RELATIONAL DATA BASES
IN
REGIONAL MANAGEMENT:
Two Case Studies
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Working Paper Nº 125
PAPER PRESENTED AT UDMS 89 - 13TH URBAN DATA MANAGEMENT SYMPOSIUM

29 MAY - 2 JUNE, LISBON
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ABSTRACT

In this paper our experience in the design and implementation of a relational data base with information at local authority level for financial and planning purposes, as well as a data base for evaluation and monitoring of FEDER financed projects are described.

These data bases are implemented using two different database management systems (RDB/VMS and ORACLE). An effort
1. Introduction .................................................. 1

2. The Project "CCALUT/FEDER"
   2.1. Aims and general description ...................... 2
   2.2. The Information structure .............................. 4
   2.3. USERS' INTERFACES .................................. 6
   2.3.1. General Development Choices .................... 6
   2.3.1.1. Organizational environment and adopted approach 6
   2.3.1.2. Implementation resources ..................... 6
   2.3.2. Implemented solutions ............................. 7
   2.3.2.1. Access to CCALUT/Feder application and database 7
   2.3.2.2. Hierarchic menu structure ..................... 7
   2.3.2.3. Locating options in the menus .................. 7
   2.3.2.4. Natural language as a reference paradigm ...... 7
   2.3.2.5. SQL by menu .................................. 8
   2.3.2.6. Accessing to the operating system ............ 8
   2.3.2.7. Other utilities ................................ 8
   2.3.2.8. Iconic representation .......................... 9

3. The Project "DGRA/Database for Local Authorities Information Management" ......................... 10
   3.1. Aims and general description ...................... 10
   3.2. The Information Structure .......................... 12
   3.3. Users' Interfaces .................................. 14

Concluding Comments ........................................ 16

Acknowledgments ............................................. 17

References .................................................. 18
1. **INTRODUCTION**

In this paper, we intend to describe our experience in the design and implementation of two databases for regional management. The first one, named project "CCRLUT/FEDER", has been developed to monitor and follow up projects applying for financial contribution from FEDER in the Tagus Valley and the metropolitan area of Lisbon, which is the jurisdiction area of CCRLUT, a regional planning body. The second one, called "DGAA/Database for Local Authorities Information Management", has been designed to provide DGAA, the central administration Department in charge of the links with local authorities including government financing, with on-line detailed information on these entities and their activities, to support diffusion of local and regional data, and provide tools for analysing and processing it.

A peculiar aspect of this experience is that two different database management systems are used, ORACLE and VAX/RDB, on two distinct computer UNYSIS 5000/50 and VAX 8350, with two operating system environments UNIX and VMS, respectively.
2. THE PROJECT "CCALUT/FEDER"

2.1. AIMS and general description

The CCALUT - Comissão de Coordenação da Região de Lisboa e Vale do Tejo is the entity in charge of the process of candidature and follow up of projects for regional development in the Tagus Valley and the metropolitan area of Lisbon, applying for financial support from FEDER, the EEC fund for regional development. The CCALUT is an autonomous institutional body of the Ministry of Planning and Territory Administration entrusted with the coordination, in that particular regional area, of technical, financial and administrative support to local authorities and other administration departments, for the implementation of regional plans and actions aiming at the regional development.

From the information management point of view the process of candidature and follow up of projects applying for financial contribution from FEDER requires a large amount of data regarding the scope of the projects (see Fig. 1), the financial streams that they give rise and the control of their physical and financial execution.

In view of the role entrusted to CCALUT for the administrative and financial follow up of FEDER financed projects, it was clear the need of an information system able to provide safe and dynamic management control over the diversity of documents and processes considered.

The requirements of the information management system include the ability of

- providing well defined decision support and control information;
- offering automated execution of administrative procedures;
- receiving slices of information that have not been foreseen initially, imposed by changes of the external environment of the organization or by the evolution of the routines adopted internally.

Thus, as a technological means to ensure the efficiency and effectiveness of the above mentioned information system, it was decided to build, in a UNIX environment, a relational data base supported by a database management system (ORACLE) and some system tools, and application software for users interface and execution of specific procedures.
Fig. 1 - Number of projects processed by CCRLVT candidate to financing from FEDER
2.2. The Information structure

A schematic representation of the information structure is given here following the entity-relationship model (Chen, 1976) (see Fig. 2).
2.3. USERS' INTERFACES

2.3.1. General Development Choices

2.3.1.1. Organizational environment and adopted approach

Attending to the organizational conditions, namely those which are likely to provide a basis for a deeply structured organic analysis and, above all, the functional unstableness of the object system, regarding either its transactions or their environment, this project has favoured an approach by outcome "targets", which is evident in the sequence of menus building the users' interface.

2.3.1.2. Implementation resources

Software

The following software tools have been used to build the application according to a module structure:

- Interactive screen generator provided by the DBMS as a direct interface to the database;
- Interactive query tools of ORACLE in conjunction with the bourne shell as a map generator;
- Q-menu to generate the tree structured users' interface menus (Q-menu is the menu generator which is part of the office automation software Q-office);
- Procedures in the programming language C to ensure special features of data integrity, security and specific forms of output;
- Several auxiliary routines in bourne shell.

Hardware

A departmental computer UNISYS 5000/50

microprocessor
2.3.2. Implemented solutions

2.3.2.1. Access to CCRLUT/FEDER application and database

Any access to the CCRLUT/FEDER application requires a user password. Once within the main menu the user will be required to provide the password for every executable option accessing into the database, unless he chooses to fix his username/password through an utility menu "PASS" (options password) for the session. The user may change his own password with the help of the same menu. In all circumstances, the username/password that has been provided regulates the execution of every available program, even the viewing of the corresponding menu, and the operations relevant for each data set (insert, query, update, delete, etc.) according to the protection rules that have been set up by the database administrator.

2.3.2.2. Hierarchic menu structure

The menus have been organized in a hierarchical way and one is identified by a designation and/or by an index number in the hierarchical tree (this is always present in the upper right corner of the screen).

2.3.2.3. Locating options in the menus

By means of an utility denoted "ONDE" (WHERE) it is possible to obtain the list of options available in the set of menus, that match a word or a sequence of words, including wild characters, in the option title. In addition, there is an utility that allows to move directly to any menu by providing its index number.

2.3.2.4. Natural language as a reference paradigm

In the interface design, natural language has come out as a paradigm for the definition of choices whenever it was reasonable to be implemented. For those situations in which the input of a sequence of characters is not providing a meaning in correspondence with the user choice, then messages have been provided to translate the consequences of the options, that the user may confirm or correct alternatively.
2.3.2.5. SQL by menu

In addition to the SQL interface facilities provided by the DBMS, a number of interactive tools for automatic definition of SQL statements have been provided in the menu structure. This approach has been adopted in flexible 'parameterised' programs for output specification and, mainly, for the inclusion of constraints in given relevant domains.

In this last instance, it has been decided either to provide conventional menus for selection of constraint modes (equality, disequality, match with wild characters, etc.) and value assigning or to offer sequences of item oriented menus adding restraints to the selection domain. These options have been taken in function of the domains under consideration.

The constraints are articulated in logical conjunction and disjunction in accordance with the context in which they are set up.

2.3.2.6. Accessing to the operating system

It is implemented a function that provides access to operating system commands and the ability to start autonomous procedures without having to give up the application and repeating the entry commands.

2.3.2.7. Other utilities

Besides the utilities already mentioned, there is available access, at any point in the menu tree, to the following functions:

- querying the data dictionary
- on-line help
- clock
- current monthly calendar
- perpetual calendar, allowing to view any monthly or yearly calendar in Christian era.
2.3.2.8. Iconic representation

In spite of having no mouse, the pre-definition of keys associated with symbols/designations of options in the screen has conceded some form of iconic representation of common options, utilities and value assigning to functional parameters (as, for example, the parameter that allows to select permanently a given candidature) up to the point in which the structure of an output is finished.
3. THE PROJECT "DGAR/DATABASE FOR LOCAL AUTHORITIES INFORMATION MANAGEMENT"

3.1. Aims and general description

The DGAR - Direcção Geral de Administração Autárquica is a central administration Department acting as a link between local authorities and central government. In particular, the financing of local authorities by central government is managed through this Department. As a result, a large amount of data regarding geographical and physical characteristic of municipalities, infrastructures, population and housing, local authorities activities and finances has to be collected for that purpose.

It stems naturally from the need of collecting and analysing a large amount of data, the implementation of a relational database. The availability of a data base in a central system widens the scope of work of the technical staff and managers. In addition, it offers the advantage of

- avoiding losses of information collected for general tasks;
- disseminating information that otherwise would be unknown or not available;
- making available information in magnetic media instead of sheets of paper;
- eliminating the input of information more than once;
- allowing for computer networks, including personal computers.

The advantages offered by small systems are kept by implementing interfaces to the database. Thus, the technical staff may take benefit from microcomputers software (Excel, Lotus 123, Symphony or others) with the advantage of incorporating data transferred from the database automatically.

The users may access to information piled up over a much longer period of time, gathered for other studies and by other entities. The access to information is also easier since data is in a single source and users' friendly interface menus are available.

The information management systems behind this relational data base is VAX/RDB. The information security is enforced by the data base administrator who also ensures that regular back ups are kept in magnetic tapes.

[10]
Data protection is another function assigned to the database administrator that provides or denies users privileges to access and manipulate data in each sector or field of information.

In this particular project, it has been accomplished the transfer of large bulks of information from other central administration departments (Serviços de Informática do Ministério da Justiça, Serviços Técnicos de Apoio ao Processo Eleitoral, Gabinete de Estudos e Planeamento do Ministério da Educação), public companies (CTT, TLP) and the National Bureau of Statistics (Instituto Nacional de Estatística).

In its very beginning, computer facilities of the Faculty of Economics, New University of Lisbon have been used to launch the project, until DGAA has installed its own computer facilities where the database is now residing, which act as the central node of a small computer network connecting offices in different locations.
3.2. The Information Structure

In contrast with the CCRLUT/FEDER project, it is adopted here a more extensive and less schematic description of the information structure.

Since a relational data base model has been chosen, we have tried to take benefit from its advantages. The design of tables has obliged to three criteria:

1. Performance as a trade-off between minimization of disk space and access time;
2. Data coherency;
3. Integrity and security of data.

The integrity and security of data is important in two facets. First, there is the essential need of protecting data against its corruption or elimination by error or bad faith (it must be kept in mind that the database is aimed to serve a large number of users) and reserving to specific user access to certain data areas. On the other hand, the objective of decentralizing the input and maintenance of the database requires a large amount of freedom in privileges to write and modify data.

The data coherence has to be at first ensured by careful codification, since different sources use distinct codes to the same entities, which may be caused by various coding approaches or distinct code updates (for instance, when new local authorities are created). Secondly, simple and efficient procedures to control and correct the input data must be implemented, namely for extensive and repetitive information.

In a first stage, a number of blocks of information have been defined, following a users point of view:

- General data on municipalities
- General data on counties
- Cities
- Towns
- Villages
- Demographic data
- Economic data for local level
- Electoral data
- Facilities and services
- Municipality finances (budgets and yearly accounts)
- Proxies and ratios of local area management

[12]
Later, in parallel with data availability, tables have been defined in the database to allow loading it. The main entities in the database (municipalities, counties, cities, towns, villages, regions and associations of municipalities) have been coded following the National Bureau of Statistics (INE) code, which is based on an hierarchical ranking of three levels of local areas (distrito, concelho e freguesia) ordered alphabetically, with some add-ons originated by local area creation since the first issue of the code, or by an internal code defined as an extension of INE Code. In addition, it is used the regional EEC code NUT (Nomenclatura de Unidades Territoriais).
3.3. Users' Interfaces

It has been mentioned above that this database intends to be a tool for technical staff enrolled in local area management and planning, and also to support diffusion of local and regional information.

Thus, it is required that a number of tools be available, namely those regarding

- Database control
- Loading and maintenance of database
- Querying and data processing

The control of the database is accomplished through RDO (Relational Database Operator), a set of commands that besides allowing data querying and manipulation, provides metadata management (creation, modification and elimination of relations, fields indexes and views), offers information protection and control of access by user, group of users and type of action (read, write, modify and erase), and gives control on information volumes.

The database loading is primarily done from other magnetic media (from tapes, diskettes, compact tapes and other computer disks through wide area networks) by means of specific input programs, or by direct input from surveys and other documentation through procedures that provide for input, validation and error correction. Whenever possible the transfer from magnetic media is adopted. This has forced the acquisition of expertise on transfer of information from UNIX, MACINTOSHes, UNYSIS and IBMs. Reversely, interfaces have been developed to allow transfer to LOTUS 123, EXCEL and WORDSTAR for further information processing.

An important aim is to offer online querying of all information available in the database. This is accomplished through a menu tree that provides nearly instant access to tables with data in every database information area, which include time series whenever it is applicable. Examples of tables are:
These procedures allow the copy of the table into a file for printing or further information processing, either directly from the screen or from a specific menu for that purpose.

The users wanting to process information in statistic-econometric packages, spreadsheets or word processors, may retrieve data from the database through the menu or using the relational database operator (ADO). This language provides for interactive querying and retrieving of data from database relations, views, and any combination of them, and offers access from users programs in PASCAL, C, FORTRAN, COBOL and BASIC to database fields, facilitating information processing prior to those packages.
4. Concluding Comments

As a first stage to evaluate our experience in the design and implementation of both databases, we have to state that ORACLE and RDB/VMS have allowed us to attain similar results with equivalent efforts. Regarding data security and protection both database management systems offer high level functions ensuring our essential requirements.

The integration of Q-Menu with ORACLE in the UNIX environment has been very convenient to build users' friendly interfaces. We have not had an equivalent tool in RDB/VMS. Therefore, we have opted in this latter case to embody PASCAL routines with the screen generator FNS.

We recognize, however, that fourth generation products VAX/RALLY and VAX/TEAMDATR, that we have not available at the time, might be even a better approach.

No effort has been made to compare access times, since the computer systems were not equivalent and the results would depend on many exogenous parameters.
The authors wish to express their gratitude to CCRLUT - Comissão de Coordenação Regional do Vale do Tejo e DGAR - Direcção Geral da Administração do Território, for having created conditions for the development of this work.
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