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Economic sciences

INFORMATION TECHNOLOGIES AS PUBLIC ADMINISTRATION TOOLS ON THE EXAMPLE OF BLOCKCHAIN

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Abstract

Today, blockchain stands as a revolutionary technology at the same level as when the Internet appeared. The relevance of this topic is due to the fact that this technology, first of all, promises new governance at both the state and global levels, based on innovative principles: cooperation, decentralization and transparency.

The research is based on the use of a complex of general scientific methods such as description, retrospective analysis, system analysis and synthesis of the subject of research, which included system-structural and system-functional analyses

Hypothesis - it is assumed that the introduction of blockchain technology as a tool of public administration can be extremely effective, in particular in the areas of identity identification, notarization, verification of diplomas and certificates, secure data exchange, etc.

In the context of digital transformation, blockchain offers a unique opportunity to build a homogeneous network whose goals are to ensure reliable exchange of data and information and to offer significant improvements in terms of operational excellence for all organizations, stakeholders serving the user of public services.

The practical importance of this study lies in the fact that the recommendations developed can be used in the development of new legislative initiatives related to the regulation of blockchain technology and its constituent elements.

Keywords: information technology, public administration, blockchain, decentralization, transparency.

Introduction. Blockchain technologies combine innovation with existing IT solutions in distributed IT systems. They radically change the way organizations, even competing ones, release and trustfully transfer data or digital assets, bypassing the central control structure.

It may seem paradoxical to think about the use of blockchain in the public sector, while its origin, thanks to the appearance of bitcoin, had a specific purpose: to deprive government agencies and trusted third parties of the ability to carry out official functions for issuing currency and monitoring financial transactions and their registration.

The relevance of the chosen topic is due to the fact that the introduction of blockchain technologies as a tool of public administration can have an impressive result, as well as increase the level of trust of citizens in the state, since the characteristic features of blockchain are transparency, accessibility and decentralization.

The purpose of this document is to show that the public sector can benefit from the unique features offered by blockchain technologies while respecting its value and offering a better experience and increased confidence to users of public services. This reflection on their use in this particular sector is based on several essential questions:

- How can they contribute to the creation of a compatible and common infrastructure, while maintaining existing architectures and applications in each relevant management body or company?
- Are there any particularly interesting prospects for a complex ecosystem in which different stakeholders need to cooperate within the framework of business procedures and logic?

- How to ensure that this cooperation is carried out while ensuring the quality, source, confidentiality and transparency of the exchanged data, which have become the only guarantees of trust for the end user?

Materials and methods. The information presented here is the result of a detailed review of the literature in the field of blockchain and documentation, publications of foreign and domestic scientists and experts in the field of blockchain technology. The most interesting study for analysis was the work of the University of Lille with KAPALT "Blockchain technologies in the service of the public sector" (Perrine de C. et al., 2021).

As part of this study, the authors inform about blockchain technologies in general, about the first seven use cases that are currently being developed or studied on EBSI or on other blockchains. Based on the experience gained within the framework of the European Blockchain Partnership, she wants to promote these technologies that have significant potential for the digital transformation of public, national and international services.

Scientific work relies on "business" experiments to describe potential opportunities, without hiding the existing obstacles to their implementation in various fields of application that are of direct interest to public administrations: certification, transactions, the third generation of digital identification or even archiving. The latter can significantly increase the efficiency of using online services, of course, by adapting the technology to the type of service performed.

The research is based on the use of a complex of general scientific methods such as description, retrospective analysis, system analysis and synthesis of the subject of research, which included system-structural and system-functional analyses. This systematic approach made it possible to investigate the essence and principle of operation of the blockchain technology from the perspective of its integral system consisting of interacting elements. Along with theoretical research methods, special methods such as formal-logical, comparative, comparative-legal, SWOT and PEST analyses, as well as the modeling method were used in this work. The use of the above methods, in particular SWOT, PEST and comparative analysis, allowed us to identify promising areas of application, identify the main advantages and disadvantages of blockchain technology in relation to public administration.

Results and discussion. The Internet has radically changed access to and exchange of information and plays a fundamental role in modern society and the economy. Nevertheless, it was difficult to imagine the full range of services offered today, when the first tools necessary for its democratization were introduced thirty years ago.

Blockchain, since the publication of the White Paper on Bitcoin as the first digital asset, has significantly expanded the range of its applications and potential use cases over the past ten years; in various forms it could play a role comparable to the role of the Internet in an area that it does not cover: trusted computer and legal transactions.

Indeed, although the Internet is the preferred means of exchanging all digital forms of information, it, as a network infrastructure, is not a guarantee of its uniqueness or functioning.

Let's look at an example of a digital service such as software. It is free, it can be duplicated for free indefinitely, and the Internet will allow us to get very easy access to it. But if it is covered by the license we want to purchase, the transaction will require, in addition to the intervention of a trusted third party, the "delegation" of our trust to the supplier (the software company that manages the license rights in accordance with its own technical rules, to which we do not have access).

Thus, we will not be able to transfer ownership of it or any of them to a third party, unlike, for example, a copy of a book purchased once and for all. It is precisely this problem that blockchain technologies are aimed at: to allow reliable peer-to-peer exchanges, bypassing a single centralized control body, providing a verifiable and continuous process of registering transactions and tracking digital assets. This is achieved on the basis of a decentralized infrastructure and on the basis of a shared and distributed registry for nodes (a technical term for defining a computer, server) in the network, while each node has a complete copy of the registry (Abelseth, B., 2018).

Blockchain is a decentralized infrastructure that registers transactions with timestamps representing a change in the state of a digital asset. The chain of these transactions makes up a common registry.

The word "transaction" here should be understood in a broad sense, not reducing to the exchange of a digital asset, but also covering its state changes (event, fact, action). In the administration, this is, for example, a file that will change the "owner" in the sense of responsible, as it moves between different organizations involved in its general processing.

Blockchain, an infrastructure based on the concept of a digital asset, ensures its traceability from the moment of its creation and throughout its entire life cycle in time accompanying it. This will be formulated, in particular, through secure exchanges that underlie relations and processes between various participants in the public sector ecosystem: from the user to the administration and a number of organizations, companies or stakeholders from the public, parastatal or corporate world. personal.

In addition to registering a transaction without a trusted third party, blockchain technologies were able to appear with the creation of Ethereum in 2015 - to automate processes, again without the need for human mediation. This is done with the help of so-called "smart" contracts (smart-contracts), computer programs based on business logic and integrated as a component supported by the blockchain.

Schematically, the environment needed to create a blockchain can be similar to a 4-layer structure (Alcantara L. T. et al., 2019):

- *Level 1 is information exchange and consensus protocols for verifying transactions that pass through the blockchain and are stored in a common registry. This layer is based solely on open source software for security and infrastructure reliability reasons.*

- *Layer 2 involves the deployment of the infrastructure and network underlying all nodes, that is, active participants in the blockchain.*

- *Level 3 corresponds to the application layer itself, consisting of smart contracts representing business rules and applications designed for end users.*

- *Level 4 symbolizes the integration of the blockchain into the existing one: other applications and data sources of the information system.*

Thus, the blockchain is clearly a decentralized infrastructure, and not a "traditional" application, platform or website: levels 1 and 2 define the characteristics of the ecosystem and management of the blockchain as such, while levels 3 and 4 represent the specifics of the response to business needs and government needs in a clean environment. All blockchains will have common and unique characteristics:

- *Consensus: on methods and, consequently, on registry entries: the compliance algorithm guarantees compliance with protocol rules and reliable execution of all transactions, which allows all interested parties to have a common and transparent vision in real time.*

- *Immutability: A transaction or event recorded in the blockchain is dated, has a historical history and can no longer be changed or deleted.*

- *Irrevocability: A transaction made in accordance with the trading rules and confirmed in accordance with the consensus rules cannot be canceled.*

- *Origin: Any asset managed by the blockchain is transparently tracked and its history is visible to entities with rights. As Anthony Lewis, director of research at R3, puts it: "when people say that blockchains are immutable, it does not mean that the data cannot be changed, they mean that it is extremely difficult to change their states without collusion or fraudulent actions, and if you try to change them, it will lead to that the data will not be changed, it will be extremely easy to detect the attempt."*

In this regard, blockchain technologies can be extremely useful and effective at the government level. Blockchain is thought of as a "peer-to-peer" type network infrastructure on which transactional applications that can be in the mode of

- *G2G – from government to government (for example, between various national and transnational government agencies or agencies);*

- *G2C - from government to citizen (between administration and citizen);*

- *C2C - from citizen to citizen (between citizens, including the element related to public service).*

Government agencies are the main intermediaries in these transactions and the guarantors of their proper functioning. The documents they issue or certify are a standard way of verifying information about people (identity cards, work permits, driver's licenses, etc.) and goods (origin of containers, product safety, etc.).

Compared to traditional centralized databases, blockchain is an easy way to verify information about people (identity cards, work permits, driver's licenses, etc.) and goods (origin of containers, product safety, etc.). Compared to traditional centralized databases, blockchain guarantees two features:

- *by design, real-time data integrity and traceability, for efficient and transparent collaboration between users without the use of a third-party trusted third party;*

- *independent execution of smart contracts for automation and protection of processes, which is a key factor in improving efficiency and quality. In the case of public services, this means, for example, that blockchain can facilitate verification of the integrity and origin of official documents without having to contact their issuing organization every time.*

Along with this, data exchange can be carried out in a completely secure way between digital wallets. Since blockchains are distributed systems with a high degree of potential automation, they can be used to efficiently design low-cost platforms, which leads to significant savings in data processing while increasing the reliability of the system (Pignatelli, F., et al., 2019).

For any type of public sector structure, possible operational improvements of blockchain technologies are aimed at:

- cost of identity verification;
- the cost of checking the origin or history;
- reducing fraud;
- audit of events and status changes;
- automation of certain processes: billing, payment, etc.;
- automatic management of the distribution of non-financial assets;
- acceleration of transactions.

Thus, blockchain technologies are the latest technologies that are constantly evolving, but which are not intended to replace, as such, technology that is already in use and which, sometimes for very many years, has proven its reliability. In a direct comparison, a more mature technology (for example, a centralized or distributed database, etc.) will provide better control over the setup and associated costs (design, development, start-up, maintenance, etc.).

Blockchain can be considered as an innovative technology with great transformative and even destructive potential, which an organization must necessarily test, risking missing the latest fashionable phenomenon. This explains that many pilot projects, up to the last few years, were started when the use of this technology was neither necessary nor even justified.

Applying this approach, blockchain is a solution that will look for a problem that needs to be solved. However, starting from the technology rather than the problem is a particularly inefficient exercise from the user's point of view. This is also a classic reason for the failure of the project on the digital transformation of organizations.

Here we propose to apply the reverse approach: "I have identified an existing problem or a new need, I am investigating which technologies are most effective in being able to meet them."

How can blockchain facilitate cooperation between administrations?

In order to avoid numerous preliminary blockchain projects launched in recent years in all sectors within the public sector, it seems important to conduct a double preliminary investigation by the beginning of the project:

1. Make sure that the technology is able to meet the necessary requirements for application (volume, performance, safety, compliance) in real production.

2. understand how one (at least) of the specific properties of the blockchain (consistency, immutability, irrevocability, origin) is really necessary for the process (Bindu, N. et al., 2019).

Having checked only the first point, we come to a project that may be technically feasible, but in which the use of blockchain as a business factor is not justified. As discussed earlier, why choose this technology in these conditions, and not another, more mature and better mastered one?

Focusing on the second point, we come to a project that, in addition to the pilot, will simply be impossible to scale or put into production; this is for reasons of management, cost, technical complexity or compliance with requirements. In this case, a very significant number of preliminary blockchain projects are detected.

Compliance with this dual approach should ensure that the proposed project is able to quickly provide one or more tangible benefits from blockchain for the public sector compared to other technological solutions between administrations, national or international:

- Elimination of redundant data validation tasks and duplication of processes using shared resources from a common source, verified and accepted as such by all parties.
- Ensure transparency and trust, since there is no "single" owner of the data of the general registry.
- Easier identification and quantification of benefits for each of the parties, since the common interest and user service represent the main value shared by the participants.

Blockchain, like any other technology, does not escape the basics of managing a digital transformation project. However, unlike a traditional project, which is most often focused on the "internal vision of the organization", blockchain usually requires an approach based on close cooperation, taking into account stakeholders and various information systems that come into play.

In this context, it is important that the creation of a blockchain project, as soon as the problem is identified and qualified, can be implemented within a project environment that ensures the integration of stakeholders.

In addition, the blockchain project is accompanied by the establishment of clear management. This will ensure smooth operation both in determining the roles of each interested party (who does what and what contributes?) and in maintaining the overall infrastructure (who pays for what?) in the long run. Creating an adequate project environment is fundamental for proper communication and cooperation between all stakeholders involved in working together in a distributed network.

You can imagine three types of blockchain projects (Engin, Z., et al., 2019):

A) this problem is 100% related to the sphere of public service and is managed by an ecosystem of administrations. We are talking about opening information repositories to ensure better coordination and cooperation of various procedures in administrations. Of course, trust in the ecosystem is implicit, it is based on the stakeholders' knowledge of each other and their common affiliation to the public sector. In this case, the blockchain infrastructure will help to achieve the highest quality of work from start to finish. In this case, the complexity of the ecosystem must be carefully studied to justify the use of this type of technology. It is quite possible, since trust between the parties is guaranteed de facto, that other technologies also solve this problem.

B) the problem affects the public service, which is the responsibility of the state that enters into a contract with a private structure. A private structure may be non-profit (example: health care, education, etc.). In this case, the state offers infrastructure and a project environment that allows you to create a level of trust, while improving cooperation and traceability. Since trust is lower than in the previous case, given a more complex ecosystem, the blockchain infrastructure is probably more legitimate compared to other technology. Here, administrations play an important role in the ecosystem and ensure the deployment of infrastructure and tools for other stakeholders.

C) the request is public, but the information comes in whole or in part from the private sector. We are talking about cases when the state wants to improve the traceability and efficiency of its services through closer cooperation with the private sector, while maintaining the degree of freedom and responsibility of the private ecosystem. Examples: tracking transactions or invoices for VAT purposes (the key of which is limiting VAT fraud), tracking social security reimbursement procedures (also reducing fraud). Under these conditions, the blockchain (distributed registry) will play a unifying role around a common and shared infrastructure, allowing standardizing procedures, representing an addition to government platforms.

In addition, it is important to remember that blockchain fits into the logic of infrastructure sharing, allowing each interested party to maintain these responsibilities and rules, while ensuring a level of transparency and accessibility (on a principle equivalent to the "need to know" principle) about the procedure under consideration to other interested parties.

From theoretical reflections on the use of blockchain technology as a public administration tool, we propose to consider practical recommendations for using blockchain to improve public services (Johnson, W. G., 2019)

1) self-confident identity

This use case is particularly different from all other use cases. It is more strategically important for States, since it is about preserving the sovereignty of individuals through their identity and, consequently, about the availability of a safe and high-quality identity. Self-confident identity is a new approach for storing, managing, controlling and exchanging data related to individuals, organizations or objects.

This approach, which is currently between research, development and several launches in the near future, can create significant value in various sectors of the economy.

There are a lot of opportunities for use in the public sector. The following cases were identified as potentially involving the largest number of Member States:

- simplify access to online administration services;*
- Application for asylum;*
- digitization of diplomas;*
- scanning of identity documents (passport, ID card);*
- Prescriptions for medications related to existing social security systems;*
- government licenses and other government documents (driver's license);*
- Public transport and social transfers (retirement, disability, maternity).*

Beyond these ambitious use cases, this is really a great opportunity for our democracies to put the citizen in the spotlight by giving him back control of his data.

In this context, several projects have emerged to introduce self-sustaining identity. These projects are overwhelmingly open source projects, allowing development of both high-quality and based on a rich ecosystem.

In Europe, initiatives like Alastria in Spain, including one of the components of the core of the project is a self-confident identity, which should appear in 2021. We can also mention the work of AgdataHub in France in the field of self-sustaining identities intended for the agricultural world (individuals, enterprises, objects), which require a relationship with Regalian in matters of civic identity (Li, J. et al., 2019).

The European Commission is also working on developing a solution for the European Sovereign Identity Framework, the ESSIF (European SelfSovereign Identity Framework 14) project. The goal is to deploy ESSIF, bringing it in line with the European Blockchain Service Infrastructure (EBSI), so that there is a convenient identification supported by the platform (hub) of personal identifiers stored in accordance with the general regulation on personal data protection.

It is important to remember that the ESSIF project in no way establishes control over the personalities of citizens at the European level, but offers a framework and strategy that can be implemented in the future. Implementation using a customizable set of tools depending on the context of use in the relevant country.

The standard and functions offered through ESSIF and EBSI allow administrations, if they so wish, to take advantage of this technological block of reliable digital identifiers intended for citizens.

2) notarization

This use case actually describes one of the main technologies used in the blockchain solution. This technology, or, better to say, this concept, which does not apply to the blockchain, is the use of "hash functions" in cryptography (Przebylowski, E. et al., 2018).

"Hash" in computer science allows you to create a cryptographic fingerprint unique to digital data (pdf file, book, name, address, contract, etc.). This computational method is more often called notarization. In this sense, the "notarization" precedent aims to demonstrate that in many cases this single function, originally included in the design of the distributed registry infrastructure, would solve many problems related to errors related to the state and the evidentiary reliability of the procedure with the participation of many stakeholders.

Thus, the blockchain infrastructure (for example, EBSI) using this method of notarization would allow registering the digital identification of documents or the status of a procedure at a time in a distributed registry, creating a mechanical link between the data and their historicization (Yermack, D., 2017).

This notarization, in the case of the EBSI blockchain, will be associated with the delegation of authority to write in this registry to the relevant administration or organization. Thus, it would allow to coordinate entire procedures in the same infrastructure, which would allow to perform the following actions:

- Save digital documents;*
- Verify their authenticity;*
- Create a secure data history with timestamps and timestamps;*
- Link digital fingerprints of files and their metadata;*
- Exchange digital fingerprints with third parties.*

This blockchain function is used here to create reliable and verified digital audit logs that allow you to automate compliance checks and confirm data integrity (Shrier, D. et al., 2016).

3) verifiable diplomas and certificates

The option of using digital diplomas chosen within the framework of EBSI is intended to lay the foundations of a European platform for managing "digital credentials": Certificate of completion of the certificate, open badges and other identity cards that cannot be forged, verified and searchable on the Internet.

The use of distributed registry technology and transparent rules is aimed at increasing confidence in the authenticity of diplomas (combating fraud), as well as reducing the time and cost of checking, managing and archiving these documents. Self-identification technology will allow you to put a citizen, a graduate, in the center of the device, making him the owner and responsible for the use of his digital title.

The data model that allows universities, educational institutions and companies to issue diplomas and certificates is based on international standards implemented in Europass (Europass is a European Union (Directorate General for Education and Culture) initiative to increase transparency of qualification and mobility of citizens in Europe.), created within the framework of the Educational Curriculum Digital ID Infrastructure project and Instruction (EDCI) of the European Commission. This is a set of centralized services that allow you to issue digital supporting documents and use them through an online portfolio or resume system in 29 languages. Europass and EBSI are designed to be used simultaneously to create a holistic ecosystem.

4) secure data exchange

In order to facilitate cross-border cooperation and provide easy access to regulated information of public/private institutions in the regulated markets of the European Union, EBSI offers a platform that provides access to a single presentation of information currently stored in various administrations of member States. Access to this information is carried out with permission based on the concept of "need to know" (Razzaq, A. et al., 2019).

The Trusted Data Shared (TDS) secure data exchange platform is based on a new approach to building a distributed and decentralized system by combining public/private organizations of all member states into a single dedicated platform. This avoids the exchange of this data and ensures both full traceability and ownership management throughout the data lifecycle.

The purpose of TDS is to develop a blockchain-like infrastructure that technically allows organizations in member states to exchange data publicly or privately and verify its validity, ownership and/or authenticity. This Trusted Data Exchange Infrastructure (TDS) is designed for certain groups of organizations in Member States that need to exchange data on a secure and reliable platform without the use of intermediaries. EBSI allows you to implement this use case with a flexible infrastructure.

5) issuance of bonds for small and medium-sized businesses to recover from CoVid19

With this use case, EBSI wants to allow the emergence of platforms for the European Union scale to finance small and medium-sized enterprises either with borrowed funds or with capital. The goal is to release and direct savings and investment policy to co-financing in the field of sustainable economy, innovation and modernization of small and medium-sized enterprises. A public platform(s) deployed at the level of Member States, the basis of which will be EBSI, will allow (a) to offer services provided not by the administration, but directly by a group of private organizations and federal authorities are concentrated around this infrastructure (Alcantara, L. T. et al., 2019).

This use case is aimed at facilitating the flow of private financing from capital owners to SMEs or eco-friendly projects.

6) The European Commission is in favour of a single European Social Security Number (ESSN)

This ambitious use case should eventually ensure the transferability of EU citizen rights between different member states. It aims to unify data exchange to prevent fraud, errors and duplication of identification data, which are difficult to handle. This type of solution will allow for simpler, safer and uninterrupted communication, data exchange between European countries and their administrations.

ESSN will be a process carried out by public authorities providing social security services to securely analyze the data of EU citizens and ensure a uniform level of service. Some countries have made further progress on this issue than others (Kossow, N., 2019). Therefore, it will be interesting to compare the approaches used in each country on this topic. In addition to the long-term perspective, numerous interdepartmental implementations within one country are possible to test the EBSI solution. This use case is closely related to the use cases of sovereign identity and secure data exchange.

7) application for asylum

This use case will aim to expand the reach of EBSI to a wide range of processes in the public sector. This will facilitate the management of cross-border and interdepartmental processes. The first problem is related to the procedure for dealing with asylum seekers. This problem, whose stakeholder ecosystem is complex and sensitive to human factors, can be found using EBSI as a unifying infrastructure solution for the safe distribution of procedure updates between stakeholders. competent authorities in matters of asylum (Marchionni, P., 2018). This use case is closely related to the use cases of sovereign identity and secure data exchange.

Conclusion. Blockchain should be considered not as a "simple" application, but as an infrastructure designed to solve many business problems in the ecosystem, especially in the field of information exchange and collaboration.

Using a consistent common data model and a language that provides the ability to model automated business logic, it allows you to deploy a network that includes a multi-stakeholder workflow that verifies and stores transactions (example: events in an administrative procedure) together.

It allows you to evaluate these general data, including datasets opened by the administration. It has the unique ability to eliminate differences or discrepancies between data structures and interpretations of these state changes.

Thus, blockchain technologies, including EBSI, make it possible to reduce or even eventually eliminate traditional "data warehouses" that have been preserved for decades between two organizations, this is completely transparent and without the need for mediation.

In the context of digital transformation, which is still too often viewed from a purely internal organizational point of view, blockchain offers a unique opportunity to build a homogeneous network whose goals are to provide reliable data and information exchange and offer significant improvements in terms of operational excellence for all organizations, stakeholders serving the user of public services. Like any implementation or introduction of a new technology, the implementation of blockchain is a complex exercise that requires the fulfillment of various requirements, the only thing that can lead to successful implementation.

The methodological recommendation is to ensure that a holistic approach is adopted, including, if possible, a general view of the problem from the very beginning, and thus avoid considering the blockchain only from its technical point of view. This balance is built around 4 main topics that are necessary for the proper completion of the blockchain project on time:

1. Applicability: why is this technology used? What specific benefits can be expected from this? What functions are needed?

2. Ecosystem: which environments, actors and their interactions require the deployment of a common/decentralized infrastructure?

3. Management: who supports what? Who has access to what information? Who confirms what? Who pays for what? Who benefits from what?

4. Feasibility: which protocol and which technology to use? What levels of performance, security, and privacy need to be achieved? What is the integration with the existing one?

When these four areas find an area of convergence, then the conditions necessary for the success of the blockchain initiative are likely to be achieved.

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Medical sciences

OVERVIEW OF ASPECT OF VASCULAR PERMEABILITY OF SENSORY SPINAL GANGLIA

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The cellular composition of paravertebral sympathetic ganglia, which is one of the components of peripheral nerves, has been the object of research by many scientists on morphology. At the same time, have not been studied in detail the mutual morphofunctional characteristics of sheath, vessels, glial and nerve elements in sensory spinal ganglions. In the available literature, it is emphasized that the data about the absence of biological barriers in the sensory spinal ganglia (SSG) belongs to Allt G. and his colleagues [1].

However, it should be noted that as early as 1976, Jacobs J.M., Macfarlane R.M. and Cavanagh J.B. published the article in the journal *Neurol. Sci.*, where they noted that intravenously injected horseradish peroxidase [HRP] was detected in perineuronal and periaxonal areas in SSG only after 5 minutes. Simultaneously, the authors noted the existence of diaphragmless pores in the peripheral parts of endothelial cells of SSG vessels, and showed that the latters and the slit-like areas remaining between neighboring endothelial cells play a key role in the outflow of intravenously injected HRP from SSG vessels [2].

Apparently, Jacobs J.M. together with his collaborators taking into account that the determined fact was unexpected (because until then it was considered unequivocally accepted that there is a hemato-neuronal barrier in all areas where nerve cells are located), they coordinated the outflow of HRP from SSG vessels with the evidence that the tracer is a foreign protein for the body and has a possible toxic effect.

In particular, it should be noted that the famous Swedish scientist Yngve Olsson and his colleagues played an important role in studying the permeability of vascular and sheath elements in derivatives of peripheral nervous system with the help of macro- and micromolecular tracers [3, 4, 5].

Among the results of research works conducted under the leadership of Olsson Y., the distribution of labeled dextran molecules (FITC-dextran) with different molecular weight [3000, 20000, 70000 and 150000 daltons] in the cerebral cortex, trigeminal ganglion and sciatic nerve is of particular importance. The authors clearly demonstrated that even the heaviest molecular weight (150,000 daltons) FITC - dextran molecules are easily excluded from SSG vessels.

For comparison, it should be noted that there are conflicting data in the literature about vascular permeability in sympathetic ganglia, which are part of the peripheral nervous system. So Jacobs J.M. (1976) and Allen DT, Kiernan JA. (1994) reported that intravenously injected HRP enters the interstitial area of the neck, abdominal sympathetic and intramural ganglia only after 5 minutes and reaches the ultrastructural areas between the nerve cells and the surrounding satellite glial cells [6].

Contrary to what was stated, Depace D.M. (1982) notes that not only macromolecular, but also micromolecular tracers (lanthanum chloride) injected into the blood vessels are determined on the luminal surfaces of endothelial cells and at the level of intercellular connections, but cannot enter the perivascular area [7]. Thus, the presence of a hematic barrier in sympathetic ganglia, which can be compared with the cerebral cortex, is highlighted.

Chinese scientists Chau Y.P., Lu K.S. (1995) note that due to the effective blood-ganglion barrier in the regions where the located the multipolar nerve cells of the upper neck and thoracic sympathetic ganglia, both the micromolecular tracer lanthanum and the protein-derived HRP with a molecular weight of 40,000 cannot leave the capillaries with somatic type endothelium [8].

On the contrary, lanthanum deposits are detected in the luminal, abluminal and subendothelial areas of vessels, as well as between small granule cells, in the entire abdominal-sacral sympathetic ganglion complex and in the areas of the upper cervical ganglion where are located small granule containing cells (SGC). This show that there is an effective blood-ganglion barrier for micromolecular tracers in the indicated areas.

Chau YP, Lu KS. (1995) found the most interesting fact that in all the studied sympathetic ganglia, HRP could not be released even through diaphragmatic windows located in the endothelial cells of visceral type capillaries. Thus, the authors concluded that the blood-ganglion barrier, which has selective permeability in sympathetic ganglia, depends on the size of the tracer molecules.

Another significance of the last result is the discovery of the absence of an effective blood-ganglionic barrier in sympathetic ganglia for lanthanum molecules in the areas where are located the small granule cells with paracrine effect.

In this regard, one of the research works by Japanese scientists of general biological importance is the determination of the dependence between the presence of the blood-vascular barrier and the types of tight junction proteins found between vascular endothelial cells in SSG [9].

The authors after injecting the fluorescent Evans blue - serum albumin complex (EBA, with a molecular weight of 69,000 daltons) into the vein, compared the topographical conditions of the tracer with tight junction proteins (claudin-1, claudin-5, occludin) located between endothelial cells under immunoconfocal microscope. While only claudin-5 protein was found among the endothelial cells in the areas where the EBA tracer was removed from the vessels, where nerve cells are located (where there is no effective blood-ganglion barrier); but in the areas where the tracer could not leave the vascular lumen, it was confirmed that in addition to the claudin-5 protein also present occludin protein between endothelial cells.

In addition to the inconsistencies between the results of scientific research devoted to the study of the permeability of vessels in the nervous system [6, 10], almost the vast majority of authors agree on two issues: 1) macro- and micromolecular tracers cannot leave the vascular lumen since the effective blood-brain barrier functions in the cerebral cortex, and 2) on the contrary, there are no structures that can play the role of a biological barrier in the areas of the brain where nerve cells are located.

The absence of a barrier in the sensory spinal ganglion raises some questions today:

- As we know, the nervous system does not have lymphatic vessels, which are an important component of the microcirculation system. How are proteins removed from the interstitial area in sensory spinal ganglia?

- What is the functional significance of the absence of a functional barrier in the spinal ganglion?

In addition to the above, the biological significance of barrier dysfunction in SSG remains unclear. We have full confidence that one of the possible directions to clarify the discussed issue, required a complex study of the histotopography and ultrastructural features of the structures involved in the flow of biological fluids (sheaths, vessels, glial and nerve elements) in the sensory spinal ganglia during normal and experimental edema.

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Philological sciences

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A PSYCHOLINGUISTIC EXPLORATION: UNRAVELING THE COMPREHENSION OF MENTAL ABILITY TERMS

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Abstract

This psycholinguistic study explores the comprehension of mental ability terms in Russian and English languages. Mental abilities, encompassing traits such as intelligence, memory, and creativity, are essential components of human cognition and communication. Through a series of psycholinguistic experiments, participants from monolingual communities were presented with mental ability terms in written and spoken formats. The study investigates cross-linguistic differences in comprehension, the influence of cultural schemas on interpretations, and cognitive factors affecting processing. Results reveal intriguing variations in term interpretations, highlighting the impact of cultural context and cognitive mechanisms on language understanding. Understanding how mental ability terms are comprehended enriches our knowledge of lexical-semantic representation and fosters intercultural appreciation of linguistic nuances.

Keywords: *psycholinguistic, mental ability terms, comprehension, cross-linguistic differences, cultural schemas, lexical-semantic representation, cognition, communication, linguistic nuances, intercultural appreciation.*

Language serves as a fundamental tool for human cognition and communication, allowing individuals to express thoughts, emotions, and concepts about the world around them. Among the myriad facets of language, the representation and comprehension of mental ability terms hold a pivotal place in shaping how we perceive ourselves and others. Mental abilities encompass diverse cognitive traits, including intelligence, memory, problem-solving, emotional intelligence, and creativity. Understanding how these concepts are comprehended across different linguistic and cultural contexts is a compelling endeavor that sheds light on the intricate relationship between language, culture, and cognition.

As an interdisciplinary field, psycholinguistics examines the cognitive processes that underlie language use and comprehension. The comprehension of mental ability terms involves intricate interactions between linguistic representations and cognitive mechanisms. These interactions, in turn, are influenced by cultural schemas, which imbue certain abilities with particular salience and significance in different societies. Consequently, speakers of Russian and English may interpret mental ability terms in unique ways, reflecting the influence of their respective cultural contexts.

Through a series of carefully designed experiments, we endeavor to explore the cross-linguistic differences in mental ability term comprehension. Participants from monolingual communities of each language were exposed to a set of mental ability terms, both in written and spoken formats. Their task was to evaluate each term's familiarity, concreteness, imageability, valence, and complexity, providing valuable insights into how these concepts are processed and perceived.

The implications of this research extend beyond the realm of psycholinguistics, fostering a deeper understanding of how mental abilities are conceptualized and represented in language. By uncovering the cognitive and cultural factors that influence language comprehension, this study contributes to the broader field of lexical-semantic representation. Furthermore, insights from this investigation may prove valuable in diverse applications, such as language teaching, communication strategies, and intercultural understanding.

The comprehension of mental ability terms across different languages gives rise to intriguing cross-linguistic differences. While these concepts may have comparable core meanings, variations in lexicalization, cultural values, and cognitive perspectives can lead to diverse interpretations in each language. This section of the study explores the specific nuances that emerge when individuals from Russian and English linguistic communities engage with mental ability terms.

Lexical Variation: One of the primary sources of cross-linguistic differences lies in the lexical diversity of mental ability terms. In Russian and English, certain mental abilities may have unique and distinct lexical representations, while others may share similar terminology. Such variations can lead to differences in emphasis and granularity, shaping how individuals express and comprehend these concepts within their linguistic framework.

Cultural Schemas and Valuation: The cultural context significantly impacts the comprehension of mental ability terms. Certain mental abilities might hold greater significance and valuation in one language compared to another. For instance, the concept of "intelligence" in English may be heavily weighted in academic and professional contexts, while the corresponding term in Russian might carry broader connotations, including emotional intelligence and practical wisdom.

Connotations and Emotional Associations: Mental ability terms can evoke distinct connotations and emotional associations based on cultural and linguistic backgrounds. A concept that is associated with positive emotions in one language might elicit a different emotional response in another language due to cultural nuances and value systems. These emotional associations can influence how individuals perceive and evaluate particular abilities.

Degree of Specification: Cross-linguistic differences may also manifest in the degree of specificity conveyed by mental ability terms. Some languages might have precise and well-defined terms for particular abilities, while others may rely on more general or encompassing expressions. This variation can affect the level of precision and nuance in communication when discussing mental abilities.

Cognitive Frames and Metaphors: The comprehension of mental ability terms is influenced by cognitive frames and metaphors that are culturally prevalent in each language. Metaphorical extensions of mental ability terms may differ across languages, revealing underlying cultural schemas and associations related to cognitive processes.

Influence of Bilingualism: For individuals who are bilingual or multilingual, cross-linguistic differences in comprehension may lead to transfer effects, where comprehension in one language influences understanding in another. This phenomenon can create additional complexities in mental ability term comprehension for bilingual speakers.

Understanding these cross-linguistic differences in mental ability term comprehension provides valuable insights into the dynamic relationship between language, culture, and cognition. The findings from this exploration can facilitate effective communication across linguistic boundaries, promote intercultural understanding, and inform language teaching strategies that cater to diverse cultural contexts. By examining the nuances of mental ability term comprehension in Russian and English, we gain a deeper appreciation of how language shapes our perceptions and conceptualizations of human cognition.

The insights gained from the study of mental ability term comprehension have profound implications for language understanding and effective communication across diverse linguistic and cultural contexts. The following implications highlight the significance of this research in enhancing language processing and promoting intercultural understanding:

1. *Language Teaching and Learning:* The findings from this study can inform language teaching methodologies, especially for educators teaching Russian, Kyrgyz, and English. Understanding the specific nuances and cross-linguistic differences in mental ability term comprehension can help teachers tailor their instruction to promote better understanding and usage of these terms among language learners.

2. *Communication Strategies:* As mental ability terms are crucial in describing individuals' cognitive traits, the study's insights can aid in developing effective communication strategies. Being aware of how different terms might be perceived and interpreted by speakers of different languages enables communicators to choose appropriate vocabulary and phrasing for various audiences.

3. *Interpretation and Translation:* For translators and interpreters working across languages, understanding the cognitive and cultural factors that influence mental ability term comprehension is vital. This knowledge helps ensure accurate and culturally sensitive translations, reducing the risk of misunderstandings and miscommunications.

4. *Intercultural Awareness:* The study's focus on cultural schemas and values enhances intercultural awareness and sensitivity. It encourages language users to be mindful of how their own cultural background may shape their understanding of mental ability terms and how these terms may be perceived differently in other cultures.

5. *Cross-Cultural Collaboration:* In cross-cultural settings, such as international business or collaborative research projects, being cognizant of the cross-linguistic differences in mental ability term

comprehension fosters smoother communication and collaboration. This understanding facilitates clearer discussions about cognitive traits, skillsets, and abilities.

Overall, this research contributes to a deeper appreciation of the role language plays in shaping our understanding of human cognition. The implications extend beyond linguistic domains, impacting various aspects of daily life, education, and professional interactions. By acknowledging the complexities of mental ability term comprehension, individuals can engage in more effective and empathetic communication, fostering mutual respect and intercultural understanding in our increasingly interconnected world.

In conclusion, the study of mental ability term comprehension in Russian and English languages offers valuable insights into the intricate interplay between language, culture, and cognition. Through psycholinguistic experiments, cross-linguistic analyses, and exploration of cognitive factors, this research has provided a comprehensive understanding of how individuals interpret and understand mental abilities. The cross-linguistic differences in mental ability term comprehension highlighted the impact of lexical variation, cultural schemas, and emotional associations on interpretation. Each language's unique representations and valuations of mental abilities reflect the diverse cultural backgrounds and linguistic systems in which these concepts are embedded. Cognitive factors such as concreteness, imageability, and contextual cues were found to influence mental ability term comprehension, shedding light on the cognitive processes involved in language understanding. The cognitive frameworks individuals use to categorize and associate mental abilities contribute to their interpretation and usage of relevant terms. The implications of this research for language understanding and communication are significant. Language educators can leverage these insights to design more effective teaching strategies, enhancing language learners' comprehension and usage of mental ability terms. Communicators can use this knowledge to tailor their messages for diverse audiences, fostering clearer and more impactful communication.

Moreover, this study underscores the importance of intercultural awareness and sensitivity. Recognizing how cultural schemas influence mental ability term comprehension promotes a deeper understanding of cultural nuances and promotes intercultural understanding in various professional and social contexts. As languages continue to evolve and interact in our globalized world, the study of mental ability term comprehension remains relevant and vital. Further research in this domain, exploring neurocognitive correlates, language variation, and bilingual effects, will continue to enrich our understanding of language, culture, and cognition.

In conclusion, the investigation of mental ability term comprehension contributes to the broader field of lexical-semantic representation, fostering a deeper appreciation for the role language plays in shaping our perceptions of human cognition. By embracing the complexities and diversity of language usage, we can build more inclusive and empathetic communication, bridging linguistic and cultural gaps for a harmonious and interconnected global society.

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Sociological sciences

GENDER EQUALITY IN THE IMPLEMENTATION OF WOMEN'S POLITICAL RIGHTS IN THE REPUBLIC OF KAZAKHSTAN

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Abstract

The presence of women in political parties – and how they encourage and develop their participation or address issues related to gender equality – is a key factor in their political emancipation. The choice of this topic is due to the fact that women's equal participation and leadership in political and public life are crucial for achieving the Sustainable Development Goals by 2030. This topic is also relevant for the Republic of Kazakhstan, as Kazakhstan strives to become one of the 30 developed countries of the world by 2050.

Theoretical and empirical analysis of the problem of ensuring equality of men and women in law, morality and public practice is carried out in the article on the basis of analytical documents and studies of international organizations, as well as the works of domestic and foreign scientists, using a combination of methods: historical, comparative and a number of others.

As part of the scientific work, a hypothesis has been developed based on step-by-step recommendations for achieving positive results of strategies encouraging women's participation in political life, which in turn should be linked to measures that parties can take at various stages of the electoral cycle.

The main conclusions are that in Kazakhstan there is a positive trend of increasing the participation of women at all senior levels of government, and an all-encompassing regulatory framework has been created that meets all standards of international law. However, there are some gaps in the implementation of political rights in the context of gender equality. The recommendations developed to improve this political sphere can be useful to representatives of political parties, the scientific community within the framework of political disciplines, as well as to all experts.

Keywords: *gender equality, world politics, Kazakhstan, international and national law, election cycles.*

Introduction. *In 2022, after two years of isolation and losses due to the COVID-19 pandemic, from which the world is gradually recovering, the leadership of women in parliaments around the world continues to improve, but at a slow pace. Women's representation in Parliament has reached new heights all over the world, and the context in which women exercise their political leadership is constantly becoming more important. From Brazil to Hungary and from Australia to the United States of America, gender and women's rights issues have shaped voter behavior and election results.*

Never before has the diversity and representativeness of women parliamentarians been as significant as it is today in many countries. The significant development of technology and parliamentary action initiated during the pandemic has become institutional, which has made parliaments more comfortable workplaces focused on modernity and gender sensitivity and compatible with family life. Women have also demonstrated their leadership in the fight against the climate crisis. Nevertheless, obstacles remain, including gender-based violence and unequal access to campaign finance, which only widen the gap between women and men in politics in many regions of the world.

The impact of politics, increased gender sensitivity in parliamentary workplaces, and public awareness are some of the positive aspects of women's participation in political life in 2022. For the first

time in the world, there is not a single parliament in which there are no women parliamentarians, and yet parity in parliament is far from the norm. In 2022, the growth rate of women's representation reached the lowest level in six years, amounting to 0.4 points, and at the end of the year amounted to 26.5%. At this rate, we will have to wait more than 80 years to reach parity.

In 2022, parliamentary elections were held in 47 countries, where an average of 25.8% of women (upper or lower chambers and unicameral chambers combined) were elected, which is 2.3 percentage points more than in the previous elections held in these countries. This progress is largely due to the significant results achieved in a small group of countries. In eight countries, the proportion of women elected or appointed to legislative chambers in 2022 was 40% or more. With 56.6% of elected women in the upper house, Australia took first place. Nevertheless, in most cases, parliamentary updates in 2022 showed negative results (29% of extensions) or a slight increase (26% of extensions and an increase of less than 2 points). In more than a third of the elections held in 2022, women won less than 20% of seats in national parliaments (Inter-Parliamentary Union, 2023).

Despite the positive dynamics of the representation of women in leading political and public positions around the world and in Kazakhstan in particular, the real picture is still far from the actual gender inequality, which is why the chosen global problem remains relevant today. In this regard, the purpose of this study is to analyze the current state of gender equality in the Republic of Kazakhstan, as well as practical recommendations for improving the conditions for the development of women's potential in the political life of the country.

Materials and methods. Within the framework of this work, data were collected, a review of relevant publications was conducted and analytical information from various sources was studied to identify problems of political and socio-economic development in relation to the topic of gender equality. In addition, updated statistics, studies and industry reports from national and international sources were analyzed. The following sources of information were studied:

- National statistical data on demography, socio-economic development and human development in the country;
- International and regional comparative statistics and indicators on gender equality and women's empowerment;
- Legislation, policies, strategies and programs related to gender equality issues;
- Research, reviews, best practices, thematic materials and accumulated experience on gender equality issues on a national and sectoral basis.

Results and discussion. Women's equal participation and leadership in political and public life are crucial to achieving the Sustainable Development Goals by 2030. Yet the evidence suggests that women are underrepresented at all levels of decision-making around the world, and that gender parity is still far from being achieved in political life. Statistics from UN Women (2023) confirm this fact:

Women in leadership positions in the state.

- As of January 1, 2023, 34 women are heads of State and/or Government in 31 countries. At the current pace, it will take 130 years to achieve parity in political decision-making at the highest level.
- Only in 17 countries is a woman the head of state, and only in 19 countries is a woman the head of government.
- Initial data collected by the UN Women structure show that as of January 1, 2023, women make up 22.8% of Cabinet ministers heading Ministries leading the political sphere. There are only 13 countries in which women occupy 50% or more of the ministerial posts heading political spheres.

Women in national parliaments.

- Only 26.5% of all national parliamentarians are women, compared to 11% in 1995.
- In only six countries, 50% or more of women are represented in parliament in unicameral or lower houses: Rwanda (61%), Cuba (53%), Nicaragua (52%), Mexico (50%), New Zealand (50%) and the United Arab Emirates (50%).

Women in local government.

- Data from 136 countries show that almost 3 million (34%) elected members of local decision-making bodies are women. Only in 2 countries this figure has reached 50%, and in 20 other countries the proportion of women in local government exceeds 40%.

As for Kazakhstan, according to the latest official statistics given below in Figures 1-3 (Agency for Strategic planning and reforms of the Republic of Kazakhstan 2023), there is also a positive trend in the

growth of women's participation in all spheres of society in the Republic of Kazakhstan, namely:

Share of women in Parliament of the Republic of Kazakhstan (Senate, Mazhilis)

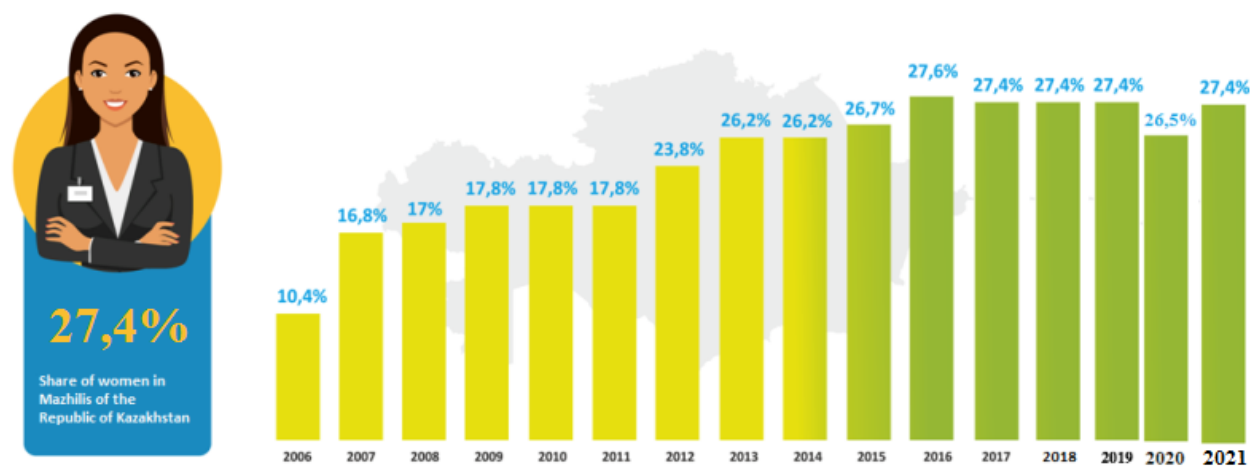


Fig.1 – Share of women in Parliament of the Republic of Kazakhstan (Senate, Mazhilis)

Share of women among heads of labour unions and non-governmental organizations*

in percent



* - accounting of heads by sex in Statistical business register has been provided since 2009

Fig.2 – Share of women among heads of labour unions and non-governmental organizations

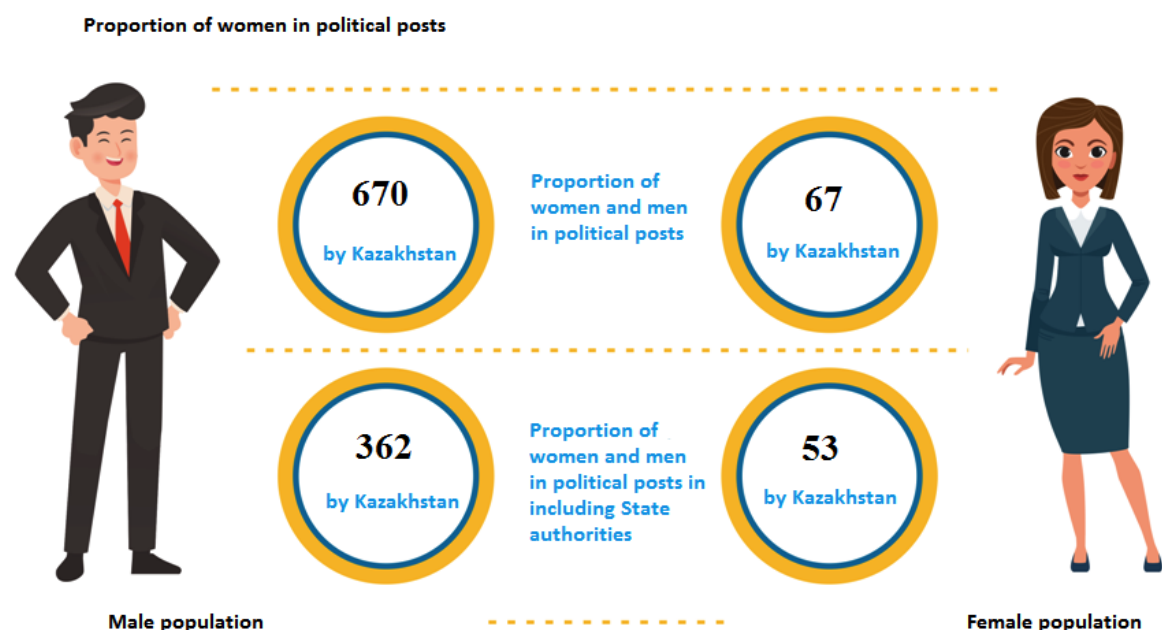


Fig.3 – Proportion of women in political posts

In general, over the years of independence, Kazakhstan has made some progress in the implementation of gender policy. The country has ratified fundamental international acts – the Beijing Platform for Action for the Advancement of Women (1995), the UN Convention on the Elimination of All Forms of Discrimination against Women (1998), the Convention on the Political Rights of Women (2000), the Convention on the Nationality of Married Women (2000), the International Labor Organization Convention on Equal Remuneration labor of men and women for work of equal value (2000), etc. In the implementation of gender policy, Kazakhstan closely cooperates with a number of international organizations: with UNIFEM (UN Women's Fund), with the Organization for Security and Co-operation in Europe, the International Organization for Migration, the British Council and the United Nations Development Program. Kazakhstan's achievements in reducing gender inequality are noted by experts of the Organization for Economic Cooperation and Development, led by Pinar Guven, a political analyst at the OECD Directorate for Public Administration and Territorial Development (OECD, 2017).

The country has created an institutional and regulatory framework for the effective implementation of gender policy. To ensure gender equality in all spheres of life of the Kazakh society at the highest state level, the Institute of Gender Policy – the National Commission on Women's Affairs and Family and Demographic Policy under the President of the Republic of Kazakhstan has been established and is successfully functioning. Regional offices of the Commission are working on the ground. The Parliament has adopted laws corresponding to international standards "On the prevention of domestic violence", "On State guarantees of equal rights and equal opportunities for men and women". The operation of these laws is mainly aimed at regulating public relations in the field of ensuring State guarantees of equal rights and equal opportunities for men and women, establishing basic principles and norms concerning the creation of conditions for gender equality in all spheres of State and public life.

To date, the main principles, priorities and objectives of gender policy in Kazakhstan are defined in the Concept of Family and Gender Policy until 2030 (News Agency Strategy2050.kz, 2021). In 2019, the first stage of the implementation of the Concept was completed, according to the results of which it is possible to state the purposeful implementation of a systematic and popular gender policy in the Republic of Kazakhstan, comprehensively taking into account national and international experience in achieving gender equality, religious and cultural characteristics of Kazakh society.

Nevertheless, the Government of the Republic of Kazakhstan and all interested non-governmental organizations still have to overcome some obstacles to the implementation of the gender equality strategy at all leadership levels of the country.

Women's participation in political life is a right guaranteed by a number of international conventions. But turning this abstract right into reality requires investment on the ground. Political parties are the key to women's participation in political life, since they are the ones who recruit and choose candidates to participate in elections and determine the political agenda of the country (Barber M. et al. 2016). And yet, while women tend to be well represented in parties at the local level or in lower-level positions, they are underrepresented in leadership positions. Since they do not have access to existing networks of influence, regardless of whether they have very limited resources, have few role models or mentors, and sometimes do not even enjoy the support of their families or community, it can be understood that their participation in political life remains significantly lower than their participation in the political life of a man.

In order to implement this strategy, the author of the work suggests studying some recommendations based on the study of recent trends that took into account the experience of foreign countries, as well as modern results of scientific work.

The most effective strategies for increasing women's participation in political parties combine the reform of political institutions and targeted support for activists (regardless of whether they are members of internal party structures or not), female candidates and elected women. They require cooperation from a wide range of actors and political parties, of all directions. The developed recommendations are divided into four stages that correspond to the "election cycle" approach: I. strategies of internal party organization II. Strategies in the pre-election period III. Strategies in the electoral period IV. strategies in the post-election period.

I. The internal organization of parties affects how different needs, interests and social demands are represented in society. Official documents and statements of a political party are important because they can provide a basis for gender equality: they define the position of the party, but also define the rules that allow it to be implemented (Ponce A. et al., 2020). Below are some of the strategies concerning the internal organization of the party:

- Consider the issue of gender equality in the party's charter. we can, for example, include a statement on gender equality in the founding documents of the party;
- Take measures, including internal quotas, to ensure the presence of women in governing boards;
- Set goals for women's participation in party congresses. For example, it is possible to organize separate forums for female delegates;
- create a department or women's sections that should be officially part of party bodies, with clearly defined roles and responsibilities defined and, if necessary, the necessary funding;
- Ensure that gender equality issues are included in all party policy guidelines.

At the pre-election stage, the recruitment and selection of female candidates is of paramount importance if parties want to ensure the presence of women in politics. The gender gap increases noticeably when we move from the stage of a candidate who is eligible to participate to the stage of a novice candidate and, even more so, to the stage of a candidate who has received a nomination from the party. It is important that the parties include rules on women's representation. When this commitment is not formal and is not set out in writing, it is much more difficult to develop strategies that allow women to enter into power structures, and it is even more difficult to hold the party accountable if it does not fulfill its promises. If the party has a weak internal structure and the rules regarding the recruitment of candidates are not clearly formulated, the decision is usually made by an elected elite, usually consisting exclusively of men.

In recent years, much attention has been paid to the introduction of electoral quotas to attract more women into politics. They guarantee the inclusion of a predetermined minimum proportion of women in representative institutions, whether as delegates, candidates or elected. About 50 countries have adopted legislation on gender quotas for candidates so that a certain number of women can run for elected office. In thirty other countries, hundreds of political parties have voluntarily adopted a quota policy for women (Feo Francesca, Piccio Daniela R, 2020). But such measures can give good results only if women are listed as eligible to participate, and if sanctions are provided for non-compliance with the law.

II. At the pre-election stage, the recruitment and selection of female candidates is of paramount importance if parties want to ensure the presence of women in politics. The gender gap is noticeably increasing as we move from an acceptable candidate to an aspiring candidate and, even more so, to a candidate who has received the nomination from the party. It is important that the parties include rules regarding the representation of women. When this commitment is not official and is not set out in writing, it is much more difficult to develop strategies to allow women to enter power structures, and it

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Political parties can take the following steps to address gender inequality in the recruitment of candidates:

- stimulate the party base in favor of candidate quotas and fix them in the party charter;*
- formulate guidelines for the recruitment of candidates to party selection committees; "ensure that female candidates hold acceptable positions;*
- cooperate with civil society organizations to ensure compliance with quotas;*
- develop strategic alliances with men, as men play a crucial role in strengthening support for such policies within the party itself;*

• expand the lists of female candidates and give them the opportunity to complete training;
• Promote multilateral relations and exchange of experience between different countries and regions. Women often cite lack of funds as one of the most constraining factors in politics.

Not only do they have to struggle to raise the money needed to run a campaign, they often receive virtually no financial assistance from their party. It is especially difficult for them to raise initial funds for the start of the election campaign.

Measures that parties and civil society organizations can take next steps to help women raise the funds needed for the campaign (Kitchens K. et al., 2016):

- create fundraising networks, which is especially important when there is no government funding and female candidates have to find money themselves to present themselves at the elections;*
- fundraising within the party to support female candidates;*
- provision of grants to female candidates;*
- limiting the costs of nominating candidates and the campaign;*
- Finance political parties by appealing to public funds, especially if regulated, in order to encourage parties to address the issue of women's participation in political life;*
- allocate funds for the training of female candidates;*
- Examine whether party funds are also used to support female candidates and address women's issues.*

III. During the election period, female candidates should be aware of the most effective methods of campaigning and communicating with voters. They are political parties that can help raise awareness among voters about women's right to participate in political life and the fact that progress in the field of gender equality benefits the whole society. Measures that parties may take during this period include, among others:

- Offer female candidates training in areas such as fundraising, message formulation, media outreach and voter communication;*
- train women and appoint them to positions of responsibility for the campaign (for example, in campaign management, in contact with voters or in communication);*
- ensure the visibility of women during the campaign by giving them more media coverage;*
- compilation of a list and dissemination of the party's positions on issues that women consider to be a priority, which will also allow to get more women's votes;*
- monitor elections, including hiring women as party observers at polling stations, especially if some of them are intended only for women;*
- provide voters with information, including messages on the importance of women's participation in voting and their right to vote as full members of society and on an equal basis with men.*
- After the elections, parties continue to play a central role in increasing women's participation in political life. At the post-election stage, they can take the following steps to promote gender equality and the advancement of women in government:*

- assess the level of gender equality in the party in order to identify and ultimately eliminate any practices or rules that directly or indirectly undermine women's participation;
- promoting reforms for equality gender aspects in political institutions, such as changing the sitting time of Parliament or adapting the parliamentary calendar, taking into account the fact that elected officials have families;
- include gender issues and women's participation issues in party politics, including by supporting reforms aimed at addressing women's issues, such as combating gender-based violence, parental leave or reproductive rights, or by promoting gender equality in party policies in areas such as access to justice, healthcare, citizenship, labor, land rights, social security and inheritance;
- Support multiparty women's networks and women's parliamentary groups, as they allow women to discuss their interests and problems there and help to integrate gender issues in parliamentary work, both in policy development and in monitoring government actions;
- ensure that elected women can be leaders in political institutions, parliamentary groups (e.g. group chair or speaker);
- Establish strategic partnerships with civil society organizations.

This list of measures is not exhaustive. They are provided on the basis of best practices as guidelines, not instructions (Kwon S. H. et al., 2017). The involvement of men is crucial for any action aimed at promoting women's participation in political life or at ensuring gender equality in general. They are important partners for achieving sustainable change. If we want more women in politics, it's not so that there are fewer men in it, but so that society is fairer for everyone.

(a) to train and sponsor female candidates Improving the methods of campaigning for female candidates in combination with other training opportunities plays a key role if we want them to run for elections in greater numbers. The training can be aimed at fundraising, developing messages, working with the media, contacting voters and outreach programs, developing campaign plans and targeted methods of communicating with voters

(b) to ensure the visibility of women during the campaign, women activists and candidates bring to the party character and skills that are useful to the party, but often ignored or misused during election campaigns. Women are often absent from party campaigns, as priority is given to current leaders and elected officials who benefit from already enjoying a certain prominence. Political parties can increase the visibility and visibility of female candidates by intentionally including them in the election campaign, especially in television ads or campaign posters, or by appointing them as a spokesperson. In several countries, women activists have used new technologies to promote their own candidacies, including through social networks such as Facebook and Twitter, and personal websites (Lee H. et al., 2016).

(c) identify and disseminate the party's positions on issues of interest to women. They consider political programs to be priorities, which indicate the maturity of competing parties. They allow them to distinguish each other on basic issues, not on issues of identity or personality. Drawing up a list of women's priorities can be a good strategy to enlist the support of women voters and achieve good results in elections. For example, women parliamentarians are at the forefront of the fight against gender-based violence and often show interest in issues such as parental leave or child custody. They fought for gender equality laws and electoral reforms that expand women's access to parliament to be included in the legislative calendar. Including issues of concern to women in the party platform can also help female candidates, as it gives them tangible topics to discuss when they try to reach out to female voters. Parties that can determine such directions will have more opportunities to solve the problems of their female voters and, thus, attract more women's votes.

(d) Gender-sensitive election monitoring and security provisions Political parties perform an important monitoring function during the election period. We are talking about a thorough check of voting procedures and the prevention of violations. Vote-buying, voter intimidation tactics, ballot stuffing, or poor organization jeopardize the integrity of voting. Insufficient security can affect candidates or voters in different ways depending on whether they are men or women, especially if the threat of sexual violence is high, which can be quite common in post-conflict surveys. 47

(f) Gender-sensitive voter education Political parties are interested in educating voters to be sure that their supporters will go to vote and that they will cast a valid ballot on election day. They invest a lot of time and money in information campaigns and can adapt messages for female voters so that they understand well what procedure should be followed. Voter-oriented information campaigns should emphasize the importance of women's participation in voting for society as a whole and emphasize their right to vote as full members of society. (Mazur A. G. et al., 2020).

IV. *The post-election period is quite suitable from a strategic point of view for conducting an assessment of gender equality. Political parties often rely on empirical information when developing strategies to support women's participation, while they could compile a report on the situation within their own parties. It would be good if they conducted a systematic analysis of the needs and capabilities of their supporters based on data collected through surveys or focus groups, as well as public opinion polls or election results. In addition, any internal party survey on gender equality should include a review of its internal rules, guidelines and commitments detailed in its program, as well as an analysis of the place given to women. To do this, it would be useful if they were constantly updated with data broken down by gender.*

(b) to train newly elected women for the majority of newly elected parliamentarians, parliamentary work is an unprecedented experience. While the parliamentary administration often offers basic training to new parliamentarians, political parties themselves organize training for members of their parliamentary group to teach them how the party works in this particular environment. This training helps to develop soft skills and can be a targeted guide for women to help them understand the rules and procedures.

(c) to promote favorable reforms to gender equality in Parliament, Parties that sit in Parliament may seek to change its culture. When women start working in these bodies, they often fall into a relatively gendered sphere – a political environment or an institutional culture and procedures that harm them. It may be necessary to conduct an assessment of political institutions to ensure that the conditions under which women should work are conducive to their participation. Consideration of issues such as the timing of parliamentary meetings, the location of women's toilets, provisions on maternity leave, etc., can lead to positive reforms in favor of women's participation. Therefore, it is extremely important to remove obstacles to women's participation in the creation of parliaments that fully take into account their interests and meet the needs and interests of parliamentarians of both sexes (Murray R. et al., 2021).

(d) take into account party policy issues related to gender and the advancement of women A survey conducted by the Inter-Parliamentary Union among 300 parliamentarians shows that common party guidelines are key factors in determining legislative priorities and deadlines. The party's governing bodies, such as the executive committees, have enormous influence. However, women are underrepresented there. Not all parties advocate gender equality in practice and do not fulfill their election promises, and there are few women in leadership positions. Wait, the support of the ruling party is one of the most important factors in the introduction and adoption of legislation on gender equality.

(e) ensure that women have access to vacant positions and retain their own. The number of women sitting in Parliament may vary in one direction or another during the term of the legislature. It happens that one of them resigns or accepts a ministerial portfolio, as a result of which her place remains vacant. In such cases (if there are no by-elections) his party may appoint another woman in her place. Parties may also decide that any vacant seat will be given to a woman in order to increase the proportion of women in Parliament. They can think of various ways to allow women to retain their seats in subsequent elections. The percentage of rotation of parliamentarians among women is higher than among men. It might be useful to ask top officials what kind of support they would need to reverse this trend.

(f) to support networks of transparent women entrepreneurs and women's parliamentary associations around the world, women have realized that, since they are a minority in Parliament, the creation of alliances and coalitions to stimulate political change provides strategic advantages. Networks of women parliamentarians can be an excellent forum for bringing together women from all parties to discuss their problems and interests, as well as for integrating gender issues into parliamentary work, both in policy development and in the political sphere. Oversight of government actions (Ohman Magnus, 2018).

(g) Establishing strategic partnerships with civil society organizations Coalitions between women politicians and civil society are useful for advancing the cause. In many cases, especially when parties sought amendments to the Constitution or the adoption of laws in favor of women's participation in political life, political activists worked closely with civil society organizations to achieve their goals.

(h) raise awareness among party members and work in partnership with men to institutionalize gender equality, members should implement policies and procedures adopted by their party, especially if they are part of a parliamentary group. The party's stated ambitions, such as the specific goals it sets or the political commitments it undertakes, mean little if party members, whether men or women, do not support and accept them. Since they make up the majority in most parliaments and dominate the governing bodies of parties, men are key partners in achieving change (Song Byong Kwon, 2020). This

may require internal training processes to raise awareness of gender equality among participants, especially men. The training that newly elected officials usually receive when entering parliament should include modules on this subject.

Conclusion. With more than a decade of experience in implementing a comprehensive gender equality strategy and an updated policy approved in 2017, Kazakhstan demonstrates an unwavering commitment to promoting equality between women and men. Since Kazakhstan aspires to become a country with a high level of economic and human development, the processes of removing obstacles to the full economic, social and political participation of women should only deepen.

At the same time, Kazakhstan has a sufficiently strong regulatory framework for the implementation of gender equality that meets all standards of international law. Also, work is currently underway to develop the concept of the draft Law of the Republic of Kazakhstan "On Amendments and Additions to Some Legislative acts of the Republic of Kazakhstan on family and gender policy", which provides for the improvement of legislation in accordance with the concluding observations of the UN Committee on the Elimination of Discrimination against Women, as well as recommendations of the Council of the Organization for Economic Cooperation and Development on gender equality. In general, national legislation seeks to achieve *de facto* social equality of men and women.

Nevertheless, consideration of women's interests and their participation in political life are indispensable conditions for democratic development and contribute to good governance. However, political parties are the main driving forces of participation in the life of the country. Undoubtedly, it is in their interests, both from a political and financial point of view, to actively promote initiatives aimed at empowering women throughout the entire election cycle. If they support them officially and openly, in particular by undertaking reforms, they can derive from this a number of political and practical advantages: changing public opinion, expanding their base, attracting new members, increasing their public funding and improving their image abroad.

Women have to face many obstacles when entering politics or joining a party, but various measures can help them overcome them at different levels and at different times of the election cycle. This research paper shows how, with the help of targeted strategies, more and a significant number of women can occupy leadership positions and remain in them. Successful strategies are based on profound changes in the political system, internal party reforms or strengthening the potential of women. A significant number of cases indicate that reforms aimed at increasing women's participation in party activities are complemented by initiatives aimed at improving gender mainstreaming in political programs. The most significant strategies combine the reform of political institutions and targeted support for party activists, candidates and elected women in order to take into account the socio-economic problems and opportunities they face.

It has become obvious all over the world that one starting point is worth another if there is a real desire to achieve equality between men and women. The parties that have been successful in this regard have been creative in their desire to promote the interests of women and have chosen approaches appropriate to their history and their own context.

However, it should be noted that, despite the diversity of strategies and approaches, some measures, such as the introduction of quotas, have proved effective in all countries in ensuring women's access to leadership positions. The authors of this study set out to present a short and accessible list of potential strategies corresponding to various stages of the electoral cycle, as well as practical examples taken from case studies. The authors hope that members of political parties and in particular their leaders, civil society organizations and those who advocate for gender equality will find good reasons to encourage women's participation in political life. They also hope that this guide will be useful to interested parties who would like to know how to act in order to promote women's representation in political parties. Moreover, this study may have its continuation as a result of the analysis of the actions taken described in the practical recommendations.

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Technical sciences

APPLICATION OF NANO-FILTRATION IN WATER TREATMENT AND IT'S COMPARISON WITH OTHER METHODS

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Abstract

The production of (safe drinking water) will be one of the problems of the world community in the 21st century. As a result, the need for water resources will increase, and on the other hand, due to the growing population and the proliferation of industries, more pollution will enter these resources. In such circumstances, the use of effective and cost-effective technologies such as nanotechnology that have higher efficiency in water treatment is necessary. Less energy consumption compared to reverse osmosis (RO) and higher rejection compared to ultrafiltration (UF) make nanofiltration membrane more and more noticeable. In this article, the capabilities of nanofiltration in water treatment, its features and benefits and its comparison with other membrane processes were investigated.

Keywords: Drinking water, Nanofiltration, Pollution, water treatment, removal percentage,

1. Introduction

Water is the essence of life present on earth. Various biological processes in living organisms are solely dependent on the presence of water [3]. Currently, there are several applications of nanostructured materials in environmental protection, such as nano-filters (for the treatment of industrial effluents), nano-powders (for the treatment of pollutants emitted from automobiles and industrial units) and nanotubes (for the storage of perfectly clean hydrogen fuel). Enumerated, but the prospects for using this new technology are much broader than this Partial and cross-sectional applications. In the recent past, the goals of drinking water treatment plants were to reduce suspended solids and eliminate live pathogens in the water, which could be achieved by conventional filtration and disinfection methods. However, with increasing concentrations of particulate matter, nitrogen compounds, organic and inorganic materials and heavy metals to water sources, conventional methods do not meet the needs of refineries and it is necessary to use relatively new processes in refineries. Recently, with the introduction of new technologies such as biotechnology and nanotechnology, new materials and solutions for water treatment as well as industrial and agricultural water and wastewater are introduced or introduced. The United Nations predicts that by 2025, about 44 countries (32% of the world's population) will have access to safe drinking water. In providing a solution to this problem, nanotechnology can be useful in two areas:

A- Production of nanocomposites and interference in their structure to separate many sources of water pollutants, which as an example of research in this field indicates the removal of heavy metals such as mercury, lead and arsenic.

B- Production of electrodes with high surface area, which are electrically conductive by putting together carbon nanotubes and other design initiatives, and are able to supply drinking water from the sea with less energy consumption (at least 12 times less than the energy of the device). Reverse osmosis and 122 times less than the distillation method) desalinate seawater [5]

Nanofiltration process, which is one of the most important separation processes in water treatment to provide drinking water from surface and groundwater sources with excessive hardness and salinity in recent years, has been significantly developed in different parts of the world [1]. Thus, further

development and improvement of NF technology is of immense importance and has spurred significant interest in the field, with publications showing a near 10 time increase in growth of papers mentioning the term nanofiltration over the past 24 years (Fig 1.) [10]. Due to the important role of nanofiltration in water treatment, in this paper the ability of nanofiltration membranes and its comparison with other treatment methods for water treatment is investigated.

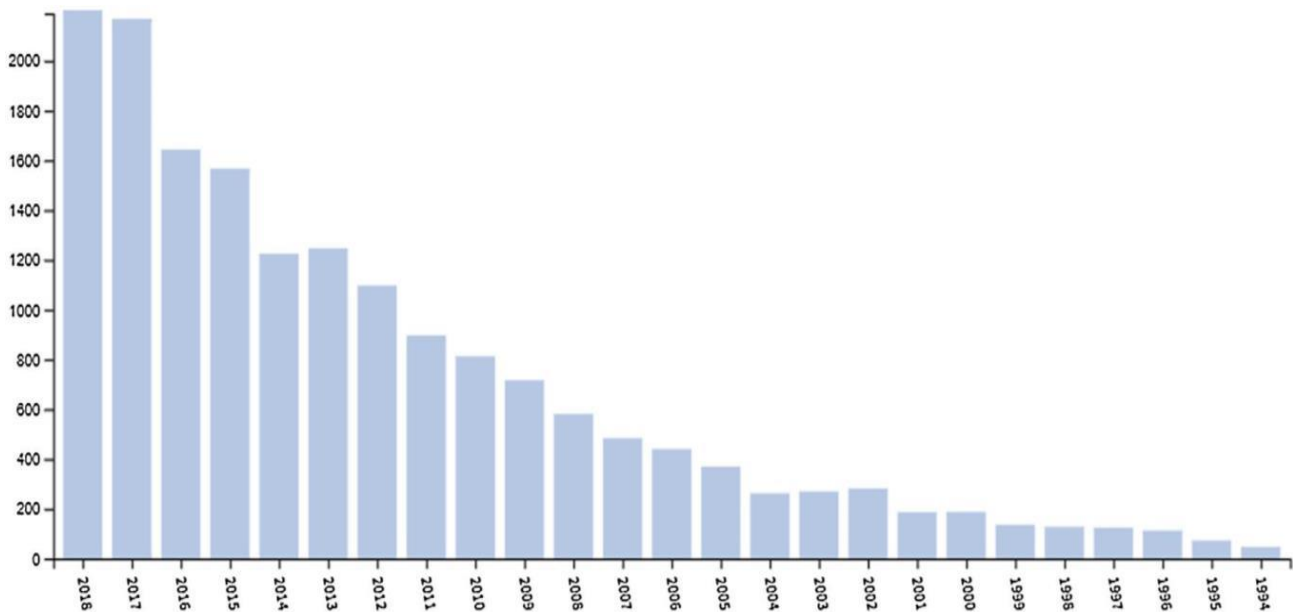


Fig 1. Number of papers on nanofiltration from 1994 to 2018. Image is taken from Web of Science.

2. Membranes segmentation

Membrane technology has called 21st century technology in the field of treatment and filtration. It has been able to set new horizons for process and environmental experts. Membranes used in water and wastewater treatment are materials that allow some physical and chemical components to pass through faster than others. Therefore, the membrane has selective permeability. To achieve this goal, it is necessary to use the driving force [1].

Division based on the governing mechanism on separation membrane processes based on the size of the smallest particle that passes through the membrane under the influence of compressive force are divided into the following types:

- Microfiltration (MF)
- Ultrafiltration (UF)
- Nanofiltration (NF)
- Reverse osmosis (RO)

These four types of filtration membranes are commercially available and have more applications in water and wastewater treatment and are divided into two distinct physicochemical processes:

1. Membrane smoothing (UF and MF) is the separation of suspended particles from the liquid phase or through the environment is porous.

2. Reverse osmosis (NF and RO) aims to remove soluble components such as heavy metal ions, sodium, chlorine, calcium, magnesium and NOM in water treatment.

The main removal mechanism in membrane smoothing is sieving and quantitative drift. But mass transfer and separation in reverse osmosis are based on the mechanism of diffusion or diffusion.

RO and NF are very useful in water treatment, but the two types of MF and UF are more common in pre-operations purification is used for desalination technologies such as RO and NF [6].

Table 1

Characteristics of four common membrane processes.

<i>Types of membranes</i>	<i>Revers osmosis</i>	<i>Nanofiltration</i>	<i>Ultrafiltration</i>	<i>Microfiltration</i>
<i>Membrane tissue</i>	<i>non identical</i>	<i>non identical</i>	<i>non identical</i>	<i>Identical and non-identical</i>
<i>Pore size</i>	<i>Angstrom 1-15</i>	<i>Angstrom 8-80</i>	<i>Angstrom 10-1000</i>	<i>Angstrom 500-20000</i>
<i>Ability remove</i>	<i>Monovalent ions and all materials larger than them</i>	<i>Bivalent ions, large monovalent ions, color and odor</i>	<i>High molecular weight proteins, organic matter.</i>	<i>Bacteria, viruses, large colloids, separators of coagulated compounds and sediment.</i>
<i>Membrane material</i>	<i>Cellulose acetate polyamide</i>	<i>Cellulose acetate polyamide</i>	<i>Ceramic, polymeric materials such as PSO, PVDF, CA.</i>	<i>Ceramic, polymeric materials such as PSO, PVDF, PP.</i>
<i>Pressure range(bar)</i>	<i>15-150</i>	<i>5-35</i>	<i>1-10</i>	<i>Less then 2</i>
<i>Types of model</i>	<i>Spiral, tubular, discoid</i>	<i>Spiral, tubular, discoid</i>	<i>Spiral, thin fibers, tubular, discoid</i>	<i>Thin fibers, tubular</i>
<i>Similar and common processes used in water treatment.</i>	<i>Evaporation, freezing, electrodialysis.</i>	<i>Soften water with soda, lime, ion exchange.</i>	<i>Sand filters, bioreactors, activated carbon.</i>	<i>Ozonation, UV, use of chlorine, bioreactors, coagulation.</i>

Nanofiltration (NF)

The issue of nanofiltration was first raised by Richard Feynman about 45 years ago [1]. The NF has emerged as an innovative technology to solve the problem of drinking water contamination. Since its introduction during late 80s, the NF membrane-based separation process so far has achieved multiple improvements [3]. Nanofiltration is a semi-permeable membrane that located between reverse osmosis (RO) and ultrafiltration (UF), its separation characteristics are based on sieve effect. But most commercial NF membranes are also charged, so ion rejection by NF membranes results from the combination of electrostatic and steric interactions associated with charge shielding, Donnan exclusion and the degree of ion hydration [7]. In ultrafiltration the number of pollutants consumed is more than the allowable limit in reverse osmosis, the purity of the resulting water is excessive therefore, nanofiltration is superior to reverse osmosis and ultrafiltration [6].

Comparison of nanofiltration performance with other membrane methods

Nanofiltration (NF) membranes have been largely developed and commercialized over the past decade and are currently one of the most promising technologies for the separation of neutral and charged solutes in aqueous solutions. Sometimes NF is defined as a process between ultrafiltration and reverse osmosis [8]. NF is one of the promising technologies for the treatment of natural organic matter and inorganic pollutants in surface water. Since the surface water has low osmotic pressure, a low-pressure operation of NF is possible. There is a high rejection of organic substances such as disinfection-byproducts precursors by the NF process. In the NF of surface waters, natural organic compounds, which have relatively large molecules compared to membrane pore size, could be removed by sieving mechanism, whereas the inorganic salts by the charge effect of the membranes and ions [9]. RO filters remove all salts dissolved in water, while NF filters give us more choice in producing water of the desired quality by creating a selective state of the material [1]. Figure 1 shows a comparison of the ability of different membranes to separate particles.

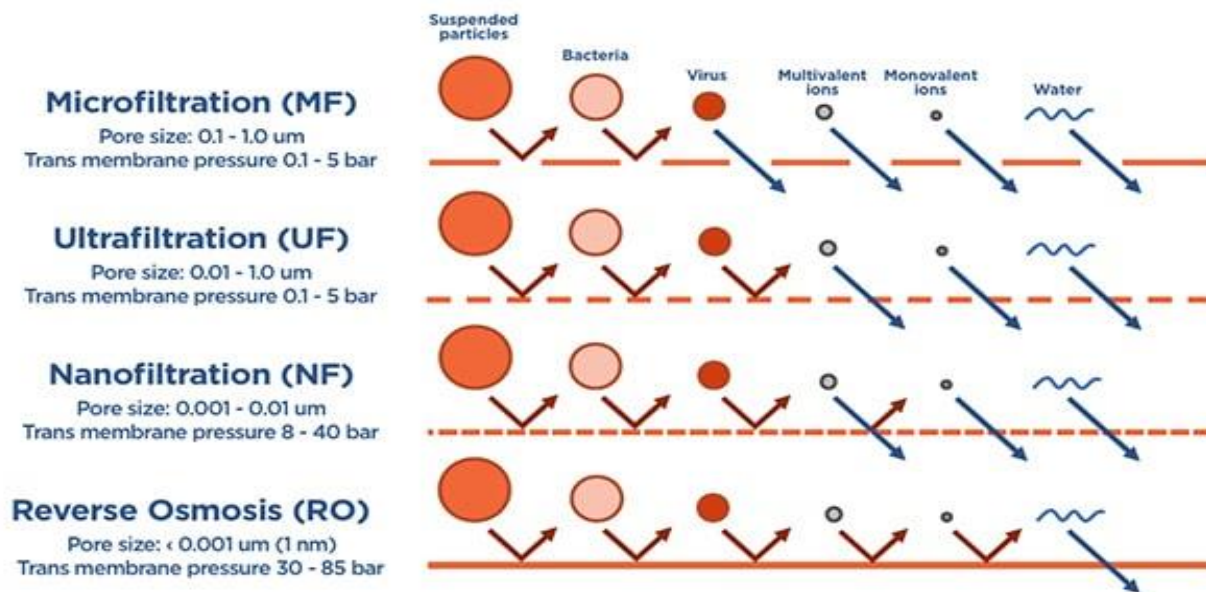


Fig 1: Membrane filtration technology pore size and retained contaminants.

Material for nanofiltration membranes

The range of NF membranes can be easily classified according to their constituent materials. Typically, these are composed of either organic, inorganic or organic-inorganic hybrid membranes, each of which have specific advantages and disadvantages [11]. Organic membranes are usually produced using mainly polymeric materials, such as poly-sulfones, cellulose acetate or polyvinylidene fluoride [10]. Most membranes used to purify and prepare drinking water are made of polymeric materials. This is due to the lower cost and better performance of such membranes, the main membranes used in RO and NF are made of cellulose (CA) and polyamide (PA) [1, 10]

Recently NF membranes based on natural polysaccharides gained more and more attention due to their abundance and environmental benignity. The problems related to the membranes prepared from natural polysaccharide and their derivatives are water solubility and excessive swelling, both of which could be solved by chemical cross-linking. (Naderi et al. 2011) used new techniques to provide useful and effective methods for the preparation of nanofiltration membranes and improve their properties. In a new meso-macro method converted membrane cavities or ultrafiltration into meso-micro cavities during heat treatment in the presence of chloride (ZnCl₂), resulting in asymmetric nanofiltration membranes prepared by hydrolysis of nitrile groups by (NaOH) [12-1]. There are several key methods to produce NF membranes, which are strongly dependent upon the materials used. Regarding all inorganic based NF membranes, these have been extensively reviewed [13, 14] and are outside the scope of this review. Concerning organic or organic hybrid materials, four of the more commonly used procedures were reviewed and discussed in depth by (Wang Zhuqing et al. [12, 13, 14]. Fig 2 shows methods of membrane fabrication.

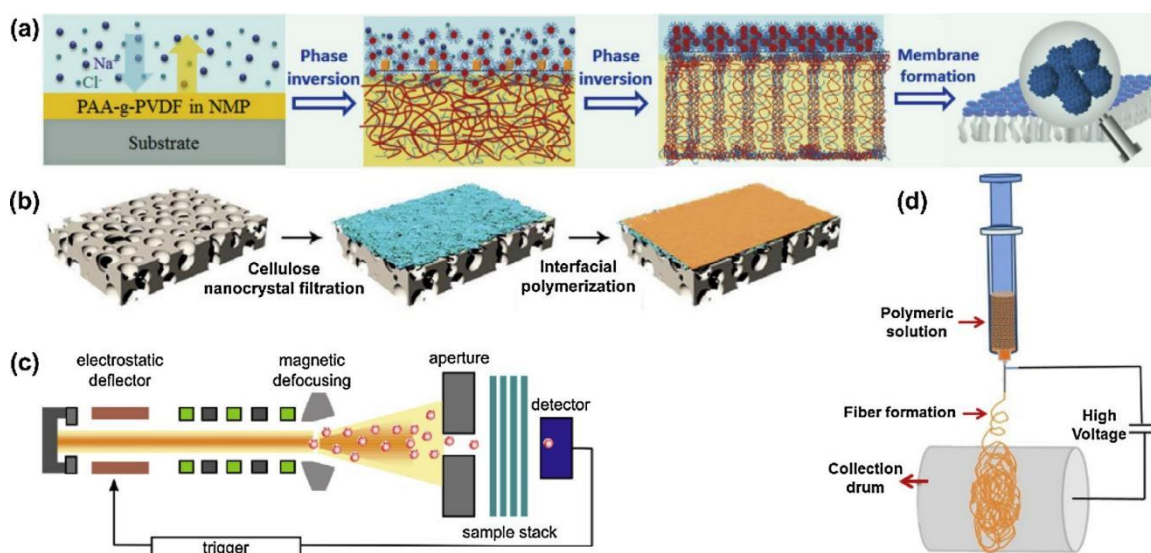


Fig 2. Methods of membrane fabrication: (a) phase inversion process; (b) interfacial polymerization methodology (c) track-etching method and (d) electrospinning process.

Removal of heavy metal ions by Nanofiltration

Among the environmental pollutants that are faced in many parts of the world, including developed and underdeveloped countries, is pollution caused by heavy metals. The difference between metals and toxic organic compounds is that metals are generally non-degradable and accumulate in the environment. Therefore, the elimination of these pollutants, which are in fact a threat to human life, is of particular importance [1]. In recent years, the use of nanofiltration membranes (NF) has increased rapidly in the chemical, petrochemical, biotech and desalination industries, since the NF technology overcomes operational problems that are associated with conventional techniques. Several successful studies have been reported which have used NF membranes as tools for heavy metal removal [15]. Most commercial NF membranes are thin-film composites made of synthetic polymers containing charged groups which can make them effective in the separation of charged metals from water [15,1]. NF membranes have real potential for efficient removal of metal ions from highly polluted wastewaters. The results obtained are discussed in correlation with both the NF membrane properties (pore size and charge) and with the chemistry of the investigated solutions [16]. Okhowat and Mousavi (2011) used artificial neural networks to predict the behavior of the nanofiltration process in the removal of heavy metals arsenic, chromium and cadmium. For this purpose, MLP network with Lunberg-Marquardt algorithm was used [1].

Color removal by Nanofiltration

Dyes are usually divided into three categories: anionic, cationic and non-ionic dyes. Anionic dyes are water soluble. Their surface charge is negative and they introduce a large amount of hydroxide ions (OH^-) into the aqueous environment. Due to their negative surface charge, they react with positively charged substances in solution [19]. Among the most widely used anionic dyes in industries are dyes (RG19) (RR198). The presence of aromatic rings in the structure of this dye causes its toxicity and carcinogenicity and makes it non-biodegradable [18].

The most important advantage of membrane technologies is their selective performance and nanofiltration is one of the newest membrane processes. These membranes separate ions from the feed solution with the help of their surface charge and the size of the holes they have. Nanofiltration in terms of ion desorption energy cost and pore dimensions in between other methods have created optimal conditions. Nanofiltration membranes are used for decolorization, purification of textile wastes, etc [18]. Nanofiltration membranes can retain 95% of divalent ions and 40% of monovalent ions making them suitable for organic, microbiological, aqueous salt, color, and hardness removal [20].

Nanofilters have been used to remove color in boggy surface water. NF pilot plant was installed to study the treatment of highly colored lake water in Muskan, Sweden [21]. Average raw water color ranged from 50 to 60 color units (CU) on the basis of the American Public Health Association (APHA) color index, whereas permeate water averaged less than 1 CU. Nanofiltration reject water varied with membrane type but averaged between 180 and 420 CU. Similarly, a Fyne process membrane plant was

installed in 1994 to treat surface water with high color (80 CU) at (Loch Awe) above Cladich, Scotland. Color in the NF permeate was reduced to 0 CU but rebounded to 2 CU in the distribution system [22].

Reduction of salts and mineral salt from salty water

One major impediment to the widespread application of seawater desalination technology (thermal-based or membrane-based) is its relatively high production costs. However, many recent advancements in seawater desalination technology have led to appreciable declines in water production costs. One such advancement is the application of nanofiltration (NF) as a pretreatment technique for both thermal and membrane-based processes [17]. nanofiltration is a promising and innovative technology which can be widely applied in drinking water and industrial effluents treatment. NF membranes allow passage of dissolved molecules with molecular weight less than 200-1000 Da and of some salts, rejecting the other ones. Thus, nanofiltration is widely used for water softening applications as monovalent ions are allowed to pass, whereas bivalent ions are rejected to a degree determined by the feed stream [16].

Nano-filter membranes have a medium capacity to remove monovalent salts. They also have the ability to effectively remove salts, heavy metals, dyes, viruses, bacteria and parasites from water and sewage [6]. (Roustaei et al.2006) by examining the use of nanofiltration in the treatment of brackish water in Kahouristan wells concluded that nanofiltration has a good efficiency in desalination of brackish water resources with electrical conductivity of 4000 [1].

Conclusion

Today, membrane technology is used in water purification industries due to its lack of destructive effect on the environment and low maintenance and large-scale operation costs, which results in the absorption of most soluble, suspended and biological pollutants in water. In this paper, an attempt has been made to provide a comprehensive view of the various properties of nanofiltration and its functions. According to the presented materials and economic efficiency, it can be said that this technology is considered as a management solution in order to reduce the effects of environmental burns. And acts as a "green technology" in the isolation of various environmental pollutants. The high volume of investment in developed countries and the large number of articles published in the last decade make the issue important.

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