

Digitization of Algeria's water resources sector

The Experience of Bordj Bou Arreridj Province

Kaltoum Djeriou¹ ♦, Soueyla Mouakeni²

¹ Hassiba Ben Bouali University Chlef (Algeria) k.djeriou@univ-chlef.dz

² Hassiba Ben Bouali University in Chlef (Algeria) sa.mouakeni@univ-chlef.dz

Received: 28/06/2023

Accepted: 14/07/2023

Published: 20/07/2023

Abstract:

Algeria suffers from a significant water scarcity, which puts severe pressure on the institutions in charge of water supply and preservation to meet current and future needs. Climate change and population growth are the most important factors that led to widening the gap between supply and demand. Therefore, many water institutions seek to meet these challenges through reform, raising efficiency and improving services by introducing digital technologies in the management of water resources.

The digitization of Algeria's water resources sector is known for its path to incarnation through the introduction of this technique into exploitation in the state of Bourj Bourejerg. . Therefore, this study aims to identify the reality of digitizing the management of water resources through exposure to the experience of Bordj Bou Arreridj. The study found that this technique would improve the public service's water supply and lift off the pressure of water resources sector. Where leaks will be discovered in a short time, and this will also contribute to reducing random and illegal connections, and thus work on the optimal distribution of these resources in the state, and then the experiment can be generalized to all regions of the country.

Keywords : digitization, water resources, ELECTRONIC DIO institution , public service

♦ Corresponding author.

I- Introduction:

Modern information and communication technologies have contributed to making huge changes at the level of institutions in providing services to individuals so, including Algeria. The use of information technology has been linked to digitization, the latter which many public or economic departments in Algeria have sought to apply to ensure quality performance and improve work methods and service provided to customers.

Algeria, as one of the countries facing a shortage and scarcity of water resources, is trying to mitigate the negative effects of this scarcity through several strategies, including the Through this study, we aim to identify the reality of the digitization of the water resources sector in Algeria by exposing the experience of the state of Bordj Bou Arreridj.introduction of digitization and technology in the management of its water resources.

Based on the foregoing, the problem of this study crystallizes in the following question;

What is the reality of digitization of the water resources sector in Algeria?

To answer this question, we put the following hypothesis:

- Algeria has taken an important step in digitization its water resources sector in order to improve its services.

In this context and based on the importance of the water resources sector in the economy and its endeavor to provide clean and safe water resources for societies, and the endeavor of countries to achieve the sixth goal of the sustainable development goals represented in ensuring the availability of water and sanitation services for all and its sustainable management, This prompted interest in developing the water resources sector by introducing information and communication technology in the management of water resources, or the so-called digitization of the water resources sector.

we used the deductive approach with its tools of description and analysis by identifying the theoretical framework for digitization and the reality of water resources in Algeria, and then reviewing the experience of the state of Bordj Bou Arreridj in digitizing the management of water resources.

The topic has been selected and addressed based on the following studies:

- A study by "Kheira Maghribi" (a working paper published in POIDEX Journal, Issue 06, September 2016) under the title: "The economics of water resources in Algeria, an analytical study of water resources, potentials and challenges." This study analyzed the reality of water resources in Algeria and the most important strategies adopted in order to achieve the economics of water resources. This study concluded that Algeria suffers from the absence of an actual application of a rational policy for the management of water resources.
- A study by "Tahtan Murad - Suleimani Muhammad" (a working paper published in New Economy Magazine, Issue 12, December 2017) under the title: "The Role of Integrated Water Resources Management in Achieving Water Security" . This study analyzed the extent to which integrated water resources management contributes to achieving water security. This study concluded that integrated water resources management contributes to improving the quality of life, strengthening local economies, creating job opportunities and expanding the circle of social participation.
- A study by "Al-Shaker Ayoub et al" (a working paper published in the Journal of Economic Growth and Entrepreneur Ship JEGE, Volume 05 Issue 02, 2022) under the title: "The role of

digitization in improving the quality of service in public administration.” This paper analyzed the effect of digitizing the public administration on improving the quality of service provided and applying this to the biometric department of the municipality of Ahmar Al-Ain in the state of Tipaza. This study concluded that there is an effective and correlative relationship between the digitization of public administration and the improvement of the quality of service provided by the biometric department of the municipality of Ahmar Al-Ain.

In order to get acquainted with all aspects of the subject, this research was divided into three axes:

- The nature and dimensions of digitization.
- The reality of water resources in Algeria.
- The reality of the application of digitization of the water resources sector in Algeria.

1. What is digitization and its dimensions

1.1 Definition of Digitization

There are several definitions of digitization, including the following:

- There are those who define it as the process of converting information sources from traditional form to digital form, and information institutions take this measure in order to provide the largest amount of information sources to beneficiaries. (Sharqi and Haddush, 2021, p. 1164)
- Digitization is a technical process of converting analog information streams into digital having discrete and discontinuous values. (Tilen and Andrej, 2019, p. 95)
- It is also known as a process of paper reproduction, which enables the conversion of the document of any kind and container into a digital series, and this technical work is accompanied by an intellectual and gainful work to organize the post-information in order to schedule it and represent the digital content, which are accurate digital mechanisms. (Ben Sabti and Saidi, 2016, p. 25)
- Digitization is the changes that occur in the way various businesses are performed, which are a result of the digital technologies that have been introduced on these methods. (Maarit & others, 2017, p. 64)

Through the previous definitions, it can be concluded that digitization is mainly related to the transfer of information from paper or traditional form to electronic form, as it works to eliminate barriers between humans and information and communication technology by using artificial intelligence techniques to achieve economic and social returns effectively and with higher productivity.

1.2 The importance of digitization and its objectives

Digitization has become an indispensable necessity at the present time to keep pace with transformations and developments at the global level, and digitization seeks to achieve a set of goals that we will address in the following points.

1.2.1 The importance of digitization:

Most institutions have recently paid attention to digitization, and many legislative texts have been approved for the necessity of adopting it in local communities due to its importance, such as the ease and speed of providing services and ensuring the accuracy of information. The importance of digitization can be identified as follows:

- **Protection of original documents:**

Digitization is an effective way to preserve sources of information or documents whose physical condition is fragile and therefore does not allow beneficiaries to view them, in order to provide an alternative copy in electronic form and accessible to beneficiaries, such as converting the civil status archive at the level of the Ministry of Interior and local authorities from its paper form to digital.

- **Immediateness and speed:**

Digitization represents a field for sharing electronic files using the source, and this provides opportunities for immediacy and speed in obtaining information.

- Digitization allows the citizen to follow up administrative files and all developments related to him, as well as the possibility of correcting errors.
- The documents can be viewed from anywhere, at any time of the day.((NEERAJ, 2017, p. 3557)
- Reconstruction of roles and functions to ensure decision-making in a consultative manner.
- It contributes to the simplification of administrative life, and enables the citizen to have permanent contact with public utilities.
- Digitization allows the possibility of integration with other media (audio, image, video), and this is what gives the information a greater value than if it was in printed form. (Bint Dakhil Allah Al-Ghathami, 2011, p. 26).
- Digitization contributes to raising the quality of services and reducing the manifestations of bureaucracy.
- Quickly completing administrative transactions and serving the interests of citizens in an electronic manner that is characterized by flexibility and clarity and deepening the concept of transparency and distance from favoritism.

1.2.2 Digitization goals

The basic idea of digital management is its vision of management as a source of services, and citizens as users who want to benefit from these services as quickly as possible when they are needed. Therefore, digitization has many goals, including:

- Ease of access to the administration and informing the citizen of developments, and the possibility of sharing it among a large number of the public at the same time, and thus can accommodate the growing increase in the number of beneficiaries of digital services that take place within a digital network equipped with the harnessing of human competencies capable of dealing with modern technology.
- Simplifying procedures, reducing their costs, and providing quality service.
- Reducing the time for executing and completing administrative transactions without the citizen having to go to the administration personally to complete his transactions, which corresponds to the waste of time, effort and energies by benefiting from remote services.
- Facilitate communication and interaction between the departments of the various institutions and with other institutions inside and outside the country of the institution.
- Replacing paper transactions with electronic office through internal networks and the Internet, which positively affects the work of the institution, and digitization makes the

administration work as a system in coordination with the requirements of information technologies and electronic communications, legislative requirements and others.

- By digitization, texts and images are entered into digital input units linked to computers from scanners, and then processed, stored, and output digitally as information. (Majdoub, 2016)
- Simplifying procedures within institutions, which is reflected positively on the level of services provided by local groups to citizens.
- Reducing the time for implementing and studying administrative files by facilitating communication procedures between the departments of various institutions, which facilitates the control process by providing a huge amount of information that pertains to citizens and transferring it to other aspects of administrative relevance.
- Canceling the paper system of the national archives and replacing it with an electronic archiving system with its flexibility in dealing with documents and the ability to quickly correct errors and publish documents to more than one party in the least possible time and benefit from them at any time. (Abdel-Lawy, 2017, p. 63)

1.2 Dimensions and requirements of digitization adoption

The dimensions of digitization lie in the following: (Sadiqi, 2017, p. 120)

- The acceleration of technological progress and the knowledge revolution associated with it, as this led to the emergence of many relative advantages for its practical applications in various fields of human life.
- Responding and adapting to the requirements of the surrounding environment, because the spread of the concept and methods of electronic management and its application to the possibilities of isolation in many organizations and societies makes it imperative for every country to join the pace of development in order to avoid backwardness and keep pace with the age of speed and informatization.

The following elements must be completed in order to adopt digitization: (Boamama and Ragad, 2014, p. 214)

- **Availability of computer hardware:** Hardware is represented in the physical components of the computer, its systems, network and peripherals.
- **Software:** It means the mental part of computer systems and networks, such as e-mail programs, databases, and programming auditing tools.
- **Communications Network:** It is the electronic links extended through a communication fabric of the Internet and Extranet networks, which represent the value network of the organization and its electronic management and the Internet.
- **Knowledge industry:** It is located at the heart of these components, and consists of digital leaders and analysts of knowledge resources, and the intellectual capital of the organization.

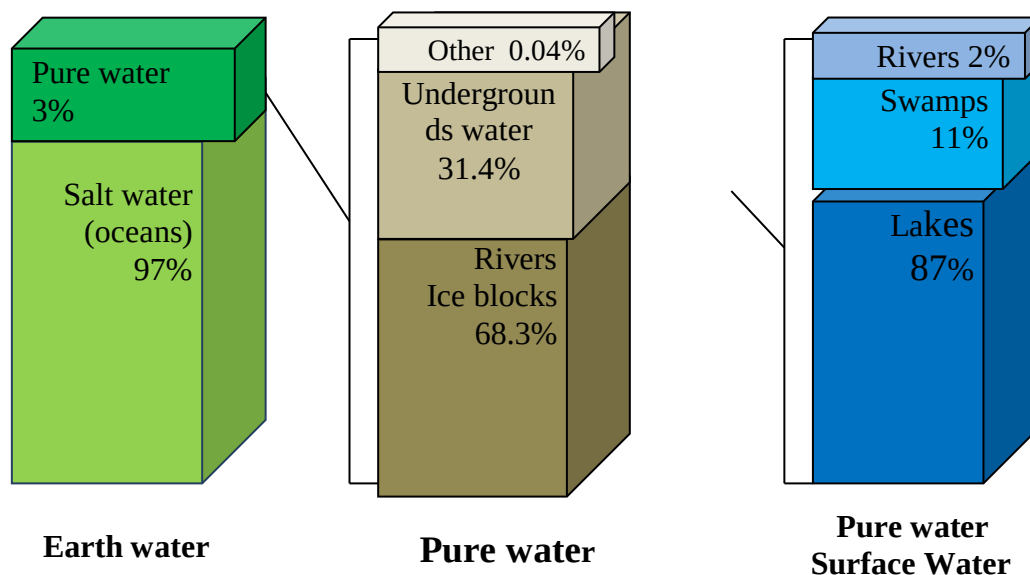
2. The reality of water resources in Algeria

There are several sources of water in Algeria, but before addressing these sources, we briefly review the distribution of water in the world and the Arab world.

2.1 Water distribution in the world and the Arab world

Looking at the water situation in the world, we note that 80% of the earth's surface is covered by water, but the fresh potable water found in the depths of rivers and lakes does not exceed 1%, which is a small percentage compared to the total water in the world, and this is shown in the following figure:

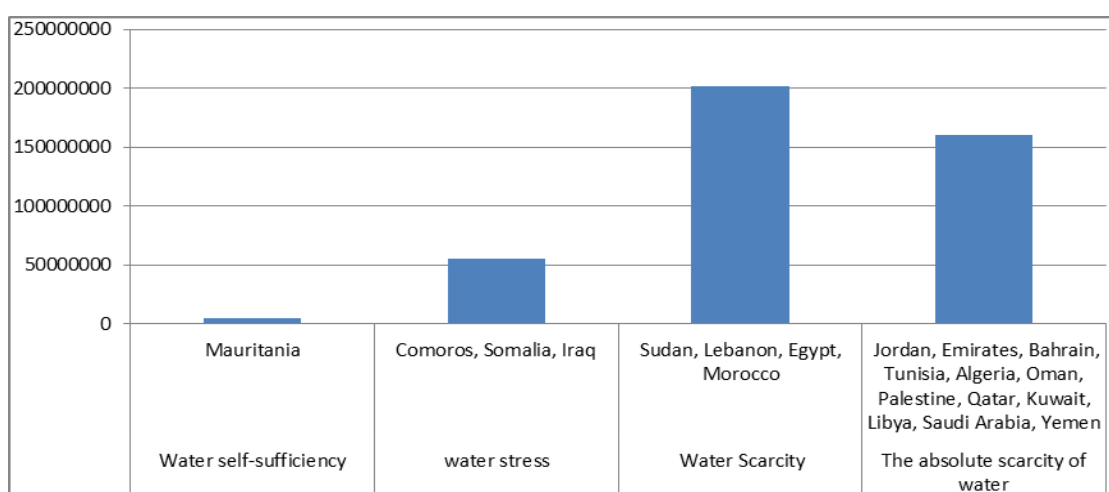
Figure 01: Distribution of water in the world



Source: (Schneider, 2002)

The share of each country in the world of these water resources or the amount of precipitation varies as a result of the geographical location of each country and the prevailing climate in it, and therefore the share of the individual varies according to the location in which he is, and the share of the Arab citizen can be clarified through the following figure:

Figure 02: Distribution of Arab countries according to the availability of water for the population



Source: UN report, 2020

From the figure, it is clear that 18 Arab countries suffer from water scarcity, as only about 76% of the population has access to water at the time of need. While about 94 million Arab citizens do not have this ability at all times, that is, of all Arab countries, only Mauritania enjoys water security or self-sufficiency in water. On the other hand, we find that Algeria is located among the countries that are characterized by absolute scarcity of water, and therefore there is an actual need for proper management of the available water resources to meet the needs of the population, whose number is increasing from year to year.

2.2 Sources of water in Algeria:

Water resources in Algeria include traditional water resources represented in surface water, groundwater, and non-traditional water resources represented in desalination of sea water, wastewater treatment, i.e. wastewater recycling, and other unconventional sources.

2.2.1 Traditional water resources

The real water resources are estimated at 19.4 billion cubic meters, as only 75% of them are renewable, of which 60% is surface water and 15% belongs to groundwater: (Al-Habitari, 2017, p. 162)

▪ Surface Resources:

It includes 17 water basins located in three groups. These basins contain 12.7 billion cubic meters: (khadraoui, 2007, p. 44).

- **Coastal basins:** the volume of their water resources is estimated at about 11 billion m³, for an area of 130 thousand km², and the annual rainfall rate ranges between 400 and 1500 mm per year.

- **High plateau basins:** The volume of their water resources is estimated at 0.7 billion cubic meters for an area of 130,000 square kilometers, and the annual rainfall rate ranges between 300 and 400 mm per year.

- **Desert basins:** the volume of their water resources is estimated at about 0.6 billion m³ for an area of 100 thousand km² and an annual precipitation rate ranging between 100 and 300 mm per year.

- **Underground Resources:** and that is in the renewable reservoirs of northern Algeria and the basins of poorly nourished desert regions. These basins include 9.3 billion cubic meters.

Algeria's water resources cover (17.25 billion m³) of water needs (4.36 billion m³). The main source of water for Algeria is rain, which constitutes its surface runoff (13.50 billion m³), while groundwater occupies the second position as a water source for Algeria.

Thus, the water sources in Algeria come from the northern areas, so we find that the northern surface water is considered the main source of water, followed by groundwater in the southern regions, which is used extensively and mainly in watering the cultivated areas in these areas, given that the general orientation of agricultural production and even agricultural has become concentrated in The southern regions as a result of several reasons, the most important of which is the abandonment of many northern regions from agricultural activity and the orientation towards industrial activity or the use of arable land for other activities. As for surface water in the southern regions, its contribution to covering the various needs for water is scarce.

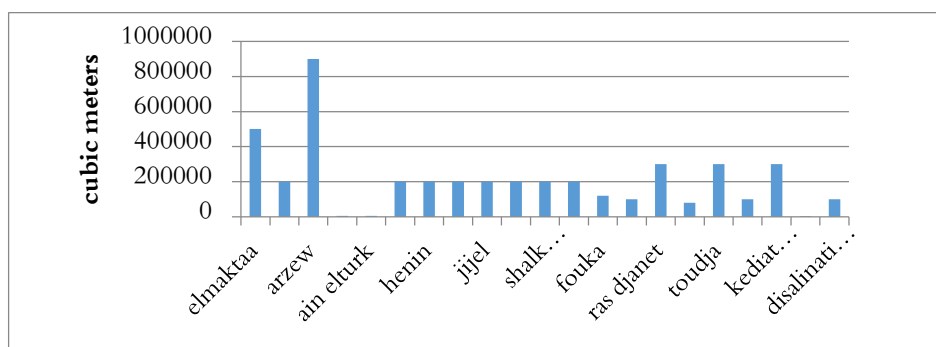
2.2.2 Non-traditional water resources

Non- traditional water resources are water resulting from:

▪ Desalination of sea water:

On the other hand, the population density in Algeria, which is concentrated in the northern regions, has led to an increase in the demand for water. In order to face this, especially in light of the low rates of precipitation in Algeria and the inability of traditional sources such as dams and others, the state tended to establish desalination plants for sea water, in addition to one plant in Tamanrasset, intended to desalinate desert water from salt. These stations and their daily production capacity can be illustrated through the following figure:

Figure 04: Daily capacity of seawater desalination plants in Algeria



Source: prepared by the researcher based on the data of the Algerian Energy Company (AEC).

From the figure it is clear that the Arzew station in the state of Oran is considered the most productive station for desalinated sea water with about 900 thousand cubic meters per day, and despite what is produced by these desalination plants, the water problem still exists, especially in the summer periods that witness an increase in the demand for water from the residents of these areas, in addition to the periods that witness difficult climatic conditions, such as strong winds and rains, which make it difficult for the tasks of these stations as a result of the increasing muddying of sea water.

The National Water Strategy 2021-2030 aims to meet the citizens' need for drinking water by desalinating sea water by up to 60%.

Currently, 22% of the needs are covered by desalinated water, and it will gradually rise to reach 42% in 2024 and 60% in 2030.

▪ Waste water treatment:

In recent years, many countries of the world have paid great attention to the reuse of wastewater because of: water scarcity and reducing environmental pollution to preserve water resources. For these and other reasons, wastewater treatment has become one of the main sources of water. Wastewater, whether sanitary, agricultural or industrial, can be treated with modern technologies and reused in irrigation of agricultural lands and in industry instead of being discharged directly and without treatment in water bodies, which causes serious environmental problems that lead to wasting an important part of water resources. (Mohsen and Wassaf, 2007, p. 31).

3. The reality of the application of digitization of the water resources sector in Algeria

An international report specialized in the water sector called for the need to deploy digital solutions to enable the most efficient and effective use of water data, especially with regard to public sector work, community needs and the environmental system.

The report issued by the international website GreenBiz recently confirmed the role of information and communication technology in achieving the sixth goal of the sustainable development goals, through efficient water use and increasing access to water through smart water management, smart pipes, smart meters, soil sensors, remote irrigation management systems, consumption, control applications and electronic billing.

3.1. Wasted water in Algeria:

The digitization of the water sector in Algeria has become an absolute necessity due to the high percentage of wasted water and its cost, as shown in the following table:

Table 01: Wasted water in Algeria

Billed production quantity (billion cubic meters)	Total production quantity (billion cubic meters)
1.8	3,6
Billed production value (billion DZD)	Total production value (billion DZD)
26	52

Source: (Baraki, 2020)

From the table it is clear that about half of the production of potable water is wasted despite the high cost of this volume, and this is due to several reasons, the most important of which are:

- The old and worn out water distribution networks in Algeria, some of which date back to the colonial period, which made them vulnerable to erosion and consequently frequent breakdowns, leakages and water loss.
- The negative and irresponsible behavior of some citizens, where random and illegal recommendations abound, or the unlicensed exploitation of water in many areas, which negatively affects the fair distribution of water between different regions and citizens and costs the state huge sums of money;
- Poor management, leaving the leaks unrepaired for a long time, either because the location of the leaks was not discovered or the failure to repair them for any reason whatsoever multiplied the lost quantities the longer the period of the leakage took;
- The lack of precipitation, especially in the recent period, as this led to an increase in dependence on groundwater and desalination of sea water, which leads to an increase in the cost of producing potable water, and therefore the cost of this production is large;
- The nature of the sources of water in Algeria is witnessing the phenomenon of muddying, that is, dams and desalination sources face the problem of not making good use of water, which leads to an increase in the cost of these resources.

3.2 The experience of the state of Bordj Bou Arreridj in the digitization of water resources

The digitization of the water resources sector aims to improve the public water supply service and to keep pace with the technical and technological development that the world is witnessing. Bordj Bou Arreridj has been chosen as a model wilaya for the application of digitization of water resources, which is represented in equipping water installations with information digitization systems for the purpose of remote control of their operation from the operations and control room of technicians. The new system that was applied in the Bordj Bou Arreridj unit

under the supervision of the DIO-ELECTRONIC institution allows, in its first stage, to identify the water levels inside the water tanks, as well as the time required for the process of filling them, followed later by the stage of controlling the operation of the valves. The last phase of this modern technology helps institutions to know the exact quantities of water produced and distributed at the neighborhood level, in addition to enabling those in charge of the Algerian water centers to set fair distribution programs according to which a comprehensive equality is achieved between the residents of the city's neighborhoods in benefiting from potable water. The most important stages on which the model is based can be summarized as follows:

- Installing technological devices produced by DIO-ELECTRONIC in all water tanks;
- automatic opening and closing of valves;
- Detection of water volume in water facilities;
- Provide accurate statistics on water consumption and distribution in the state;
- Detecting leaks quickly and working to fix them as soon as possible.

This exemplary and modern management experience has proven successful to a large extent in the early stages, as it can be generalized to all regions of Algeria in view of the positive results achieved that would preserve the water wealth in Algeria.

3.3. Digitization of services provided to customers:

These are the services provided by the companies in charge of managing water resources in Algeria, and the matter relates to:

- **The Water and Disinfection Company of Algeria (SEAL):** The SEAL Foundation is considered one of the leading and active institutions in the irrigation sector. It launched a new experience, in order to develop the organization's relationship with its customers through the website: <https://wakalati.seal.dz> . Which enables the customer to pay consumption bills, submitting complaints and reporting in case of errors when billing, obtaining a statement of previous bills, taking care of customers with special needs by providing the regular bill service or the Braille technology for blind customers.

Sial has also established two online payment platforms, Fatourty Mob and Baridi Mob, that allow customers to pay their bills quickly and safely without the need to move around, in order to provide greater flexibility to customers in paying their bills, in addition to creating an operational telephone reception center available to respond in real time to customer requests and concerns.

Within the framework of the modernization of water distribution, a remote monitoring and control system is used to supervise the facilities and ensure a fair distribution of water according to the availability of the resource.

Sial is also committed to providing high-quality public service and improving customer services by providing innovative solutions, as digitization represents a challenge to meet the needs of its customers.

- **The Algerian Water Company:** the experience of this company is emerging or in its infancy, so to speak. The customers of this company can pay their bills through the Algerian Post website, meaning that digitization in this company was limited to the partnership between it and Algeria Post to pay the bills only. To be circulated after that to banks and other financial institutions through the signing of a partnership agreement between banks and financial institutions and the Algerian Water Company, and in

comparison with the Sial Company, we note that the latter preceded the Algerian Water Company, which is a competitive advantage for it.

Through the study, we have reached the following results :

- The introduction of digitization through the devices established by DIO-ELECTRONIC for the rational management of the potable water network in the state, through which leaks will be discovered in a short time, and this will also contribute to reducing random and illegal connections and thus work on the optimal distribution of these resources, and this matter helps to provide water to meet the daily needs of the population and the needs of economic activity and thus improve economic and social development.
- Sial's reliance on digitization has contributed to the improvement of public service, by bringing the citizen closer to the administration and simplifying the procedures related to paying bills, thus reducing the cost to the customer.
- The Algerian Water Company seeks to improve its services, as it recently signed an agreement between it and banks and financial institutions to enable its customers to pay their bills electronically via the Internet through the institution's electronic platform or its electronic application.

Conclusion

Algeria is living in a difficult situation in the field of water. The scarcity that we noticed through the statistics provided highlights the need to work on the optimal utilization of the available water resources and limit the waste and loss of this important wealth, and the digitization of water networks that many countries are working on through the introduction of modern technologies in the management of their water resources and huge sums have been allocated for this. In this context.

Based on the previous results, the following recommendations can be made:

- Accelerating the generalization of the digitization of the water resources sector throughout the national territory by removing all obstructing factors, in order to reduce water waste, reasonable and sustainable use and recycling of water resources.
- Enhancing the infrastructure to digitize and modernize the water resources sector.
- Holding special training courses in the field of digitization for employees of the water resources sector.
- Continuous updating and periodic renewal of technical devices and equipment.

References:

- 1.Gorenšek Tilen, Kohont Andrej. (2019). CONCEPTUALISATION DE LA NUMÉRISATION. International Journal of Euro-Mediterranean Studies ,12(02).
- 2.tihinen maarit, other. (2017). tackling the digitalization challenge:how to benefit from digitalization in practice. international journal of information systems and project management , 05(01).
- 3.khadraoui, a. (2007). Eau et Impact environnemental dans le sahara Algerien. Alger.
4. NEERAJ. (2017). Digitization and its Impact on Economy. International Journal of Creative Research Thoughts (IJCRT) , 05.

5. أحمد المهدي المجدوب. (2016). مفهوم الرقمنة. ليبيا: مركز ليبيا المستقل للإعلام والثقافة.
6. ارزقي براق. (2020). ترشيد وعقلنة استعمال المياه في الجزائر. *وزارة الموارد المائية، الجزائر*.
7. العربي بوعمامة، و حليلة رقاد. (2014). الاتصال العمومي والإدارة الالكترونية - رهانات ترشيد الإدارة الالكترونية والخدمة العمومية. *مجلة الدراسات والبحوث الاجتماعية* (09)، 27.
8. زوبيدة محسن، و سعيدي وصاف. (30 06، 2007). الموارد المائية في الجزائر وأدوات تسييرها المتكامل لمياه الشرب. *مجلة الحقيقة*، 06(01).
9. شينيدر. (2002). *موارد المياه. موسوعة المناخ والطقس*. نيويورك: مطبعة جامعة أكسفورد.
10. عبد السلام عبد اللاوي. (2017). أهمية الرقمنة الإدارية في عصرنة وتفعيل الخدمة العمومية بالجزائر. *مجلة صوت القانون*، 01(07)، 63.
11. عبد المالك بن السبتي، و ابتسام سعيدي. (2016). معوقات تطبيق مشاريع الرقمنة بالمكتبات الجامعية الجزائرية" المكتبات الجامعية لولاية قسنطينة نموذجا". *البوابة العربية للمكتبات و المعلومات*، 25.
12. فوزية صادقي. (2017). دور الرقمنة في تحسين الخدمة العمومية بالجزائر - دراسة تحليلية للجماعات المحلية. *أطروحة دكتوراه في علوم الاعلام والاتصال*. كلية علوم الإعلام والاتصال السمعي البصري، الجزائر: جامعة قسنطينة 03.
13. محمود شرقي، و صليحة حدوش. (2021). دور رقمنة الإدارة المحلية في إضفاء الشفافية وتعزيزها في الجزائر. *مجلة صوت القانون*، 07(03).
14. مسفرة بنت دخيل الله الغثمي. (2011). مشاريع وتجارب التحول الرقمي في مؤسسات المعلومات-دراسة للاستراتيجيات المتبعة-. *مجلة RIST*، 19(01)، 26.
15. نبيلة الحبيطري. (ديسمبر، 2017). أمن الموارد المائية في الجزائر : الواقع والمستقبل. *مجلة أبحاث ودراسات تنمية*، 04(01)، 162.