

Article

CONCEPTUAL MODEL OF AZERBAIJANI LANGUAGE ECOSYSTEM IN THE ELECTRONIC GOVERNMENT

Modelo conceptual del ecosistema lingüístico azerbaiyano en la administración electrónica

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Abstract: Introduction. The digital age, characterized by the development of technology and benefits of the Internet, threatens the preservation of linguistic diversity. Technological revolutions, disasters, pandemics, wars and rapid changes in the demographic situation in the world lead to the destruction of language ecosystems and the disappearance of language diversity. In this regard, protection of language diversity has become one of the urgent issues in the rapidly globalizing world under the influence of information technologies. Therefore, safeguarding the Azerbaijani language and expanding language services on the e-government platform are crucial concerns. This study aims to analyze the challenges and opportunities for integrating the Azerbaijani language into e-government platforms in the context of digitalization and globalization Methodology. The article examines approaches, views and initiatives related to the impact of globalization on the linguistic-cultural space and language processes. Effects on languages of peoples of the world in the digital age and innovations caused by digitization were analyzed, an overview of related works was conducted, and problems of the Azerbaijani language in online environment were indicated. Results and Discussion. This article studies conceptual bases of Azerbaijani language ecosystem formation in the e-government. It explores the preservation of linguistic diversity and the implementation of linguistic technologies in e-government. The study highlights the necessity of developing various language services to establish a unified system. We propose that in order to protect the Azerbaijani language in the integrated information space, it is necessary to develop national, corporate and individual language corpus. The technical integration of the language at various levels in the e-government will create ample opportunities for the formation and development of the national language corpus. The article proposes approaches and a conceptual model regarding the formation of Azerbaijani language ecosystem on e-government platform and indicates complex issues to be solved by application of linguistic technologies.

Key words: E-government, Language diversity, Linguistic technologies, Language preservation.

Resumen: Introducción. La era digital, caracterizada por el desarrollo de la tecnología y los beneficios de Internet, amenaza la preservación de la diversidad lingüística. Las revoluciones tecnológicas, las catástrofes, las pandemias, las guerras y los rápidos cambios de la situación demográfica en el mundo conducen a la destrucción de los ecosistemas lingüísticos y a la desaparición de la diversidad lingüística. En este sentido, la protección de la diversidad lingüística se ha convertido en una de las cuestiones urgentes en un mundo que se globaliza rápidamente bajo la influencia de las tecnologías

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de la información. Por lo tanto, salvaguardar la lengua azerbaiyana y ampliar los servicios lingüísticos en la plataforma de administración electrónica son preocupaciones cruciales. Este estudio pretende analizar los retos y las oportunidades de integrar la lengua azerbaiyana en las plataformas de administración electrónica en el contexto de la digitalización y la globalización Metodología. El artículo examina enfoques, puntos de vista e iniciativas relacionados con el impacto de la globalización en el espacio lingüístico-cultural y los procesos lingüísticos. Se analizan los efectos sobre las lenguas de los pueblos del mundo en la era digital y las innovaciones provocadas por la digitalización, se realiza un repaso de los trabajos relacionados y se indican los problemas de la lengua azerbaiyana en el entorno en línea. Resultados y discusión. Este artículo estudia las bases conceptuales de la formación del ecosistema lingüístico azerbaiyano en la administración electrónica. Explora la preservación de la diversidad lingüística y la aplicación de tecnologías lingüísticas en la administración electrónica. El estudio destaca la necesidad de desarrollar varios servicios lingüísticos para establecer un sistema unificado. Proponemos que, para proteger la lengua azerbaiyana en el espacio integrado de la información, es necesario desarrollar corpus lingüísticos nacionales, corporativos e individuales. La integración técnica de la lengua a varios niveles en la administración electrónica creará amplias oportunidades para la formación y el desarrollo del corpus lingüístico nacional. El artículo propone enfoques y un modelo conceptual en relación con la formación de un ecosistema lingüístico azerbaiyano en la plataforma de la administración electrónica e indica cuestiones complejas que deben resolverse mediante la aplicación de tecnologías lingüísticas.

Palabras clave: Administración electrónica, Diversidad lingüística, Tecnologías lingüísticas, Preservación de las lenguas.

1. Introduction.

Background. In the era of digital technologies, characterized by the ubiquity of information technologies and the advantages of the Internet, a threat to linguistic diversity may arise. Currently, there are more than 7000 languages, each characterized by unique characteristics influenced by factors such as lifestyle, age, social status of speakers and geographical region of speakers. In 2024, according to UNESCO, at least 40% of the 7,000 languages estimated to be spoken in the world are endangered, and on average, a language disappears every two weeks. In recent decades, rapid development, innovations brought by technology, and the increasing number of endangered languages have caused concern among international institutions, governments and researchers. The current trend shows that the basis of globalization is the Anglo-American model of society, and English language resources are more abundant on the Internet, comprising around 60% of online written content – followed by Russian and Spanish, with 5.9% and 3% respectively. According to different statistics sources, Azerbaijani language resources are less than 0.1%.

Importance of language preservation. The process of globalization, along with changes in language protection, necessitates serious measures for safeguarding and developing the Azerbaijani language. These efforts are particularly important on digital platforms. (Languages in a Globalising World, 2003; Gurbanova, 2010; Aliguliyev et al. 2021b). The studies provided in 2021 indicated that 76.9% of online languages relate to the world's top ten most spoken languages. Studies show that by 2100, half of the world's

languages are predicted to be either extinct or on the verge of extinction (IDIL 2022-2023). Recognizing this threat, UNESCO is leading efforts to preserve local languages and integrate them into the digital world. The aim of this global initiative is to conduct research on the barriers that prevent indigenous communities from accessing digital resources. It also seeks to identify the necessary steps for integrating indigenous languages into digital platforms (IDIL 2022-2023).

Amid increasing efforts towards the formation of the Information Society, most countries are trying to develop digital government solutions with the application of information technologies. The realization of the e-government initiative, in addition to enhancing efficiency in public administration, serves as a platform for preserving multicultural, religious, and linguistic diversity. It also requires significant actions to be taken at the government level. E-government is a platform to provide government services to citizens as well as other residents of a country, through an internet enabled platform (Basahel & Yamin, 2017).

In the digital landscape, increased exposure to dominant languages through digital platforms can lead to language shifts and decreased use of minority languages (Cassels, 2019; Tan & Jehom, 2024). In the digital age, language of ethnic groups, certain dialects may be marginalised or even erased due to insufficient support and resources, posing a challenge to language preservation. (Tan & Jehom, 2024). The digital era has had both positive and negative effects on minority languages. As a positive impacts of the digital era on minority languages can be indicate increased access to learning and preservation opportunities. Digital platforms like Duolingo, Memrise, YouTube, and online dictionaries help people learn and preserve minority languages. Projects like Google Translate and Wikipedia expand support for lesser-known languages. Online archives and linguistic databases document endangered languages for future generations. From point of community engagement and networking, Social media (Facebook, WhatsApp, Telegram) allows speakers of minority languages to connect globally. Digital storytelling, podcasts, and blogs create new spaces for minority languages to thrive. Online activism raises awareness about language rights and revitalization. Artificial intelligence-based tools like text-to-speech, automatic translation, and voice recognition are increasingly integrating minority languages, for example Google Assistant.

There are some negative impacts of the digital era on minority languages. From point of dominance of major languages, English, Mandarin, Spanish, and other major languages dominate online spaces, limiting the digital presence of minority languages. Many websites, apps, and software do not support smaller languages, forcing speakers to switch to dominant

languages. Due to globalization, younger generations often prefer global languages for job opportunities and social integration. Minority languages risk becoming like offline languages spoken only in homes or rituals but not in digital platforms. Many minority languages lack keyboards, spell checker, and AI support, making them hard to use online. High costs and technological barriers prevent small communities, ethnic groups from developing digital content in their languages. Form other hand, we consider that digital communication (texting, social media) encourages abbreviated or simplified versions of languages. In daily life use of auto-translation often distorts meaning, leading to loss of nuance and dialects. Currently, the digital era presents both opportunities and threats to minority languages. While technology can revitalize and promote linguistic diversity, it can also accelerate language shift if minority languages are not actively supported in digital spaces. Currently, the digital era presents both opportunities and threats to minority languages. To preserve minority languages, governments and communities must implement comprehensive strategies to invest in digital tools, education, and AI-driven language support.

Objectives of the study. E-government was established as a tool of increasing the efficiency of provided services by strengthening the public sector activity via forming a new information environment (Alshehri & Drew, 2011; Mittal & Kaur, 2013; Vasilyeva & Kononenko, 2016; Iqbal et al., 2020; Aliguliyev & Yusifov, 2014). At the same time, the ability of developing countries to fully utilize the advantages of e-government remains very limited. They also face various challenges in implementing e-government projects (Yadav et al., 2021; Yadav et al., 2022). These problems include political-administrative, infrastructure, demographic, language and other social factors that play a key role in the efficient management of e-government and development of citizen-centric solutions. (Alguliyev et al., 2021a; Yadav et al., 2021). Demographic characteristics of citizens, such as gender, age, education, social status, and language, significantly influence user behavior. These factors also impact the acceptance and use of e-services. In this regard, multilingualism is one of the most important issues in the development of effective e-government solutions. The development of information technologies and the dominance of the English language on digital platforms limit access to e-services. This particularly affects the general population, minority groups, and ethnic communities living in the country (Mittal & Kaur, 2013; Torgby & Asabere, 2014). In countries with multiple spoken languages alongside the official state language, such as Indonesia, Nigeria, Cameroon, India, Mexico, Brazil, and China, the operation of e-government sites in the dominant language creates challenges. As a result, the majority of the population is unable to access these services (Pérez-Salazar et al., 2016; Most

multilingual countries, 2023). Most English-language content on the digital platforms, especially for e-government, makes the problems of protecting language diversity and ensuring multilingualism more urgent.

E-government initiatives in Azerbaijan primarily operate in Azerbaijani in the country's official language (E-government portal). The National E-Government Portal offers services in both Azerbaijani and English, aiming to enhance accessibility for a broader audience. Despite Azerbaijan's rich linguistic diversity, with minority languages such as Lezgian, Talysh, Avar, Russian, and Tat spoken within its borders, there is limited evidence of e-government services being available in these minority languages. This lack of linguistic inclusivity may pose challenges for minority language speakers in accessing digital public services.

E-government can serve as a powerful tool for preserving linguistic diversity by integrating minority languages into digital public services. Government websites, mobile apps, and online forms can be offered in multiple languages, ensuring equal access for speakers of minority languages. For example, automated translation and AI-driven chatbots can provide real-time support in various languages. Providing public services in minority languages strengthens their legitimacy and official recognition. Legal and administrative documents in multiple languages empower citizens to use their native language in formal settings. From other hand, digital services can collect data on language usage, helping policymakers make informed decisions about language preservation. Note that, social media and government forums in multiple languages encourage citizen participation and dialogue. From this point of view, digital platforms and multilingual voting platforms enable minority language speakers to engage in democratic processes. While the Azerbaijani government has implemented policies to promote ethnic, cultural, linguistic, and religious tolerance, the integration of minority languages into e-government platforms remains limited. Enhancing multilingual support in digital services could improve accessibility and foster greater citizen participation across all linguistic communities in Azerbaijan.

This study aims to analyze the challenges and opportunities for integrating the Azerbaijani language into e-government platforms in the context of digitalization and globalization. In the article, we focused on: first, how globalization and the digitalization process impact languages; second, why is it necessary to create an ecosystem of the Azerbaijani language in e-government for various purposes and how to create it?

This article is organized as follows: Section 2 examines the impact of digitalization on linguistic diversity and some positive and negative impacts of the digital era on minority

languages. Section 3 presents a comparative survey of related works and the current state of the Azerbaijani language in e-government. Section 4 discusses an architectural-technological bases of the language in e-government. Section 5 proposes approaches and a conceptual model regarding the formation of Azerbaijani language ecosystem on e-government platform. Finally, Section 6 offers conclusions and recommendations for future language policies in the digital environment.

2. Globalization and its impact on languages.

All information is transmitted via signs pertaining to certain languages and cultures. From this point of view, concept of a single information space is of key importance for understanding the dynamics of language changes and has a significant impact on the course of linguistic and cultural processes. Thus, the real areal of the Anglo-American linguistic and cultural space goes far beyond the territories of the respective states due to the enormous coverage of English-language contents and spread of the Internet (Crystal, 2001; Laletina, 2011; Dobrosklonskaya, 2012). The result of the collapse of the USSR was not only changes of a state and socio-political nature, but also noticeable changes in the existing cultural and information space (Dobrosklonskaya, 2012). In this context, the impact of globalization on the cultural sphere has led to significant qualitative transformations in linguistic and cultural processes, driven by the application of information technologies.

In globalization process, some dominant languages, which is doubtlessly the dominant or in other words - claimant global language, is a real threat to any language (Crystal, 2003; Alakbarova, 2012; Dobrosklonskaya, 2012). In the information space, due to economic, political and socio-cultural reasons, rapid dissemination of English-language resources far exceeds resources in all other languages. Of course, one of the main features of the modern geo-linguistic map of the world is the undeniable dominance of the English language, which is manifested, among other things, in the sphere of media. Note that, the total volume of English-language media, due to a number of political, social or cultural reasons, significantly exceeds the volume of media resources in other languages of the world.

While technology offers new opportunities for language preservation and revitalization, it also poses challenges that can accelerate language disappears (Tan & Jehom, 2024). For example, due to digital divide and the dearth of platforms, applications, and software for minority or non-dominant languages is representative of the experience of low-resourced language speakers on the Internet (Meital & Jason, 2022). In the study (Ferré-Pavia et al., 2018) analyzed the Internet reality and performance of European minority language media, including a comparison of the evolution of traditional media websites

between 2009 and 2016. The 10 language communities are Catalan, Galician, Basque, Welsh, Irish, Frisian, Breton, Corsican, Scottish Gaelic, and Sámi. The findings indicate that nine out of 10 news organizations have some presence on the Internet in the form of websites and/or social media. Compared with data collected in 2009, the average number of media organizations with no Internet presence has decreased from 29% to 9.2%. In the digital landscape, low language diversity in digital spaces reflects the decline in minority languages. When languages are not supported in digital platforms, users have less ability to take advantage of social platforms, e-commerce and other Internet services that are increasingly a part of global daily life.

English has become the main language of communication in Europe, including Western and Eastern countries. According to the Dutch linguist Fischer (Fischer, 2006), role of language as an international communication tool has its negative sides, such as not very high level of proficiency (knowledge), cultural diversity, differences in structure and meaning in different languages; there's also a fear that other languages will lose their national authenticity and will be dominated by a foreign culture, represented in English.

Starting from 1990s, the dominance of the English language led to the emergence of concepts called "linguistic imperialism", "media imperialism", "cultural imperialism", "information imperialism" or "linguo-cultural" by various researchers and caused discussions in wide audiences (Dobrosklonskaya, 2012; Albuquerque, 2024; Moghadam & Barani, 2025). Considering that in the conditions of the information society, linguistic and cultural influences are carried out mostly through media channels, influence of the dominant language on the unified information space, including its impacts on the Azerbaijani segment is also evident. In that connection, the preservation of the Azerbaijani language in integrated information space is a particularly issue, and it is imperative to carry out assessments at mentioned geo-linguistic, interlinguistic and intra-linguistic levels and to develop effective mechanisms.

3. Related works.

Linguistic diversity on the Internet. In the Information Society, advantages of the Internet and rapid development of social media pose a great threat to the preservation of linguistic diversity. In the digital age, the English language, which relies on the strong economy of leading countries such as Great Britain and the United States, global media resources, and a large-scale database, is rapidly penetrating the linguistic space of national languages. Currently, about 60.7% of available Internet resources are in English, 31.5% are mainly in Russian, Spanish, Turkish, Persian, French, German, Japanese, Vietnamese,

Chinese, Arabic and Portuguese, and the remaining 7.8 % are in other languages (Aliguliyev et al., 2021b). The main reason for the dominance of the English language in the world is the rapid development of science, education and technologies in this language, the fact that this language acts as a locomotive of Research and development (R&D) (digital platforms, large-scale contents etc.). According to UNESCO experts trying to objectively assess the linguistic landscape of the planet, 50% to 90% of the world languages can be completely destroyed or disappear by the end of the XXI century (Language Vitality and Endangerment, 2003; Aliguliyev et al., 2021b). The study (Nabibayova, 2023) discussed the formation of linguistic demography on the national e-government platform, its problems and solutions. The article shows the complications of establishing linguistic demography, raises different problems and presents certain proposals for their solution. The study reviewed (Asadova & Mammadova, 2023) natural language processing problems in Azerbaijani language. The article proposed developing new resources such as annotated corpora, improving machine learning models, and exploring deep learning techniques.

Universal Declaration on Cultural Diversity adopted by UNESCO in 2001, reviews a link between biological, cultural and linguistic diversity. Declaration recommends cooperation areas to the Participant States in the following (Aliguliyev et al., 2021b):

- supporting linguistic diversity and expanding the opportunities for using multiple languages;
- expanding linguistic diversity on all levels of education, promotion of learning several languages from an early age;
- incorporating data exchange methods and tools that create full cultural communication opportunities into the traditional education system;
- promoting public entry to global data network including diversity in cyberspace etc.

The Europe's Digital Decade 2030 strategy aims to transform the EU into a global leader in digital innovation by 2030. While digitalization offers opportunities for inclusion, linguistic diversity remains a critical challenge. The EU recognizes multilingualism as a fundamental value, but the dominance of major languages in digital spaces risks marginalizing minority and regional languages. The EU aims for 80% of adults to have basic digital skills by 2030. However, many online learning platforms and digital training programs are not available in minority languages. The goal is all key public services to be available online, but many e-government platforms lack multilingual support. Currently, digital ID systems, healthcare portals, and social service platforms are not always accessible in regional and minority languages, reducing citizen participation. To ensure linguistic diversity in Europe's

Digital Decade, the EU focused on integrate multilingual AI, digital education, and inclusive e-government services. Without targeted policies, minority languages risk digital exclusion, undermining Europe's commitment to cultural and linguistic diversity.

Comparative evaluation of approaches. There are several related works that can be associated with this research. Some of these related works tend to focus more on linguistic diversity and accessibility on websites, in information search, standardization, automated readability assessment, language policy, language technologies, and realization of different applications on e-government platforms.

The article (Burckhardt, 2021) provides an analytical and structured overview of the different approaches discussed in literature related to the study of linguistic diversity and equality in public administration. The study reviewed public policies implemented in different countries to address such inequalities. The article examines linguistic diversity between members of staff working for government agencies, and how governance models, public policies and public management practices are related to their minimization.

The study (Pérez-Salazar et al., 2016) is devoted to linguistic diversity issues and the accessibility of marginal groups to Mexican government websites at different levels. This study provides an assessment of the indigenous language provision on Mexican government websites at a government and local level. The study results show that no local indigenous-language content is available from e-government websites, and there are accessibility issues in some regions. Thus, the local population faces digital inequality as well as very difficult living conditions. In the study (Lata & Chandra, 2007) researchers have addressed the major challenges and issues involved in the multilingualism aspects while working towards standardization of e-governance solutions in India. The study examines the benefits of adopting open standards and open-source software in implementing multilingual e-governance solutions. The study (Harvey & Brazier, 2022) examined the search behaviours and performance of native and English as a second language speakers while using e-government tasks. The research defined differences between native and English as a second language speakers. The study results shows that significant differences between groups of varying language proficiency in terms of search performance, used time, identification of relevant docs and self-perceived performance and confidence. The study (de-Dios-Flores et al. 2023) is devoted to analyzing the language technologies for a multilingual public administration in the case of Spain. The study presented an overview of the most promising language technologies in terms of their relevance from the point of view of multilingual communication between citizens and the administration. The article reviewed

the existing technologies for Spain's co-official languages, and presented some ideas on how these could be integrated towards the multilingual transformation of Spanish public administrations. Table 1 summaries the details of the related work by providing a comparative survey that defines key contributions and outlines some of the features or issues.

Table 1.*A comparative survey of related works*

References	Key contribution	Features or issues					
		Conceptual approach	E-service	Functionality	Platform	Multilingual	Analytical metrics
de-Dios-Flores et al. (2023)	E-government solution, Multilingual public administration, linguistic technologies	+	+	+		+	
Mamedova & Mammadzada (2023)	Automatic transliteration systems, Expert systems, Multilingual solution	+		+		+	
Harvey & Brazier (2022)	E-government solution, Information search, Second language Speakers		+	+	+		
Mammadzada (2021)	Multilingual solution, Transliteration techniques	+	+			+	
Alguliyev et al. (2021a)	E-government solution, Cloud-based Linguistic technologies	+	+		+	+	
Morato et al. (2021)	E-government solution, Government websites, Prediction tools		+	+	+		+
Yadav et al. (2021)	Sustainable e-government projects, Case study, Demographic indices	+		+	+		+
Burckhardt (2021)	Linguistic diversity, public administration, language management	+				+	+
Gomaa (2020)	E-government portal, Language policy	+			+	+	+
Mensah et al. (2020)	Unified model of electronic government adoption	+	+	+	+		+
Das & Saha (2018)	Electronic Governance, Linguistic technologies, Digital Etymology system	+	+	+		+	+

Pérez-Salazar et al. (2016)	Linguistic diversity, government websites	+		+	+	+	
Monaka & Mutula (2010)	Linguistic framework, Methodological tool	+	+	+		+	
Rodrigues et al. (2010)	E-government solution, Human language technologies, natural language interface		+	+	+	+	
Lata & Chandra (2007)	Multilingual e-governance solutions	+		+	+	+	

As indicated in Table 1, most of the related work provides various aspects of the use of linguistic technologies and applications on e-government platforms. We compared the related works focused on key contributions (like a proposed e-government solution, multilingual public administration etc.) and features (like a conceptual approach, e-service etc.) which were analysed in the studies. Summary of the results of related works shows that although language problems are examined from various aspects on the e-government platform, there is no comprehensive approach to solving the issues. From this point of view, the complex approach is very important in the case of the formation of the language ecosystem in the e-government platform.

We propose that in order to protect the Azerbaijani language in the integrated information space, it is necessary to develop national, corporate and individual language corpus. In addition, there is a need to digitize a large number of resources (dictionaries, atlases, etc.) and create websites in Azerbaijani language. Nowadays, it is particularly important to develop new mechanisms for teaching and evaluating the Azerbaijani language using ICT. Despite the widespread use of information technologies, artificial intelligence and natural language processing methods in other languages, there are problems with their application to the Azerbaijani language, which is another critical issue. The reason for this is the lack of ontology, thesaurus, frequency dictionaries of various purposes, a database consisting of sentimental and vulgar words, national language corpus of the Azerbaijani language and other necessary resources (stemming, lemmatization, tokenization, etc.).

- Elimination of listed problems will allow to solve below mentioned issues in integrated information space:
- Summarization and classification of texts and speeches in Azerbaijani language (text mining, audio mining etc.);
- Computer-based recognition and analysis of speeches in Azerbaijani language;

- Synthesis of artificial speech from Azerbaijani texts on the computer, developing human-computer (robot, drone etc.) dialog systems (chatbot etc.);
- Determination of emotional tonality of texts and speeches (opinion mining, sentiment analysis etc.)
- Development of good-quality computer translation software between Azerbaijani language and other world languages;
- Development of technologies that allow automatic detection of foreign terminology entering Azerbaijani language through online channels;
- Continuous monitoring and evaluation of ecological condition of Azerbaijani language on digital platforms, developing solutions related to the development of the language;
- Development of national search engine;
- Ensuring the information security of the Azerbaijani language on digital platforms and effective solutions against cybercrime;
- Development different language services on e-government platform;
- Creation national anti-plagiarism applications.

Creation of the mentioned tools will allow to ensure the preservation, development and wide application of the Azerbaijani language for various purposes by solving a large number of problems related to the Azerbaijani language on digital platforms.

One of the important issues to be solved in this field is development of an Azerbaijani language ecosystem in e-government environment. Thanks to such socio-technological architecture, transformation of national languages into an integral part of e-government platform, their positioning in this technical platform will greatly contribute to preservation and development of languages in the era of globalization.

4. Architectural-technological bases of the language in e-government.

New methods, algorithms, approaches must be developed, and a number of applications must be developed in order to make national languages a part of the e-government and to ensure the natural development of this platform on all segments. To achieve this goal, it is important to solve the following issues (Aliguliyev et al., 2021b):

- solving localization (using the national language) and globalization (using the main foreign languages) problems in order to ensure the accessibility of e-government to all citizens and foreigners temporarily living in the country;

- using the capabilities of e-government platform for language documentation of national minorities residing on the country's territory;
- regular evaluation of the existing language situation in the country by analyzing large volume data collected from e-government system;
- processing intellectual analysis methods of language use, and application of feedback mechanisms in e-government environment, mass media, social media etc.;
- ensuring the purity of language in the e-government system, spelling, orthography, transliteration, terminology, dialectology issues, names and surnames, vulgarisms, formation of services language industry services (machine translation, speech recognition, language learning and language proficiency level assessment, etc.), such as language national corpus, etc.;
- solution of technical issues in order to support application of national domain names and multilingual internet;
- application of proposed models for preservation and development of national languages in a globalization environment.

Application of such model will enable collection, analysis, evaluation and purposeful use of the data on different functional language modules on the national e-government database.

5. Formation of an ecosystem for Azerbaijani language in e-government.

Being considered the main value of the countries, as well as of the EU, language diversity and freedom of expression in a society are the basic principles of the formation of e-democracy.

Note that, although the multilingualism of Europe has a fundamental socio-cultural value, linguistic diversity can be considered a barrier that can significantly affect communication between people (European Agenda 2020, 2010; The European Language Cloud, 2015; Alguliyev et al., 2021a). In this regard, maintaining "unity and diversity" is an overly complicated issue.

There is a number of technological solutions to prevent linguistic division or language preservation in online environment. The rapid development of language technologies, such as machine translation, text mining, semantic analysis and speech recognition technologies, enable the elimination of language barriers between people, as well as the preservation of language diversity and the development of multilingualism on digital platforms (Gurbanova,

2010; The European Language Cloud, 2015; Aliguliyev & Mahmudov, 2018; Dubey, 2019; Yadav et al., 2023).

Implementation of language technologies means people can write, read and communicate in their native language online, and for others, they have access to information in their native language with which they can communicate. Application of language technologies in digital platforms will enable the formation of a single information space between countries by eliminating the language barrier, protecting the language and developing multilingualism in e-government environment.

The realization of state programs and projects for language protection initiatives on the e-government platform must be carried out on a stage-by-stage basis. Currently, trends in Azerbaijan demonstrate that different organizations and individuals prepare separate language-related application products, for example, national transliteration system (Mammadzada, 2020, 2021; Asadova & Mammadova, 2023; Mamedova & Mammadzada, 2023). However, these products cannot be widely utilized due to different reasons (commercial etc.). These systems need to be integrated into e-government systems and overall, an ecosystem of Azerbaijani language needs to be established. The Azerbaijani language ecosystem in e-government refers to the integration, accessibility, and digital presence of the Azerbaijani language and support multilingualism within e-government platforms. It encompasses the linguistic policies, technological tools, and user interfaces that enable citizens to interact with government services in their native language, ensuring inclusivity, efficiency, and digital accessibility. The integration of language services and systems into the e-government system allows providing various services to citizens with the provision of language diversity, as well as the principle of a single window. The main goal of the e-government concept is to determine the service needs of citizens using modern technologies, create new services, improve existing services and implement a targeted information strategy. Most projects created with the concept of e-government work on the principle of saving resources for both institutions (public and private) and citizens. This has positive results in terms of increasing service speed and quality, as well as providing uninterrupted service. As a result, it will become possible to render complimentary and unlimited Azerbaijani language services (orthography, terminology, dialectology, translation) to society, citizens and everyone on virtual space. It is clear that these technological innovations must ensure the language policy of the state, i.e. utilization, protection and development of the official state language, including establishment of translation and transliteration relations into other languages. For this reason, it is necessary to provide

financial support to state-implemented projects in this field. A conceptual model of the ecosystem of the Azerbaijani language is proposed in Figure 1. As it can be seen, e-government and its functional components must be built according to the requirements of the Azerbaijani language in order to establish the ecosystem of Azerbaijani language in electronic environment.

For this purpose, functional components of Azerbaijani language must be created on a digital platform in such a way that they can interact with each other in e-government environment and provide uninterrupted online language services (terminological, orthographic, vulgar, translation, etc.) to citizens. In this regard, it is necessary to use international standards for teaching and evaluating the Azerbaijani language. Citizens' linguistic skills must be assessed based on national standards in writing, reading, listening and speaking. In order to support the language policy of the state, a linguistic demography system must be established as a part of the e-government environment and sociolinguistic analyses must be conducted on various aspects, and necessary proposals must be developed.

Figure 1.

Conceptual model of the ecosystem of Azerbaijani language on online platforms

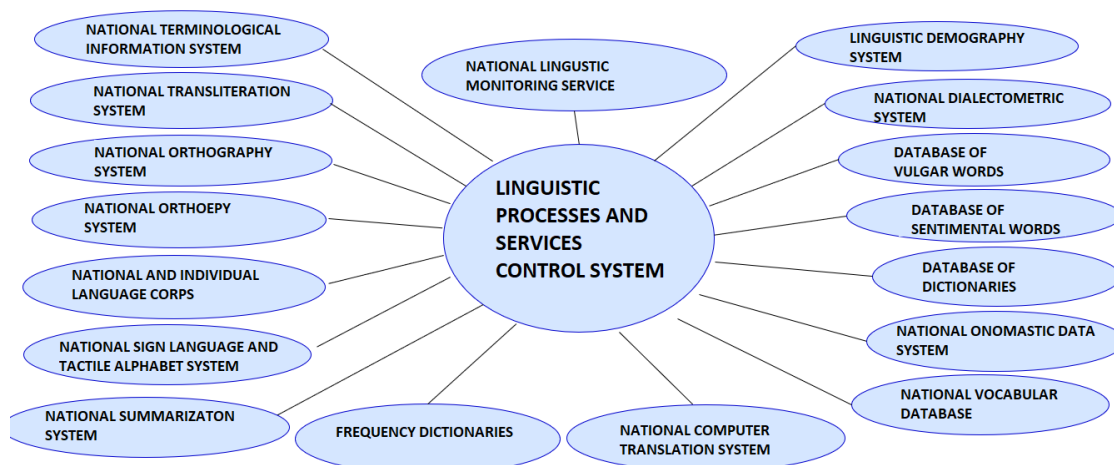


Figure 2 shows the conceptual model of the ecosystem of Azerbaijani language for e-government platform. Evidently, establishment of the ecosystem of Azerbaijani language in online environment is essential for formation of e-government concept.

Considering international experience, language ecosystems must have an open architecture and must be constantly improved and developed in accordance with technological challenges. Also, while carrying out these works, along with the Azerbaijani language, requirements of the languages of other ethnic minorities must be taken into account, and appropriate online language ecosystems must be created for them within the framework of the state's multicultural policy.

Considering above mentioned, we propose to solve the following issues for the formation of Azerbaijani language ecosystem in e-government environment:

- Integrating e-services into a single space and formation of e-Azerbaijan environment;
- Standardization of e-services and support of multilingualism, ensuring that the services provided are available to all citizens regardless of their nationality, language of communication, place of residence, etc.;
- Development of mechanisms for availability of e-services for all categories of population considering language diversity;
- Creation of a virtual language education platform;
- Creation of a national search system;
- Development of linguistic technologies and apps (speech recognition, machine translation and localization, context mining, language sanitization);
- Development of national transliteration systems;
- Taking actions for development of language industry;
- Development of national antiplagiarism system;
- Development of national antivirus service;
- Mobile applications for language preservation;
- Creating digital archives;
- Development of a dialectological base and formation of language culture in the online environment etc.

A step-by-step approach is very important to ensure the integration of various systems and services into a single platform. We propose realization stages of integration of various systems and services to e-government as shown in Table 2.

It is clear that to create various systems and modules, it is first necessary to develop the electronic infrastructure. This may vary depending on the e-government strategy implemented in the country. Currently, the development of e-government in case of Azerbaijan is realized on the

Figure 2.

Conceptual model of the ecosystem of Azerbaijani language in e-government

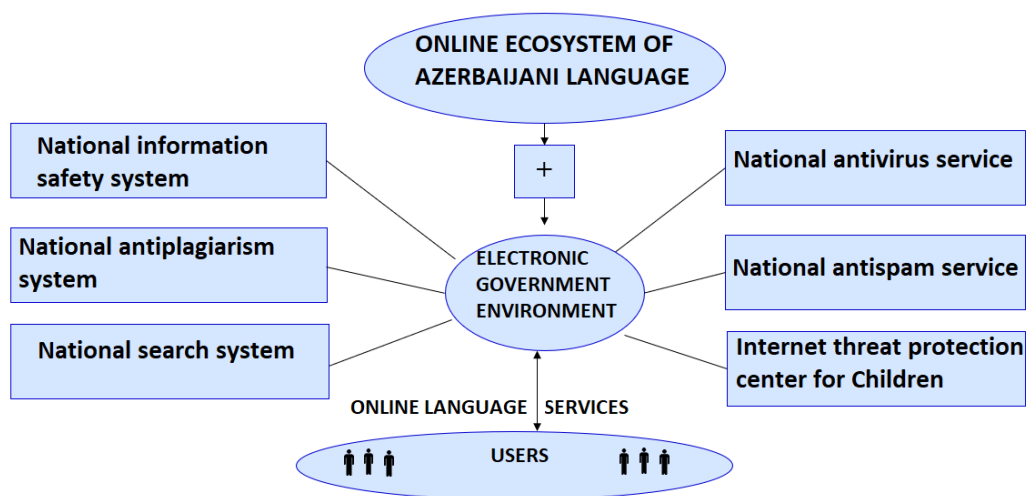


Table 2.

Realization stages of integration of various systems to e-government

Stages	Tasks / Actions
1.	Development of e-infrastructures, such as different modules and linguistics services
2.	Development of linguistics processes and service control system
3.	Standardization of data collecting and transfer
4.	Enhance networking and connectivity
5.	Establish an interoperability framework
6.	Identify integration platforms
7.	Government legislation for electronic data processing
8.	Establish a verification mechanism and synchronization
9.	Online Services and high-level integration
10.	Delivery of e-government services

basis of the integration of the solutions offered by the government institutions and the integration of various services into a single platform. In this stage, the main difficulties are the use of different software and platforms when developing various systems. In particular, these shortcomings are more clearly visible in the services provided to citizens. Various tools, such as personal identification numbers (PIN), can be used to implement systems integration. Currently, the services provided by individual government agencies are integrated into the e-government platform using PIN. It is clear that a control system must be created to implement the development and integration of linguistic services. This system controls the processes of creating infrastructure, services, and development of various tools and mechanisms. In the process of creating various databases and systems, standards for data collection, processing and transmission must be defined. Network infrastructure must be

expanded and mutual exchange channels developed to ensure integration into a single platform. An interface must be created to integrate the defined systems into a single platform. One of the most important issues at this stage is the formation of a certain legal framework for the processing of electronic resources and the determination of authority. For this stage, the issues of information security, cyber security, personal data protection, and data confidentiality must be taken into account. Synchronization, constant updating and validation mechanisms must be developed for data transfer and integration. After defining the synchronization mechanisms, services can be integrated.

The proposed methodology emphasized streamlining e-government services for their sustainability. Optimized services were defined as complete and integrated services, where users could acquire specific government services. This would require the integration of various e-infrastructures into the e-government system. Integration is to be done along with the establishment of e-infrastructure in order to save government resources, and to avoid other risks. Without integration, governments could end up with several individual fragmented applications and databases. Integration would interconnect systems and modules that shared similar interests in order to enhance service delivery. Therefore, we emphasized the integration of various modules, systems, and applications in the stage of establishing the ecosystem of the Azerbaijani language in e-government.

Creation of Azerbaijani language ecosystem in e-government environment offers new tools and opportunities for language protection. The application of linguistic technologies for the protection of the Azerbaijani language on digital platforms will enable the development of effective solution for conducting assessments at geo-linguistic, interlinguistic and intra-linguistic levels. The technology created through various digital tools, platforms and collaborative efforts will enable the formation of a language ecosystem for the preservation of endangered languages, linguistic diversity, and passage to new generations.

6. Conclusion and future work.

The emergence of dominant global languages, urbanization problems, and changes in the demographic situation against the background of crises, pandemics, and wars create a danger of losing knowledge based on age-old traditions within very sensitive language ecosystems. However, despite these difficulties, the possibilities of modern technology and linguistic tools promise hope for the preservation of linguistic diversity and local languages. In this research paper we explore the role of technology in preserving endangered languages and highlight the importance of creating a language ecosystem to preserve linguistic diversity. Preservation of endangered languages in the digital age requires innovative solutions.

The article examines the conceptual basis of Azerbaijani language ecosystem formation on online platform. Conceptual bases for forming a single ecosystem are studied in order to integrate national languages into e-government and to ensure the natural development of this platform on all segments. Formation of such ecosystem will create conditions for collection, analysis, evaluation and purposeful use of information on various functional modules of the language on e-government platform.

Currently, the biggest obstacle to the creation of the Azerbaijani language ecosystem is the lack of a national language corpus. National language corpora are created by linguists and other field experts for the purpose of scientific research and optimization of the language teaching process. Many systems (as shown in Table 1) cannot be created without a national language corpus. National language corpus is an information search system aimed at collecting texts in digital form in any specific language. The corpus contains all styles, genres, stages of development, features, phonetics, grammar, phraseology, dictionaries and other elements of the language. Texts intended for the national corpus cannot be entered into the system directly, but after a certain processing process (linguistic processing, marking, etc.). The national corpus of the language consists of a number of sub-corpora - the main corpus (written texts), dialect texts, poetic texts, language teaching, lexicography, oral speech, multimedia, etc. can be arranged. The national corpus is an open system and its structure and functions can be changed at any time if necessary. Taking into account the current experience, it is necessary to create a national language corpus and make it an integral part of the e-government. The technical integration of the language at various levels in the e-government will create ample opportunities for the formation and development of the national language corpus.

Protecting and developing local languages can only be achieved through the transformation of language services into a significant component of e-government. By providing various e-services with the use of linguistic technologies and continuously improving these systems, monitoring and analyzing the processes taking place in the language, determining trends, and making decisions, it is possible to prepare proposals for relevant government institutions. In the future research work, we will consider the issues of integration of the proposed conceptual model into the existing e-government system. Development of models and algorithms for the creation of all modules and integration into a single platform for the formation of the Azerbaijani language ecosystem will be considered.

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