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Using Databases in Decisions Systems for Businesses

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Abstract: The paper presents the usage of databases that store business data into a warehouse star model that permits to create queries using SQL language and business intelligence tools. This kind of model allow to the decision maker to create complex reports and graphs based on the columns from the dimension tables and measures from fact tables, that can be the base for creating alternatives and scenarious acording to the economical indicators. Building alternatives and scenarious is an elaborate task and must have a background in existing data structured in databases that have a special structure of dimensions and fact tables. This data warehouse star model allow complex analyses such as rollup, drill down, slice and dice through the dimensions and fact tables by using special tools such as online analythical processes and complex queries based on views and snapshots. To create simulation envolves changing strategic economical indicators and keeping restrains on others so they reflect reality and the business environment. The business environments require analyses on large amount of data, big data and necessitate advanced tools to query through numerous criterias and also to create different realistic scenarious that allow choosing one option, so the business manager can use the right tool to gain economic advantage.

Keywords: Business Intelligence Tools, Datawarehouse Star Model, SQL Queries and Reports,
System Support Decisions, Analytical Tools and Management Decision

1. Introduction

Objectives of decision-making process aimed at adopting the best solution from many possible alternatives. The optimal solution or satisfactory is obtained using either algorithms or formulas within optimization models, either by experiencing various possible alternatives in a process simulation.

Optimizing the use of a certain class of models for finding the best solutions. For each class there are methods to solve specific, are selected depending on the number of low or very high number of alternatives, the availability of statistical formulas or methods. Among the methods most commonly used are decision analysis and mathematical programming [1, 2].

Decision analysis applies to situations which have a relatively small number of alternative solutions. Each alternative are attached estimates and probabilities of achievement. Solving the problem is to build decision tables or decision trees, from which it selects the best alternative. Tabelelele decision highlights a possible alternative schematic characteristic information. Decision trees, in addition to decision tables, chart highlights the relationship between the variables of the problem, making it possible representation of complex situations.

Apply mathematical programming problems which lead to the formalization of a mathematical relationship between decision variables and purpose. In addition to the measurable value of which is seeking optimum value, the model states and restrictions on them. The simulation, conducted testing process is carried out using computers on a defined pattern [2, 6]. It is used in complex systems, where it is difficult or impossible to predict beforehand structural and functional changes, or various influences from the environment. It is the only method that can be applied to unstructured problems.

Among the advantages are:

- support the simulation model provides a functional form of expression of the links between the phenomena studied. Such testing may be actions that can be made explicit in the framework model;
- enable better decision-making structure problem,

allowing exploration of information flows and operational procedures without interfering with the actual operation of the system;

- using cybernetic control system, which underlies decision making in practice;
- There are a large number of parcel simulation program.
- simulation models have a procedural nature, their solution involving the processing of experiments created within the system.
- data model can be used in the construction of real observations (numerical values) or knowledge.
- These are translated into algorithms which are executed by a computer system. This led to consideration of simulation as one of the most powerful tools in decision making. Simulation becomes a technical coordination of procedures using the computer. Limits of simulation include:
- support of simulation model is simplified, built pursuing one goal, one key criterion. The solution offered is one spot that has no counterpart in the real system.
- always taking into account the unique factors of a problem specific results can not be transferred to other issues;
- results are difficult to interpret, being dependent on random factors; no matter how powerful your computer is, the optimal solution is difficult to obtain a model that has many equations and a significant number of parameters.

These limitations have led to the use of simulation only when the interactions between components of the system are complex, when factors random have a significant and requires a large number of observations on the behavior data, the problem can not be solved by an algorithm or experiments direct. For issues which were not can directly apply optimization methods, the optimum results from different experiments possible alternatives. Tested values of different variables and decision highlights the consequences of decisions on the result of values [1, 3]. The simulation can be conventionally divided into the following steps:

- the problem and research purpose;
- model development and data collection system;
- model verification and validation;
- describing experiments on the computer;
- simulation execution and achieving results;
- analyze the simulation results.

2. Decision Support Systems Based on Data Structured in Databases

In order to build models, the decision is based on information provided far more comprehensive than reports and other economic indicators required or provided by the business itself. Quantitative mathematical models are embedded in base models, managed by subsystem a management model that requires separate users from the physical aspects of data processing and storage that extract, create, delete and modify models.

Decision making process, conducted with the help of tools, methods and techniques, conduct to the scenarios constructed according to a definite objective. Interaction replaces classical execution, procedural, with a performance conducted by decider according to the stages of solving a problem decisions that necessitate different inputs. The activity of the coordinations of inputs is done in most cases with specialized software systems that create analytical databases or modeling languages. In the first case, the user is provided customized views of data stored by performing a diverse set of operations on transactional data.

To build specifications the optimal approach is based on the analysis of data to extract information from data and obtaining knowledge for decision making. To be more precise, a specific problem highlighted in a model is called one of the most used tools in the decision making simulation. The next logical of optimization and forecasting, simulation assists with the running complex patterns, resulting variables whose analysis highlights the value adopated lead to a decision. The outputs from the process of decision making, represented by analytical indicators reflecting the performance of the system analyzed variables results the evaluation criteria or implementation plans of the decisions [2, 3].

Evaluation of search results depends on the method of presenting results and depends on the facilities of component dialog with users that provide inputs. Besides maintaining traditional information representation formats like charts, maps and diagrams used currently to represent multidimensional data there are used new types of dynamic graphs. The decident system uses a dialog interface with the key users of the company, enabling connectivity and communication between networks with different topologies and areas.

After analyzing the results achieved and the objectives of their reporting, signaled differences and after identify problems it was reveal the need to take action. Trying to solve them in a particular category determined tackling by a standard method employment. The information is selected factors that have caused the deviation from the desired result and appreciate the importance they have in context. In complex cases, the problem breaks down into sub-problems more manageable, easier structured. Solving the result of communication between all stakeholders, sharing the general manager responsibilities both at decision-making levels and the corresponding subproblems defined. The result of the information stage is a formal description of the problem identified the category to which it belongs and responsibilities involved.

For example, after the first phase, the scope may relate to excessive spending decisions of a functional department, inventories too high or adoption of a draft research and

evaluation on the introduction of computers [3, 4].

In the model design phase defines a model for decision shall be tested and validated under real system. Modeling takes expression of reality by means of abstract entities possessing quantitative and qualitative attributes. Based on patterns defined by an efficient simulation can generate alternatives. Intuition, creativity and experience allow decision-makers compare alternatives; predict outcomes of each alternative separately.

For choosing the solution which takes the results of the previous stages, the action is chosen according to the criterion of selection and decision-making model. From model design and solution choice there is a strict demarcation, certain activities may be conducted during both phases, and return of election phase in phase. After the final resolution of the model, select the best alternative is chosen implementation plan. The choice of solution is closely linked to proper evaluation of the results of said solution. The assessment in turn depends on the search method.

Structural problems use mathematical formulas and analytical method to achieve an optimum solution. In order to improve efficiency the best solution search algorithms are used. When the number of alternatives is too large, then testing some or all of the possible solutions is possible by using an incremental search method. Time and memory space limit searches, in most situations the decision maker stopping at the best of the tested solution to a certain moment. For complex problems, solving is carried progressing from one situation to another, until a final statement, which is the solution. Methods called heuristics, based on a thorough analysis of the issue. Basically successive tests are performed, the search progressing from a solution to another.

Implementation is the phase that involves the integration model chosen solution in context and simulating the real system. Issues raised by the communication solution, accepting the decision or the additional costs of implementation are sluggish, and the decision-maker plays the important role of mediator.

Assisting decision states that the decision is the responsibility of the user. It receives relevant and substantiated elements on activity in the real system and builds models for solving future decision making on the basis of current assessments.Of the foregoing that a decision support system provides a filtering of information provided to decision makers and indicates certain restrictions. Basically, it helps the decision maker during operation and defining the problem, generating satisfactory solutions and retention strategy. The role of a decision support system is to automate the decision making process manager, but rather to assist and develop the capacity of its intuitive, helping him to react as quickly and with greater efficiency [1, 5].

The architecture of a system aimed at its components and how they interact, types and operations allocated to each component.

For an interactive decision support system architecture includes the following subsystems:
- Data management subsystem
- Subsystem management models
- User subsystem dialog

Data management subsystem consists of the following elements: database management system oxidase data, data dictionary and declarative query language. The database is built to meet the information requirements of the system and is an interrelated database operated by one or more users, one or more applications. The database contains no internal data, external data and personal data.Internal data consist from the current activities of the organization and operations of various functional departments image. Data external economic information circulated nationally and internationally and usually come from the industrial sector of which the company, legal regulations. Personal data is data that relates to the behavioral aspects of decision-makers in making decisions. Whatever the nature of their data is stored in relational databases, transactional system data or data warehouse, built on subjects of interest. In current systems, the company's intranet, are increasingly present data accessible through web browsers and multimedia items such as maps, images, sounds.

The data source, internal or external, data is extracted and managed by a management database. The management of the database depends on the organization of data. In most cases there is SGBS transactional relational data system and a management database for multidimensional data warehouses created. The data dictionary is a catalog of all data from the database. It contains data definitions, data sources and their intrinsic significance. The data dictionaries are permitted operations to add new data, deletion or retrieval of existing information according to certain criteria. The most common data dictionary used in the first phase of decision making is data mining to identify their problems and opportunities. The SQL language is used, which accepts requests for data from other systems.

The subsystem management model consists of the following components: base models, the management models, dictionary and processor execution models and integration patterns

Base models contain the set of models that make it possible to analyze the facts and the choice of options in terms required by the user. It is the component that differentiates interactive decision support systems to other systems. The models are domain-specific and models can be classified into strategic, tactical and operational models models. Strategic models assist decision makers in developing the overall strategy of the company in matters concerning the development of corporate objectives, choice of location of equipment, environmental impact analysis on the work of the organization. Tactical models are applied to the organizational subsystems and assist the user in taking decisions for allocation and management subsystem resources available [3, 6].

The models are used currently in operational and

transactional system that aims of the organization. Database management system allows creating new models models using programming languages, update and modify existing models, establish interdependencies between models. Manage in a logical manner a variety of models to consistency of the data model and provides integration of application systems components maker.

3. Developing an Interactive Decision Support System Based on a Data Warehouse

In building a data warehouse is based on the analysis of data. Extract information in order to obtain information for decision making. Basically there are two steps: designing and populating data.

Design is the stage where the data warehouse model is chosen, depending on the complexity of the system real user requirements and data structure existing in the company (databases, Excel spreadsheets...)

Building a data warehouse there are three models: type star, snowflake patterns type and constellation type models. Conceptual models are multidimensional and designed to organize data necessary decision-making process on issues. The models may change depending on the context, presenting the data in a structure bed, easily designed and accessible to end users.

In such a model is highlighted:
- quantitative data centralized called measures of activity
- quantitative criteria for centralized aggregation, referred sizes
- relational table that stores the measures identified by

the facts dimensions is called table
- Tables where aggregation criteria has explicit codes, called type tables list. Facts associated table.

The star is the type of aggregation criteria when codes are explained in type tables list. Using data from lists, star type structure enables higher levels of aggregation on the initial size [4, 6].

Data warehouse star

The eastern type constellation when several schemes that use the same type star catalogs. The advantage is that the same warehouse can store different facts that have certain common coordinates and therefore share the same lists.

Deposit constellation

The type is snowflake if any alternative classifications for the same code by integrating undersize and alternative dimensions. To analyze the evolution of the value of Supplies Company based on several criteria required of users, you can define a data warehouse type star.

In figure 1 is described a star warehouse model for sales:

In such a model the dimensions have a corresponding key in the fact tables (ex. Id_dim_customer – primary key from Dim_customers has a corresponding key in Fact sales – foreign key). This model permits to create complex query by simply choose the attributes from dimensions and a measure from the fact table. It also is possible to create graphics based on queries that contain attributes from dimension tables and measures from the fact table.

Inserting data into dimensions can be made through an insert SQL command:

INSERT INTO DIM_CUSTOMERS (ID_DIM_CUSTOMER, CUSTOMER_NAME, CUSTOMER_AGE, CUSTOMER_ADDRESS) VALUES (1, 'CLIENT 1', 27, 'ADDRESS 1');
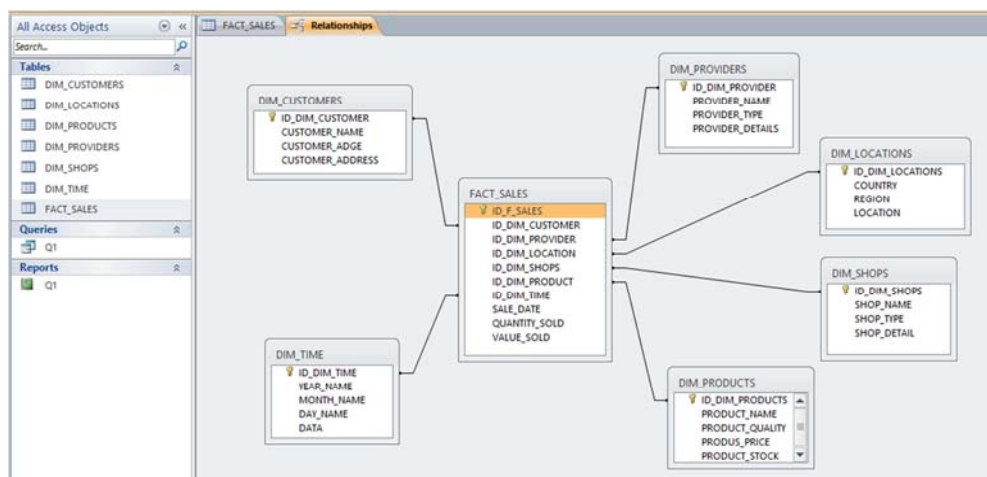

Figure 1. *A star warehouse model for sales.*

Inserting data into the fact table is made also through an insert SQL command based on a trigger fired when inserted data into dimensions is:

INSERT INTO FACT_SALES (ID_F_SALES, ID_DIM_CUSTOMER, ID_DIM_PROVIDER, ID_DIM_LOCATION, ID_DIM_SHOPS, ID_DIM_PRODUCT, ID_DIM_TIME, SALE_DATE, QUANTITY_SOLD, VALUE_SOLD) VALUES (1, 1, 2, 2, 3, 1, 4, '01-AUG-2016', 154, 1958);
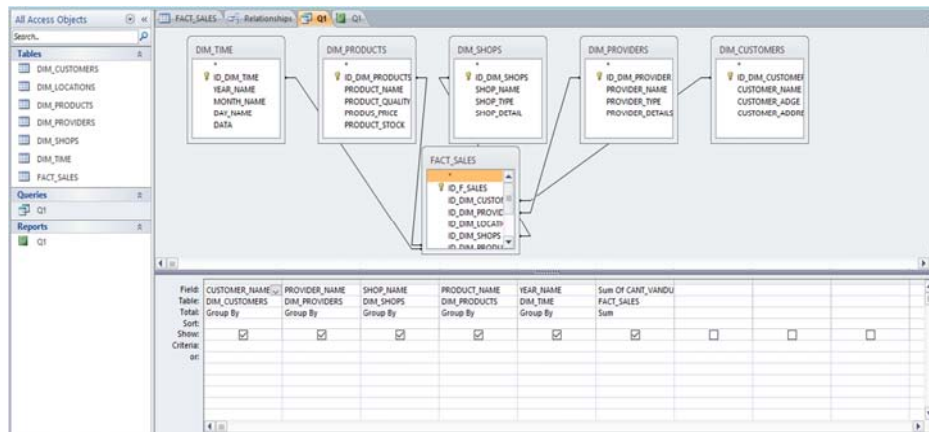
Creating a query into a star model warehouse:

Figure 2. Building a query in a star warehouse model for sales.

The query code:

SELECT DISTINCTROW DIM_CUSTOMERS.CUSTOMER_NAME, DIM_PROVIDERS.PROVIDER_NAME, DIM_SHOPS.SHOP_NAME, DIM_PRODUCTS.PRODUCT_NAME, DIM_TIME.YEAR_NAME, Sum(FACT_SALES.QUANTITY_SOLD) AS [Sum Of CANT_VANDUTA]

FROM DIM_TIME INNER JOIN (DIM_PRODUCTS INNER JOIN (DIM_SHOPS INNER JOIN (DIM_PROVIDERS INNER JOIN (DIM_CUSTOMERS INNER JOIN FACT_SALES ON DIM_CUSTOMERS.[ID_DIM_CUSTOMER] = FACT_SALES.[ID_DIM_CUSTOMER]) ON DIM_PROVIDERS.[ID_DIM_PROVIDER] = FACT_SALES.[ID_DIM_PROVIDER]) ON DIM_SHOPS.[ID_DIM_SHOPS] = FACT_SALES.[ID_DIM_SHOPS]) ON DIM_PRODUCTS.[ID_DIM_PRODUCTS] = FACT_SALES.[ID_DIM_PRODUCT]) ON DIM_TIME.[ID_DIM_TIME] = FACT_SALES.[ID_DIM_TIME]

GROUP BY DIM_CUSTOMERS.CUSTOMER_NAME, DIM_PROVIDERS.PROVIDER_NAME, DIM_SHOPS.SHOP_NAME, DIM_PRODUCTS.PRODUCT_NAME, DIM_TIME.YEAR_NAME;

Based on the queries it can be built reports that helps the decision makers to choose what direction should have their actions. An example of a report based on the query above is represented in the image bellow:

Figure 3. A report based on a query in a star warehouse model for sales.

A star warehouse model is an advanced method to obtain data analyses and various reports that can be the base of the decision making. This kind of model offers many choices by changing initial data into the targeted values and so many strategies can be made [4, 6].

4. Conclusions

The advantages of using databases for Decision Support Systems in businesses involves creating numerous queries by the decision maker and also allow to create many scenarios and variants to choose from. In the business area is crucial to store data into a warehouse such as a star modell and create many queries and reports so the decision maker can see the trends of the economical indicators and helps him to make a decision that can improve those numbers or it can be useful to implement a strategy for a further development [1, 3]. The databases permits

flexibility in creating queries by choosing columns from dimension tables and measures from the fact table and so the decision maker may choose what economical indicators is useful to analyse and also permits to create different types of graphs such as columns, pies, scatter points or webs. By simply analysing these reports and graphs helps the decision maker to create different scenarious by changing target indicators and corelate with the economical indicators that can't be changed [2, 5]. The methods specific to the databases such as SQL language and the Business Intelligence tools allow businesses to explore data and to create alternatives that helps to choose the optimal variant according to the economical restrictions that came from the business environment. It is very important to store data into a warehouse model and then to create future strategies that can help a company to expand or to grow the profit in a realistic way based on complex analyses and alternatives.

References

[1] Daniel J. Power, *"Examples of decision support systems (DSS) aiding business decision-making"*, http://searchbusinessanalytics.techtarget.com/tutorial/How-decision-support-systems-DSS-can-help-business-decision-making, 2015;

[2] Chang L, *"Database Technologies for Decision Support System"*, https://blogs.msdn.microsoft.com/csliu/2010/02/05/database-technologies-for-decision-support-system/, 2016;

[3] Gupta, Jatinder N. D., Thomas M. Harris, *"Decision Support Systems for Small Business"*, Journal of Systems Management, 2015;

[4] Muller-Boling, Detlef, Susanne Kirchhoff, "*Expert Systems for Decision Support in Business Start-Ups.*", Journal of Small Business Management, 2015;

[5] Ramon Barquin, *"Data warehousing: building the foundation"*, http://searchdatamanagement.techtarget.com/, 2014;

[6] Surajit Chaudhuri, Umeshwar Dayal, Venkatesh Ganti, *"Database Technology for Decision Support Systems"*, IEEE Computer Society Press Los Alamitos, CA, USA, 2014;

[7] URI: http://searchcio.techtarget.com/definition/decision-support-system

[8] URI: http://www.dictionary.com/browse/decision-support-database

[9] URI:http://www.waterencyclopedia.com/Da-En/Data-Databases-and-Decision-Support-Systems.html

[10] URI: https://blogs.msdn.microsoft.com/database-technologies-for-decision-support-system/