

 reviewed paper

Smart Data for Smart Government – a Show Case from Abu Dhabi Distribution Company

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1 ABSTRACT

Geographical Information Systems (GIS) has become an important and smart tool in planning, and serving the community, the local authorities and governments, decision makers and planners, etc.

This paper is a showcase of GIS application in planning and managing the water infrastructure system in Abu Dhabi, United Arab Emirates (UAE), in particular the maintenance. It emphasizes the importance of smart data in decision making and smart planning.

The paper presents first a description of the Abu Dhabi Distribution Company (ADCC), the data provider, and an overview of the use of GIS in its different departments, as an example of how Abu Dhabi government is going toward smart planning and sustainable development. The paper also explains in brief the causes/types of damages that may occur in the water supply systems precisely the pipes.

The practical part of the paper presents the case study and explains the methodology. The research work consists of mapping by using GIS the locations of the accidents that happened in the water pipes in different time periods in the Abu Dhabi central area. It also localised and mapped the types of damages identified as technical or caused by a third party. This represents the uniqueness of the paper, as it presents this data for the first time as a geospatial information to a decision maker at ADCC, unlike the non-spatial data that was used before. The paper ends by discussing the findings and presents the results of the discussion with one of the decision makers at ADCC Company, and includes some recommendations.

The objective of the work presented in this paper is to show through a case study how Smart Data can help Governance to be Smart.

2 INTRODUCTION

2.1 Overview of ADCC

Abu Dhabi Distribution Company (ADCC) was established in November 1998. Its role is to distribute water and electricity to all customers in the emirate of Abu Dhabi and guarantee the high quality of its services. It covers the three regions: Eastern Region (Mussaffah and Baniyas), Western Region (Liwa, Silla) and Abu Dhabi Island. ADCC's is responsible for the planning, design, construction, and operation of the Abu Dhabi water and electricity distribution network. ADCC is owned by the government of Abu Dhabi through the Abu Dhabi Water and Electricity authority (ADWEA), which determines all business relating to the formulation, development and implementation of the policy of the government in relation to the water and electricity sector in Abu Dhabi. However, ADCC continues to operate within the overall policy framework set by ADWEA, particularly in the areas of personnel, procurement and financial policy.(ADCC website, 2016)

2.2 An ArcGIS Database for Water Supply/Demand Modelling and Management in Abu Dhabi

An ArcGIS Database is used in ADCC to provide real-time data for Water Supply/Demand Modeling and Management. It was done by a water resource scientist and its team in Abu Dhabi Emirate, UAE

A supply-demand model balance up to year 2020 has been developed by a water resource scientist and its team in Abu Dhabi Emirate, UAE (Fig.1). They linked the demand locations to the supply sources to predict the future water surpluses and shorts. While GIS is widely use in managing the water and electricity supply system, it is less used in the maintenance operation. The system still relies on numeric data such as the street number in a format of excel sheets to locate the damages (Table 1 and Table 2). Hence, the necessity of mapping the geospatial information in order to offer the decision makers a good visibility and a better understanding of the situation.

The aim of this paper is to provide a smart data that not only save time and efforts in its collection and representation, but offers the right information in a the best way possible to produce smart governance, that mean to be intelligent, fast, efficient, sustainable and right.

The following section: methodology explains what was the data proposed to the decision makers and how it could help them in their governance.

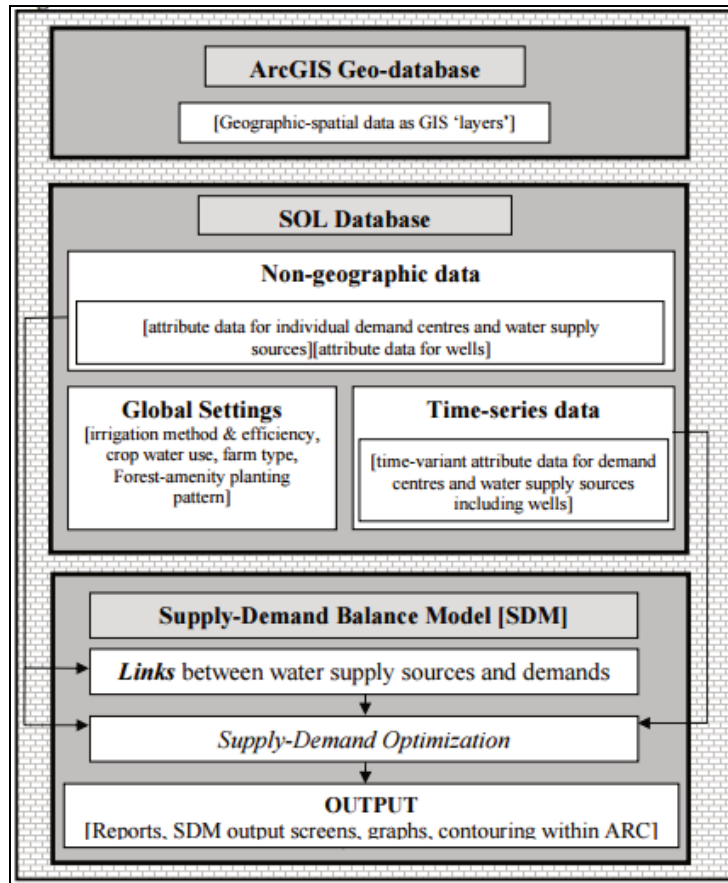


Fig. 1: Example of Numerical Database of Water pipes damages in Central Abu Dhabi Area.

2.3 General description of the types of damages in water pipes

According to the literature, observations and interviews with technicians and managers at ADDC, the damages in water pipes maybe caused by several factors, some of them are purely technical, others are related to nature and catastrophes and the rest are caused by humans. Hereunder, we mention the most known ones:

- Technical, such as an unexpected high pressure of water that exceeds the capacity of the pipes.
- Some unusual continual flow in the water pipes causes Burst pipe risk.
- Material used affects the “life” of the pipes. Some materials become rusted after short times.
- Aging and deterioration of the pipes cause leaks and damages.
- Neglecting the monitoring of the ambient temperature of water flow leads to some damages in the pipes. For example, if the temperature falls below 3 degrees there is a risk of freezing, which is not applicable in our case since there is no snow in UAE.
- Natural disasters such as floods and earthquakes, explosions, breakage in the pipes.
- A third party factor that might intentionally cause damages to the pipes such as during constructions.

3 METHODOLOGY

This research is about mapping the damages of the water supply pipelines in central Abu Dhabi area, in UAE from 2006 to 2013 having an equal time intervals of 3-4 years that was chosen for convenience purpose.

With the corporation of the Abu Dhabi distribution company (ADDC) we got the GIS data that needed for this application, which is related to the plots and divisions, the rods, the pipes and main pipes network. The excel sheets that stored the following information (Table.1) have also been provided:

- The year of the damage stored in the database as day, month and year.
- The type of the damage
- The location of the damage saved as district and division, identified by numbers and characters (Table 2)
- The number of damages per year was figured out from the initial data.

Description	Work Type	Location/Tag	Status	Target Start	Scheduled Start	Resp. Section	Failure Class
Damage Caused by third party, Supervise the Work by Water O&M Directorate NO.P-1/Case:	CM	DW-AUH-W35-PLSM-200DI	CLOSE	23/11/2013 07:00	23/11/2013 07:00	W-CEN	PIPE
Damage Caused to Water Main Pipeline, Repair by Water O&M Directorate:at Plot No. P - 37 Case No.	CM	DW-AUH-E22-PLSM-150DI	CLOSE	18/11/2013 14:00	18/11/2013 14:00	W-CEN	PIPE
Damage Caused by third party, Supervise the Work by Water O & M Directorate at Plot No. C - 33 Case No.	CM	DW-AUH-E13-PLSM-150DI	CLOSE	18/11/2013 11:00	18/11/2013 11:00	W-CEN	PIPE
Damage Caused to Water Main Pipeline, Repair by Water O&M	CM	DW-AUH-W0401-PLMN-100DI	CLOSE	21/11/2013 14:00	21/11/2013 14:00	W-CEN	PIPE
Damage Caused by third party, Repair by Water O&M Directorate: at Plot No. 138 Case No.	CM	DW-AUH-W1801-PLSM-150DI	CLOSE	20/11/2013 01:30	20/11/2013 01:30	W-CEN	PIPE
Damage Caused by third party, Repair by Water O&M Directorate at Plot No. Opposite AL Helal Bank Case ID.	CM	DW-AUH-W12	CLOSE	10/11/2013 15:00	10/11/2013 15:00	W-CEN	PIPE
Damage Caused by third party, Repair by Water O&M Directorate at plot no. A 28 Case no.	CM	DW-AUH-W50-PLSM-150DI	CLOSE	25/11/2013 14:00	25/11/2013 14:00	W-CEN	PIPE
Damage Caused by third party, Supervise the Work by Water O&M Directorate at plot no. 2	CM	DW-AUH-W1803-PLMN-300DI	CLOSE	07/04/2013 14:00	07/04/2013 14:00	W-CEN	PIPE
Damage Caused by third party, Supervise the Work by Water O&M Directorate at plot no. 4	CM	DW-AUH-W20-PLSM-150DI	CLOSE	08/04/2013 09:15	08/04/2013 09:15	W-CEN	PIPE
Damage Caused to Water Main Pipeline, Repair by Water O&M Directorate:	CM	DW-AUH-W0401-PLMN-100DI	CLOSE	10/04/2013 07:00	10/04/2013 07:00	W-CEN	PIPE

Table.1: Example of Numerical Database of Water pipes damages in Central Abu Dhabi Area.

Table 2: Location of the Damaged Water Pipe Stored as a numerical Data.

Three years: 2006, 2010 and 2013 were chosen according to the available data, and the software used is ArcGIS, version 10.2.

Firstly, the location of the damages on each year based on the SQL (select by attributes) was found and layers for the chosen years were produced. Then, the layers of the different years were compiled in one general map named: Location map of water pipes damages (Fig. 2).

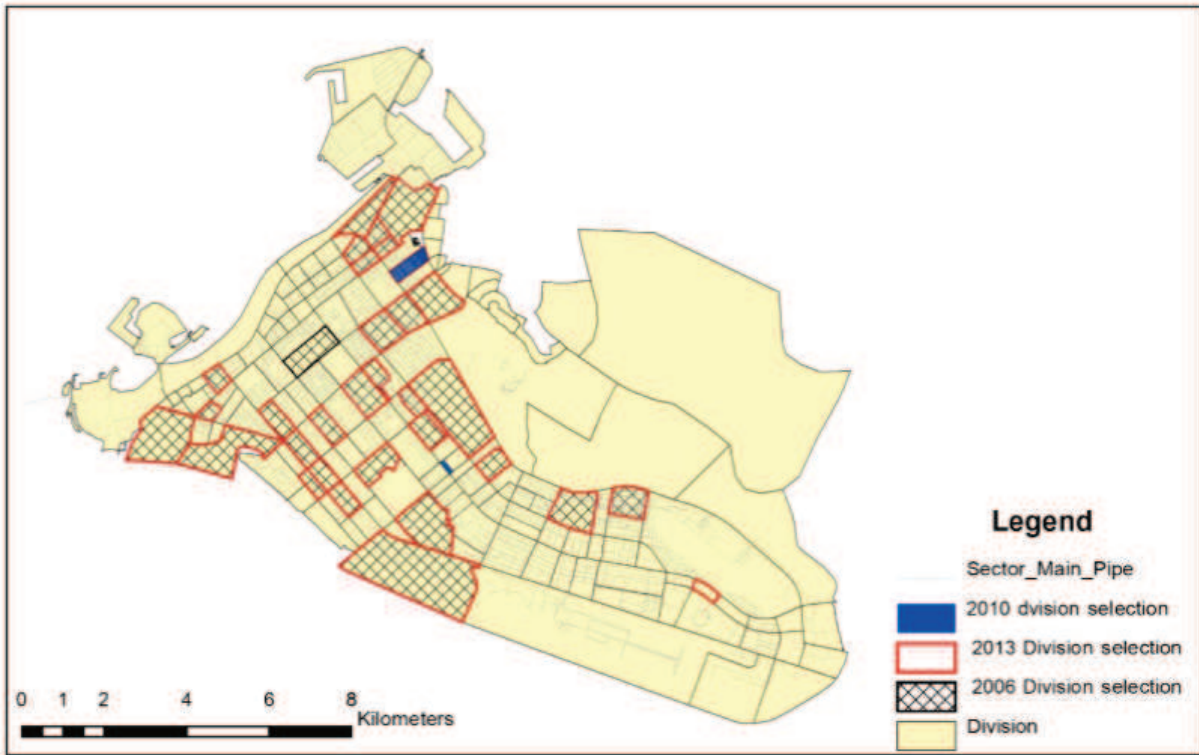


Fig. 2: Location Map of Water Pipes Damages in Abu Dhabi Central Area.

Secondly, the types of damages were mapped for the three years (Fig. 3) and compiled in one map called: Types of water pipes damages map.

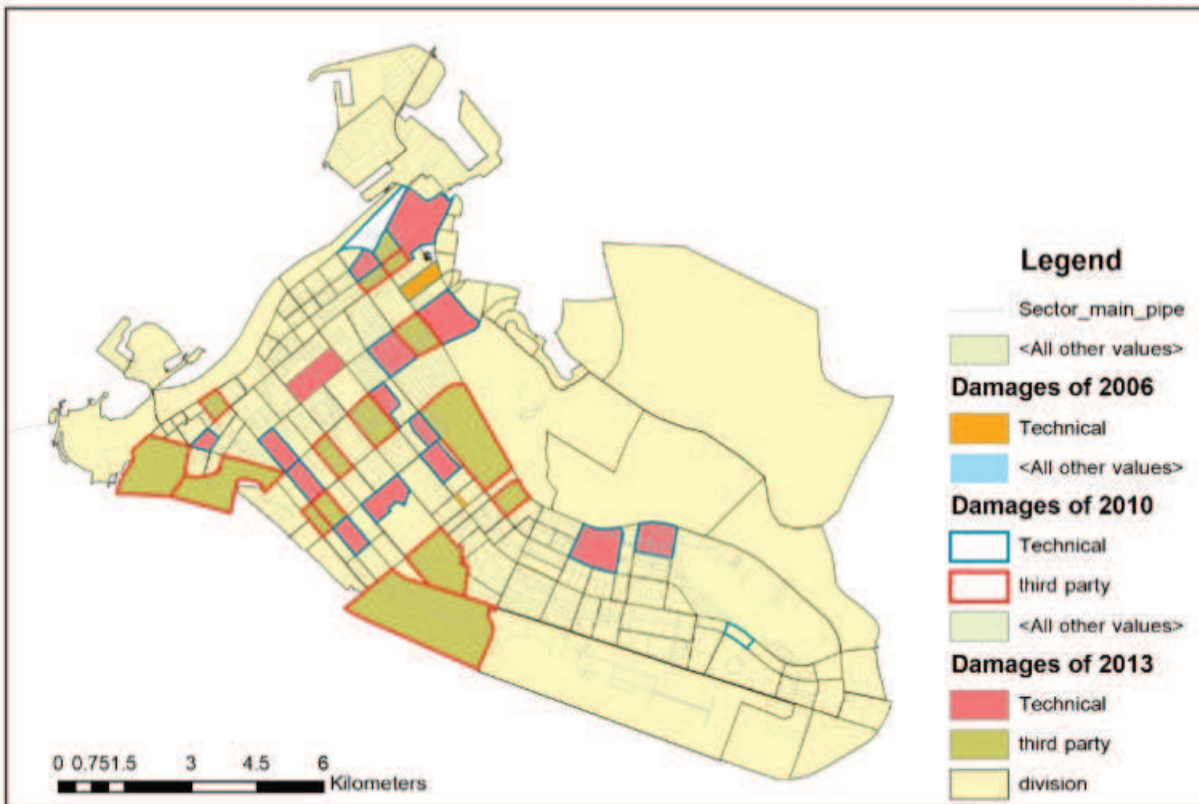


Fig. 3: Types of Water Pipes Damages Map in Abu Dhabi Central Area.

After that, graphs representing non-spatial data were produced (Fig. 4 and Fig. 5) and combined with the spatial data (map produced in order to create a better visualization and understanding of the situation to the decision makers at the ADDC.

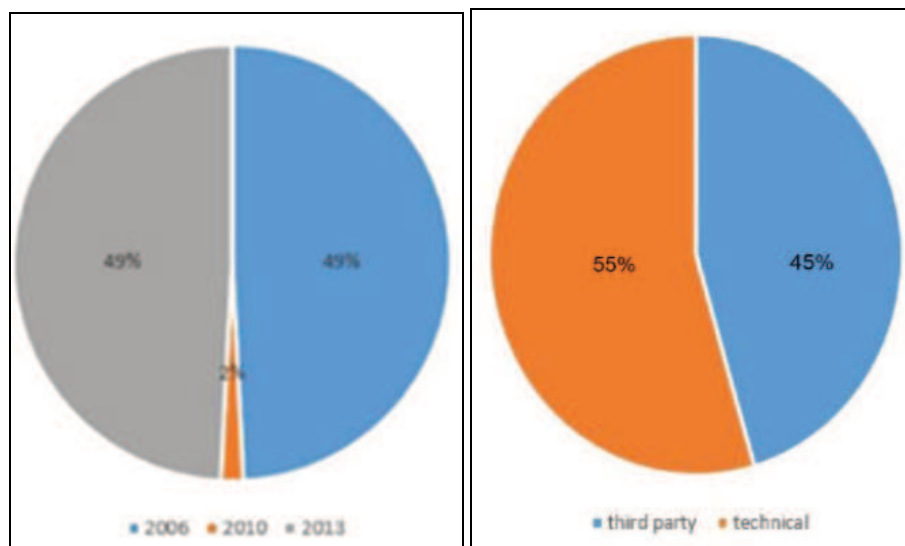


Fig. 4 (left): Percentage of Water Pipes Damages per Year. Fig. 5 (right): Percentage of Water Pipes Damages per Type.

It is important to note here that the records related to the water pipes damages are stored as an excel sheet and mapping of damages location was not done before or used in the decision making process. These two maps represents a smart data produced by a smart planning support tool: GIS for a smarter/more intelligent

4 FINDINGS

The GIS maps show that the water pipelines damages happened mainly in Al Bateen area, Bainunah street, and the area around Al Salam street. This is because of the constructions that happened in these areas during the interval period 2006 to 2013, due to the urban development that follows the Abu Dhabi 2030 masterplan. These constructions, which are either new developments or belong to renovation projects caused the accidents and damaged the pipelines. The Analysis also shows that the third party caused more damages due to the constructions that happened during the study period 2006 to 2013 as explained earlier.

It is important to note here that showing the results of the analysis to a decision maker at ADDC, has helped her getting a better understanding of the situation: location of the damages through year and their causes/types. This inspired her to think about the following points in order to find a solution to decrease the number of accidents and damages:

- It is sometimes easier for a rich contractor who intentionally damages the pipe to pay the penalty amount without any problem, hence a second thought has to be given to the financial penalty imposed to third party after causing damages.
- The legislative penalty Might not be enough or strong.
- Maybe there is no enough control onsite from the ADDC or other governmental entity to check and control the construction project in order to avoid the pipe damages while digging.

5 CONCLUSION

The literature review and the several applications of GIS through years since the end of the 70's have shown its importance not only as a mapping, modeling, spatial analysis and visualization tool, but also as an effective and smart tool in the planning and strategic-decision making process.

Beside its main advantage, which is saving money, time and efforts, GIS can facilitate the visual communication between the company and the customer; help the decision makers to take the proper actions in the right time and place, hence think and act smart!

This research was a showcase of using smart data for smart decision making process and smart governance in the Abu Dhabi Distribution Company (ADDC).

The water pipes Damages that occurred in 2006, 2010 and 2013 were mapped and the types of damages either technical or caused by a third party were localized and spatially represented. The uniqueness of this research is represented through the initiative of mapping for the first time and spatially representing this information that was used only as numerical one.

The geospatial data produced by the author of this research, was presented to the responsible person in the ADDC to take actions, and was smart and very useful. It made a big difference in understanding the situation and looking for solution comparing with a non-spatial data that has been used.

Nowadays many governmental institutions and private entities from different scale and nature in Abu Dhabi and the whole United Arab Emirates (UAE), are using GIS to store their meta-database and to represent their data. The GIS is getting widely used as a smart planning support tool to achieve a smart and sustainable planning.

The ADCC is launching more GIS applications and projects in the coming years to fully use the power, high capacities, and advantages of GIS. The goal is to increase the efficiency of the company in supplying the customers and to raise the quality of its services to the community at the international standards, based on the advanced technology.

6 ACKNOWLEDGMENT

My sincere thanks go to the Abu Dhabi Distribution Company (ADDC) for providing the data and for their collaboration, and also to Abu Dhabi University who funded this research. My warm thanks go also to my undergraduate students of Architecture: Hadil Nabil, Sarah Mousa and Sabrin Al Amri who helped in this work.

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