



CONCEPTUAL FRAMEWORK FOR THE DEVELOPMENT OF AN E-GOVERNMENT LICENSING SYSTEM

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ABSTRACT

The term electronic government (e-government) is widely used to describe the utilization of Information and Communication Technologies (ICTs) to digitize government functions and procedures. One of the e-government system's most used functionality is issuing licenses to citizens and businesses. Governments usually develop centralized e-government licensing systems to issue a specific license type, hence limiting the possibility of system expansion and integration with other government bodies. However, a flexible solution enabling a platform for the rapid transformation of specific and various license-issuing processes and integration with other government bodies could reduce the time and cost of e-government projects. This paper presents such a novel e-government licensing framework developed with the waterfall methodology and implemented in Serbia. Firstly, the system requirements were set as flexible, low coding, continuous improvement, and digital transformation of all government licensing processes. Secondly, a generic government licensing process containing recurring activities was identified as the BPMN process model. The process is then integrated with horizontal e-services such as Government Service Bus, Electronic Identification(eID), eDelivery, eNotify, eSeal, ePayment, and National Government Portal. The main contribution of this approach is the attempt to automate and manage licensing process through a Business Process Management engine to achieve a low-coding and flexible development and maintenance environment. The designed e-government licensing framework was successfully applied to transform and digitalize Serbia's e-services into a standardized, integrated platform, where e-services are designed as a customizable e-licensing process and managed through Business Process Management software.

Keywords: e-government, e-licensing, business process management, digitalization

JEL classification: O31, O32, O33, O38

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INTRODUCTION

E-government was developed with the incentive to offer integrated online data and transactional public services to citizens, businesses, and other government bodies (Doran et al., 2023; Stefanovic et al., 2020; Benany et al., 2018). The expected benefits of e-government systems are the reduction of costs, improved performance, and efficiency (Almarabeh et al., 2010). According to the United Nations E-government Survey (2022), many more countries and municipalities are pursuing digital government strategies, with some



radically different from those guiding earlier e-government initiatives. From the years 2018 to 2020, the prevalence of some transactional online services, such as issuing business licenses, increased by 47% and became the third most commonly offered online public service in the world. Furthermore, from the years 2020 to 2022, trends in the provision of online transactional services show that applying for a business license, a building permit, and a driver's license were among the most utilized services (United Nations E-Government Survey, 2022).

Therefore, the terms e-government licensing system or e-licensing have been established to represent systems enabling online submission and issuing of various types of licenses and permits to citizens and businesses. Governments are investing in the development of e-licensing systems that should be easy to use, accepted by government employees (Ahn et al., 2021; Muthu et al., 2015), and reducing the license and permit processing times (Onate et al., 2018). Modern e-government systems should be mature, e.g., horizontally integrated across different functionalities and presented through a one-stop government portal (Gkikas et al., 2022; Layne et al., 2001). The main obstacles in the development of such systems are Information and Communication Technologies (ICTs) infrastructures, government support, human capital, data and information integration, security and privacy, and business processes (Wibovo et al., 2023; Sulehat et al., 2016).

The literature regarding the e-licensing systems, as most e-government literature, is focused on the system's acceptance and intention to use rather than on the practical information of the system's architecture and implemented ICTs. There is a lack of methodologies and workflows of the actually transformed government processes, elaborating on the obstacles such as data and information integration and Business Process Management (BPM). Previously implemented e-licensing systems did not report on the standardization and management of government processes through BPM, integrated with the contemporary ICTs, which is one of the main obstacles in the development of such systems (Sulehat et al., 2016).

The e-licensing framework presented in this paper was built and is operable as an essential part of the Serbian e-government infrastructure. Serbia's government agencies currently use over 40 complex Information Technology (IT) systems developed independently to cover only certain government institutions/sectors' specific needs. The lack of integration into the national government framework has led to huge discrepancies between e-government systems, both conceptually and technologically, as well as the high maintenance cost of such systems.

The process of issuing licenses to citizens and businesses brings the most revenue to the government. However, only some license types are available online through the currently operating e-government system. In the year 2018, the International Finance Corporation (IFC), a member of the World Bank Group (WBG), operating in partnership with the UK Good Governance Fund and the British Embassy in Belgrade, signed a cooperation agreement with the government of the Republic of Serbia to implement the project for the improvement of the business environment. The project goal was to develop and implement an online



transactional business licensing information system in Serbia that can manage online submission of applications and issue various business licenses through a single online contact point, an e-government portal.

The main contribution of the presented approach is the identification of a generic licensing process easily applicable in similar scenarios and the solution for government process management through a BPM engine, achieving a highly flexible and customizable environment and more convenient continuous improvement maintenance. Furthermore, the paper reports on the novel approach for the integration of a BPM engine with more commonly utilized horizontal e-government services.

The remainder of the paper is organized as follows: Section 2 gives an overview of existing e-licensing systems and analyzes implemented horizontal e-government services; Section 3 presents the research methodology; Section 4 presents the developed framework; Section 5 discusses the results of the implementation of the e-licensing system in Serbia and discusses possible improvements, and Section 6 concludes the paper.

RELATED WORK

Prior to developing the e-licensing conceptual framework, literature reviews were conducted to review the existing e-licensing systems and gain insight into the ICTs and horizontal e-services implemented in modern e-government systems aiming for high maturity levels.

Previous e-licensing systems

An online e-government system facilitating the issuing of permits and licenses to citizens and businesses is in the literature referred to as an e-permitting or an e-licensing system. The published literature on the topic mostly presented and analyzed different online application systems developed and regulated by government bodies. The approaches can be divided based on the type of permit, e.g., the license being issued. As the terminology is considered, e-permitting systems were developed with the purpose of submitting an online request for a building permit in the construction industry, while e-licensing systems issue any license or permit of interest for citizens and businesses.

The idea of e-permitting arrived in northern Europe in the early 2000s (Meijer, 2005). However, the realization came later, e.g., Finland developed and implemented a successful e-permitting system for building permits, used by 60% of the municipalities (Shahi et al., 2019), alongside residence permits for foreigners. Their automated model-based e-permitting system was intended for separate municipal jurisdictions and incorporated ICTs such as web-based applications, Building Information Modeling (BIM) system, and, most notably, a code compliance checking system that automatically compares the building request documentation with the rules, regulations, and guidelines.

Eirinaki et al. (2018) proposed a cloud-based e-permitting framework to support the building permit process, tested on the New York City data. The framework integrates data mining and data analytics to support the end-users through the process of using an online application by recommending suitable types of permits.



In other parts of Europe, like Greece, Bellos et al. (2015) reported that an electronic building permission system was not yet developed and proposed a framework by examining such systems' end-users.

Messaoudi et al. (2019) developed a virtual permitting framework using BIM systems, giving guidelines on how to develop an e-permitting system for the state of Florida. The framework includes steps such as mapping the current permitting process, designing the process workflow, integrating BIM standards, and developing software to check compliance with the predefined regulations. Although not published in a scientific journal, North America's and Canada's governments have released digital platforms for the online submission of construction permits and licenses (Lawrence, 2015; Singh, 2017).

By observing the e-permitting systems, it was concluded that this term was specifically used for systems issuing building and construction permits.

The term e-licensing refers to systems enabling online submission of various types of licenses and permits, such as business licenses. The earliest e-licensing systems were reported in 2007. Ojo et al. (2008) presented a framework for developing electronic public services systems in China, issuing various types of licenses using a workflow engine to manage the licensing process.

Periasamy et al. (2007) presented an already implemented one-stop licensing portal called OBLs (Online Business Licensing Service) in Singapore that issues business licenses to start-up companies. As Singapore is the leader in e-government development, the OBLs system was one of the first e-licensing systems to utilize automated code compliance checking.

Tan et al. (2010) proposed an improvement of the OBLs portal by integrating the business license issuing process across multiple government agencies in Singapore. Barokah et al. (2013) suggested an online industrial business licensing portal in Indonesia developed as a web application.

Researchers surveyed the government agencies' employees in Jordan and discovered that licensing is the most common online service (Alhubsan et al., 2015). A study conducted in Malaysia focused on factors affecting employees' intention to use technology-enabled service delivery and concluded that perceived usefulness, ease of use, and visibility are positively related to using an e-licensing system (Muthu et al., 2016).

Onate et al. (2018) surveyed the government employees issuing business licenses in the Philippines and discovered that the e-licensing system is highly acceptable and significantly reduces the issuing time. The research on e-licensing in Indonesia suggested improving a system that will issue business licenses and all types of licenses to citizens and businesses (Batara et al., 2020). The system will be developed as a one-stop shop for various licenses and implemented as a web application. Furthermore, another primary study presented an online single submission (OSS) system in Indonesia (Hermawan, 2020) as an online permit system that issues various license types to businesses and citizens, improving the e-government system's efficiency and service quality. Maulana et al. (2021) suggested that a mature e-government business licensing service should integrate Customer Relationship Management (CRM) systems with BPM, with the utilization of the Enterprise Service Bus (ESB) for service integration and cloud and cybersecurity solutions for adequate infrastructure.



ICTs implemented in mature e-government systems

Service-oriented architecture (SOA) is the most commonly implemented ICT in the e-government integration and interoperability frameworks, where each consumer is responsible for discovering the relevant services and communicating with their service providers in a direct way.

SOA is not a new concept and is usually implemented to model government services and integrate them in a, e.g., service catalog (Yli-Huomo et al., 2018; Paul et al., 2012; Ma, 2010; Echevarria et al., 2015; Penna et al., 2015; Riyanto et al., 2018; Abdullah et al., 2017; Sedek et al., 2015; Tebib et al., 2015). However, due to the diversity of government agencies, a middleware component is usually implemented to ease the integration of information systems within SOA architectures (Mecca et al., 2016). Other authors implemented Platform-as-a-service (PaaS), a cloud computing concept enabling service integration without the complexity of building and maintaining the infrastructure (Muller et al., 2016). Setiawan et al. (2018) developed a service-oriented-based data reference model suitable for integrating heterogeneous systems to facilitate accurate data input from trusted sources.

Frequently implemented ICTs such as the Government portal and single-sign-on (SSO) are usually combined, enabling businesses, citizens, and other government bodies' single entry point access to integrated e-government services. SSO is a method for authenticating an authorized user to multiple computer systems within a distributed computing environment after a single network sign-on (Zwattendorfer et al., 2014). The centralized government portal aggregates information from multiple sources and personalizes it for each user. Strong electronic authentication methods, called eID, require a user to sign-on on to the government portal only once and enable interaction with various secure elements within the system, as long as the session is not interrupted (Yli-Huomo et al., 2018). Furthermore, there is a possibility of a Citizen Card, used for unique identification and authentication of citizens in online procedures of the public administration (Ivkovic et al., 2010). One of the main concerns regarding SSO is the security and privacy of the system users. One of the solutions is to move all the security logic to a dedicated server to create a single authentication point for the whole system (Ma, 2010; Riyanto et al., 2018; Sedek et al., 2015; Tebib et al., 2015; Mecca et al., 2016; Setiawan et al., 2018). Another system to guarantee network security is the public key infrastructure (PKI), which is an identity authentication scheme based on digital certificates, and provides identity authentication even in the open cloud environment (Abdullah et al., 2017; Sedek et al., 2015). Another technology enabling privacy and security is an eSignature, where a qualified electronic signature has the equivalent legal effect of a handwritten signature (Marsalek et al., 2017).

Complex Event Processing (CEP) and Enterprise Service Bus (ESB) are often implemented in integration and interoperability frameworks. CEP can allow the collection and monitoring of data incoming from different sources within the e-government operability framework, while ESB serves as a middleware component in an SOA and integrates available services (Maulana et al., 2021; Mahmoud et al., 2019; Oumkaltoum et al., 2019; Setiawan et al., 2018.). ESB is also utilized together with Business Process Execution Language (BPEL) for service orchestration within an interoperability framework (Maulana et al., 2021; Penna et al., 2015), for



monitoring and enforcing data protection laws (Riyanto et al., 2018), and to monitor and enforce compliance requirements in inter-organizational service integration platforms (Gonzales et al., 2014).

Less frequently ICTs utilized in available literature are cloud technologies (Ahmad et al., 2013), blockchain technology (Rukanova et al., 2023), semantic web services (Adadi et al., 2015; Alshehab et al., 2019; Sta, 2017; Alqahtani et al., 2014), Artificial Intelligence (AI) and data mining techniques (Sienkiewicz-Malyjurek, 2023; Mahmoud et al., 2019; Oumkaltoum et al., 2019; Adadi et al., 2015), ePayment (Yli-Huumo et al., 2018; Sedek et al., 2015), Big Data (Mahmoud et al., 2019; Patel et al., 2019), and BPM (Candiello et al., 2012).

The results of the presented literature suggest that research papers are not reporting on utilized ICTs in a detailed manner and that BPM is underutilized as a technology that could enable seamless automation and management of government processes. Hence, the e-government licensing framework presented in this paper contributes to the literature by presenting how licensing process can be modeled and managed through BPM software while concurrently integrating contemporary ICTs as horizontal e-government services to achieve interoperability and integration.

METHODOLOGY

The project for developing an e-government licensing system in Serbia was supported and funded by the IFC, a member of the World Bank Group, in cooperation with the UK Good Governance Fund and British Embassy in Belgrade. The project goal was to develop a flexible e-government licensing system that can issue various types of licenses based on a generic license-issuing process. The project was planned and executed through a waterfall project management methodology (McCormick, 2012), including defining systems requirements, designing the conceptual framework, implementing the designed e-licensing system, and proposing a maintenance strategy.

The project's main goal was to develop a flexible e-licensing platform that could support issuing various license types and easily adjust business rules when government regulations or execution of the licensing process change. Furthermore, the e-licensing system had to be low-coding, enabling government employees to change certain specifications of the licensing process. The components that could enable fulfilling these requirements were, according to the literature review, a BPM engine integrated with horizontal e-services such as Government Service Bus (GSB), Electronic Identification (eID), eDelivery, eNotify, eSeal, ePayment, and National Government Portal. The components are interoperable, reusable, and customizable and can be used in different e-government systems and agencies to transform various government services. This approach enables similar functionalities among the systems, interoperability, and integration between the government agencies, simplifies the maintenance, and lowers the maintenance costs. Furthermore, the licensing process is modeled with BPMN 2.0 and supported by a BPM engine, allowing customization of the process regarding the license type and the government bodies involved.



The development of the e-government licensing system according to the defined conceptual framework was performed in several stages. After the initial development of horizontal e-services and the definition of a BPM tool, the staging phase was conducted to test the software by the IT experts and enable user acceptance testing by the government employees as end-users of the e-licensing system. The final phase was setting up the e-licensing system in the production environment and determining the maintenance strategy. To enable continuous improvement and maintenance of the deployed system, the project team established the technical support team and trained the government employees at The Office for Information Technologies and E-Government to align the licensing process according to the changes in business logic and legislation.

THE CONCEPTUAL FRAMEWORK OF AN E-GOVERNMENT LICENSING SYSTEM

This section presents the traditional, generic license issuing process in Serbia, the e-government licensing conceptual framework, and its integration.

The traditional licensing process

Steps that a client has to undertake to acquire a license without any use of electronic services, e.g., the traditional license issuing process, are identified and described below.

1. Search for a service

The first step a client undertakes is searching for a specific service, e.g., issuing a specific type of license. The client acquires basic information on the government service, which is found in government agencies.

2. Authentication and authorization

The government often requires citizens and business representatives to authenticate themselves in the process of applying for governmental service. For authentication, the user of the service provides proof of identity by governmentally issued ID with biometric information. The request form for the process often has the required field for the personal signature of the client.

3. Forms

The first visit to the government counter usually results in issuing blank forms, such as a request for a license. The filling of the forms could be too demanding and challenging to complete on the spot, or the clerk requires additional documentation, which raises the time and resource cost of service application.

4. Fees

Many governmental services imply the payment of one or more administrative taxes. Taxes can rarely be paid on the spot and require the users to visit the bank and return with proof of payment.

5. Delivering forms

The client should often bring (signed) application forms and required attachments, usually obtained by other governmental institutions, in the original or copy form.

6. Decision process

The decision process is not transparent, and the user is not aware of the current status, which may lead to the abuse of authority, decision prolongation, and different decisions based on the clerk's will.

7. Result

At the end of the process, the user gets an officially certified paper with proof of the decision.

The e-government licensing conceptual framework

Figure 1. presents the e-licensing system architecture, where clients such as citizens, business representatives, and government bodies can access the single entry point National e-government portal. Each ICT component has a unique role in the e-licensing system's architecture, such as providing a single entry point portal (National e-government portal), enabling secure and valid electronic payment (ePayment), a GSB to integrate various services, PKI for authentication and security, SSO, and electronic identification (eID), the electronic delivery of issued and signed or sealed permits (eDelivery, eNotify), a BPM engine that enables automation of an e-licensing process, and keeping all government registries regarding the permitting process in a single cloud database. Clients authenticate themselves through an eID and have access to government services. A BPM engine manages the e-licensing process, consisting of the: Administration module, where the business data model and data manipulation are defined; The application module, where the business rules are defined; The permitting process management module, enabling creation, scheduling, and of processes or subprocesses; and finally, the custom reporting module added to the IBM BPM software package to enable reporting on the process execution as well as statistics regarding the issued permits and governments bodies involved in the licensing process.

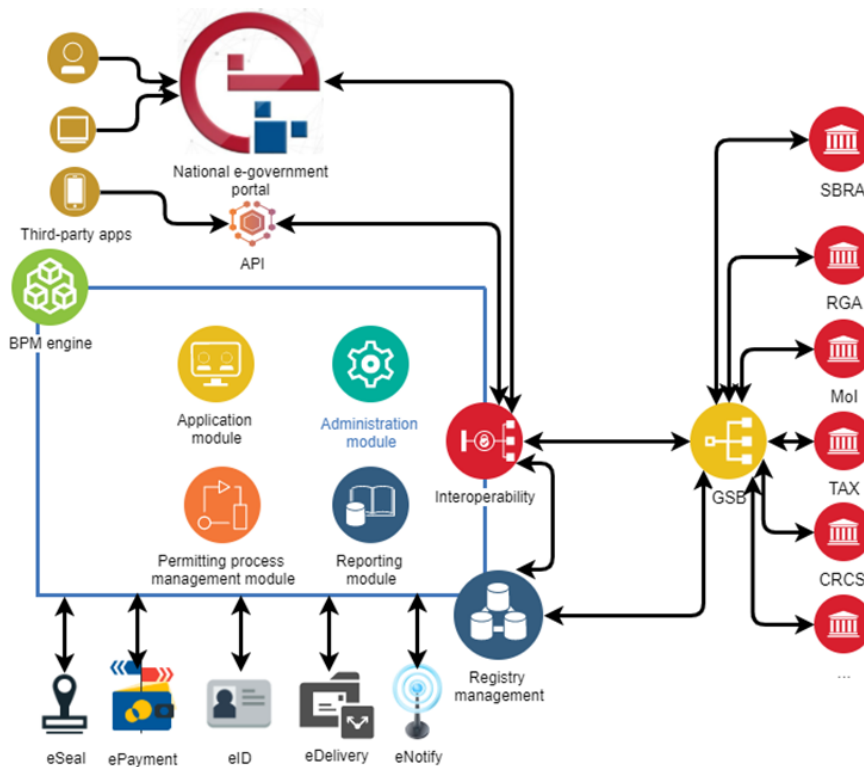


Figure 1. The e-licensing system architecture

GSB – Government Service Bus; SBRA – Serbian Business Agency Registry; RGA – Republic Geodetic Authority;
 MoI – Ministry of Interior; CRCSI - Central Register of Compulsory Social Insurance

Issued licenses are automatically stored in an issued licenses registry, to which government agencies have access through the GSB. Additionally, an API was developed to enable access from third-party applications if needed.

The e-licensing process model

To create an abstraction of the classical government permitting process, the previously described steps of a traditional permitting process are modeled as a workflow and integrated with ICTs presented in Figure 1., enabling the transformation to an integrated and interoperable e-licensing system.

Figure 2. presents the e-licensing process with the integration of reusable ICT components identified at the top of each task in a process.

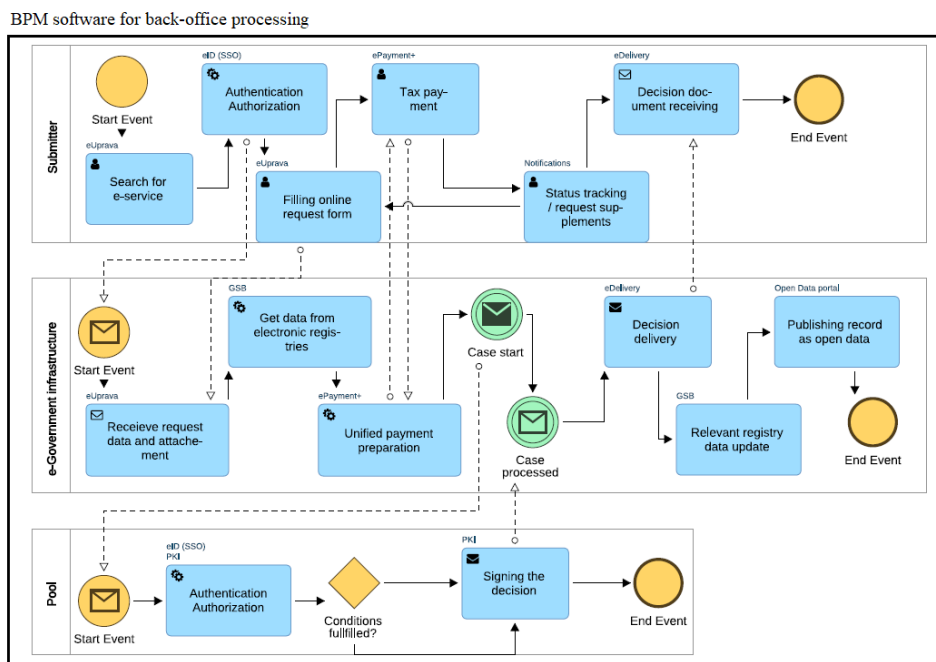


Figure 2. The e-license issuing process model with integrated ICTs

The ICT components and their overall utilization within the e-licensing process are the following:

C1 – National e-government portal

The National e-government portal (eUprava) enables the single entry point functionality and supports e-licensing activities such as searching for a service, filling out forms, and receiving request data and attachments. The portal provides information in a customer-centric manner, organized by Life Events. The given information is searchable and search engine optimized. All published services have meta-data with standardized keywords, and comprehensively searchable catalogs of information and services are provided. Each filled form is treated as a separate request and stored in the repository for processing and later archiving. Data stored in the database is used to create an official document in the form appropriate for further processing. Automatic API methods expose the data collected by web forms for easy integration with other government systems' back-ends seamlessly. The API provides all necessary methods to transfer electronic data and documents into another governmental agency's repository for further processing.



C2 - eID

Using the eID component and the SSO concept, the users authenticate themselves once using a username/password, two-factor authentication (2FA), or qualified certificate for authentication to gain seamless access to connected but independent computer systems. The SSO shares centralized authentication servers that all other applications and systems use for authentication purposes and combines this with techniques to ensure that users do not have to enter their credentials more than once. Commonly SSO systems support different authentication mechanisms, which leads to the SSO system being capable of handling credential mechanisms used by distributed systems.

Role-Based Access Control (RBAC) is an access control mechanism defined around roles and privileges. This greatly simplifies the management of permissions. SSO and RBAC systems are implemented to manage various roles of a client with different privileges in a multiuser environment where the users belong to different governmental institutions' departments.

C3 - ePayment

The payment of fees is enabled through the e-payment component. Each payment has a unique ID, and the e-payment system has information about each transaction and monitors the account to pair the announcement of payment with cleared transactions. The system supports various channels of payment like Bank transfers, payment cards, and self-service kiosks. The e-payment component is independent, capable of being seamlessly integrated with other governmental systems through industry-standard technologies like web services, and has legal recognition as the mechanism for electronic payment of administrative fees.

C4 – PKI

The legislation established legal recognition of PKI for authentication and digital signing of the documents as well as recognition of official PKI providers. The approach for establishing the PKI is to stipulate a mandatory certificate on the personal ID card and to establish only one trusted body, either governmental or private.

C5 – eDelivery and eNotify

After the decision on license issuing is made, the client receives the decision and validly sealed license through the electronic document delivery component - eDelivery. The user gets a notification through the eNotify component on the National e-government portal that the new message is received without knowledge of any detail, like who the sender is and the message content. After using a qualified certificate to prove his identity, the user electronically signs the proof that the message has been received before opening the message.

C6 – Government Service Bus

Complex governmental services consist of acquiring information from different institutions. The real-time acquisition of the relevant data among the various electronic governmental registries is the key factor in making service efficient and cheaper. Once the permit is issued, it is stored in the issued permit registry and is available to other government institutions.

C7 – BPM engine



BPM was implemented as a component of the e-licensing system to support licensing process design, analysis, execution, and monitoring. A BPM execution engine is configured to enable high productivity and low-coding licensing process automation. Consequently, any changes to the process's requirements have to be accommodated by changing a BPMN standardized model with no coding. Government legislation considering the licensing process, electronic documents, and electronic signatures is implemented through work patterns and business rules.

The BPM execution engine supports routing tasks to human or system actions based on process flow, re-assignment, and escalation of tasks during the process execution, including multi-level escalation and alerts in case of expired deadlines. The back-office processing of government processes, e.g., license request applications, may be implemented either using the BPM engine or by using an external information system. If a government body in charge of the process uses a document and workflow management information system for processing requests, then a case file is transferred to that system for back-office processing, and the external system provides status updates on all phases of the process to the government BPM engine.

The system for handling electronic requests can accept additional electronic documents, storing them safely and securely in a digital document repository, e.g., issued license registry, and linking those to any other needed documents. The repository with all previously stored documents and all documents originating from the administrative procedures the user previously applied is accessible to the user. Those documents are digitally signed with a qualified electronic seal. The issued licenses are available to all government agencies of concern through a GSB, and each client has access to issued and sealed licenses through the e-government portal interface.

C8 – Government Computer Cloud

Government services are migrated to a government cloud environment, enabling the development of new services without conducting public procurement procedures for obtaining hardware, which could often be lengthy, costly, and without a certain outcome. This method enables dynamic resource allocation, depending on immediate re-source needs (e.g., demand for some services could reach a peak due to deadlines or media announcements).

RESULTS AND DISCUSSION

To enable a platform for the implementation of e-government systems such as the e-licensing system, the government of Serbia adjusted the Law on Administrative Procedure, acknowledging the lawfulness of electronic services. Furthermore, the Law on Electronic Documents, Electronic Identification, and Entrusted Services in Electronic Business enabled the lawful utilization of eID and eSeal. The Law on Electronic Government introduced the usage of the GSB for data exchange, eDelivery, eNotify, and the National Government Portal for providing electronic services.

More than 50 administrative procedures for the transformation of current eServices to the presented e-licensing system have been undergone in Serbia on a national level and have been in a production environment



since the middle of 2021. The e-licensing system is currently implemented by five different government institutions to issue various license types to businesses. The Plant Protection Administration implemented the e-licensing system to support the execution of 25 administrative procedures, such as the Recognition of registration of plant protection products. The Ministry of Internal Affairs implemented the e-licensing system to support twenty administrative procedures, such as Permission for technical inspection of the vehicles and Permission to a legal entity to issue registration labels. The Tobacco Administration implemented e-licensing to support six administrative procedures, such as a Permit for tobacco products' retail trade. Finally, the National Employment Service supported the processes of Reporting the need for employment and the selection of candidates. Furthermore, the Ministry of Environmental Protection uses e-licensing to support 12 administrative procedures, including Permits for the export and import of fluorinated gases with the greenhouse effect.

With the aim of continuous improvement and maintenance of the deployed system, the project team established the technical support team and trained the government employees at The Office for Information Technologies and E-Government to align the licensing process according to the changes in business logic and legislation.

As the Law on Administrative procedure is the same for all government bodies in Serbia, and the e-licensing system is based on some variant of the generic e-government process supported by BPM software, other government agencies can easily transform their e-services to the e-licensing platform. Additional components that should be built in this case are electronic registries integrated with the GSB in situations where a government body does not have one. The electronic registries could utilize blockchain technology, which the developed e-licensing platform may easily support.

It would be beneficial to establish a separate government unit that would operate when additional government bodies are transforming to the e-licensing platform on the organizational level. The unit would be responsible for mapping the organizational scheme and workplace systematization of the government body, as well as creating an employee database in the RBAC module of the eID component to determine specific roles of employees based on their jurisdiction.

CONCLUSION

Governments are transforming license-issuing services to e-services by utilizing the most common e-government horizontal e-services and concepts, such as SOA, one-stop shop, SSO, ePayment, and eID. However, the potential of applying BPM in the field of e-government is not sufficiently exploited.

In this paper, a new e-government licensing framework was introduced, which enables rapid transformation of current licensing services to an integrated and interoperable platform managed by a BPM software and integrated with contemporary horizontal e-services, such as Government Service Bus, Public Key Infrastructure, eDelivery, eSeal, ePayment, and National Government Portal. The framework is based on a generic e-government license issuing process, which can be easily modified and maintained through BPM



software. Furthermore, the framework enables a single-entry point functionality with the eID component for authentication, PKI for authentication and digital signing of the documents, electronic payment of fees, the electronic delivery of validly sealed licenses, and the exchange of information between government agencies. An issued license registry automatically stores issued licenses that are available to other government bodies. The proposed framework was utilized in Serbia to transform more than 50 administrative government procedures into the e-licensing system.

Future work will be focused on examining the overall success of the currently implemented e-licensing system by distributing a questionnaire to the end-users, e.g., government employees. Furthermore, blockchain technology could be utilized while creating issued license registries.

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All authors have contributed to the paper equally. All authors have read and agreed to the published version of the manuscript.

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