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Full Length Research Paper

Investigation in the deployment of a geographic information system

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After a presentation of the cereal activities in Tunisia, we present a systemic analysis of project of deployment of a geographic information system (GIS). This analysis is based on the objective oriented project planning (OOPP) method. The exploitation of the systemic analysis method enables us not only to analysis and to identify the information of the cereal activities but also to lead to an efficient management of cereal transaction. This analysis enables us to identify the information needed for the deployment of a GIS in the Office des Cereales in Tunisia.

Key words: Geographic information system, data analysis, objective oriented project planning method, specific objective, global objective.

INTRODUCTION

The geographic context, the climatic environment and the social tradition and culture of Tunisia, whose alimentary tradition is based particularly on the consumption of cereals, shows an important deficit of the national production and cereal consumption.

In Tunisia, the Office des Cereales represents the official organism of cereal commercialisation, it participate, with private co-operatives, at the harvest and the cereal storage. It possesses the monopoly in cereal importation that is intended to human consumption (Annabi, 1998). Because of the nature of activities of cereal transaction, the notion of the space is important since the movement of cereals evolve in an environment of information. Indeed, the state of the situation of the movement of the cereals in Tunisia organized currently by two systems of information: a developed classic system and using an environment of data base Oracle with tools of Visual Basic development and a new geographic information system (GIS) exploiting the notion of information layers of which the one of relative basis to the geographical localization of units of cereal storage.

In order to assure an efficient management of cereal activities, the Office des Cereales exploits a system of information that stocks currently, analysis and visualize some spatial data at a time and no spatial. This is how we studied our various applications in this environment of the GIS of the fact of its innovating aspect and of the suppleness of its communication. We exploited the structuring established by the objective oriented project planning (OOPP) method. The object of this paper is to present a systemic analysis of project of a GIS deployment based on the OOPP method (AGCD, 1991; Gu and Zhang, 1994).

PRESENTATION OF THE OOPP METHOD

In order to analyze the project of a GIS deployment, we adopt a systemic logic allowing situating the project in its intern or exterior environment. In fact, the systemic analysis belongs to a scientific tendency that analysis the elements of a complex process as a component of a set where they are in a reciprocal dependence relation. Its study field is not limited to the mechanisation of the thought: the systemic analysis is a methodology that organise the knowledge in order to optimise an action (Lakhoua, 2009).

The systemic analysis of a production system has a mission to define the general strategy of the modelling study to achieve (Landry and Banville, 2000; Lakhoua, 2008). This strategy must enable the fixation of the modelling limits, by precisely making the frontiers of the system to model and specify between the data that are really exchanged in the different component of the production system and those that the modelling study will cover.

In order to offer a model project of a GIS deployment, we adopt the OOPP method. In fact, the OOPP method (AGCD, 1991; Peffers, 2005) constitutes a tool of a global systemic modelling, enabling the analysis of a complex situation by a hierarchical decomposition until it reached an elementary level that allows for an operational planning. This method, widely used in the planning of complex projects, involves many operators and partners.

In Tunisia, OOPP method was used in development projects

financed by bilateral or multilateral co-operation mechanism (with Germany, Belgium, Canada, World bank…), in upgrading of a different structures (Training and Employment through MANFORME project, Organisation of the Tunis Mediterranean Games, 2001…) and in restructuring private and public enterprises…

The two determining steps for the OOPP analysis are (Lakhoua et al., 2006):

(a) The scheme of planning project (SPP) that consist in establishing a global diagnostic of a situation by elaborating a tree of problems using a causal logic and by transforming it to a tree of objectives ;
(b) The scheme of planning activity (SPA) that, according to a logic « Medium - Detailed » lead to an hierarchic analysis of the results to achieve.

In fact, these steps constitute a preliminary action for establishing a project that requires a global piloting and evaluation system (PES). The parameters defined as the SPA can be represented in a « Matrix of Activities » that comported: the number of the activity, the code of the activity, the designation of the activity, the responsible of the activity, the collaborators of the responsible, the objectively verifiable indicator (OVI), the verification source (VS), the necessary resources according to their categories : Infrastructure, human resources, equipment and consumables, logistic (energy, transport…), informational resources…

ANALYSIS OF THE PROJECT OF GIS DEPLOYMENT

Let's recall first of all the different phases to succeed the deployment of a GIS: Definition of needs; development of the load notebook; choice of the GIS; conception of the geographical data base and its installation; starting of the project. In order to define needs of the enterprise in GIS, we present some questions of an elaborate investigation of the office des cereales:

(a) For what domain will the GIS be used?
(b) What is the objective of the GIS?
(c) What are for results waited of the GIS?
(d) What information will be used by the GIS?
(e) What supports will be used?
(f) What circuits will information borrow?
(g)What is the procedure for the validation of information?
(h) What are files to use?
(i) What are sources of the different information?
(j) What are responsibilities at the level of the production, validation and the utilization of information?
(k) What storage of information?

The phase of development of the load notebook conditions the success of a product in part. Indeed, the quality of the product results a compromise between the demand, reliability and the final cost. In a first approach, we can distinguish the main stages in the development of a load notebook:

(i) To recover the maximum of information on the customer's needs.
(ii) To distribute these needs in four categories: functions, performances, constraints and details.
(iii) To land in a first time that the functional aspect.
(iv) To construct a hierarchical diagram of functions.
(v) To retail and to complete the diagram with the team of project.
(vi) To construct a matrix of functions while sequencing these in: indispensable, desirable or superfluous.
(vii) To establish for every function the quantitative performances, the qualitative performances and constraints.
(viii) To propose a first - project to the customer.

According to a more rigorous approach, it can be necessary, the use of methods for example the SADT method that is more suitable to the realization of a load notebook. In the case of our application, we adopted the systemic method OOPP. In order to analyze the different activities of the project of deployment of a GIS, we exploited the systemic method OOPP. The different specific objectives (SO) permitting to reach the global objective (GO) “Deployment and exploitation of a GIS” are:

(i) Visualization and localization of the geographic data;
(ii) Identification of the information of the infrastructure of the cereal storage system;
(iii) Construction of a geographical data base;
(iv) Exploitation of the GIS in the office des cereales.

The presented analysis (Figure 1) is limited to the level of the results permitting to reach the GO: “Deployment and exploitation of a GIS”.

ANALYSIS AND DEPLOYMENT OF A GIS

Today, information has become at the moment a strategic weapon and its life has become very short; so, an information system of an organisation must be reliable and quick, that is, it justifies the importance of an information tool (Ayari et al., 2001; Baazaoui et al., 2000; Bernhardsen, 1993).

In fact, a GIS represents a group of information equipment, software and methodology for keyboarding, storage and data exploitation, which the majority is spatial referring, allow a simulation of a process as a grain silo, a management and a decision help (Berry, 1993; Bolstad, 2005; Caloz and Collet, 1998; Chang, 2007). A GIS allows the representation and analysis of all information with geographic character in the way that all the events are produced. As a matter of fact, it stores the world information like thematic leers that can be linked together with geography (Chesnais, 1998; Claramunt et al., 1997; CNT, 1998).

This concept, simple and powerful, shows the efficacy to solve many practical problems. The GIS exploit all the

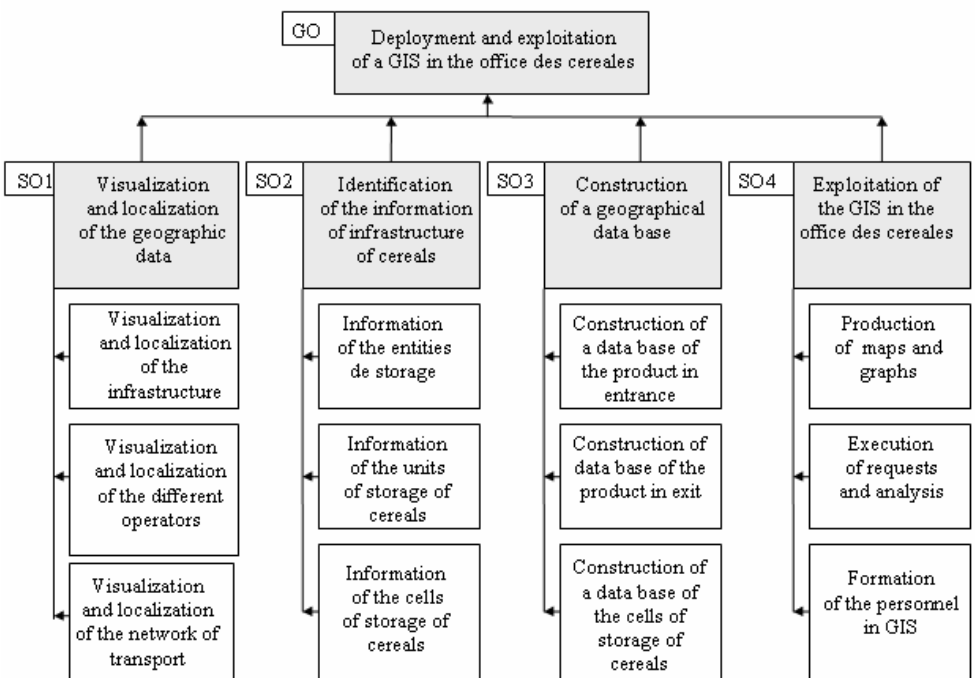

Figure 1. Analysis of a project of GIS.

Table 1. Identification of the entities of the GIS.

N°	Entity	Attribute
1	Center of storage of cereals	Code_Center Name_City Capacity_Center Type_Center Product Quantity
2	Unit of storage of cereals	Code_Unit of storage Code_Center of storage Capacity_Unit of storage Product Quantity
3	Cell of storage of cereals	Code_Cell of storage Code_Unit of storage Type_Cell of storage Capacity_Cell Product Quantity
4	Handling equipment	Code_Matériel Code_Center Number _Elevators Number_Carriers Nombre_ rockers …

possibilities offered by data bases (request and static analysis) by a unique visualisation of them (Elangovan, 2006; Longley, 2005; Teoh, 2009; Tomlinson, 2005). We introduce the appropriate information of all the cereal storage centres. We class information by entity of storage and we indicate the identified entity (Table 1).

Figure 2 presents the different symbols used in order to represent with the GIS the infrastructure of the Office des Cereales. We exploited the MapInfo software to keyboard, manipulate and manage all cereal storage data, to do query and analysis and to display maps and graphs (Figure 3).

The list of data to keyboard on the table of received cereal produces in a grain silo: Received share produce code, origin product code, produce, origin product, quantity product, quality product, storage cell code, date of reception, and instant of reception. The list of data to keyboard on the table of expedited cereal produces of a grain silo: Expedited share produce code, product, destination code, destination produce, quantity product, quality product, storage cell code, date of expedition and instant of expedition. The execution of requests allows us to search the city capacity (Figure 4), the substructure grain silo, the cereal quality, the cereal stock, the cell stock, the length section during a cereal transfer from a centre to another.

In order to represent with the GIS the different road or railway sections used by the Office des Cereales permitting the determination of distances browsed by carriers of cereals (trucks, wagons…) with the best

Figure 2. Different symbols with GIS.

MapInfo - [PRDENTRE Browser]

File Edit Objects Query Table Options Window Browse Help

Code_lot_produit_enti	Nom_produit	Quantite_prod	Date_entré	Code_cellule_stockage
BDL-17/11/1999	BDL	26.02	11/17/1999	S/ST BIR EL KASSAA-U7-C1
BTI-18/11/1999	BTI	785.9	11/18/1999	S/ST BIR EL KASSAA-U7-C12
BDL-18/11/1999-a	BDL	157.86	11/18/1999	S/ST BIR EL KASSAA-U6-C1
BDL-18/11/1999-b	BDL	18.06	11/18/1999	S/ST BIR EL KASSAA-U7-C1
BDL-18/11/1999-c	BDL	31.03	11/18/1999	S/ST BIR EL KASSAA-U0-C0
BTO-19/11/1999	BTO	89.98	11/19/1999	S/ST BIR EL KASSAA-U0-C0
BDL-19/11/1999	BDL	33.94	11/19/1999	S/ST BIR EL KASSAA-U6-C1
BTI-19/11/1999	BTI	800.28	11/19/1999	S/ST BIR EL KASSAA-U7-C12
BTO-20/11/1999	BTO	56.86	11/20/1999	S/ST BIR EL KASSAA-U0-C0
BDL-20/11/1999	BDL	75.26	11/20/1999	S/ST BIR EL KASSAA-U6-C1
BTO-21/11/1999-a	BTO	175.36	11/21/1999	S/ST BIR EL KASSAA-U0-C0
BTO-21/11/1999-b	BTO	48.265	11/21/1999	S/ST BIR EL KASSAA-U0-C0
OI-21/11/1999	OI	23.06	11/21/1999	S/ST BIR EL KASSAA-U1-C30
OI-22/11/1999	OI	23.06	11/22/1999	S/ST BIR EL KASSAA-U1-C30
BTO-23/11/1999-a	BTO	161.8	11/23/1999	S/ST BIR EL KASSAA-U0-C0
BTO-23/11/1999-b	BTO	90.87	11/23/1999	S/ST BIR EL KASSAA-U0-C0
BDL-23/11/1999	BDL	62.54	11/23/1999	S/ST BIR EL KASSAA-U6-C3
BDL-24/11/1999	BDL	238.8	11/24/1999	S/ST BIR EL KASSAA-U6-C3
BTO-24/11/1999	BTO	69.035	11/24/1999	S/ST BIR EL KASSAA-U0-C0

Figure 3. Example of cereal transfer.

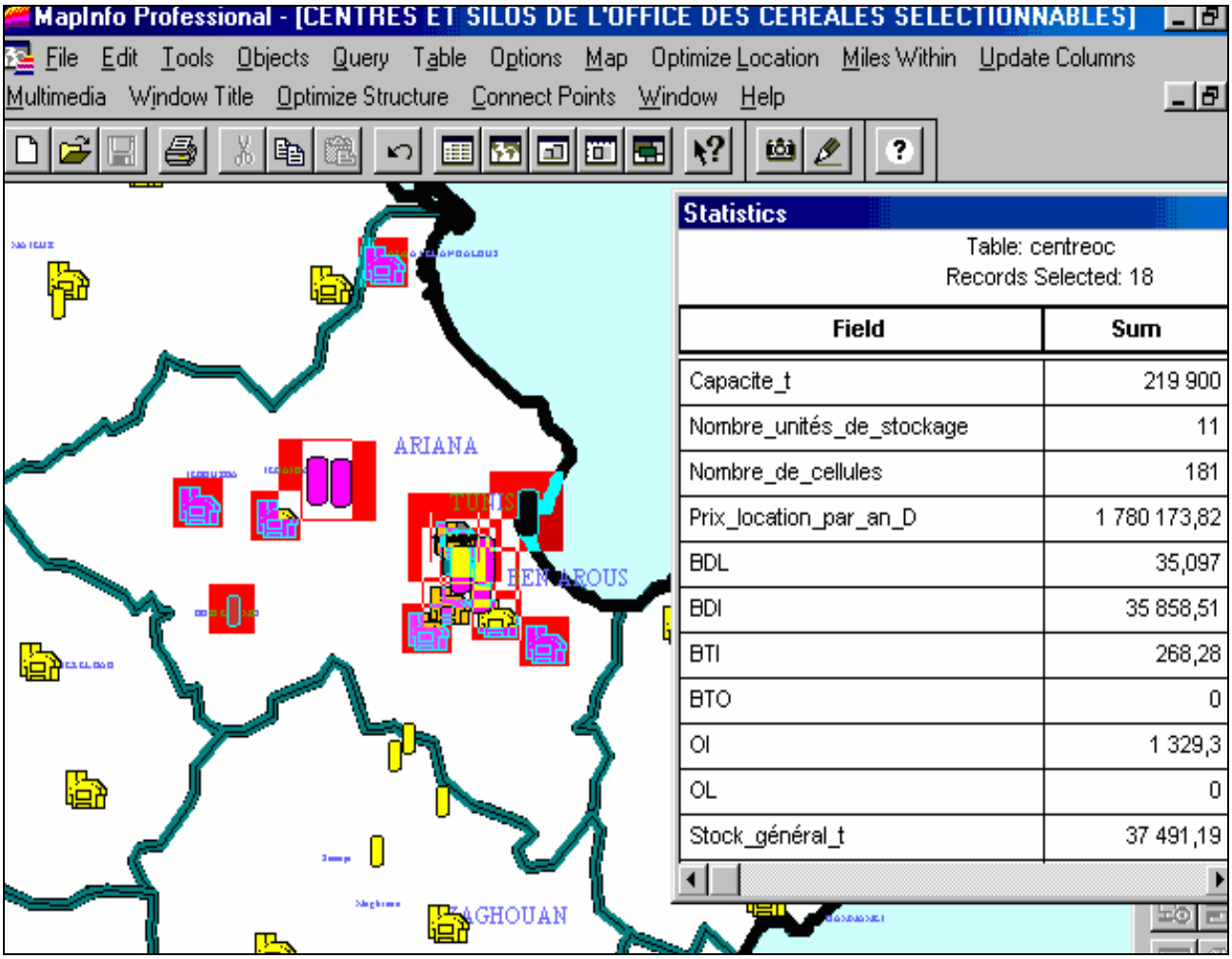

Figure 4. Evolution of the stock of cereals. Yellow key represent, not selected grain silos, while red key indicates selected grain silos in Ariana.

precision, it is necessary to exploit the well stocked data by satellites (Figure 3).

CONCLUSION

A GIS differs from other computerized information systems in two major respects. First, the information in this type of system is geographically referenced. Secondly, a GIS has considerable capabilities for data analysis and scientific modelling, in addition to the usual data input, storage, retrieval and output functions.

In this paper, we presented an investigation in the deployment of a GIS in the Office des Cereales in Tunisia. A systemic analysis based on the OOPP method of the project was presented. This application of GIS offer many tools to create interactive queries, analyze spatial information, edit data, maps, and present the results of all these operations.

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