Managing Knowledge and Data for a Better Decision in Public Administration

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Abstract: *In the current context, the society is dominated by the rapid development of computer networks and the integration of services and facilities offered by the Internet environment at the organizational level. The success of an organization depends largely on the quality and quantity of information it has available to develop quickly decisions able to meet the current needs. The need for a collaborative environment within the central administration leads to the unification of resources and instruments around the Center of Government, to increase both the quality and efficiency of decision - making, especially reducing the time spent with decision - making, and upgrading the decision – making act.*

Keywords: *administration, strategy, decision, complex systems, management, infrastructure, e-government, information society, government platform.*

JEL: *M1; M15.*

Introduction

Institutional analysis and definition of information architecture at the organization level, down to the last level, due to a work environment in a continuous evolution, doubled by complete usage and operation of information resources, contribute decisively to a high quality of services and information provided.

Definition of some working models, within complex systems of high functional responsibility, by integrating all components (hardware and software) leads to an increased efficiency of the cost and expenses ratio. Structuring on hierarchical levels of organizational infrastructure at different levels of importance and criticality, and implementation of consistent security policies in an information system leads implicitly to a reduction in costs related to performance, security and maintenance of the organizational system.

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To develop a real foundation of the decision, there must be taken into account, above all, implementation of an integrated communications infrastructure and application. Development of advanced software tools for integration and aggregation of information should be basic feature in the implementation of information architecture at the organizational level. This would allow:

- Real-time access to information;
- Providing a single access point to information;
- Aggregation of data at central level;
- Improvement of decision – making process;
- Effective communication;
- Opportunity to improve / streamline the flow of activities and the planning process.
- Development of a collaborative, coherent and active in the collaboration with other entities.

Decision strategy based on a complex / critical system should always pay attention to the context of time and trends and development of a decision-making system.

For a long time, information technology (IT) was seen as a support field type, as hardware technology provider helping organizations work more efficiently and has been used from the outset to extend to new directions of development. Over the years, IT has become the backbone of organizations, leading up to the point where it would be impossible for many to work without IT facilities. "There is not anymore separate from, but is an essential element of organization" (Grembergen, 2004). As a result of increasing its role, the function that IT performs within an organization is constantly changing (Salle, 2004).

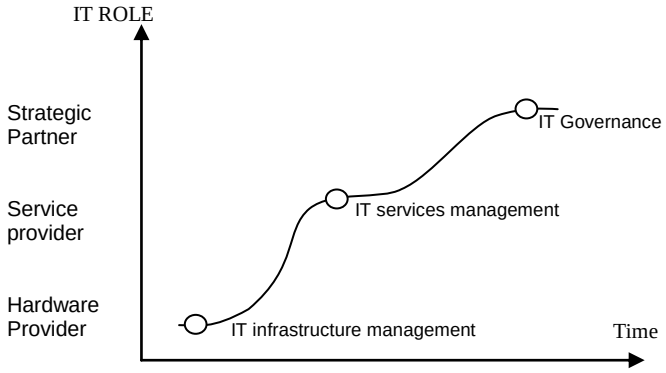

Figure 1. IT role evolution within organizations

Thus, Van Grembergen (Grembergen, 2004) outlines that by these changes "IT is not only a success factor for survival and prosperity, but also an opportunity for differentiation, in particular to gain a competitive edge." The role fulfilled by the "new" IT should be undoubtedly implemented in organizations by

implementing a strategic IT management that is focused on services and by the establishment of a strategy capable to align with the objectives of the activities carried out by organization (Figure 1).

Whereby the evolution of IT sector from simple technology providers to the service providers, there should be adopted a new vision of IT management. IT Service Management provides IT services provided at the center of IT management and is commonly defined (Young, 2004), as "a set of processes that work together to provide IT quality services in real time, depending on the level of services required to be addressed. This overlaps over areas of management such as system management, network management, systems development management, and over many other areas such as change management process, management of activities and incident management".

The difference between IT Service Management and IT Governance has long been subject to confusion and myths. Peterson (Peterson, 2003) gives us a clear picture of the differences between these two notions. "Since the IT management focuses on providing effective IT services and equipment as well as current IT activities management, IT governance is facing a doubling of applications that contribute to the performance of current operations and IT transformation, shaping and positioning for the future challenges of the organization "(Salle, 2004) (Figure 2).

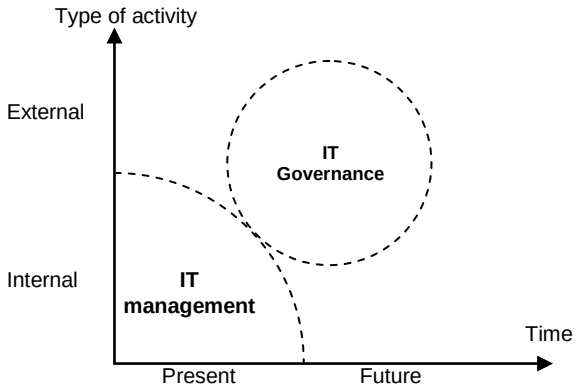

Figure 2. IT Governance and Management

In the specialty literature, various definitions have been proposed for IT Governance ever since 2001, IT Governance Institute (ITGI) suggested that "IT Governance is the responsibility of an organization management. It is an integral part of organization management and consists in management of different structures within organization and processes managed by them by which it is made sure that IT use supports the strategy and objectives of the organization "(ITGI, 2001). The key in this definition is given by extending the concept of IT and aligning this field to the scope of activity of the organization, regardless of its specificity.

1. IT governance

IT Governance Institute (ITGI, 2001) suggests that "fundamentally, IT Governance is concerned with two things: that it provides an added value to current activity and that risks are reduced." This leads to the four main sectors of the IT governance, all driven by stakeholder value. Two of them are focused on results: delivering added value and risk diminution. The other two are focused on activities management: strategic aligning to objectives and performance measuring (Weill & Ross, 2004). As noted by Van Grembergen (Grembergen, 2004), while providing value is focused on value creation, risk management is focused on activity value conservation.

1.1 Control Objectives for Information and related Technology (CobiT)

Together with the Common Criteria and BS 7799 (ISO 27001), COBIT standard (ITGI, 1998) (Control Objectives for Information and Related Technology), elaborated by ISACA (Information Systems Audit and Control Association - International Association of Information System Auditors) is the third international standard that can lead to development and growth of IT security systems.

COBIT is a set of control objectives in computer science, accepted and recognized internationally, which can be applied in security control and IT regulation field.

During the process of elaborating COBIT standard, there were considered especially IT issues made of three different professional groups:

- high level management people provide assistance regarding the risk management of information environment in continual moving, in decisions on investments needed to create controls.
- users provide control and information services security.
- Information system administrators create a uniform basis for evaluating internal controls, respectively for estimate and consultation activities for management.

1.2 COBIT concept

COBIT standard can be approached from three perspectives:

(1) IT processes,

(2) Classification of information,

(3) IT resources.

These three perspectives are represented as a COBIT Cube presented in Figure 3.

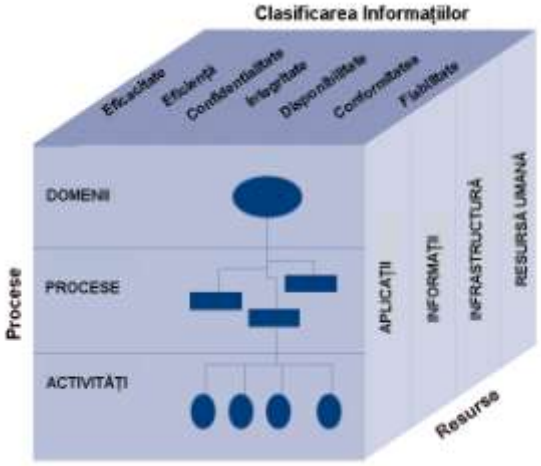

Figure 3. COBIT Cube

1.3 IT processes

The set of control objectives identifies 34 existing processes within the information technology (IT) divided into four areas with a high level of control approach over these processes, and 318 detailed control objectives and audit guidelines to assess the 34 IT processes.

Defining the activities and tasks are necessary to achieve measurable and quantifiable result upon which decisions can be made, on the importance of IT within an organization.

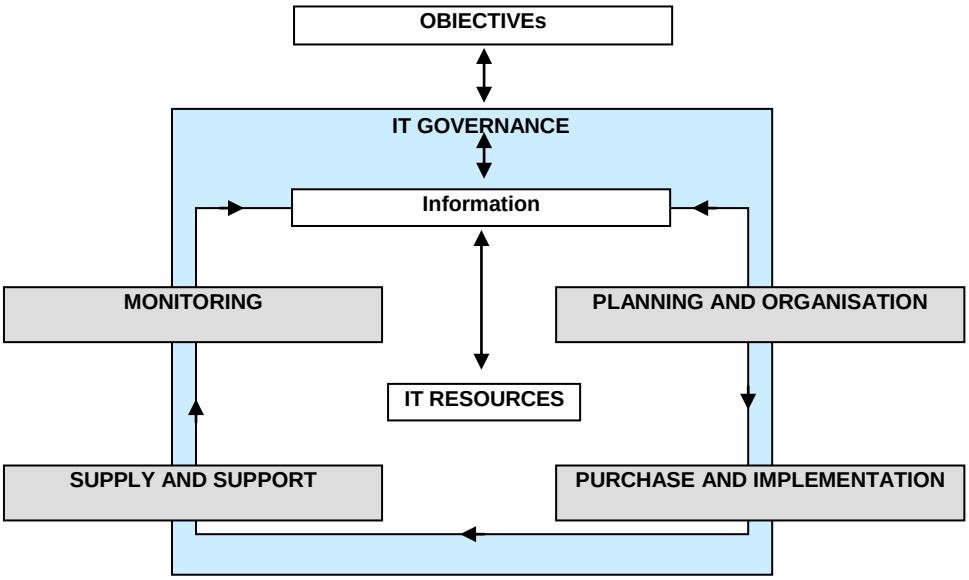

Figure 4. CobiT Domains

1.4 Planning and organization

This area refers to the strategy and tactics adopted at the organizational level, to identify ways in which information technology can best contribute to achieving the objectives at the organizational level. In addition, achieving the strategic vision needs to be planned, communicated and managed from different perspectives of development of the organization.

Within this area, there must be implemented the following objectives:

- good organization;
- a high technology infrastructure.

1.5 Acquisition and Implementation

To achieve the implementation of an information technology strategy, IT solutions must be identified, developed or purchased, and implemented by integrating them into organizational work processes (Bacivarov, Bacivarov, Mihalache, 2003). In addition, changes and maintenance of current systems are covered by this area to ensure a continuous life cycle for these systems.

1.6 Supply and Support

This area refers to the effective provision of services required, ranging from traditional operations over security to ensuring continuity in training aspects. In order to provide services, the necessary support processes must be developed and this area includes most of the time the actual processing of data by application systems.

1.7 Monitoring

All IT processes need to be evaluated regularly in time so that their quality and compliance be consistent with control requirements (Bacivarov, Bacivarov, Mihalache, 2003). This area deals with the objectives of monitoring management activities, process control of organization and the possibility to ensure an independent monitoring provided by an internal and / or external audit.

1.8 Classification Criteria

COBIT was developed starting from the correlation between risks to which the activity of an organization is subject, by the need to control specific processes and technical aspects. COBIT provides recommendations for various IT areas and a framework for carrying out processes presenting information in a logical structure and easy to use.

COBIT develops the needs of Quality, Reliability, Control and Security of organizations by providing seven criteria that can be used to define what is necessary to IT:

- *Effectiveness*: the information is relevant and pertinent to the organization activity; information is delivered timely, fairly, consistently and easy to use;
- *Efficiency*: provision of information through the optimal use of resources;
- *Confidentiality*: protection of data sensitive in terms of unauthorized disclosure;
- *Integrity*: accuracy and completeness of the information, accuracy in accordance with the mission (the role) organization;
- *Availability*: the information is available when needed, now and in future;
- *Compliance*: In accordance with laws, regulations in force;
- *Reliability*: provision of management adequate information to decision - making factor for it to manage the system and to exercise their responsibilities;

1.9 IT resources

Framework defines five categories of IT resources:

- Date: objects in the broadest sense (text, graphics, sound);
- Application systems: manual and programmed procedures;
- Technology: hardware, operating systems, middleware, networks, databases, multimedia;
- Facilities: environmental resources, including power, buildings and water;
- Staff: staff, skills and productivity plans.

2. Complex systems of high functional responsibility

In Romania, the design of complex information systems (Oprea, Dumitriu, Meşniţă, 2008) of high functional responsibility has achieved significant progress in recent years, however, practical experience in administration institutions has shown that often the analysis were limited to partial approach of an information system, as the description of information supports, documents or processes used for processing, overlooking the idea of a complex system. Given the negative effects of this approach, it is imperative to note that only an integrated approach to information system leads to what is defined as complex decision-making management in public administration, in Romania (Androniceanu, 2010).

The main features of a complex information system include:

- data collection on the state of the run system;
- transmission of data for processing;

- processing of data with a view to ensuring the information necessary to decision-making process;
- decision-making;
- transmission of decisions to execution;
- ensuring the control and implementation of decisions.

Information system connects the run system (Figure 5) and decision-making system, as their subordinates.

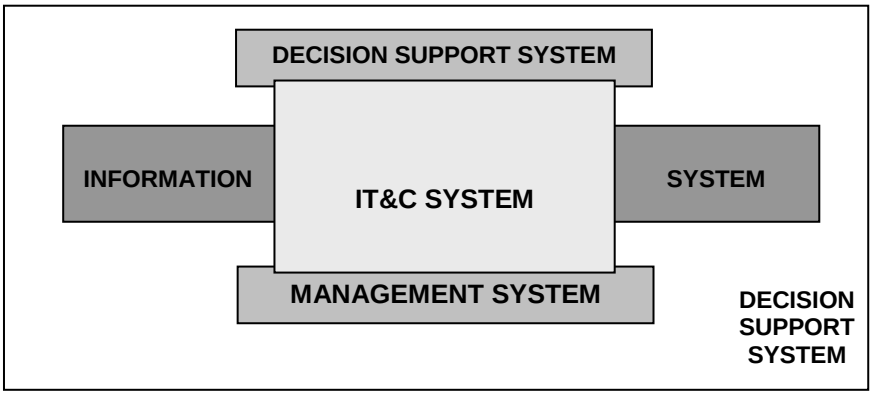

Figure 5. Relations between systems in a large complex system of functional responsibility

In an public administration organization, a fundamental role of management is the control or monitoring of how decisions are met. A decider factor always needs information and monitoring of the implementation of the decisions to achieve goals. Thus to achieve these objectives, an important factor is the decision support systems for the elaboration process and decision - making. A system to facilitate the decision is a computerized system that provides users, models for data use in solving problems it must solve (Sprague, Watson, 1993).

Systems to facilitate the decision can be implemented on common equipment, they rely on evolutionary models that provide information for decision making process (Stanciu, 2004). In this respect, first a hybrid system is created, and as time passes and the user interacts with the system, the coverage of information and data increases significantly, the system is evolving by adaptation.

It should be noted that such systems are designed to provide support in decision -making and not to make the decision, in each system, there are several alternatives to ensure the solution to various problems. There are 3 ways on how to monitor information systems based on decision support systems:

- The first direction is related to building control systems, which are limited in the area of cost control and on the other hand in the improvement and development of new information systems. Complex computerized information

systems enable public institutions to carry out a large number of operations, while ensuring permanent control and reduction of errors.

- The second direction is given by the implications of information systems outside a public institution. Lack of experts will lead to the acquisition of application packages. As a result, public institutions generally, and especially small ones, will be required to change work procedures to take advantage of existing technology. They will buy systems "turn-key" designed for a certain level of generality and will have to adapt procedures as required by the system.
- The third direction concerns the contribution of information systems to increase efficiency and derives from the fact that the information gets a growing expansion in organizational structures, use of information and information processing technology should be a component of the institution's strategy.

3. Decision support systems

The technologic emphasis in information field is focused on data storage and this to the detriment of means of data processing in useful data in decision making. (Androniceanu, 2010). Thus, decision makers are often forced to spend long periods of time browsing among multiple data sources of organizations to collect and seek relevant information they need, instead of analyzing such data.

Difficulties in accessing information are:

- Obtaining data takes too long and is usually delayed,
- The necessary information appears in an inappropriate format
- Their analysis adversely affect the performance of the decision,
- Information is rarely consistent and is subject to constant changes.

In systems working with databases, performance criterion is essential, it represents the element to be pursued throughout the life of a system from the planning stage, through design, programming, testing and use of database, so that the responsibility for ensuring quality and system performance is maintained at a high level.

This approach at the central apparatus of the Government facilitates the achievement of:

- rapid tests,
- organization,
- prioritization,
- development of a complex of preventive measures available immediately.

Decision support systems (DSS) are a coherent set of instruments used in decision-making process. Taking into account multiple criteria simultaneously, leds to the classification of issues studied in several classes of problems, solving a class of problems is done by using increasingly more methods and techniques, work procedures based on data and information processing (Druzdzel, Flynn, 1999).

A decision support system extends the capacity of the decider to process available information quickly and to tackle complex, time consuming problems,

reduces duration of decision-making process, improves the quality of decision - making, encourages exploration and learning process, creates a strategic or competitive advantage for the organization.

Along time, there were built and studied a wide variety of systems that provide support in decision-making and which have been grouped under the name of decision support systems or systems for decision management (Management Decision Systems) (Druzdzel, Flynn, 1999). Terms such as business intelligence, data mining, online analytical processing, knowledge management are used for systems which aim is to inform and assist decision makers in decision -making process.

Objectives pursued by using these data-oriented SSDs within central public administration are:

- integration of facilities provided by information technology in the investigation of processes taking place in the public administration;
- training of users and creators of SSD, reusable software products applicable in the management of management processes at the level of an organization;
- study of real problems and finding realistic solutions in terms of efficiency;

The instruments used in decision analysis such as modeling and simulation of complex processes of decision, presentation of facilities offered by different program packages as well as practical applications, case studies proposed for study and solving for each type of problem, provides a real framework for checking and fixing the knowledge used and for the correct use of working models and efficient operation of existing software products.

Usually there are several possible models to be used that provide essential information required but to substantiate the decision, one have to go through the following stages:

PREDICTION - SOLVING / SIMULATION - OPTIMIZATION

Experience shows that using models based on decision support systems and data repositories lead to significant increases in the coefficients of reliability, response capabilities, significant reductions in material, financial, human resources, and simplification of data collection and processing procedures.

3.1 Characteristics of support for decision- making

Based on the foregoing elements, there can be identified main features (Power, 2003) of decision support- systems:

- provide support to decision makers in semi-structured or unstructured problems solving;

- provide support in decision -making and enables decision-makers to control the decision-making;
- support all stages of decision-making;
- improve effectiveness of decision -making;
- use data and models;
- facilitate the learning process;
- is generally developed using an iterative, evolving process;
- support all levels of an organization's management;
- can provide support for multiple independent or interdependent decisions;
- support a single user or a group of users.

The types of decision support systems can be classified by the type of decision problem in systems:

- data- oriented;
- models -oriented;
- Knowledge-oriented;
- focused on documents or knowledge management system (Knowledge Management System);
- group (Group Decision Support Systems);
- inter-organizational and intra-organizational (Inter-organizational / Intra-organizational DSS);
- Web-based (Web-based DSS);

3.2 Architecture of a decision support system based on data

A support system for data-based decision -making has the following architecture (Velicanu, Muntean, Lungu, Ionescu, 2003):

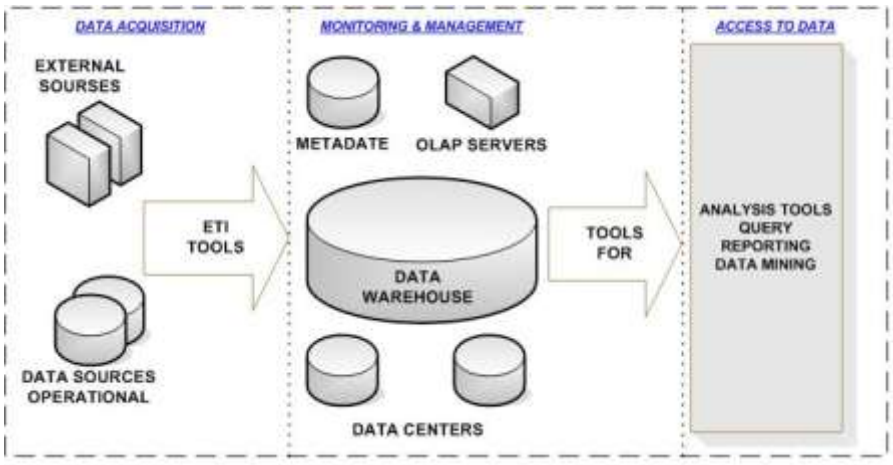

Figure 6. Component architecture of a decision support system oriented on data

Instruments for extracting data from operational databases and external sources. Extracting data from external data sources is typically accomplished through standard interfaces, it is a time-consuming process, especially when the data repository should be integrated with "legacy systems" (legacy systems) that are achieved by using a variety of databases management systems. These are either old (type network, hierarchical) or relational or object oriented.

Instruments for data "cleaning", transformation, and integration. Since a data repository is used for decision- making, it is important that the repository data be correct. Due to the large volume of data used and heterogeneous data sources, there is a high probability of errors and anomalies in the data (inconsistent descriptions, missing data, failure of integrity constraints, etc.). Therefore, they are important the instruments that help detect and correct data anomalies. There are three categories of such instruments: Data migration tools that allow simple transformation rules, instruments and tools for cleaning and those for monitoring allowing the discovery of rules and relationships (or signal failure rules) among analyzed data.

Instruments for loading data into the data repository

After extraction, cleaning and processing, data must be loaded into the repository. During the process of loading the data, there are sometimes additional activities such as checking integrity constraints, sorting and aggregation, to build derived tables stored in the repository, building indexes, etc.. Loading instruments are generally used. To populate the data repository, a loading tool should allow the administrator to monitor the loading process, to interrupt it and to restart it after a failure without losing data integrity.

Instruments to regularly update the deposit, data sources update. It consists in propagating changes taking place in data sources to the data repositories (change corresponding to the basic data and derived data, stored in repository). Arising problems depend on the time when the update is done and how. Typically, the repository is updated regularly (daily or weekly). If some OLAP applications require current data, it is necessary to propagate every change that takes place in data sources.

Update techniques are set by the administrator of data repository and depend on user requirements, traffic, characteristics of data source and database servers` facilities. Most commercial loading equipments use incremental loading during an upgrade to reduce the amount of data to be loaded into repository. Only modified tuples are inserted. However the load process is more difficult to manage. Incremental loading is treated as a sequence of short transactions (it periodically ends, ex after every 1000 seconds or after a few seconds) that must be coordinated to ensure consistency of derived data. Most SGBD offer replication techniques. There are two replication techniques: data shipping and transaction shipping.

Query instruments, report generators, analysis instruments and instruments for data mining. Instruments for queries (eg Power Play / Cognos, Business Objects / Business Objects, IBM's Query Management Facility, etc), tools for multidimensional analysis (OLAP) (ex. Express Analyzer, Express Objects / Oracle etc.), tools for analysis statistical and data mining tools allow users to access information stored in SSDOD and analyze them. Metadata is defined as "data about data" or "data describing the significance of the data", the quality of results depends on the amount of information necessary for decision making. Since a data repository reflects the business model of an organization, an essential element of repository architecture is metadata management.

The date repository are different types of metadata:

- Administrative metadata include all information required for setting up and use of a repository (descriptions of source databases, tools and utilities used, definitions of repository scheme, derived data, dimensions and hierarchies, predefined requests and reports, data centers location and their contents , data mining and "cleaning" , transformation rules, data updating, user profiles, control authorization and access;
- Business metadata include business terms and definitions, data owners;
- Operational metadata (operational metadata) include information collected during repository operation, such as repository data type (current and archives) and statistical information such as usage statistics, error reports, etc.

Monitoring and management instruments. A large number of instruments is used to create and manage a data repository:

- tools for analysis and storage capacity planning,
- repositories management tools,
- tools for system and network management used to measure traffic between clients and servers, between repository servers and operational databases, etc.

4. Modeling of a data-driven decision support for the analysis of a sectoral activity in a public administration organization

The complexities of decision-making processes require detailed study of situations in which multiple criteria are taken into account simultaneously. When carrying out a specific IT activity within an institution of public administration, use of data-driven method is most appropriate, as there may be outlined the performance indicators suiting this activity sector within an organization.

The complexity of calculations required to be made in a very short time is characterized by the elements mentioned in table 1.

Table 1. The elements considered along the implementation process

ELEMENTS	IMPLEMENTATION DIRECTION
criteria used in decision- making;	TECHNICAL
objectives pursued;	TACTICE
level of involvement of human factor – decider;	OF SPECIALITY
set of alternatives comprising all possible variants for action to attain the objectives considered;	TACTICES TECHNICALS
set of consequences and alternatives that may include as many consequences as alternatives exist (one state - condition of certainty) or more possible consequences for each alternative (multiple possible states - conditions of risk or uncertainty);	FINANCIAL, TECHNICAL, HUMAN RESOURCES

Multidimensionality (taking into account several criteria simultaneously) is an obstacle which can be overcome by resorting to techniques for modeling and structuring of data in normalized tables (Velicanu, Muntean, Lungu, Ionescu, 2003). The following steps are required:

- **Identification of variables**. Based on the study and analysis of the activity for which the system is built, the variables of that activity are identified (grit of these variables is also specified).
- **Identification of dimensions and hierarchies.** The following hierarchical dimensions are identified: DEPARTMENT (directorate, service) and TIP_ACTIVITATE (type of activity). The size of an organization is a dimension with structure in hierarchical levels: Department, Director and OFFICE.
- **Defining n-dimensional cubes/ multicub structure**. For the activity of a department within an institution, there is defined a multicub structure with one global dimension: time.
- **Refining the multidimensional model.** Dimensional structure identified in the previous step can be refined by adding or deleting dimensions. To remove insignificant values and reduce blast of cube derived data, we can combine two or more dimensions in a single dimension.

After completing these steps, there is necessary a logical design and physical implementation of the decision-making system. The system is built to provide concrete data, measures to ensure high performance (level of services) for an activity specific to IT sector within an organization of public administration. To ensure quality in carrying out an activity, detailed data is stored in a relational database, aggregated data being stored in a multidimensional database.

To develop multidimensional database, is recommended to use the following dimensions:

- DIRECTIE dimension is a dimension with totals included and contains within its organization sub forms;
- NIVEL_DIRECŢIE dimension (levels in the hierarchy of directorate);
- TIME dimension (duration proposed for analysis).

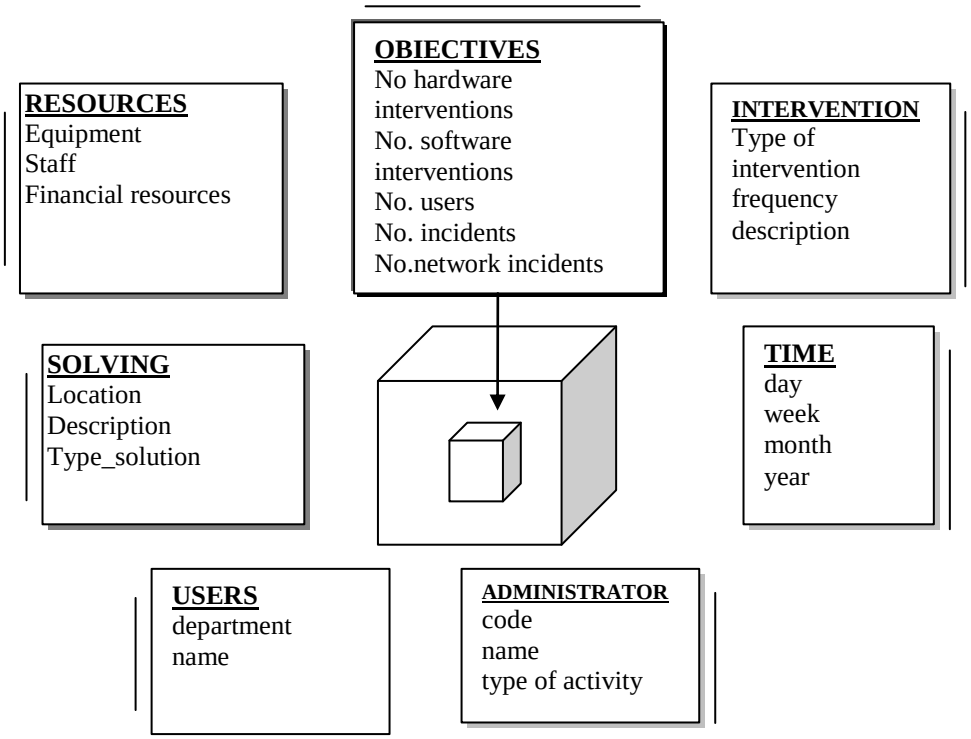

Figure 7. N-dimensional cube for analysis of maintenance activities

The next step is to identify associated variables and relations between dimensions, the data being loaded into a database source, by creating too an appropriate interface to allow applications and multidimensional operations.

Such a system to assist decision was implemented experimentally over four weeks, in an IT department of a public institution. This way of analysis was repeated after 6 months of the first experience.

Processes modeling and definition of n-dimensional cube for maintenance work led to the following graphic representation of the number of interventions by type of incident followed.

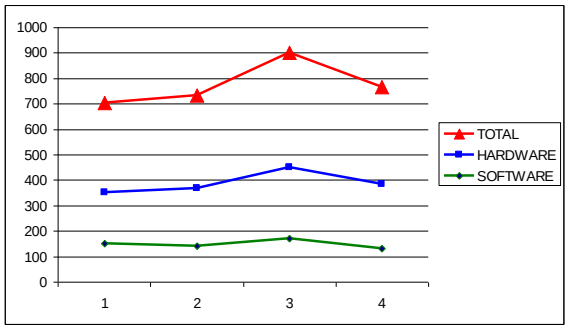

Figure 8. Number of hardware and software incidents -interventions - Phase I

After studying the types of problems chosen, and the large number of incidents - interventions, decision makers drew to the following conclusions:

- A large number of software incidents, by defining a high grit (client-server applications, browsers, operating systems) led to the decision of standardization of software versions and centralized update of available updates for your operating system from users.
- A high number of hardware incidents required upgrading IT equipment fleet by a number 50% of those which were with at least two incidents in the database record.

After the implementation of decisions resulting from the first experiment, repeating the experiment led to the following representation of incidents - interventions by category -hardware and software, as we can see in figure 9.

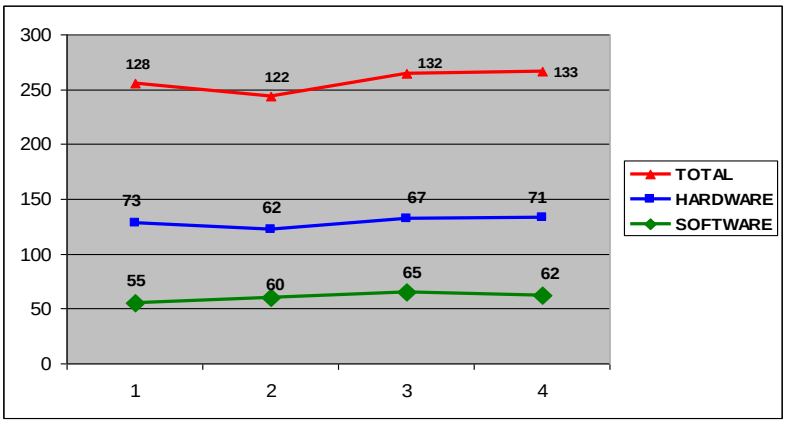

Figure 9. Number of hardware and software incidents - interventions - Phase II

Following the development and implementation of such a support model to assist decision, there can be made different types of analyses:

- graphical representation of the workload of staff (graphic evolution of the number of incidents);
- graphic evolution of the types of problems;
- developments of response time (solving average time to achieve goals);
- statistics.

Using such an instrument, based on data, provided decision -makers with a clear view of the problems in the IT sector (hardware and software infrastructure) of the organization studied the possibility of implementation of concrete measures for activity upgrading. With a clear view of the problems in the maintenance work, after the implementation of measures, efforts of the IT organization within organization were directed towards development (provision of new services, the wider range of technologies, training IT staff, etc.). Changing the specificity of the main activities (maintenance) to a tactical objective (development) provides

organization with added value and limited risk, implicit transition to IT Governance.

Conclusions

Use of coherent policy and strategy in evaluating performance by means of databases is a fundamental aspect in a performing activity and provides important information and details about the strengths and weaknesses of an organization / institution, on what can be improved, and how to optimize the whole system in its entirety.

By optimizing database systems through the implementation of decision support systems coupled with strong IT Governance strategy within each organization, there can be obtained advantages such as:

- Avoid buying expensive equipment and services;
- Reducing the maintenance cost of calculation systems and control of systems renewal;
- Decrease in response time with all the benefits of promptness;
- Decrease in stress of beneficiaries who must wait processing or generating of some situations and / or reports, and not least, avoid loss of confidence by reducing waiting times.

Data repositories and multidimensional analysis tools (OLAP) allow creation of complex systems that provide decision-oriented data access and combine functionality of direct access to data, generating immediate reports with analytical possibilities of multidimensional systems.

The potential of Information Technology in the reform and modernization of public administration has been exploited to a lesser extent, making an intra-government work platform (government intranet) lays the foundation and extends the concept of e-Government to facilitate the achievement of important functions, such as decision making, concern for public policy development and public-private government programs as well as monitoring, evaluation, and their fair sizing.

It requires, in this context the need of a new institutional approach structured on the principle of access and continuous renewal of information, in which the Internet, as a factor of globalization, is a digital reflection of contemporary society.

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