitors (Diaz, 2012) . This underlies the importance of each SME has well identified its business model and differentiation with its competitors.

E-commerce

With the incorporation of new technologies in the business sector it created a new way to make transactions, known as e-commerce. This can be defined as the distribution, purchase, sale and marketing of any type of service or product.

According to Teresa Moreda (eCommerce, 2015), the concept of e-commerce not only includes the purchase and sale of electronic goods, information or services, but also the use of the network before or after sale activities.

From this we can realize that e-commerce is commercial or financial transactions carried out between companies, consumers or organizations through electronic communication infrastructure.

Business intelligence

The term business intelligence was coined by Gartner Group in the late eighties, describing it as the ability of members of a company to access information resident in a database and explore, so that the user can analyze that information and develop her theories and knowledge that will be essential for making certain decisions critical to business (Gálvez, 2015).

You can define business intelligence as "the continuous monitoring of environmental signals, especially those that allow anticipating a future situation, whether to react or act

purposefully against the mid- exercised by a set of capabilities that the company you must put in place, and understand as business intelligence "(Eisenmann, 2011).

Knowledge Management

Knowledge management brings together a number of techniques for the management, control and transmission of all information gathered, and so ensure that knowledge is not restricted to certain areas or people, or be forgotten, preventing may be given to use appropriate (Casadesus-Masanell, 2010).

Its implementation in the systems business intelligence helps us during handling and transport of information from a company and its subsequent use in decision-making.

Material and methods

For the project the Kimball methodology was used, which is divided into 4 main stages: results project planning, analysis, development and testing, and. See Figure 1.

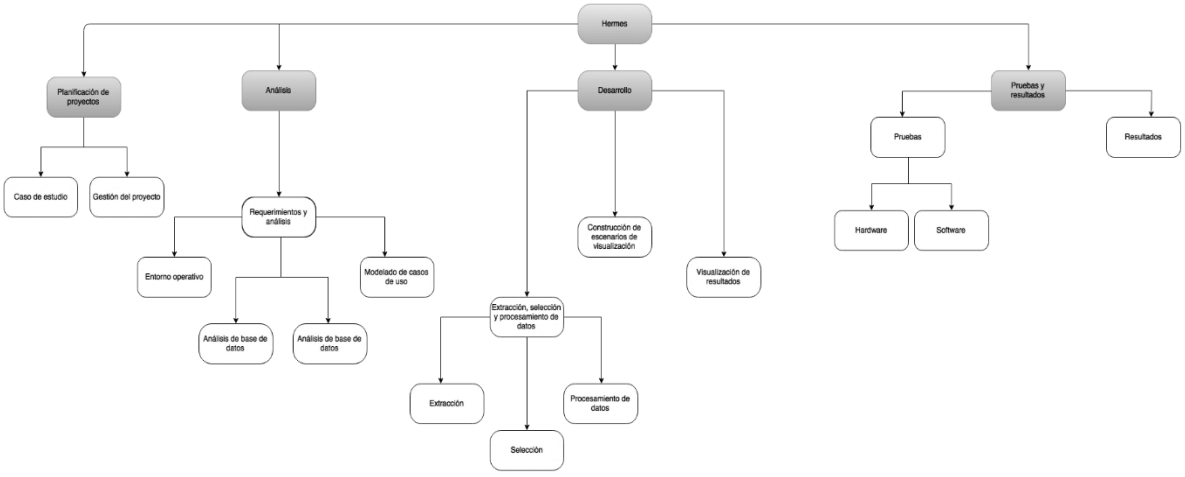

Figure 1. Stages of the methodology for the project.

In turn, the overall architecture of this project is divided into four areas, which are mentioned and briefly described below.

Project planning. At this stage it describes and analyzes the case study, later to achieve manage the project by making a planning of activities.

Project management

For the project the project "E-MALL CLQ an e-commerce platform for SMEs of the State of Colima," whose main purpose was to implement and make available 200 companies e-commerce sites will be taken as a basis, with in order to encourage the use of the Internet as a channel for marketing their goods and / or services. It was agreed to use the data generated from transactions in them, however, it declined to take any data that involved personal information about the owners, employees or customers.

From the analysis of the "E-MALL" project, 4 main stages for the project to be developed were identified, they were divided into sections and each was assigned modules. Hence the approximate time duration of each was determined. Table 1 shows the planning of activities related to the project.

Table 1. Planning stages

Etapa	Sección	Modulo	Horas
Planificación de proyectos	Caso de estudio	Caso de estudio	10
	Gestión del proyecto	Planeación de actividades	10
Análisis	Requerimientos y análisis	Entorno operativo	40
		Análisis de base de datos	60
		Modelado de casos de uso	40
		Resumen de las funcionalidades	20
Desarrollo	Extracción, selección y procesamiento de datos	Extracción	147
		Selección	133
		Procesamiento de datos	133
	Construcción de escenarios de visualización	Construcción de escenarios de visualización	116
	Visualización de resultados	Visualización de resultados	111
Pruebas y resultados	Pruebas	Hardware	50
		Software	70
	Resultados	Resultados	40
		Total	980

Analysis

At this stage the requirements of the operating environment, the database server, and application server, client, functional nonfunctional necessary for the development of the architecture are described. All of them are outlined below:

Operating environment. For each of the modules should consider the following requirements.

a) Requirements Database Server:

- Operating System: Windows Server 2008 64-bit Service Pack 2.
- BD Manager: SQL Server 2012 T-SQL language. Spanish version.

b) Requirements Server Aplicativos:

- FTP with its own user and password
- Operating System: Windows Server 2008
- Language: C # with Razor
- IDE: Microsoft Visual Studio 2012.3
- OpenXMLSDKv2
- Wget
- Libraries: jQuery, Highcharts, Bootstrap 3
- Framework: ASP, MVC 4.0, .NET
- BD Manager: SQL Server 2012 T-SQL language. Spanish version.
- Permit read / write in the Reports folder (to be found within the application directory). In this folder the files that are generated when system users perform their queries will be saved, so you should have enough space.
- User that accesses the server, data base BD_HERMES (read and execute permission procedures) and permission to install stored procedures and views.

- User that accesses server applications, read / write, to install the data base BD_HERMES.

c) Customer Requirements

PC with navigator Explorer 11+, Chrome, Firefox y conexión a internet.

d) Functional Requirements

Table 2 describes the functional requirements.

Table 2. Functional requirements

ID	Nombre	Descripción
RF1	Reportes	Se generarán reportes de acuerdo a determinados filtros o campos de consulta.
RF1.1	Reportes exportar	Permitirá generar el reporte en PDF mostrando los principales campos del acto.
RF1.2	Reportes gráficos	Podrá generar diferentes tipos de gráficas de acuerdo a campos específicos. Podrá descargar las gráficas en formato PDF, JPEG, PNG y SVG.

e) Non-functional requirements

Table 3 nonfunctional requirements described, which are shown below.

Table 3. Nonfunctional requirements

ID	Nombre	Descripción
NF1	Compatibilidad de navegadores	El sistema debe ser visible en los navegadores IE11, Google Chrome y Mozilla Firefox.
NF2	Confiabilidad	El sistema tendrá que estar en funcionamiento las 24 horas los 7 días de la semana.
NF3	Diseño de interfaz	El sistema presentará una interfaz de usuario sencilla para facilitar su manejo a los usuarios del sistema.
NF4	Documentación	Se entregará el código debidamente estructurado, de manera consistente y predecible.
NF5	Errores	El sistema deberá de contar con manejo de errores, los cuales deben estar en un lenguaje apropiado para la comprensión del ciudadano.
NF6	Responsivo	El sistema debe adaptarse a diferentes tamaños de pantallas, con una resolución mínima de 480 pixeles.

f) Users

Table 4 shows the internal and external users and their privileges are identified.

Table 4. User Roles

	Privilegios		
Rol	Importación de datos	Gráficas estadísticas	Reportes estadísticos
Empresario	X	X	X

g) Diagram of general architecture and layers

Then Figure 2 shows the overall architecture diagram and layers, which can identify the components involved in the system, the various component parts and their interaction.

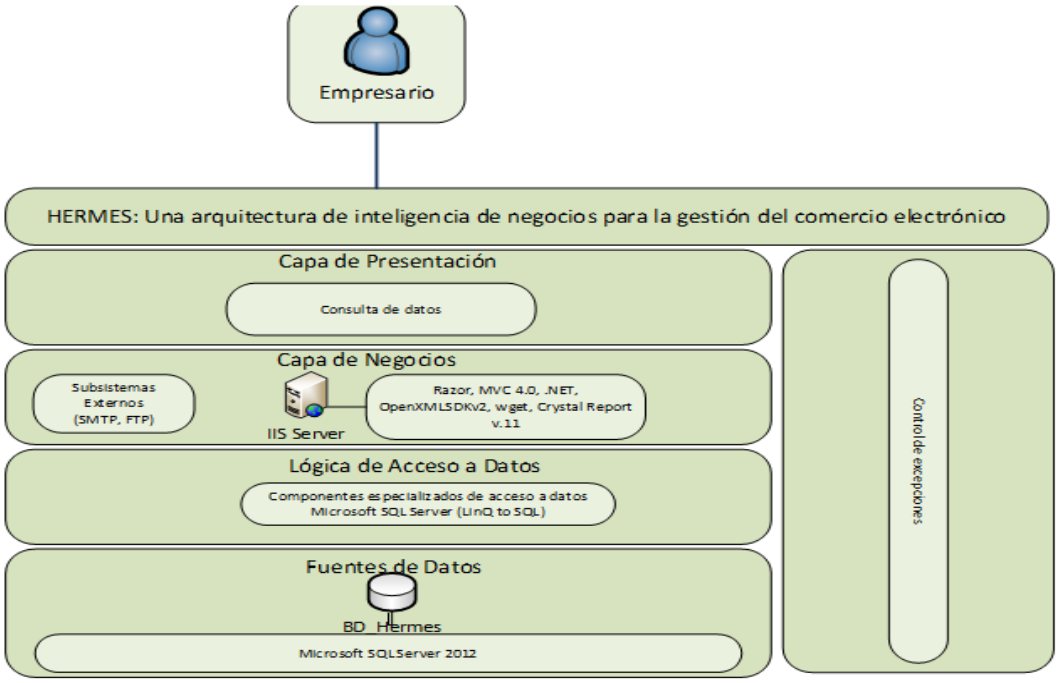

Figure 2. Diagram of general architecture and layers

h) Use Case Modeling

This section serves as a reference point for the design of business intelligence processes. These describe the system functionality and design the overall architecture. Table 5 you can see the actors involved.

Table 5. Actors involved in the system.

Actor	Descripción	Responsabilidad
Usuario final	Se encarga de ejecutar los procesos de inteligencia de negocios, analizar los datos generados y crear estrategias para la mejora en el proceso de toma de decisiones..	Ejecutar los procedimientos de inteligencia de negocios.

i) Use case diagram

Then Figure 3 shows the case of general use of the Hermes project, allowing us to obtain an overall description of the system and the actors involved.

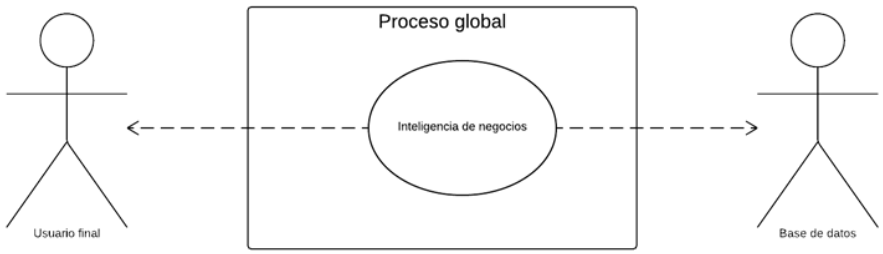

Figure 3. Global process

Once the project is known globally diagrams specific use for each area of architecture are presented. See Figure 4.

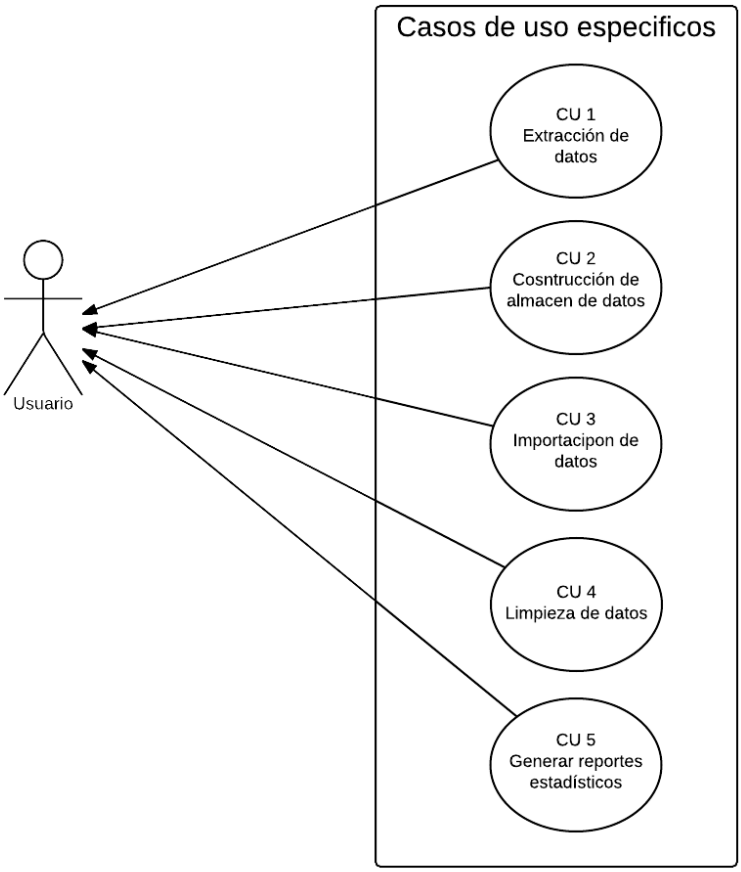

Figure 4. Specific use cases

Development

Extraction, selection and processing of data

During this stage the user must import the data from the following tables: Product, Stock_Avaliable, Carrier_Lang, Orders, Manufacturer, Category_Product, Product_Lang, Order_State_Lang and Order_Detail, Shop, Order_History. They must have a valid extension (.xls or .xlsx). Once the necessary files are obtained, it will start with the data extraction process and the file type is selected to be exported. See Figure 5.

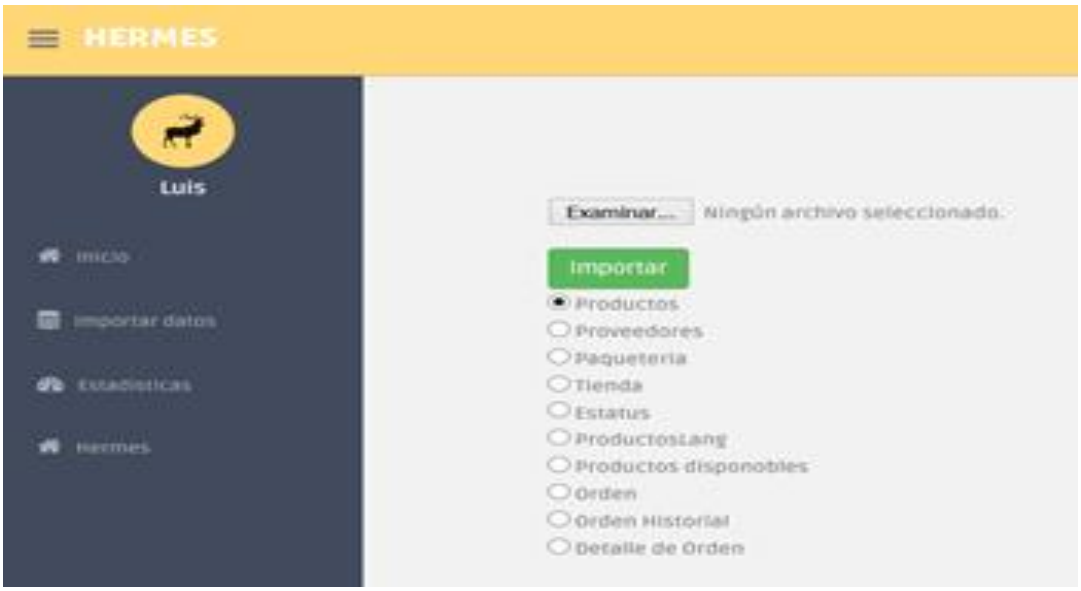

Figure 5. Data Import section

To achieve this process the "NPOI for .Net" tool is used, which is used to read and manipulate files in the Office tool. With this data in the Excel file are extracted; once achieved this goal data is processed. Figure 6 shows a section of code used for the development of this stage.

```
try
{
    Session.Add("celda", "");
    Session.Add("tipoDato", "");
    if (Request.Files["archivoExcel"].ContentLength > 0)
    {
        HttpPostedFileBase file = Request.Files["archivoExcel"];
        string extension = System.IO.Path.GetExtension(file.FileName);
        if (extension == ".xlsx" || extension == ".xls" )
        {
            var radioTipo = Request.Form["tipo"];
            byte tipo = Convert.ToByte(radioTipo);
            MemoryStream output = new MemoryStream();

            if (tipo == 1)
            {
                IWorkbook excel = ProcesarExcelProductos(GetByteArrFromFrile(file));
                excel.Write(output);
            }
```

```
private IWorkbook ProcesarExcelProductos(byte[] fileData)
{
    ClearErrorList();
    #region Variables
    IWorkbook excelBook = WorkbookFactory.Create(new MemoryStream(fileData));
    //ExcelProveedores datosExcel = new ExcelProveedores();
    UsuarioLogueado usuarioLog = Session["appUsuario"] as UsuarioLogueado;
    String nombreUsuario = usuarioLog.Usuario;
    int idUsuario = usuarioLog.ID_Usuario;
    #endregion
    ExcelProductos datosExcel = importacion.GetExcelProductos(excelBook);
    if (datosExcel.errores.Count() > 0)
    {
        SetListaErrores(datosExcel.errores);
        ThrowError();
    }
```

Figure 6. Code section part 1.

In the second step the step of cleaning and processing of data is initiated; They are extracted only the necessary data and stored in the model temporarily for cleaning and then start the validation stage. Figure 7 shows a portion of code used for performing this process.

```
setTipoDato("numérico");
Celda cell = GetCellValue((int)ExcelProductosEnum.id_product, currentRow);
Valor.ID_Producto = Convert.ToInt32(cell.value);
Valor.CeldaID_Producto = cell.cell;

cell = GetCellValue((int)ExcelProductosEnum.id_manufacturer, currentRow);
Valor.ID_Proveedor = Convert.ToInt32(cell.value);
Valor.CeldaID_Proveedor = cell.cell;

cell = GetCellValue((int)ExcelProductosEnum.id_category_default, currentRow);
Valor.ID_Categoria = Convert.ToInt32(cell.value);
Valor.CeldaID_Categoria = cell.cell;
```

```
ISheet currentSheet = excelBook.GetSheetAt(i);
if (currentSheet != null)
{
    int totalRowsAtSheet = currentSheet.LastRowNum;
    if (sheetName.ToLower().Contains("ps_product"))
    {
        #region Maestro de Tienda
        for (int j = 0; j < totalRowsAtSheet + 1; j++)
        {
            IRow currentRow = currentSheet.GetRow(j);
            if (currentRow != null)
            {
                int totalCellinRow = currentRow.LastCellNum;
                if (totalCellinRow >= 1)//Se asegura que existen al menos  1 columna con los datos
                {
                    Celda cell = GetCellValue(0, currentRow);
                    if (!String.IsNullOrEmpty(cell.value))
                    {
                        ProductosExcel Datos = GetProductos(currentRow);
                        if (Datos.ID_Producto > 0)
                        {

                            if (Datos.ID_Producto <= 0)
                                listaErrores.Add(String.Format("La clave del Producto  {0} de la celda {1} debe ser mayor a 0", Datos.ID_Producto,

                            if (Datos.ID_Tienda <= 0)
                                listaErrores.Add(String.Format("La clave de la Tienda  {0} de la celda {1} debe ser mayor a 0", Datos.ID_Tienda, (
```

Figure 7. Code section part 2

After completing the validation process, the data are inserted into the data warehouse. 8 shows a part of the code used during this process.

```
setTipoDato("numérico");
Celda cell = GetCellValue((int)ExcelProductosEnum.id_product, currentRow);
Valor.ID_Producto = Convert.ToInt32(cell.value);
Valor.CeldaID_Producto = cell.cell;

cell = GetCellValue((int)ExcelProductosEnum.id_manufacturer, currentRow);
Valor.ID_Proveedor = Convert.ToInt32(cell.value);
Valor.CeldaID_Proveedor = cell.cell;

cell = GetCellValue((int)ExcelProductosEnum.id_category_default, currentRow);
Valor.ID_Categoria = Convert.ToInt32(cell.value);
Valor.CeldaID_Categoria = cell.cell;
```

```
ISheet currentSheet = excelBook.GetSheetAt(i);
if (currentSheet != null)
{
   int totalRowsAtSheet = currentSheet.LastRowNum;
   if (sheetName.ToLower().Contains("ps_product"))
   {
      #region Maestro de Tienda
      for (int j = 0; j < totalRowsAtSheet + 1; j++)
      {
         IRow currentRow = currentSheet.GetRow(j);
         if (currentRow != null)
         {
            int totalCellinRow = currentRow.LastCellNum;
            if (totalCellinRow >= 1)//Se asegura que existen al menos  1 columna con los datos
            {
               Celda cell = GetCellValue(0, currentRow);
               if (!String.IsNullOrEmpty(cell.value))
               {
                  ProductosExcel Datos = GetProductos(currentRow);
                  if (Datos.ID_Producto > 0)
                  {

                     if (Datos.ID_Producto <= 0)
                        listaErrores.Add(String.Format("La clave del Producto  {0} de la celda {1} debe ser mayor a 0", Datos.ID_Producto,

                     if (Datos.ID_Tienda <= 0)
                        listaErrores.Add(String.Format("La clave de la Tienda  {0} de la celda {1} debe ser mayor a 0", Datos.ID_Tienda, (
```

Figure 8. Part code sections 3

If the insertion of data ends successfully recorded in a cell in Excel document the word "inserted successfully", as shown in Figure 7. If at any stage an error occurs, the system throws a pdf file by specifying the error.

4	4	0	1	0 75	0	2	Insertada con éxito
5	5	0	1	0 120	0	2	Insertada con éxito
6	6	0	1	0 25	0	2	Insertada con éxito
7	7	0	1	0 15	0	2	Insertada con éxito
8	2	1	1	0 30	0	2	Insertada con éxito
9	2	2	1	0 26	0	2	Insertada con éxito
10	2	3	1	0 30	0	2	Insertada con éxito
11	2	4	1	0 30	0	2	Insertada con éxito
12	3	5	1	0 100	0	2	Insertada con éxito
13	3	6	1	0 100	0	2	Insertada con éxito
14	3	7	1	0 100	0	2	Insertada con éxito
15	3	8	1	0 100	0	2	Insertada con éxito
16	5	9	1	0 40	0	2	Insertada con éxito
17	5	10	1	0 40	0	2	Insertada con éxito
18	5	11	1	0 40	0	2	Insertada con éxito
19	1	12	1	0 10	0	2	Insertada con éxito
20	1	13	1	0 10	0	2	Insertada con éxito
21	1	14	1	0 10	0	2	Insertada con éxito
22	1	15	1	0 10	0	2	Insertada con éxito
23	1	16	1	0 10	0	2	Insertada con éxito
24	1	17	1	0 10	0	2	Insertada con éxito
25	1	18	1	0 10	0	2	Insertada con éxito
26	1	19	1	0 10	0	2	Insertada con éxito
27	1	20	1	0 10	0	2	Insertada con éxito
28	1	21	1	0 10	0	2	Insertada con éxito
29	1	22	1	0 10	0	2	Insertada con éxito

Figure 9. File successfully inserted

Once data processing completed construction of viewing scenarios, which are analyzed with different ways of viewing that can be achieved with the data obtained develops. In our case the Morris.js and Highcharts tool with which different types of graphs are generated, resulting in a better user interaction and developing them simply and intuitively be used. See the examples of Figures 8 and 9.

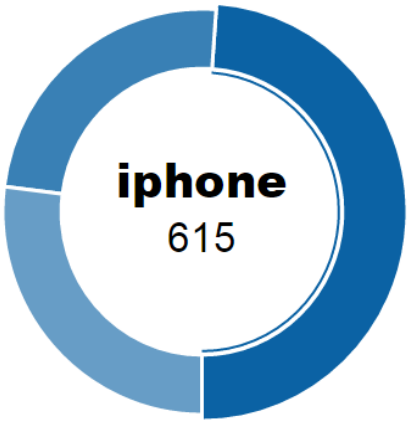

Figure 10. Example scenario display

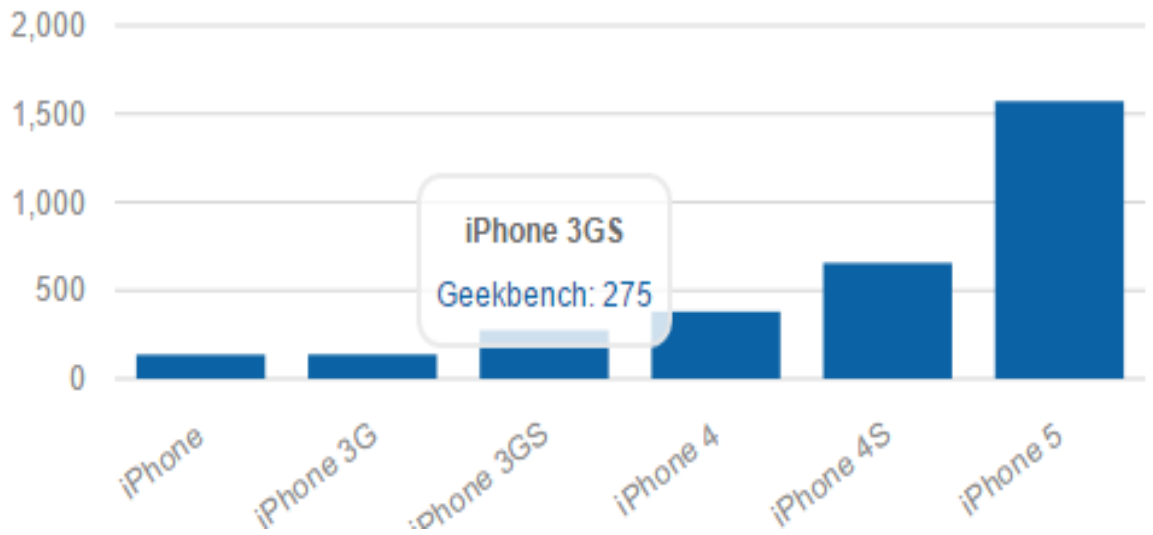

Figure 11. Example scenario display 2

There are more than 5 different ways to display the information. The analysis of the data produced by the software is important to select one that display information more effectively part.

1. **Tests and results.** This section discusses the various tests that were performed, which were intended to see how the project in the area of production. The test results are taken into account to make the necessary changes in both the code and the hardware.

Hardware. To test the performance of architecture computers DELL Vostro testing of different characteristics are made. See Table 6.

Table 6. Hardware tests

Equipo / Datos	100	500	750	1 000
Procesador Pentium 2 GB de RAM 120 GB disco duro	Funcional	Falla	Falla	Falla
Procesador Core I3 4 GB de RAM 500 GB disco duro	Funcional	Funcional	Funcional	Funcional
Procesador Core I5 4 GB de RAM 500 GB disco duro	Funcional	Funcional	Funcional	Funcional
Procesador Core I7 4 GB de RAM 500 GB disco duro	Funcional	Funcional	Funcional	Funcional
Procesador Core I7 8 GB de RAM 500 GB disco duro	Funcional	Funcional	Funcional	Funcional

With the above results it is concluded that the minimum requirements for optimal performance of the architecture are: I3 Core processor, 4 GB of RAM and 500 GB hard drive. For the following tests shall be based on the use of a computer with the aforementioned features.

Software. They automated with "Selenium", a set of tools for developing scripts for testing web applications in different languages like java, ruby, python, perl, php or .net tests were performed.

Scripts test cycles were performed, which were able to detect misspellings, validation and consistency, according to documents made.

From the detection of errors, these were resolved and a list was generated with the incidents detected throughout the whole process. All adjustments made to solve each of the problems identified were also recorded.

With respect to the main screen of architecture he worked on the design of different interfaces, concluding that the fund should be blue since this symbolizes confidence. The result of the interface shown in Figure 12.

Figure 12. Home Screen

The project was divided into two modules. The first module, data import, was performed by integrity testing and random data, presenting flaws in the program. To solve these problems new validations and errors detected functions were added.

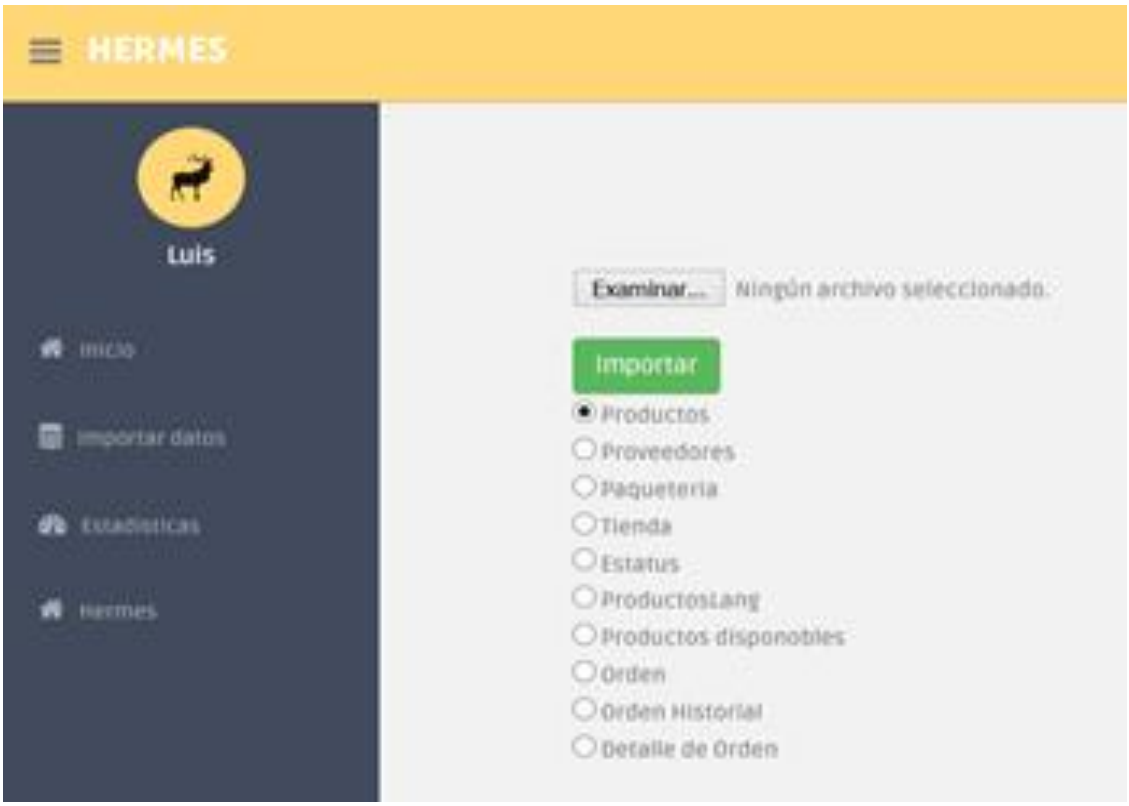

Figure 13. Import Data section

In the second module, reports and statistics, problems were detected in the ares export data to test them in different browsers (Firefox, Chrome and Internet explorer also known as "IE") as the tools used had some effects display , which they did not work in IE, therefore it was decided to change the visualization tool. This worked well in all browsers. 14 shows the result of statistics.

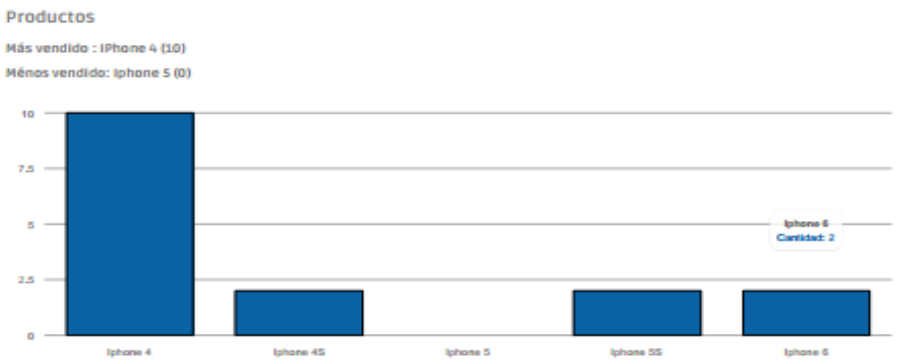

Figura 14. Exportación de datos

Conclusión

Based on the above it is concluded that the main objectives of the project were achieved, since a web platform which managed to apply the techniques of ETL for processing data originating from transactions of companies belonging to the project "developed E -MALL ". The implementation of new process technologies such as the HERMES project, can help optimize the decision-making process by strengthening the operation of SMEs in the State of Colima, in order to generate competitive and successful companies.

Efficiency in obtaining statistics helps analyze the results and to streamline decision-making. It also generates new administrative strategies.

Using this tool will generate positive changes within SMEs to be helpful in the process following companies to achieve success and profitability. The benefits of implementing this architecture business intelligence can be collected in the medium or long term, reflecting the competitive advantages derived from the optimal use of architecture and the knowledge generated.

SMEs business and society in general of the State of Colima will benefit by having a technology platform that, on the one hand, increases the commercial competitiveness of companies and, on the other hand, facilitates the analysis of business transactions from buyers.

Recommendations

To continue and improve this research is recommended that in the future the following points are developed:

- Add compatibility with other extensions in importing data, since this is only done through xls or xlsx files. This would help companies that do not use the currently valid extensions.
- Make compatible export statistics with XML and Excel files, as only done in PDF extension.
- Generate a Web service that interested users can use quickly and optimally.

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