

## **Utilization of Blockchain Technology in Greek Public Administration**

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### **Abstract**

The use of the blockchain technology in Greek public sector appears to be beneficial for both the citizens and organisations. However, since this innovative technology is still in its infancy, a series of challenges exist in e-government. This paper presents the existing e-government infrastructure in Greece, the benefits and obstacles of the adoption of this promising trend for the recruitment process in public sector. More precisely ASEP which is an independent authority that acts as the institutional guardian for meritocracy regarding recruitment in Greek public administrator aims through the QualiChain research project to take advantage of the blockchain technology so as to improve and simplify the recruitment and competency management procedures.

**Keywords:** Blockchain, e-Government, Public administration, Public sector recruitment.

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## 1. Introduction to Greek e-Government

Nowadays, due to the rapid evolution of the Information and Communication Technology (ICT), all the governments across the world try to provide the public with responsive, efficient and effective electronic services. More precisely the governments take advantage of the ICTs so as to accelerate administrative transformation which is often captured by the label of e-Government. The main goal of the e-Government is to be able to offer an increased portfolio of electronic services to the public in an efficient and cost-effective manner.

The main boost regarding the e-government was initiated by European Union (EU) funding on respective actions. In Greece, the vision regarding the electronic government is described in the Greek Digital Strategy.

According to the current Greek Digital Strategy (2016-2021) [1], the government aims to build a more efficient, transparent and accountable administration, through the use of ICT and the support of the necessary governance and monitoring mechanisms, while maximizing constituent satisfaction, increasing participation and recovering confidence by offering constantly enhanced electronic services and promoting a new digital culture.

Specifically, the Greek government is oriented on the listed principles (Figure 1)



**Figure 1: e-Government principles**

In addition, there are three strategic axes of intervention based on the Greek Digital Strategy (2016-2021)

- Modernization of the state and the administration: gradual interoperability and compliance between all administration systems and services
- Reconnection of the citizen with the state and the administration: guarantee end user services through single points of contact
- Coordination of horizontal ICT policies in the public administration: provide open data by default. All public administration units will upload data for the use of citizens

According to the 2019 eGovernment Benchmark [2] it is remarkable that Greece has shown the biggest absolute improvement (penetration and digitisation) and it is one of the 11 new countries that joined the Very-High EGDI (E-Government Development Index) group in 2018.

## **2. Existing e-Government Infrastructure**

According to the Digital Government Factsheet 2019 [3] the e-government infrastructure components in Greece are indicatively organised into the main categories:

### **Portals**

- Taxisnet is a Greek online tax and custom services portal, including e-filing of VAT forms with payment through banking services, e-filing of income tax forms, personalised information for income tax assessment and e-delivery of tax certificates [4].
- The National Portal ERMIS provides, from a central point, complete briefings to Greek citizens and enterprises with regards to their transactions with the public administration either natural or electronic [5].
- The Interoperability Center which is a Web Services Management and Support platform, aiming at the interconnection of the electronic services of the Public Administration.
- Diavgeia portal includes all decisions of public administration bodies [6].
- The Services Directive Portal is dedicated to providing service provisioning in Greece [7].

### **Networks**

- The SYZEFXIS network is aiming at the development and updating of the public sector's telecom infrastructure by satisfying all their needs for communication through telephony (telephone communication between organisations), data (PC's communication - Internet) and video (teleconference - training).

### **Data Exchange**

- The BI-Health system ensures the collection and processing of the analytical and aggregated data of the Territorial Public Health Units at a central operational level and allows the dissemination of information to the management mechanisms with the ultimate aim of improving the quality of the provided health services [8].
- Geodata is providing open geospatial data and services for Greece, serving as a national open data catalogue, an INSPIRE-conformant Spatial Data Infrastructure, as well as a powerful foundation for enabling value added services from open data [9].

### **eID and Trust Services**

- The allocation of the Social Security Registration Number (AMKA) to every citizen and the accomplishment of the electronic (medical) Prescription program were critical components in order to ensure reliability, security and transparency of the information handled.
- LEPS enable existing certified e-Delivery, e-Notifications and remote e-Signature services in the private sector to use the pan European eID infrastructure for crossborder electronic identification and authentication, while complying with eIDAS specifications and rules. As part of the project, the objective is to customise the Greek Financial Services and Integration with eIDAS Infrastructure and customise the Greek Post Electronic Services and Integration with eIDAS Infrastructure.

### **Knowledge Management**

- Opengov.gr is a portal dedicated to responding to citizens' needs for information, merit and participation in shaping decisions. It includes three initiatives: a) Open calls for the recruitment of public administration officials, b) Electronic deliberation. Almost every piece of draft legislation and policy initiative is posted in a blog-like platform prior to submission to parliament, c) Labs OpenGov (Labs.OpenGov.gr) attempts to release the power of decentralised knowledge and explore new ways to tackle modern public administration problems.
- The Citizen Service Centres (or “KEP” in Greek transliteration) are the administrative one-stop service centres where citizens can access public service information and over 1000 standardised administrative procedures. The “KEP” network is supported by an online platform, eKEP.
- Gov.gr is an extension of eKEP. It will be the electronic contact between the citizens and the public electronic services. However, the Citizen Service Centres (KEP) and Ekep in its conventional form will remain to serve the elderly.

### **Base registries**

- National Citizen Registry is responsible for the provision of digital public services regarding: 1. birth, 2. marriage or civil union and 3. death. There is also interoperability with Citizens Service Centres (one stop shops) to provide digitally citizens birth certificates and family status certificates.
- The Hellenic Republic Human Resources Registry has already been fully implemented in a digital forum called “Apografi”.

## **3. Blockchain Overview**

Blockchain technologies, are presented as a major breakthrough with great potential in public sectors [10]. Moreover, blockchain is introduced as a distributed ledger that is shared among participating parties in a network, used to record transactions that are verified by a consensus mechanism that creates trust in the network [11]. Based on this architecture any transaction can be executed without the use of any intermediary [12] while storing of these transactions take place in a distributed way [13].

Governments have started to explore the benefits and the challenges in adopting blockchain technology into the public sector. It is believed that blockchain has great potential benefits for the government since it is a combination of technologies such as distributed ledgers, cryptography, hashing and consensus protocols.

In addition, the main characteristics of the blockchain are [14]:

- **Decentralization:** Unlike a traditional transaction which is validated through a central trusted agency, every node in the network can validate transactions and has an identical copy of the ledger [15]. This mechanism causes transactions in a blockchain to have advantages in fault tolerance, data consistency, higher user control, attack resistance, transparency and it also enables the removal of third-party intermediaries, such as a notary or financial institutions;
- **Persistency:** The use of a consensus mechanism, a time-stamp, and a cryptographic seal means that invalid transactions will not be admitted and it becomes impossible to edit, delete or copy transactions that are already recorded in the blockchain [16]. These blockchain features provide for data consistency, fraud protection, ownership assurance and immutable records of the transactions;
- **Anonymity:** Interactions based on blockchain technologies take place between two individuals using cryptography, by which their identities are covered by pseudonyms [15]. In this way, user privacy will be better protected than in classic electronic transactions;
- **Auditability:** All transactions in a blockchain are stored in chronological order, including the previous block’s hash and storage of the hash of the current transaction which is meant to connect the next block when added. With this mechanism, transactions can be easily verified and tracked.

These characteristics support and provide some important benefits for the public services (Figure 2) including improvements in data quality and quantity, transparency, open-accessible-sharing information, data safety, privacy, reduce transaction's cost, increase government credibility, standardization-flexibility [17], [18].



**Figure 2: Benefits of the blockchain technology for the public services**

More precisely, using blockchain technology in the public sector each citizen can record any individual certificates and personal or public information on the same platform, providing a digital identity for each record. Thus, the citizens, the government and other organisations or institutions will have direct access to information, easily and quickly by using the digital identity directly that will improve the interoperability, simplify some bureaucratic processes and speed up procedures [19], [20]. Regarding the transparency all the transactions and historical data are visible on a chain and cannot be modified [17], [21]. Non-Repudiation is another useful feature provided by blockchain technology. In addition, it does not require a third party to guarantee the transaction history [22]. Data safety comes of the consensus mechanism that is being used by blockchain technology and ensures the consistency and integrity of the data since it is computationally impractical to launch an attack against the blockchain network [12]. Thus, this technology is resilient against many threats [23]. In addition, based on the architecture of the blockchain technology anonymity establishes and promotes privacy by using a cryptography solution such as asymmetric encryption or public key cryptography for authentication [24], [25], [26]. Moreover, since transactions conducted without third-party intermediaries the transaction's cost can be reduced. Blockchain

technology can provide citizens access to reliable and consistent governmental information and set up the trust between citizens and governments [27], [18].

However, since blockchain is on early stages of development, its adoption is extremely challenging on technological aspects. Therefore, despite the potential benefits various challenges have arisen (Figure 3):



**Figure 3: Technological challenges of blockchain adoption**

Despite the fact that the data immutability is a critical issue for data integrity, at the same time, it becomes a great barrier for blockchain technology since in certain occasions sensitive information might be needed to be erased. In addition, this requirement comes in conflict with the General Data Protection Regulation (GDPR). The need for scalability appears due to the limited block size and current consensus method which includes the validation of any transaction by every node in the network before its publication in the blockchain. In case that only few transactions per second can be processed by using the blockchain technology they might be delayed [28]. Therefore, techniques that reduce transaction time and computer power requirements have to be provided.

Security and reliability issues are still questioned by some researchers, focused on cybersecurity issues and threats [18], [29], [30], [31]. A blind trust on the blockchain technology may include risks [20]. Therefore, security challenges behind this innovative technique is on concern [32]. Moreover, protection includes the implementation of various security policies and tools so as to detect and be protected by the threats [33].

Usability depends on the users engaged and the trust that the blockchain technology

will establish and prove as well as the chosen programming language for the implementation [32]. The development of an interoperable blockchain architecture is needed in order to identify some design principles that promote interoperability and flexibility. The establishment of the efficiency for the blockchain technology requires cost and computation effectiveness since a number of different systems and organizations will be combined.

#### **4. ASEP into E-Government**

The Supreme Council for Civil Personnel Selection (ASEP) is an independent authority that acts as the institutional guardian for the principles of transparency, publicity, objectivity and meritocracy regarding civil service recruitment in Greece and implements provisions for Civil Personnel and Highly Qualified Personnel vacancies. Public or private organisations issue the required qualification components. Provisions regarding civil personnel job positions are being announced to the public by ASEP through newsletters, a well-structured website or press. ASEP provides electronic services to the citizens through e-ASEP Information System (IS). More precisely, the citizen makes the registration on the e-ASEP system and then can proceed to record personal data, education titles, certificates, awards, work experience, publications and conference participation, as well as social criteria. Since the registry is completed the citizen can apply electronically for an announced job vacancy via a relevant submission point. Additionally, the candidates through the e-ASEP are able to manage their registry, view the final result or even make an objection.

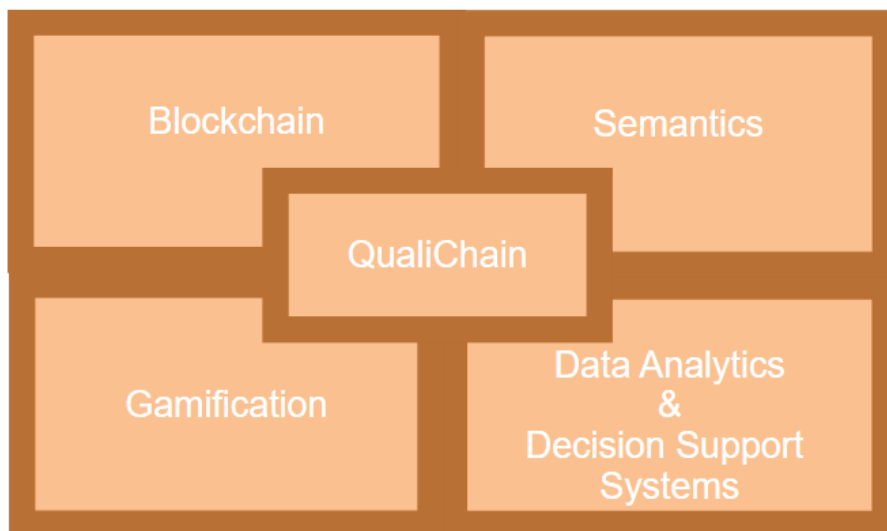
The final results come of a non-automated internal evaluation procedure made by ASEP. Following the final results public entities hire the candidates and make the final validation of their qualifications components. The validation process is non-automated and consequently the duration is lengthy.

##### **4.1 Description of QualiChain**

QualiChain is a research and innovation project, endeavoured to design and implement a distributed infrastructure for the management, verification, storage, sharing and analysis of academic and employment qualifications by focusing on the assessment of the potential of the blockchain technology. It is also about investigating the central research challenges with the help of a set of pilot use cases and continually evaluating the performance and potential of the pilots inside QualiChain.

The technologies that are applied in this project so as to deliver the QualiChain solution are mainly the Blockchain, Semantics, Data Analytics and Decision Support Systems, and Gamification (Figure 4)





**Figure 4: Technologies in QualiChain**

- **Blockchain**

QualiChain will take advantage of the blockchain technology to setup a distributed platform for storing, sharing and verifying academic and employment qualifications. The project exploits the opportunity to strengthen its societal, economic, political, and cultural impact, and to foster the development of new business and education models. QualiChain relies on live online certificates backed by the blockchain and demonstrates its use for improving the learning accreditation and recruitment processes. Through the use of Blockchain technology, verification will become more secure, traceable and transparent for the benefit of all stakeholders involved (learners, education bodies, educators, and employers). Secure and instant online certificate verification enables the disintermediation of the process, bypassing third-party mediators and improving efficiency of dependent processes. Blockchain technology enables self-sovereignty and identity management, with full GDPR compliance. However, security risks due to maturing technology may be risen since not yet tested for large scale applications.

- **Semantics**

Semantic technology enables project stakeholders to adhere to standard skill and skillset descriptions – learners will own standard machine-interpretable and – verifiable skills, employers and educational bodies will be able to explore job market supply in terms of standard recognised skills and skillsets. QualiChain will promote and enforce semantic interoperability through domain-specific standards and ontologies (including a Blockchain ontology). The extracted knowledge will be integrated and semantically described using ontologies. The selection of an adequate set of vocabularies, or their completion through a collaborative ontology design exercise, will enable a customised QualiChain Knowledge Acquisition pipeline to generate a representative and dynamic knowledge graph. In addition, the

need to securely access and obtain knowledge from various sources (including Blockchain) iteratively to arrive at these smart suggestions can introduce scalability issues.

- **Data Analytics and Decision Support Systems**

Data analytics consist of the next abstraction level after the previously presented semantic layer. The general goal is to benefit from the aforementioned techniques to build new knowledge out of data and thereby add value to it. These analyses will then be used to feed the decision support systems assisting the project's end-users with their use-cases. Technical difficulties to realise complex computations and scalability issue when huge amounts of data are considered may occur.

- **Gamification**

QualiChain intends to explore the practical (technical, political, socio-economic, legal and cultural) implications of taking advantage of gamification techniques for ensuring acceptance and adoption of the QualiChain solution. To achieve this objective, a gamification solution will be built including: quizzes around company challenges, related questions and behavioural puzzles so as to personalise and add a fun element to the recruitment process; components in order to capture and assess the candidates' actual behaviour and capabilities such as time management, creative and innovative thinking or problem-solving, skills; retention processes by creating mechanisms of collaboration and competition with a transparent point system within the company community, employees will continue to be motivated and focused; competency development process through the measurement of the employee on-the-job performance, by providing simulated work environments as training. Gamification strategies will be used as a motivational tool to help employees reach tangible goals, by using game elements such as scores, competitions, badges, awards, and levels to motivate and maintain the employees in an encouraging and enjoyable system.

## **5. ASEP Pilot in QualiChain**

ASEP will be staffing the public sector using QualiChain platform and services for supporting and simplifying public sector recruitment and competency management procedures. More precisely the ASEP pilot under "staffing the public sector" use case focuses on leveraging QualiChain for optimising internal evaluation procedures pertinent to the selection and recruitment with respect to their qualifications. Furthermore, it takes advantage of the QualiChain technological solution for improving public sector personnel management procedures. The solution's Blockchain based digital ledger will be used for validating the education titles as submitted by candidates, whilst verifying their credentials, in the framework of proclamations and relevant assessment and recruitment procedures announced by ASEP for staffing public bodies. Additionally, the recruitment and competency management services of QualiChain will be exploited to enhance through a

Decision Support System not just the check of the candidates' stated qualifications, but the internal evaluation procedure which leads to a short list of those to be interviewed and ultimately to the identification of the best possible applicant for the role. More precisely, regarding the scenarios by ASEP regarding the recruitment process for Civil Personnel positions includes:

1. The issuing organisation issues a qualification component (either an academic qualification or a work experience certificate) for a citizen.
2. The issuing Organisation, after getting the candidate's consent, uploads the qualification component to QualiChain and sends it to the Citizen.
3. ASEP announces positions/vacancies on QualiChain.
4. Citizen/Candidate gets notified of new vacancies via a Data Analytics Tool embedded in QualiChain.
5. Candidate signs up to ASEP's Registry (if not already registered), fills in their qualifications, uploads the relevant proof of qualifications declared (e.g. university degree) along with a public to ASEP's Registry and applies for the vacancy they are interested in.
6. ASEP confirms the validity of the proof of qualification declared and potentially its metadata (e.g. year of graduation).
7. ASEP marks the qualification, whose validity has been confirmed to its Registry, as a Level 6 qualification. A Level 6 registered qualification means that this process does not have to be repeated for this qualification.

Regarding highly qualified personnel, the process contains three additional steps:

8. ASEP uses QualiChain's MCDSS (Multi Criteria Decision Support System) to get an initial ranking of candidates.
9. Based on this initial ranking, ASEP proceeds to the stage of interviews.
10. ASEP uses QualiChain MCDSS to get the final ranking.

Based on the blockchain technology, recruiters will be able to verify the authenticity of each qualification or micro-accreditation easily, helping them to identify the best fit between candidates and opportunities from as broad a picture of candidate skills as possible. The process without verification always has a risk of being manipulated by fraudulent candidates, who could potentially gain unethical benefits from records that cannot be easily checked. Using "semantic profiles" to mean semantic descriptions of opportunities – job postings – which include machine-readable representations of the skills and experience they require through vocabularies which match those used in Smart Badges, to support matching qualifications to opportunities. In addition, QualiChain reinforces the citizens to better communicate more of themselves when seeking opportunities, meaning they can use more of their genuine advantages to achieve those opportunities and advance their goals.

Specifically, ASEP pilot has the following main objectives:

- Provide personalised candidate notifications for job vacancies by matching individual profiles with available jobs in the civil service.
- Using the blockchain digital ledger in order to validate academic and professional qualifications of individual candidates.
- Improve the efficiency of the recruitment process in terms of time and credibility.

## 6. Conclusions

Based on the QualiChain project ASEP will be able to verify the authenticity of each qualification or micro-accreditation easily, helping them to identify the best fit between candidates and improving the recruitment process. Moreover, the use of new technologies such as the blockchain in the public administration promises a potential transformation of the relationship between government and citizens.

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