# The Future Challenge: Data Warehouse as a Method of Data Integration from Public Administration Legacy Systems for Decision-making in Republic of Macedonia

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**Abstract.** Significant enhancements of Information systems (IS) which are used in the Public Administration were made in the last few years in R. of Macedonia. The huge part of them was donated from the EU and UN organizations. The purpose of implementation of such kind of IS was to upgrade and improve the citizens' services, to decrease the waiting time in obtaining the desired documents and to enhance the access to public information. Also, the aim was to alleviate the administrative worker's job. Many of the PA's functions were enhanced, but, indeed, there wasn't succeeding data integration. Data was entered in the separated databases, in the different platforms and applications, under the diverse operating systems and servers. Data isn't available for entire organization. Data integration from the discrepant IS which are implemented in the PA's parts have the strategic meaning for gaining information for all levels of managers' decision making process as well as for gaining accurate and unique data, prepared for managerial reports in different formats.

**Keywords:** Data warehouse, local government, public administration, information systems, decision making, public managers.

## 1 Introduction

The last decade in the Republic of Macedonia passed in remarkable improvement of IS in public administration, as a result of EU projects which efforts were directed toward increasing of the professionalism and efficiency improvement of the public administration in the country [8]. The final goal of the projects was strengthening the citizens service, decreasing the overall waiting time of the citizens, to improve the access to the public information and to further facilitate the work of the administrative workers, by which there had to be accomplished a better productivity achievement and dedication [11]. Many software solutions were prepared for many different parts of public administration on national and local governmental level for every type of public service and public affiliation [3]. However, all the process of introduction and implementation of different information systems in specific parts of public

administration as ministries, public enterprises, agencies and local governments was not strategically leaded and previously successfully coordinated by IT experts. The solutions were prepared on different hardware and software platforms, from different equipment producers, operational systems, databases and software platforms, instead of unique coding system of the entities and creating a data dictionary on a national level in the Republic of Macedonia [13]. Because of the previously mentioned reasons, the information systems remained disintegrated without any possibility of their connection into a unique integrative system on applicative level and with many different data formats that are very difficult to connect when is necessary. Many efforts for getting a relevant data on national level are made by the State Statistical Office of the Republic of Macedonia which mission is to secure integrity statistical view on annual level, but that is still far away from a real integration that can secure relevant information for the needs of the high-level public managers in every areas that has to be on-time and directed towards the processes that are subject of decision-making [12].

Considering the previous reasons, our research will be directed toward the analysis of inherited information systems in different parts of public administration, their functions and possibilities as well as data that is subject of use by the different information systems. That means that we will analyze the current databases and entities that are within information systems, changes and processes that are processed in information systems. The second part of our research, in this paper, will be directed toward researching of the information needs of public managers in public services, sectors, ministries and high-level governmental officials that make decisions and have a need of unique integrative data from different areas in the decision-making process. Comparing both approaches of analysis of the information bases that are available (bottom-up approach) and analysis of the information needs of public managers in public administration (top-down approach) we will propose a strategy for solving the problem of securing the needed information for decision-making by the top public managers on the national and local governmental level. Because of the complexity, we decided to split the overall project in several different parts- analysis of the needs of the individual work segments- in ministries, agencies and in the local self-government units in the Republic of Macedonia [4].

## 2. An Analysis Of Different Parts Of Public Administration In The Republic Of Macedonia And Their Applicative Solutions

The analysis of information systems in different parts of public administration is a very complex task from organizational as well as informational aspect. The whole analysis of the public administration system in the Republic of Macedonia requires strategic approach and to achieve that is necessary to create a project that will include a large number of team researchers that possess a high level of IT knowledge as well as organizational and operational knowledge about the processes that are subject of analysis. The project will require huge time and effort and can result in best valuable solutions about the problem i.e. the most real, most optimistic, most pessimistic solution of the problem, and to define all pre-conditions that must be satisfied for each

offered solution and possible actions that can threaten the realization of this type of complex project in organizational as well as in technical aspect [7, 5]. This type of project will cost the Government of the Republic of Macedonia a lot of money and time and still the remains the question: Which solution will be chosen and when that solution will be implemented.

Considering all the above-mentioned, we concentrated our research in the local governments in the Republic of Macedonia, by using the model of local government and it's functioning within the overall governmental setting in the Republic of Macedonia [4, 14].

The research showed that the local government posses different hardware as servers, as well as working stations. The servers process data as Windows Server, Unix and Linux operational systems. The client stations of the final users are personal computers that process data Windows client platform and are supplied with MS Office packages and an increased number of applications that are used for executing of their specific tasks and the needs of the service where they are located. The administrative workers as users are connected in hardware LAN networks in the department and there is no intranet network that is connected to all equipment in all sectors and services in local governments. The big part of the local government employees have an internet access, but can not use the resources of the other services in the local government. The information that are preparing for higher-level public managers of the sectors and in general, the office of the mayor are in Office format that are get by using manual or Excel calculations and are delivered in hard copy. Because of the needed time for preparing this types of reports to the other services and sectors, those employees that get the information and make decisions (high-level public managers in local government) get obsolete information and the decisions are derived without having enough information about the whole process [7]. On picture 1 is displayed "it is" condition of the hardware networks that are present in some parts of the local government and which are located in different locations in the local government. All are installed in specific IT companies, depending on that who is donator of those hardware and software components under different operational systems with different databases and applicative solutions [2, 9, 10]. They are not connected each other, are not software (and hardware) compatible and their code systems are not compatible each other. Might be that one of the biggest limitations are not of technical but organizational nature and lacking a serious information about which data is considered within the separate IS in the local government. For example, the public finance department in the local government posses a server application for financial issues that is not connected with the department of planning and analysis of plan implementation and the department of communal issues besides the fact that the data is entered through positions and codes in the financial books of the local government. The application about the financial work is prepared in ACESS while other applications are prepared using other platforms, such as Windows, MS SQL server base with Visual Studio.NET platform, some as applicative data LINUX operational system and MySQL base, some others as Oracle, DB2 as well as concepts such as Content management systems with different bases and web-based systems. The applicative supports of each separate section as well as areas of application are depictured on below Picture 2.

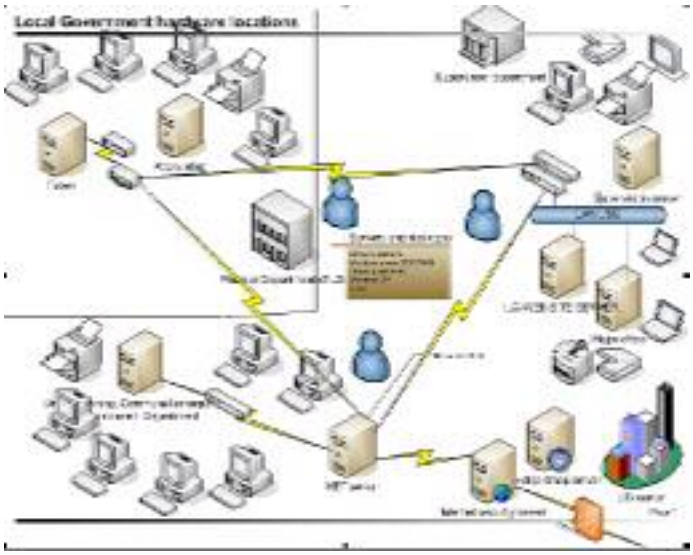

**Fig 1** A Global Scheme of Hardware Platforms in the LG' Self-Unit- "it is" situation

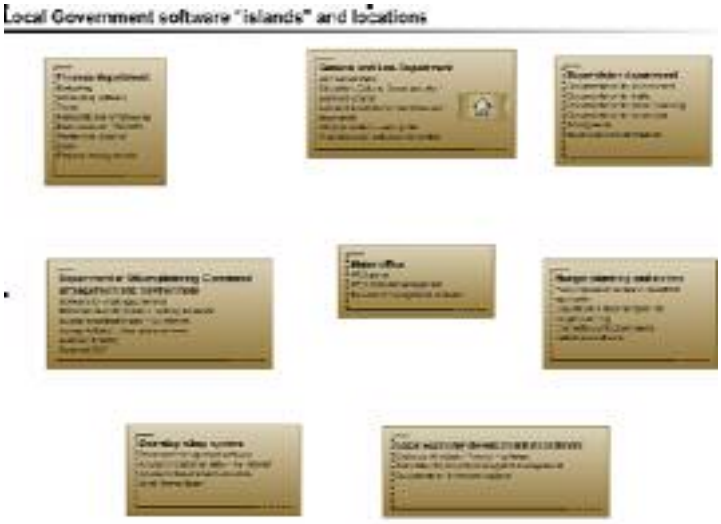


**Fig 2**- Applicative Support for the Fields covered by the Separate Local Government Services that are made of Different Operational Systems and are not mutually connected (i.e. closed within the Services without possibilities for Data Exchange with other parts of the Local Government)

The analysis of the Local Government database showed presence of inconsistent entity naming according the existing separate needs, inadequate entity codes, different code lengths, descriptions, unique measures and inadequate coding for entities about

the needs of all sectors and services within sectors. There are many examples. The IS base of the communal services does not include special codes of positions that are needed for the financial services. Also, the salary application does not include differentiations according the needs of the financial sector and main book application. Additional difficulties make the situation of documentation lack for the existing and inherited IS within different public services as well as the permanent fluctuation of IT employees in and out of the services. All these inconsistencies require data reorganization in different bases, which means inconsistency problems with IS of the different applications within the same public service/services. Aldo, there is a big possibility for communication at HML level, it is inappropriate for many data that needs to be analyzed, filter, transform and prepare for managerial support in the decision-making process. The schemes that we constructed for that purpose are of ER type diagrams with entities that show data details about the inherited IS of the local governments. One example for that type of scheme is displayed on Picture 3. The next phase can be their application in creating G-graphic and C-graphic.

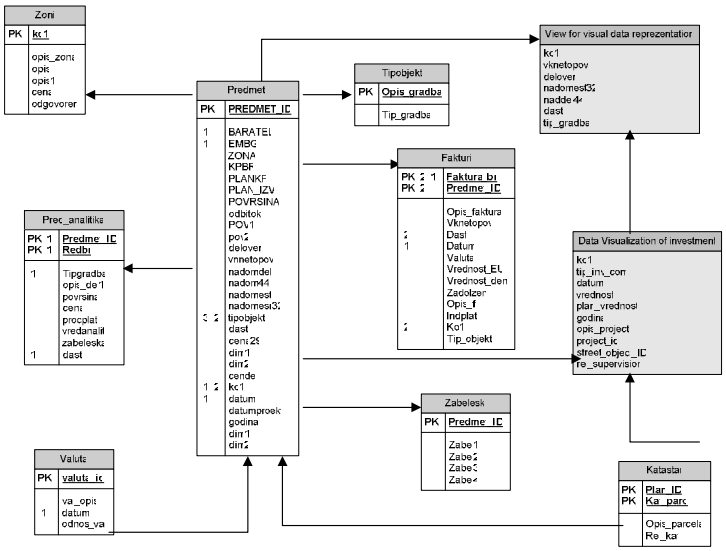


**Fig 3** An Example of ER diagram of the bases of one of the services in the local government- the Division of Communal Affairs in the Department of Urbanism, Ecology and Communal Works within Local Government

## 3. An Analysis Of The Information Needs Of The Management Structures In The Local Government

It is our believe that the absence of strategy for building a consistent IS on local governmental level and its connection with the national governmental bodies [15] i.e. ministries, agencies, funds etc.- undoubtedly brought to disparate systems that are very difficult to integrate from the semantic aspect as well as from the aspect of

compatibility of different entities that are subject of interest and their possible modifications.

The next section of this paper will lead us to the analysis of information needs of the top level officials in public administration and management (in this case the local government bodies as the Mayor, City-council members and their numerous consultative bodies that prepare the plans, financial reports, detail plans and the plans for local government investments. They need to have on hand the overall databases that are prepared and stored in different specific bases of data in different services and departments within the local government. It is evident that the needed data have to have aggregate and sometimes analytical character- a possibilities for getting drill-down of the data from aggregate bases. It is particularly important to get tax data according paid codes that can not be extracted from analytical data because they are not entered in time of payment for communal or other services- from project payments to payments for control of the project implementation of public interest. Other possibility that is required is tracking the costs of the services and departments, areas and streets, types of investments, project codes etc. There are other needs and possibilities for getting data about current costs and incomes in different areas with possibilities for tracking of the planned and already implemented in objects, projects and investment codes as well as a need for control of the work of all inspectorates, without any difference if they are located in local government or within the ministries. In other words, are the inspectorate's cases subject of proceeding or they are just left in the office desk?

The implementation of plans and eliminating the gaps between planned and already implemented are very important indicators during the process of control. All these needs are based on the interviews given by local government managers on top-level- elected as well as appointed public managers even to the lowest operational-control level [4].

Besides, one of the barriers that we faced with during our top-down analysis was the lack of knowledge about the possibilities that are offered by the practical applicative solutions from the top administrative managers and their assistants. It is our believe that there is a need of additional training for the public managers in local government in order to become more knowledgeable about the data that is collected within their local government by which they can become more consciousness about the information power of the data that is collected, stored and analyzed in local government databases [5] as well as the advantage that they might have in the decision-making process for important segments of their work connected serving one general purpose- rightful ad appropriate use of the public money which is their primary responsibility and public duty on a workplace.

## 4. Comparing The Analysis Of The Inherited Local Government (Is) And Information Needs Of The Public Managers In The Local Government

The next phase that is very important in order to really consider the possibilities of fulfilling the information needs of the high-level public officials in local government is comparison of the information needs with the possibilities that are provided by the already inherited systems in the local government. In order to make this analysis, at first it is very important to create G-graph diagram [1] by which on visual basis will be displayed the goals of the manager's structures and after that they will be connected with data sources i.e. bases from which those purposes will be implemented. This diagram can be transform in so-called C-graph (connectivity graph). In doing that, there is a need for creating ETL procedures by which the data from inherited (legacy) systems will be extracted from the transactional information systems (TIS), will be transformed, defined, coded again or enriched with additional codes and descriptions and after that entered in the newly established, refreshed and upgraded databases with integrated data for the needs of the public employees [6] - (Data Warehouse). This concept secures constant work of TIS systems with parallel creation of the decision-making support systems and the operational control of the managerial and analytical human resources. Besides, the detail definition of all needed data about the data warehouse, its back and front metadata requires wider and detail analysis prepared on the basis of clear and precise documentation [6]. Examples of G and C-graphs about the transformation of the goals in appropriate connection diagram [1] are displayed on Pictures 4 and 5.

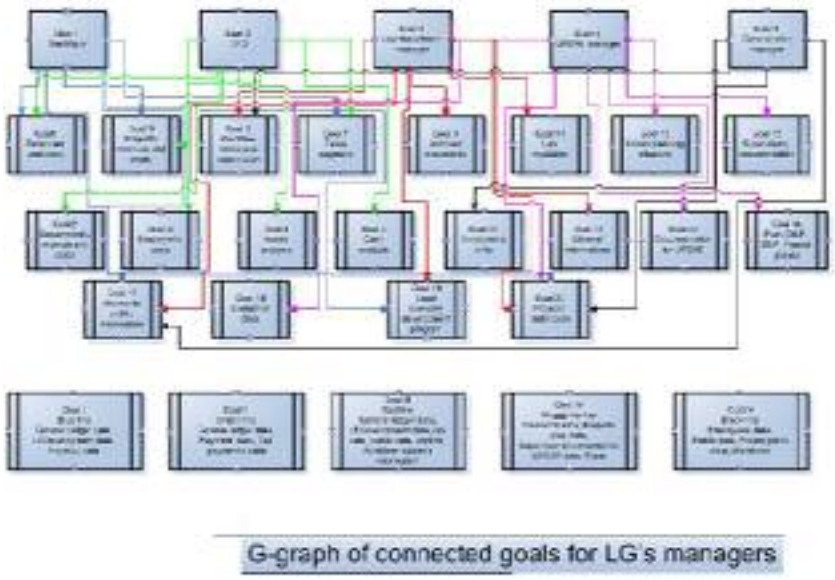


**Fig 4** G-graph of local government data

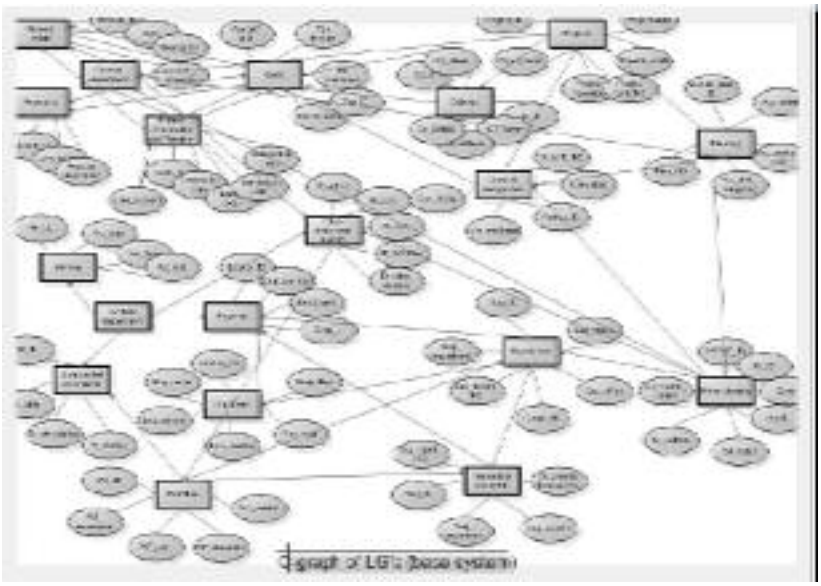

**Fig 5** C-graph of local government data

## 5. Proposed Concept For Solving The Problem Of Fulfilling The Information Needs Of The Local Government Public Management Structures

The solution that is imposed after executed analysis is the creation of local government data warehouse that will have the needed granularity of the data and will secure on-time data for the local government decision-making needs. The analysis of the complexity of the proposed data warehouse needs to include an analysis about the need for creating data marts for specific public services that can be created as replications of the central data warehouse or as virtual data marts that can be created from the inherited systems on applicative level.

With the main goal of realizing the experiences of data integration in the EU countries, we searched for solutions that are already used as integrative concepts of the public administration data in EU country members. The solutions that we searched for are in HTML scope of solutions about data transfer from one to other platform with a very similar concept as the proposed one- Data warehouse for the needs of the high-level public managers in some EU member countries. But, what is important is that the governments in EU countries already had prepared strategic concepts of integration of their IT systems and all processes are implemented according those concepts. Other important element is their dedication to the problem (what is missing in the Republic of Macedonia) and the third, most important concept are the large investments in computerization and automation in all segments of public administration that provides big synergy in solving all administrative problems of operational character. The last and most important factor for the success of the

administrative managers in EU countries will be mention the high level knowledge about IT technologies and permanent training financed by the national and local government institutions in EU member countries.

From our previous made research and the conclusions derived from one part of public administration in the Republic of Macedonia i.e. local government about the inherited IS and information needs of the high-level local government public managers, the most optimal solution is the creation of data warehouse that incorporates many flat and dimensional tables in form of snow-flake structure. The proposed data warehouse is depictured on Picture 6 below. The details that are needed for the high level public managers are defined in the metadata dictionary. Some of the flat tables are initially empty but there are recommendations about how inherited TIS systems should be changed in order to be filled in the future. On-time data update in data warehouse will result in better decision-making and that can be accomplished by using appropriate ways for refreshing and updating the data with on-time start of the updating procedures or so-called trigger procedures for events in certain databases in the inherited systems. The accurate functioning of data warehouse will depend on the effective and efficient work of the data warehouse administrator and of the appropriate training of the public managers in how to use those data by using final tools in getting reports, visual images and other different types of analysis.

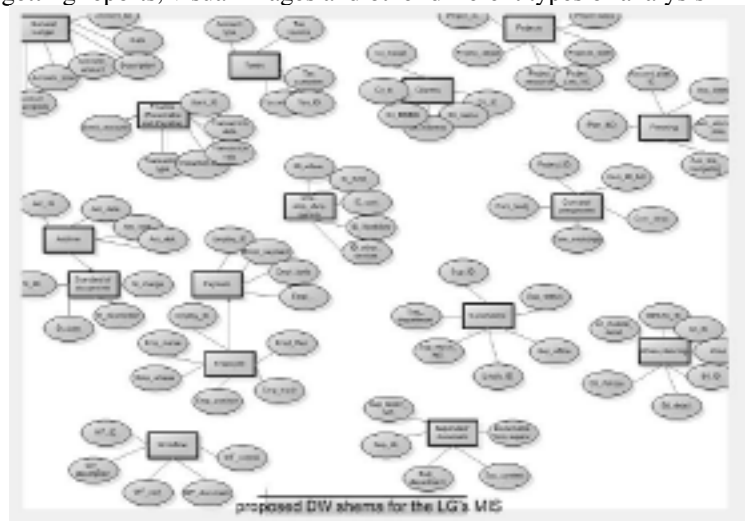


**Fig 6**- Proposed data warehouse for the local government in the Republic of Macedonia

## 6. Conclusions

Data integration of the inherited IS in public administration in the Republic of Macedonia is very complex task because of the complexity and differentiation of the platforms upon which are build the TIS systems in the services and sectors of the public administration as well as the absence of a plan for data integration and unique

data dictionary for all entities that are subject of interest of all public administration institutions. As a consequence, we propose partial data integration that are of interest of the high level public management officials by creating a separate data warehouse for the needs of a particular segments in the public sector, in this case the local government. The data that will be a part of the data warehouse needs to be characterized with defined granularity, updating period and metadata dictionary. All this data warehouses are possible to be used by the high level public managers in the local government by creating a conceptual local government intranet network that can be a solid base for getting valuable information for the decision-making needs of the elected and appointed management structures in the local government.

This concept requires a detail analysis about the data sources of the inherited IS, detail study analysis of the information needs of the local government public managers as well as creating G and C graph schemes that will define the future needed data warehouse structure. By incidence, from the already created data warehouse can be created so-called data marts that can support operational control and management on a divisional level within the department.

In order to achieve integration on the national level in the Republic of Macedonia there is a need of a strategic plan with a unique coding system, data dictionary and integration of the separate data warehouses in order by using extranet (or some type of Claude network) to get data that is highly desirable for the highest level of public management in the local government. It is more than certain that the concept requires professional planning, data protection and detail knowledge of the overall data fluid in every segment of the local government and public administration in general in the Republic of Macedonia.

## References


1. G. M. Marakas, Modern Data Warehousing, Mining and Visualization, 2003, Indiana University, New Jersey
2. SQL Server Architecture, SQL Server 2000 Data Warehouse and OLAP Components, 2009, www.microsoft.com
3. UNESCO. Sustainable Urbanization. 2009, http://www.unesco.org/en/esd/
4. Opstina Prilep. Annual report 20007. 2009. www.prilep.gov.mk
5. E. Turban, E. McLean, J. Wetherbe, "Information Technology for Management – transforming business in the digital economy", John Wiley&Sons
6. Reeves, L., (2009): A Manger's guide to Data Warehousing, Wiley Publishing, Inc.
7. Moss, L.T., (2003), Business Intelligence Roadmap: The Complete Project Lifecycle for Decision- Support Applications, Addison Wesley
8. Cvetkoski, A, & other, (2003), Low Market, NGO AGTIS, Prilep, R. of Macedonia
9. Schrader, M.,& other , (2009): Oracle Essbase &Oracle OLAP, The McGraw-Hill company.
10. Sorensen, J.E., (1999): Creating a DW using SQL server, DMDV'99.
11. http://www.undp.org.mk/, 2011, UNDP Macedonia
12. www.stat.gov.mk, 2009/2101, DZS, R. of Macedonia
13. www.sas.com, 2009/2010, SAS Institute Inc.
14. www.prilep.gov.mk, 2011
15. www.vlada.mk, 2011