

## **Application of Business Intelligence in the warehouse department as support to improve the planning, logistics and distribution of goods to educational institutions of the State of Mexico**

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### **Abstract**

The companies regard information as a valuable asset, this has significance once they make a meaningful and useful advantage out of the information, i.e. When you can consult information quickly, safely, at the time and in the format that is required, so that the person who is responsible for decision making in the organization will avoid uncertainty and intuition, and surely will take better and informed determinations, for this purpose many organizations have resorted to the use of business intelligence. Business Intelligence assists on having a better understanding of the organization, improving the decision-making process, facilitates the way to access and share information, helps identifying 'junk' in information systems and enables analysis in real time. In regards to the Department Store, the lack of information of this type, does not allow the sufficient support in order to plan define the logistics and distribution of goods to the Agency (administrative units and schools) in an informed manner, which results in the bad distribution and misuse of resources, this problematic takes greater importance in the context of the Educational Reform where one of the important principles is to improve the physical, material and pedagogical conditions in schools.

### **Business Intelligence, Decision Making, Information Systems, Management of Projects**

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## Introduction

Have a general knowledge of the organization, know the financial situation, visualize the degree of progress of established programs and goals, detect opportunities, analyze trends, propose future scenarios, among other aspects, have become a necessity of the company, obtain this Information at the time and in the business language that is required is paramount for the decision-making process and even more in a highly competitive environment framed by the globalization of the market. This is the environment of Business Intelligence (BI).

Curto Díaz, Conesa Caralt (2010) define Business Intelligence as the set of methodologies, applications, practices and capabilities focused on the creation and administration of information that allows better decisions to the users of an organization. This research focuses on the use of Business Intelligence (BI) in public administration, the Directorate of Material and Financial Resources (DRMyF) has been chosen as the organization object of study. The intention of this investigation is to propose a project of Business Intelligence in the DRMyF, developing the case of the Warehouse Department.

## Justification

The central theme of this research work is the application of Business Intelligence in public administration, particularly in the DRMyF, it is important to mention that various IT projects have been developed in the organization under study, which have allowed to know the processes DRMyF substantives as well as the development environments used in the existing Information Systems, which motivates to propose the development of a Business Intelligence project (focusing on the Warehouse Department) as an adequate and viable alternative to support for the decision-making process.

With regard to the Warehouse Department, to be able to consult information that serves as a support to plan the logistics and distribution of the goods to the agency (administrative units and schools), will directly impact on the equitable use of resources, provide the necessary goods to use in the school year (chairs, tables, desks, blackboards, personal computers, printers, stationery, etc.) as well as material for maintenance (cleaning material, waterproofing, paint, etc.).

It is significant to note that the approval of a BI project depends on the formal justification of the project, which is why the administration of projects is used in order to present a project plan that identifies the requirements; address the diverse needs, concerns and expectations of stakeholders, maintain an active communication with stakeholders, in addition to contemplate the management of scope, quality, activities to be carried out, budget, resources and risks.

In relation to the BI project in the DRMyF it is appropriate to mention that there are some factors that favor the realization of the project, such as:

The technological platform and the Information Technology personnel required for the development of the project will be provided by the Information Unit, which is represented by the Department of Information Technology and Telecommunications (DIT).

The DRMyF and the DIT are located in the same line of Directorates that depend on the Coordination of Material and Financial Resources. For years, ICT services have been provided and various IT projects have been developed, which has fostered an appropriate and collaborative working relationship.

The cost of a project has always been a decisive factor in determining its viability, because it involves making an investment in financial, material, human and technological resources, in relation to the cost of the BI project is included in the allocation of financial resources and authorized personnel in the budget for fiscal year 2017, that is, no additional expense would have to be incurred in the purchase of equipment, software, personnel hiring or training for the development of the project.

### Problem

A decentralized public body whose institutional objective is to offer basic and normal quality education throughout the entity, with the mission of covering the educational needs at its different levels, from initial, preschool, primary and secondary education to upper secondary education and superior.

The Warehouse Department depends on the Subdirectorate of Material Resources and Services, which in turn is part of the Directorate of Material and Financial Resources (DRMyF), and is the administrative unit in charge of controlling the entry and exit of real estate they enter the warehouse in addition to being the area responsible for the logistics and distribution of the goods to the agency (administrative units and schools).

Through the development of Information Systems (IS), it has been possible to automate important and substantive processes in the different areas of the organization, which has been decisive to offer goods and services of better quality, as is the case of the Warehouse Department.

At the operational level, the DRMyF's SI have fulfilled their purpose, but when it is necessary to consult information that serves as support for decision-making at the managerial level, it simply can not be obtained immediately or in the business language that is needed. . The problem lies in the fact that the information generated from the ISs is not used in a useful and meaningful way by means of an IT alternative, such as Business Intelligence (BI), which allows consulting information (historical, ordered, classified, purified and grouped) that serves as a support for the decision-making process, which causes misinformed decisions, based on intuition and uncertainty. Regarding the Warehouse Department, the lack of information of this kind, does not allow planning and defining the logistics and distribution of goods to the agency (administrative units and schools) in an informed manner, which has an impact on poor distribution and inadequate use of resources. The negative impact of this problem represents:

- Not having the necessary goods to use in the school year (chairs, tables, desks, blackboards, personal computers, printers, stationery, etc.).
- Lack of maintenance material in schools (cleaning material, waterproofing, paint)
- Consequently, it means (in the cases that correspond) to have facilities in inadequate conditions for the correct teaching of classes in the schools.

This problem also impacts on the administrative units that share information with the Warehouse Department (Acquisitions, Budget, Accounting, Treasury and Inventories) because the decision makers in these areas need to consult information that is not available and require other means to obtain it.

## Research Questions

Why is it important to analyze the technological infrastructure and human capital to implement a Business Intelligence project in the Directorate of Material and Financial Resources?

What are the Business Intelligence tools that could be used in the web application of the BI project in the DRMyF?

In what way does the use of Business Intelligence generate a benefit in the DRMyF?

## Objectives

### General objectives

Design a Business Intelligence project for the Directorate of Material and Financial Resources. Analyzing the case of the Warehouse Department, in order to obtain information that serves as support for the decision-making process.

### Specific objectives

- Analyze the technological infrastructure and human capital for the development of the Business Intelligence project.
- Determine the information that is required to consult to develop the Business Intelligence tools that will integrate the WEB application.
- Formalize the proposal through the BI project plan based on the Guide to the Fundamentals for Project Management (PMBOK Guide).

## Theoretical framework

Only the concept of system has been the subject of multiple studies, with different approaches and points of view, in our days it is common to have a relationship with some type of system consciously or unconsciously, that is part of it or that is interact with some, so it is not surprising that research continue to be conducted and new trends are developed on this concept, Bunge (2012, p.325) comments that there are no isolated things: that everything interacts with other things, in such a way that all things concur and form systems (a world of systems), also establishes as a foundation that everything is a system or a component of a system. Under this approach it is interesting and fascinating at the same time to study the principles applicable to systems in all fields of research that make up the General Systems Theory. In the first instance it is pertinent to conceptualize what a system is, Skyttner (2005, p.58) refers to a definition expressed by Russell Ackoff, which determines that a system is a set of two or more elements that satisfy the following conditions:

1. The behavior of each element has an effect on the behavior of the whole
2. The behavior of the elements and their effects on the whole are interdependent.
3. The subgroups of the elements formed, have an effect on the behavior of the set, but none has an independent effect on it.

## Warehouse Department

Its objective is to organize, operate, evaluate and control the actions of reception, storage, conservation and supply of the acquired goods, with the purpose of keeping them in optimal conditions of use and provided to the administrative units, for the development of their assigned functions, in accordance with current regulations on the subject.

## Functions

Plan, operate, manage and control the reception, storage, conservation and supply of the acquired goods, and provide them to the administrative units of the agency in optimal conditions of use.

Prepare and submit to the Subdirectorate of Material Resources and Services for authorization, the program for the physical inventory survey of the warehouse, verifying that it complies with the current regulations in the matter.

Propose and operate the mechanisms of an administrative nature, which allow it to improve and control the reception, storage, conservation and supply of materials to the administrative units.

Supply the goods and materials to the administrative units of the agency, based on the supply requests that they send.

Apply and keep updated the records for the inventory control system, regarding the inputs and outputs of warehouse materials.

Perform the physical inventory survey of existing goods in the agency's warehouses, in accordance with the previously authorized program and other applicable regulations.

Prepare and present to the Subdirectorate of Material Resources and Services, the reports and reports regarding the storage and supply of goods, and propose the mechanisms that allow improving their administration.

Prepare and send to the Accounting Department, for registration, the reports of inputs and outputs of warehouse.

## Research Methodology

This research begins with the concern to suggest the use of Business Intelligence BI in public administration, with the purpose of offering an alternative that serves as a support for decision making. Derived from the participation in the development of various computer projects in the organization under study for 25 years, it has been possible to detect problems and visualize areas of opportunity in the different administrative units, which have allowed enriching and shaping this research project.

By the means to use to obtain the data, it is a mixed investigation, because it works with secondary information sources (documentary research) and primary sources of information (field research), relying on data collection tools such as interviews, Work meetings and observation.

For the control and manipulation of the variables is a non-experimental investigation, the phenomenon is observed as it occurs in the natural context, to later analyze it.

For the period in which the research is carried out (May 2016 to December 2016), it is of a transversal nature.

Hernández Sampieri et al. (2014) indicates that by scope, the research may be: exploratory, descriptive and explanatory. Regarding this study, it is exploratory: because it addresses the issue of business intelligence in public administration; usually business intelligence is associated with private companies, so there have been few investigations in this regard, descriptive: the decision-making process is analyzed in the Directorate of Material and Financial Resources, taking as reference the case of the Warehouse Department.

## Type of Research

Because of the scope, the research is exploratory: because it addresses the issue of business intelligence in public administration; usually business intelligence is associated with private companies, so there have been few investigations in this regard, descriptive: the decision-making process is analyzed in the Directorate of Material and Financial Resources, taking as reference the case of the Warehouse Department .

The population selected for the development of this research is the Directorate of Material and Financial Resources.

With respect to the sample of the selected population, it is represented by those responsible for the following administrative units:

- Warehouse Department Headquarters
- Subdirección de Recursos Materiales y Servicios
- Directorate of Material and Financial Resources

The measurement instrument that is used in the development of research for the collection of information are interviews, in their types (semi-structured and open). The participants and the points to be discussed are mentioned below:

Owner of the Warehouse Department.

Head of the Subdirectorate of Material Resources and Services.

Owner of the Directorate of Material and Financial Resources.

Staff of the Systems Development Department.

*Open interview*

*Decision making*

*Decision-making process*

*Information to be considered in a general manner, to serve as a support for the decision-making process (Information from the Department of*

*Warehouse)*

*Information sources*

*Historic information*

*Level of detail of the information*

*Business Intelligence (BI)*

*Knowledge of Business Intelligence*

*Use of Business Intelligence*

*Semi-structured interview*

*Decision making*

*Decision-making process*

*Design of the departmental database (Data Mart DM) of the*

*Warehouse Department (Department Information)*

*Identify key department information*

*Analyze information*

*Information to load in the Data Mart (DM)*

*Format to use to show the information*

*Business Intelligence (BI)*

*BI tools*

*Design of Executive Boards, operational, with use of different types of graphics (Dispersion, Histograms, Pareto).*

### *Preset reports.*

### **Proposal**

Companies need information to understand their operations, have knowledge of their customers, competitors, suppliers, partners, shareholders and employees. They need to learn about what happens in the organization, analyze their operations, have the capacity to respond to internal and external pressures and make decisions that help manage costs, increase revenues and increase sales and profits.

The application of BI in public administration has a different use perspective, focuses on supporting the decision-making process, which allows to follow up the strategic plans of the organization and finally achieve the institutional objectives, which are reflected in offering better goods and services.

Under this context, the proposal for the use of Business Intelligence is made as an excellent option to support the decision process in the organization under study, because it would have a better knowledge of the company, decisions based on Intuition and uncertainty and you could consult information that is safe, understandable and in the moment that is required.

Once the existing BI alternatives for the acquisition, contracting or development of BI products have been analyzed, the own development of the BI Tools that integrate the WEB application as part of the BI project in the DRMyF in the Department was opted for. of Warehouse, derived from the research carried out in the organization under study, it was determined that there is sufficient technological infrastructure and human resources for the development of the project, in addition to a specialized IT area, represented by the Department of Information Technology and Telecommunications .

The business intelligence project at the DRMyF is based on the BI environment proposed by Laudon et al. (2012) and considers the following elements:

Elements of the Business environment	Type of element considered by Laudon et al. (2012)	Elements to consider in the BI project in the DRMyF
Intelligence	Call centers Website Mobile devices Blogs Shops Suppliers Government employees	Warehouse Department Information System
1 Business environment data	Databases Data warehouses Data Market	Data Market
2 Business intelligence infrastructure	Statistical models Data mining OLAP Production Reports	Identify the information required to develop the BI tools
3 Business analysis toolset	Business strategy Performance Management Integral Scorecard Forecasts	Reference to the SI of Performance Management Regulations applied to the administrative units involved
4 Users and management methods	MIS DSS ESS	Web Application
5 Platforms	Reports Control boards Command Pictures Desk Mobile Web Portal Social media	Reports Control boards WEB application accessed by PC and mobile devices

**Table 1** Elements of the BI environment, elements in the BI project. Own elaboration based on diagram in Laudon et al. (2012, p.464)

With regard to the information needs resulting from the interviews held with the owners of the administrative units involved in the project, the required BI tools were proposed.

The proposal of the Business Intelligence project, includes as a final result the development of a WEB application that integrates the required BI tools, which can be executed by any computer or mobile device connected to the corporate network or the internet, to consult information of a graphic and summarized way, in a simple language, that serves as support for the decision-making process.

## Results

In relation to the research carried out in the organization under study, it was concluded that the use of BI Business Intelligence represents an important alternative to obtain meaningful information that will support the decision-making process and focus its efforts, knowledge and experience to achieve the institutional objectives, which are ultimately reflected in offering better goods and services.

With the intention of directing the present study, the following considerations were obtained:

- It is important to analyze the technological infrastructure and human capital that is required for the implementation of the BI project in DRMyF because it allows knowing the elements of the Business Intelligence environment that interact with the organization so that it can be decided which integrates the Intelligence project of business.

- Analyzing these aspects is fundamental for managing the integration of the project to develop the business intelligence project plan in the Directorate of Material and Financial Resources.
- It was detected that the middle and upper management of the DRMyF interviewed require consulting information from the Warehouse System that can not be obtained immediately, which could serve as support for the decision-making process in their respective fields.

The Project of Business Intelligence Project in the Directorate of Material and Financial Resources. (Case Warehouse Department), considers the management of the following areas of knowledge according to the PMBOK guide:

- Project Integration Management.
- Project Information (Context and Analysis).
- Project scope management.
- Constitutive act of the project, Work Breakdown Structure (WBS).
- Management of the stakeholders of the Project.
- Identification of Interested.
- Management of Project Human Resources.
- RACI matrix.
- Management of Project Communications.
- Communications Matrix
- Project Time Management.



- Activity Schedule, Critical Route, Gantt Chart.
- Management of Project Costs.
- Estimation of Costs.
- Quality Management and Project Risks.
- Quality Plan and Risk Planning.
- Project closure
- Closure Acceptance Form.

### **Context for the development of the WEB application (BI Business Intelligence Tools)**

A decentralized public organization whose institutional objective is to offer basic and normal quality education throughout the entity, with the mission of meeting the educational needs at its different levels, from initial, preschool, primary and secondary education to upper secondary education and higher.

The department of Warehouse depends on the Subdirección of Material Resources and Services, that in turn forms part of the Direction of Material and Financial Resources (DRMyF), and is the area in charge of the control of the entrances and exits of the real estate that enter to the warehouse in addition to being responsible for the logistics and distribution of goods to the agency (administrative units and schools).

Through the development of Information Systems (IS), important and substantive processes have been automated in the different areas of the organization, which has been decisive to offer goods and services of better quality, as is the case of the Warehouse Department.

At the operational level, the DRMyF's SI have fulfilled their purpose, but when it is necessary to consult information that serves as support for decision-making at the managerial

level, it simply can not be obtained immediately or in the business language that is needed. . The problem lies in the fact that Business Intelligence (BI) is not used to consult information (historical, ordered, classified, purified and grouped) that the Information Systems (SI) generate, therefore, in many cases they take Misinformed decisions, based on intuition and uncertainty. Regarding the Warehouse Department, the lack of information of this type, does not allow planning and defining the logistics and distribution of goods to the agency (administrative units and schools), which affects the maldistribution and use of resources. The negative impact of this problem represents:

Not having the necessary goods to use in the school year (chairs, tables, desks, blackboards, personal computers, printers, stationery, etc.).

Lack of material for maintenance in schools (cleaning material, waterproofing, painting).

Consequently, it means (in the cases that correspond) to have facilities in inadequate conditions for the correct teaching of classes in the schools.

With the present Analysis, we intend to make the proposal for the development of the WEB application (BI Tools) as part of the Business Intelligence project in the Materials and Financial Resources Division (case Warehouse Department).

### **Critical Success Factors (FCE)**

With respect to the development of the WEB application (BI Tools) as part of the Business Intelligence project in the Department of Warehouse Materials and Financial Resources, the FCEs are mentioned below:

- It has the support of the Directorate of Material and Financial Resources.

- Sufficient human capital to develop the Business Intelligence project.
- Technological Infrastructure suitable for the development in WEB environment.

(Servers, Internet connection, and the corporate network).

- Trained staff.
- Computer equipment suitable for the WEB environment.
- Design and proper construction of the Data Warehouse.
- Continuity of the project in case of a change of administration

## Conclusions

Based on the research carried out, it was detected that the middle and upper management of the DRMyF interviewed required to consult information from the Warehouse System that can not be obtained immediately, which could serve as support for the decision-making process in their respective areas.

Using the information generated by the Warehouse System, in a useful and meaningful way through the use of Business Intelligence (BI), represents an added value to the use of the System.

The benefits that would be obtained with the use of Business Intelligence, in the first instance represent consulting information of the Warehouse System that can not be obtained immediately, that serves as a support to plan the logistics and distribution of the goods to the agency (units administrative and schools), which could translate into allocate resources in an equitable manner and where they are really required, providing the necessary goods to schools, and thus have facilities in suitable conditions for teaching classes.

It is significant to mention that having the possibility of consulting this type of information could make the decision to supply materials and furniture to the schools that require it in the short term, according to the inventory reported by the Warehouse Department.

The implementation of the Business Intelligence (BI) project in the Warehouse Department, contemplates the development of a WEB application, which will be integrated by the following BI tools:

- A control panel integrated by reports and graphics, with the option to carry out specific searches.
- Detailed views of the information consulted, drill down.
- Forecasts using standard statistical tools.

Developing a Business Intelligence project is a feasible and adequate alternative according to the study carried out. It has the technological infrastructure, sufficient human and financial resources, it was determined that the BI Business Intelligence project in the DRMyF is viable, there is no additional cost for its realization because the ITL, as IT responsible area, has the ability to develop the BI tools that will integrate the WEB application.

The BI project has an inclusive philosophy in the sense that it considers the use of other BI tools that could be acquired or developed in future stages, in order to make a more robust project.

It is significant to mention that the true potential of the use of Business Intelligence in the DRMyF, will be able to be shown when it is possible to integrate the information of the existing IS in the Data Warehouse of the Management.

It is important to point out that the present investigation proposes the use of Business Intelligence (BI) to respond to the problems posed, however it is not the only option because there are other alternatives that could be useful for the support of decision making.

One factor identified as a major threat to the acceptance of the project is corruption, it is well known that the lack of credibility and honesty of some middle and top managers in public positions could hinder the implementation of BI projects, because it could be consult historical information that you do not want to disclose, but it is also true that you should start using BI Business Intelligence to give clarity to government efforts, in order to improve the goods and services offered, in turn to exercise the assigned resources efficiently and transparently.

The implementation of the BI project aims to be a trigger for its use in other areas. It also aims to be a reference guide for the implementation of BI projects in public organizations.

Finally, it is important to indicate that this study is only a starting point and that there is the possibility of continuing with more in-depth research that contributes ideas, concepts and improvements to this project.

### Recommendations

It is important to involve all the participants in the project, clearly communicating the purpose and purpose of the BI project in DRMyF, so that it can work in a coordinated manner according to the assigned activities in each phase of the project.

The support and participation of the sponsors is fundamental, because the authorization and allocation of resources depend on them, so it is crucial to keep them informed of the activities that are being carried out according to the established communication matrix, in order to achieve a commitment to the project from its initiation to the conclusion.

The project plan in the Warehouse Department is a document that establishes the initiation and planning criteria for the project in a simple and understandable way, so only aspects applicable in the present study, taken from the guide of the Fundamentals for Project Management (PMBOK), with the aim of providing clarity and formality to the proposed result of the research carried out.

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