

E-management as a mechanism to improve water services - The case study of digitization of the water resources sector in Algeria-

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Abstract :

The aim of this article is to examine the digital management mechanisms. Depending on our study on the analytical and descriptive approach to describing and analyzing the phenomenon, especially those related to electronic management, digitization, as we relied on the quantitative approach that includes accurate water statistics, and we relied on the legal approach by addressing the most important laws related to the digitization of the water resources sector in Algeria. In this study, we reached results, the most important of which is the need to pay attention to electronic management and digitization of the water resources sector, the need to support electronic management of the water resources sector.

Keywords: electronic management; development; digitization; Water Governance

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1. Introduction

Water is one of the most important topics up for discussion, as it is a finite resource in view of climate change and global warming, the increase in the Earth's temperature, the problem of desertification and drought, and pollution problems related to the environment and water. Today's water resources require greater care and attention from those responsible for them. In many countries around the world, the problem is no longer just one of water scarcity, but also of how to manage this vital resource for life and development. To preserve this vital resource, countries must focus on its rational management by creating a participatory mechanism that relies on modern digital technologies to quickly identify and address any malfunctions or defects. The old-fashioned management approach, based on slow procedures, field inspections and paperwork, is no longer adequate in light of recent digital developments, particularly the emergence of modern digital technologies (NTIC), artificial intelligence, the information revolution and digital devices.

like other countries worldwide, Algeria has worked to promote development and implement water governance by adopting e-government in the water resources sector through digitization and transforming it from a paper-based sector to a modern digital sector.

The importance of this topic stems from the importance of water itself, as well as the importance of digital technology today as an alternative to traditional paper-based transactions or management.

However, the main question remains: to what extent has Algeria been able to implement the concept of digitization in the water resources sector in the context of water governance and sustainable development?

Our main question encompasses several hypotheses, as follows:

- The more rational the management of water, the more governance we achieve.
- The more management relies on digital technology, the more it leads to improved public water service performance.
- If there are modern technical means and sufficient human and financial resources, this will lead to the success of water governance in Algeria.

2. The concept of e-government:

Before discussing the concept of e-government and digitization issues, we must first address the definition of governance and its linguistic and terminological meaning.

2.1 Definition of digitization

The term digitization refers to the process of converting data and information from paper files and documents into a digital format for preservation and protection. This involves creating discrete units of data called bits, which organize the information, and then processing that information separately into units called bytes. Once data and information are converted into digital forms, they can be processed by computers and computing-capable devices such as digital cameras and digital hearing aids. To illustrate, digitization can also refer to processes such as scanning an image or converting a report into a PDF and storing it on a computer. (Shukri Shaker Shiber, 2010, p. 11).

2.2 Definition of e-government

Although the term e-government is relatively new, according to contemporary management literature, which indicates that it first appeared in late 1995 in the US state of Florida at the Central Post Office, there are many definitions of this term, which has been defined as: "The use of electronic means and technologies in all aspects of practice, organization, procedures, trade or advertising."

E-government has also been defined as: "the completion of administrative transactions and the provision of public services via the Internet, without customers having to visit government departments in person to complete their transactions, with the associated waste of time, effort and energy" (Aishour, 2009-2010, p. 12).

E-government is also defined as: "the function of performing work using electronic systems and means, and performing administrative functions such as planning, organization, control and decision-making through the use of information technology systems within the organization on the one hand, and connecting the organization with influential groups such as suppliers, buyers, customers, competitors, government agencies and bodies, with the aim of developing the organization's relationships with its environment" (Eban, 2015-2016, p. 22).

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The World Bank defines it as: "A modern term that refers to the use of information and communications technology to increase the efficiency, effectiveness, transparency and accountability of government in providing services to citizens and the business community, and empowering them with information, thereby supporting the efficiency of government procedural systems, eliminating corruption, and giving citizens the opportunity to participate in all stages of the political process and related decisions that affect various aspects of life" (Beljil, 2012-2013, p. 9).

3. E-government for water resources:

Electronic management relies on an information system for water management, which Algeria has adopted in its laws for the republic. The information system for water management is defined as follows: (Mohsen, 2012-2013, p. 243).

Water management information system: "A coherent set of rules, procedures and processes for the implementation and flow of water information, through which data and information about water are collected, organized, processed (converted into information), stored, disseminated and distributed to make it available to anyone who requests it, transparently (without bias). This information may be available online (on the Internet) through an intranet or the Internet.

The water management information system consists of a collection of data, reports, encyclopaedias, databases, services, individuals and infrastructure necessary for collecting, processing and disseminating water data in the form of accurate quantitative and qualitative information that helps solve water problems. These elements are structured and organized to respond to the needs of individuals interested in general environmental information, and information about water and public national property. It thus brings together the various parties involved in environmental information in the field of water through a series of projects organized by water authorities, with the aim of developing databases and a service portal that meet users' needs for water data to analyze and solve water problems and participate in appropriate decision-making.

4. E-management technologies for water resources in Algeria:

Algeria has worked to develop and modernize its water resources sector by introducing an electronic system for water resources in Algeria. Algeria has taken advantage of modern internet technology and software in its water resources sector, It has created several mechanisms such as digital portals, electronic payment systems, and multiple websites whose role is to inform individuals about various statistics on the state of water resources, the percentage of completion of structures such as dams, rainfall rates, etc.

Among the mechanisms introduced by the legislator within the framework of e-government for our water resources sector is Law No. 05-12 of 2005.

In the context of informing citizens about water in Algeria, we have Law 05-12 of 2005, and specifically Article 66 thereof, the Ministry of Water Resources has established an integrated water information management system that works jointly and in coordination with other information systems and databases developed by public bodies specializing in the field of water, and has prepared materials specifying the methods of organization and operation of this system (water information) with regard to the standardization and exchange of data in the water sector in terms of: data coding and collection, indexing, forms and agreements for information exchange, data flow, mechanisms and devices for updating, etc. (Law 05-12).

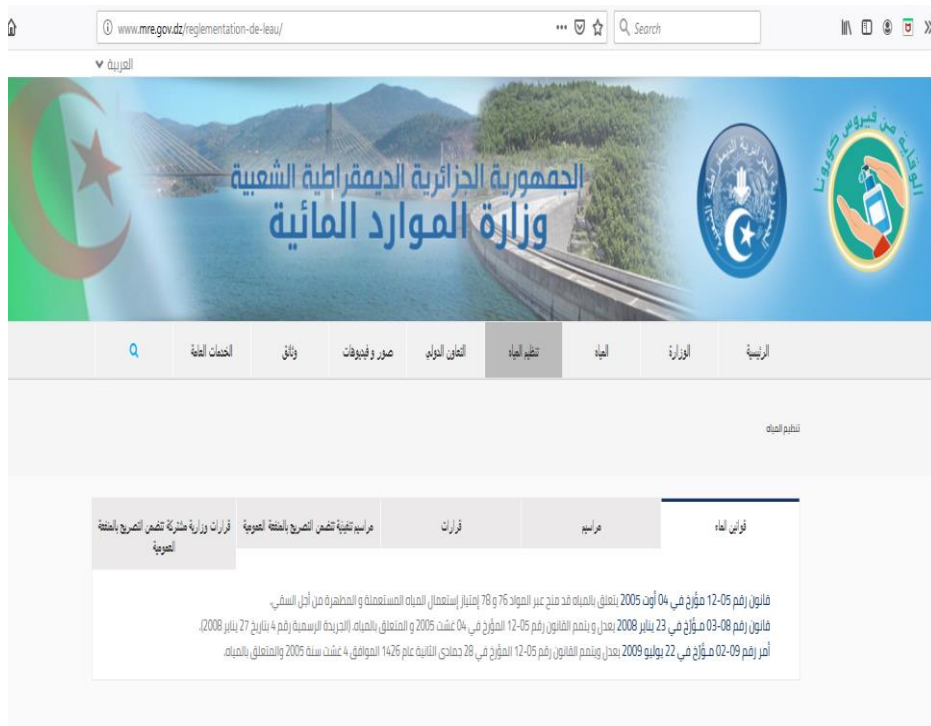
According to Article 02 thereof, "integrated water information management system" means a set of tools and procedures for managing geographical, technical, statistical, economic, institutional and legal data relating to water in order to facilitate access to, exchange and exploitation of such data.

Article 03 of the same decree stipulates that the integrated management of water information shall be organised and operated in the form of a network comprising the various central and decentralized bodies of the ministry responsible for water resources, the public institutions under its authority and other stakeholders in the water sector. (Executive Decree No. 326-08).

4.1 Electronic portals:

The water resources sector in Algeria has several different electronic portals that make it easier for service users or anyone with an interest in water resources to access the relevant portal and contact any entity, for example:

4.1.1 The Ministry of Water Resources' electronic portal:



Source: Official website of the portal, available at: <http://www.mre.gov.dz>

4.1.2 The electronic portal of the National Agency for Dams and Transfers:

The National Agency for Dams and Transfers has launched an online application for dam management called "Dams of Algeria". (Algerian Press Agency, 2017). This technology provides access to a wide range of content, including geographical information based on cartographic data such as Google Earth, and allows users to view geographical data on dams across the country and determine their locations. The application is also a tool for monitoring and reporting on the development of water levels in dams (daily reserves, recorded supplies, evaporation rates, etc.) at the national level and for the real-time management of information on dam water resources. It also allows for the monitoring of dam construction projects and water transfers, as well as the monitoring of raw water quality () in the various dams in operation.

4.1.3 Electronic payment services :

This service relies on technologies such as bank card payments. The electronic payment service was launched in the water sector in Algeria in 2016, overseen by the Ministry of Water Resources and the Environment, represented by its then minister, Mr. Abdelkader Wali, on 29 December at the Sofitel Hotel, in the presence of the Deputy Minister of Finance in charge of the digital economy and modernization of financial systems, Mr. Moatassem Boudiaf. The process was extended to citizens in 46 provinces across the country through the electronic payment system after the signing of a partnership agreement between the Algerian Water Company, the Bank of Agriculture and Rural Development, the Automatic Cash Company and the Interbank Automatic Relations Company (Ministry of Water Resources).

Minister Wali confirmed that the adoption of the electronic system for paying water bills was part of the reforms adopted by the water resources sector to rationalize water management, modernize the sector and establish economically efficient institutions, which can only be achieved through the use of modern technologies and their application in the service of the digital economy and citizens. The Deputy Minister also pointed out that the service is available to bank card holders (Bouabouch, 2016).

4.1.4 Payment by gold card:

To pay bills, customers must log in to the virtual office of the Algerian Post Office on the Baridinet website and then click on the "Login" button, where a window will appear showing the services provided by the institution in the form of icons and images. Here, the user clicks on the water bill image, A window will appear showing the three institutions involved in this service: SEAL, Sonelgaz and Algerian Water. Finally, after selecting the institution to which they wish to pay, users must fill in the form with the necessary information (invoice number, invoice reference, EBP key and the amount to be paid).

After clicking on the "Confirm" button, the user will see a page with information about the payment (transaction number, transaction date, transaction status, invoice number for which the payment was made, transaction amount). The customer can also download a copy of the payment receipt in PDF format.

It is worth noting that the electronic payment service for water, electricity and gas bills is protected and encrypted with SSL protocol, which appears next to the link in the browser's address bar as <https://> (SSL) protocol, technically known

as the Secure Hypertext Transfer Protocol, in green, and the Secure Socket Layer (SSL) protocol, abbreviated as SSL includes a high level of security in the hierarchical protocol sequence system. This protocol provides security in a way that is invisible to the user, as the operations performed by the protocol are carried out above the basic service layer of the Internet protocol suite. Software that uses transmission control protocols assigns a port or socket to both ends of the connection. This is done by mapping the software procedures at each end of the connection. Most of the protocol procedures are executed when the exchange of information begins and a secure communication channel is requested. The protocol begins to work when the user's computer requests authentication from the server. The user's request specifies the encryption algorithm that can be used, as well as the challenge text. The challenge text is, in short, random material that is returned within encrypted content to prevent the resending of previously used encrypted texts, which means that the challenge text is different from the encrypted texts. The authentication returned by the server is in the form of a certificate containing the server's public key signature and the server's preferences for the encryption algorithm to be used. The user's computer then generates a private key, encrypts the server's key, and sends the result to the server. The server then returns the encrypted message with the original key, which is used to generate the keys needed to send messages. The SSL protocol can encrypt all communications between ports immediately and without user intervention, providing security support for all Internet applications, especially email, Telnet, and File Transfer Protocol, in addition to various exchanges that take place on the web, all of which can be protected by SSL.

5. Prospects for developing the water resources sector in Algeria

During 2025, the seawater desalination sector witnessed significant improvement, marked by the commissioning of five new desalination plants with a total production capacity estimated at approximately 1.5 to 1.8 million cubic meters per day. This raised the total national capacity to over 3.7 million cubic meters per day. At this rate, the contribution of seawater desalination to meeting drinking water needs reached approximately 42 to 45 percent by the end of 2025, compared to only about 18 percent five years prior, making Algeria one of the African countries most reliant on desalination. According to official statements, the state aims to meet 60 percent of drinking water needs through desalination by 2030, based on a national program that includes a total of 31 desalination plants under construction or operational. These projects have been accompanied by

substantial financial allocations, with official data revealing that investments in the water and irrigation sector during 2025 exceeded 400 billion dinars, a large portion of which was allocated to the desalination plant, transfer networks, and interconnection lines between the coast and the interior regions.

6. Conclusion

At the end of this article, we can say that the technological developments that led to the emergence of information technology have greatly contributed to changing the style of management, which has moved from the traditional style to the modern style, with the emergence of the term e-government. The latter has become the focus of attention for various systems due to its advantages and benefits in terms of delivering information to the largest segment of society in a timely manner and with minimal effort and cost, and in terms of processing quantitative data, graphs and various statistics.

At the end of this article, we have reached the following conclusions and recommendations:

6.1 Conclusions

- Water is a vital and important resource that must be preserved.
- Water resources, whether globally or in Algeria, remain finite and require greater attention.
- Algeria is striving to develop a sustainable development strategy to conserve and develop water resources.
- Information systems are an important tool for successful water governance, as they provide information and knowledge about water and are therefore a tool for the participatory and sustainable management of water resources.
- Algeria has sought to integrate digital technology into its management system, and this has not excluded the water sector.
- Algeria has harnessed all its material (technological) and human resources to serve the digitization and digitalization of the water resources sector in Algeria.
- Algeria has relied on numerous mechanisms and models for the electronic management of the water sector in Algeria, such as water management information systems, electronic portals, websites, etc.

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- Algeria seeks to develop its digital system for the water resources sector by learning from countries that have preceded it in this field.

6.2 Recommendations:

- Water must be conserved and not wasted, as it is a vital resource.
- More attention should be paid to finite resources, either by finding alternatives or by developing them (in the field of water). Alternative technologies such as seawater desalination should be explored.
- Information systems must be developed, as they contribute to sustainable development by providing information and facilitating the participatory management of water resources.
- The need to provide tools that help move towards greater digitization of the water resources sector (advanced equipment that keeps pace with constantly changing technological developments).
- The need to train and develop human resources capable of mastering the technology used in the water resources sector in Algeria.
- Attempting to develop the digital system by drawing on the experiences of leading countries in this field and seeking to establish partnerships with them.
- Prepare information systems and provide qualified personnel to operate them for the purpose of analyzing needs and focusing on data management methods and tools.

7. Footnotes and bibliography

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