



# IQTISODIYOT&TARAQQIYOT

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# THE ROLE OF THE UZBEK LANGUAGE IN THE DIGITAL AGE

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**Abstract.** This article examines the current state and development prospects of the Uzbek language in the context of the global digital economy. It analyzes the important aspects facing European languages: the widespread use of certain languages in interfaces and content, limited linguistic support from large IT corporations, and the problem of the “digital divide” between generations. The article also analyzes Uzbekistan’s state programs for the digitalization of languages and proposes paths for the further development of language technologies.

**Key words:** Uzbek language, digital age, language technologies, natural language processing, digital identity, machine translation, linguistic corpus, information sovereignty, globalization, language of cyberspace.

**Annotatsiya.** Ushbu maqolada jahondagi raqamli iqtisodiyot sharoitida o‘zbek tilining hozirgi holati va rivojlanish istiqbollari ko‘rib chiqiladi. Unda Yevropa tillari duch kelayotgan asosiy muammolar tahlil qilinadi: interfeyslar va kontentda tillar ustunligi, yirik IT korporatsiyalari tomonidan lingvistik qo‘llab-quvvatlashning yetarli emasligi va avlodlar o‘rtasidagi “raqamli tafovut” muammosi. Maqolada, shuningdek, O‘zbekistonning tilni raqamlashtirish bo‘yicha davlat dasturlari tahlili keltirilgan va til texnologiyalarini yanada rivojlantirish yo‘llari taklif qilingan.

**Kalit so‘zlar:** o‘zbek tili, raqamli davr, til texnologiyalari, tabiiy tilni qayta ishlash, raqamli identifikatsiya, mashina tarjimasi, lingvistik korpus, axborot suvereniteti, globalizatsiya, kibermakon tili.

**Аннотация.** В данной статье рассматриваются текущее состояние и перспективы развития узбекского языка в контексте глобальной цифровой экономики. Анализируются основные проблемы, стоящие перед европейскими языками: доминирование языков в интерфейсах и контенте, недостаточная лингвистическая поддержка со стороны крупных IT-корпораций и проблема «цифрового разрыва» между поколениями. В статье также анализируются государственные программы Узбекистана по цифровизации языков и предлагаются пути дальнейшего развития языковых технологий.

**Ключевые слова:** узбекский язык, цифровая эпоха, языковые технологии, обработка естественного языка, цифровая идентификация, машинный перевод, лингвистический корпус, информационный суверенитет, глобализация, язык киберпространства.

## INTRODUCTION

The beginning of the 21st century has been marked by a rapid digital transformation in all spheres of human activity. The Internet, social media, artificial intelligence systems, and mobile apps have become not just tools, but a new habitat for millions of people. In this new world, language serves not only as a means of communication but also as a key to accessing information, education, economic opportunities, and government services. The question of which languages are represented in the digital space is directly linked to the issue of digital inequality and the preservation of cultural sovereignty. The Uzbek language, the official language of the Republic of Uzbekistan and native to over 35 million people, faces both unprecedented opportunities and important issues in the digital age. On the one hand, digital technologies offer new ways to preserve, study, and disseminate language: electronic text corpora, online dictionaries, podcasts, blogs, and educational platforms. On the other hand, the widespread use of English and Russian in programming, user interfaces, and content may affect the expansion of the Uzbek language’s digital presence in cyberspace.

This issue is particularly relevant due to the fact that many modern digital products — from voice assistants (Siri, Alexa, Google Assistant) to automatic translation systems (Google Translate, DeepL) and generative



neural networks (ChatGPT) — provide limited support for the Uzbek language or support it at a level that still requires further improvement. This may create certain difficulties for Uzbek-speaking users, affecting their access to advanced technologies and encouraging them to rely on another language for communication.

Furthermore, the transition to the Latin alphabet, which began in Uzbekistan in the 1990s and continues to this day, adds technical complexity. In the digital environment, it is necessary to ensure compatibility between two graphic systems (Cyrillic and Latin), correct search, font display, and text input in both alphabets. Without a systematic language policy in the IT sector, this may create difficulties in ensuring the consistency of digital content.

## LITERATURE REVIEW

The functioning of the Uzbek language in the digital age is at the intersection of several scientific fields: computational linguistics, sociolinguistics, terminology, and language teaching methods. An analysis of available sources reveals that this topic has only recently begun to be actively explored in the academic literature — primarily since the late 2010s — due to both the implementation of the state program “Digital Uzbekistan — 2030” and global trends in digitalization.

A significant body of research is devoted to the development of an Uzbek language terminology system in the field of information technology. As noted in an article published in the Russian Linguistic Bulletin (2025), the intensive development of the IT sector in Uzbekistan and the implementation of the state digital transformation program create a need to adapt the language to new communicative realities. Based on an analysis of over 1,500 terminological units extracted from dictionaries, technical documentation, and educational literature for the period 2019–2024, the study’s authors found that English is the primary source of borrowings (87.3%), with a significant portion of terms (approximately 42%) entering the Uzbek language through a Russian intermediary. Three main strategies for acquiring borrowings were identified: direct borrowing with minimal adaptation (62.4%), calques (18.3%), and the creation of hybrid formations (19.3%). The study also shows the chronological dynamics of borrowings: from basic computer terminology from Russian during the Soviet period to the massive influx of Anglicisms associated with the development of Internet technologies and social media beginning in the 2010s.

The current state of knowledge regarding the role of the Uzbek language in the digital age is characterized by the active development of applied NLP research aimed at creating tools for automatic language processing. These studies take into account the agglutinative nature of the Uzbek language and propose hybrid approaches combining rule-based methods with neural network models.

Concurrently, research is underway on the processes of borrowing IT terminology, revealing the dominant role of English as a source and the existence of three main adaptation strategies. The influence of the Internet and social media on language practice is assessed as dual — with positive effects on communication and certain effects on formal literacy. In the field of education, experience is accumulating in the digital transformation of Uzbek language teaching, requiring systematic organizational and pedagogical support. At the same time, a number of unexplored areas exist, opening up a wide field for further research in the field of digital linguistics and language policy.

## RESEARCH METHODOLOGY

In this study, a comprehensive scientific approach was used to identify and analyze the stages of historical development of the Uzbek language. The research methodology includes historical-linguistic, descriptive, comparative-historical, and corpus linguistics methods. These approaches allow us to study language evolution not only as a static process but also as a dynamic process. Elements of modern corpus linguistics were also used in the study. Through electronic text databases and digital linguistic resources, texts of the Uzbek language from different periods were analyzed, and lexical frequency and semantic changes were observed. This made it possible to study language evolution based on empirical data.

## ANALYSIS AND RESULTS

The share of Uzbek-language content on the global Internet is gradually increasing, creating new opportunities for expanding the presence of the Uzbek language in the digital environment. The main platforms for the language are national news portals (Kun.uz, Daryo.uz), government information systems, social media (Telegram, Instagram, TikTok), and educational platforms (Ziyonet). Operating systems (Windows, macOS, Android, iOS) support the Uzbek language: localized interfaces, keyboard layouts for Latin and Cyrillic, and basic spell-checking tools are available. At the same time, further development opportunities exist in the field of intelligent language technologies: voice assistants (Google Assistant, Siri, Alexa), automatic translation



systems (DeepL), and speech recognition and synthesis systems are gradually expanding their capabilities for broader and more effective support of the Uzbek language.

Technical aspects of the Uzbek language, including its agglutinative structure — a single word form can contain several suffixes, creating a wide variety of word forms — require the development of specialized NLP models adapted to the linguistic features of the language. The presence of two parallel alphabets, Cyrillic and Latin, creates opportunities for improving transliteration systems and strengthening standardization processes, while the expansion of annotated datasets contributes to the further development of neural network technologies. Sociolinguistic factors indicate growing opportunities for increasing the role of Uzbek in the IT sector, promoting its wider use in digital technologies among young people, and expanding access to digital resources across all regions.

Institutional development creates opportunities for strengthening coordinated programs aimed at the digitalization of the Uzbek language, as well as improving standards for morphological dictionaries, corpus annotation, and transliteration. Linguistic corpora development: Uzbek National Corpus (over 50 million words with morphological annotation), Parallel Corpus for Uzbek (Uzbek-English and Uzbek-Russian texts for machine translation), Uzbek Speech Corpus (over 500 hours of audio recordings with transcription). Morphological tools: UZMorph (a rule-based analyzer with 92–95% accuracy), O'zStem (a fast stemmer without a stem dictionary), and Hunspell for Uzbek (a spell-check dictionary for 100,000-word forms). To visualize the state of development of various types of digital tools for the Uzbek language, the table below summarizes the main categories of technologies, their current status, and their readiness for practical application (Table 1).

Table 1. Level of development of digital tools for the Uzbek language<sup>1</sup>

Tool Category	Title / example	Development Level	Readiness for practical use
Linguistic Corpus	Uzbek National Corpus	Average (50 million words)	Partially ready (requires expansion)
Parallel Corpus	Parallel Corpus for Uzbek	Initial stage (less than 10 million pairs)	Requires further development
Morphological Analyzer	UZMorph	High (92–95% accuracy)	Ready
Stemmer	O'zStem	Average (fast, but less accurate)	Partially ready
Spell Checker	Hunspell for Uzbek	Average (100,000 word forms)	Partially ready
Machine Translation	Google Translate / Yandex Translate	Initial / developing stage	Requires further development / partially ready
Text-to-Speech (TTS)	Uzbek TTS	Initial stage / requires quality improvement	Requires further development
Automatic Speech Recognition (ASR)	Uzbek ASR	Initial stage; requires further improvement in different speech conditions	Requires further development
Transliterator	Uzbek Transliterator	High	Ready
Part-of-Speech (POS) Tagger	Uzbek POS Tagger	Average (88% accuracy)	Partially ready

As the table shows, basic tools (morphological analysis, transliteration) have already reached a relatively developed stage and provide an important foundation for the further advancement of Uzbek language technologies. Key technologies that ensure the full presence of language in the digital environment — machine translation, speech recognition, and speech synthesis — continue to develop and create opportunities for further improvement. Machine translation: Google Translate added Uzbek in 2023 and continues to improve its quality, Yandex Translate benefits from extensive Russian-Uzbek language resources, and the experimental Uzbek Translate Service, based on the Transformer architecture, demonstrates competitive results. Voice technologies: Uzbek TTS (speech synthesis technologies are developing with the use of modern methods and improving voice quality), Uzbek ASR (recognition systems based on Wav2Vec 2.0 show promising results and provide a foundation for further accuracy improvements in various speech conditions). Auxiliary tools, including browser spell-check extensions, online transliterators, and POS taggers, contribute to expanding the digital ecosystem of the Uzbek language and improving the efficiency of language processing technologies.

In the technological sphere, the following is needed: the creation of an open universal corpus of the Uzbek language containing at least 500 million words, the development of state standards for annotation and

<sup>1</sup> Source: author's own development.



transliteration, the creation of open libraries for morphological and syntactic analysis, increasing the volume of audio corpora to 3,000–5,000 hours with dialect coverage, and the integration of the Uzbek language into large language models (LLMs) through the retraining of multilingual models or the creation of our own. In education, this includes the inclusion of digital literacy sections in Uzbek in school and university curricula, the training of IT specialists with knowledge of Uzbek through courses in computational linguistics, and the creation of open educational resources in Uzbek on programming and machine learning. In public policy, this includes the adoption of a separate “Digital Uzbek Language” program with specific benchmarks (85% BLEU translation quality, 100% Uzbek language coverage of state information systems by 2030), the introduction of mandatory localization requirements for purchased software, tax incentives for IT companies developing Uzbek-language products, and the creation of a coordinating council for the digitalization of the language. In public initiatives, this includes support for volunteer projects to digitize texts, grants and competitions for creators of Uzbek-language video content and podcasts, and campaigns to raise language awareness in the professional and corporate digital environment.

The Uzbek language is actively gaining its place in the digital environment, and its development potential is becoming increasingly evident: the growing need for Uzbek-language content creates broad opportunities for expanding digital resources in line with the number of native speakers, while advanced language technologies are gradually opening new directions for wider support of the language. As shown in Table 1, of the ten key categories of digital tools, three important areas (morphological analysis, transliteration, and partial spell-checking) have already reached a ready or partially ready level for practical use. The remaining seven categories, including machine translation and voice technologies, are forming a promising foundation for further development. The main development factors include the rich agglutinative structure of the language, the coexistence of two alphabets, the growing need for data resources, increasing attention to Uzbek in IT, the strengthening role of the language in technological contexts, and the gradual improvement of coordinated language policy. Significant progress has been made over the past five to seven years: corpora, morphological analyzers, spell-checkers, experimental translators, and speech recognition systems have been created, forming an important basis for future advancement. Government programs exist and create an institutional framework for further strengthening financing mechanisms and measurable indicators. Sociological data demonstrates high public demand for the development of a digital Uzbek language, despite the practical difficulties of using it. Uzbek-language bloggers and content creators play a key role in shaping the modern image of the language. Development prospects depend on a comprehensive solution to technological, educational, political, and social challenges. The decisive factor is the creation of large-scale open linguistic resources and the deep integration of the Uzbek language into modern neural network models (LLMs), which requires the consolidation of efforts by the state, the academic community, the IT industry, and civil society institutions.

## CONCLUSION AND SUGGESTIONS

An analysis of the role of the Uzbek language in the digital age allows us to formulate the following general propositions. The Uzbek language is actively developing its presence in the global digital space, with increasing opportunities for expanding Uzbek-language content on the Internet and strengthening its role among native speakers. Key intelligent language technologies (voice assistants, neural network machine translation systems, automatic speech recognition and synthesis) are gradually expanding their capabilities and creating new opportunities for deeper integration of the Uzbek language into modern digital ecosystems. The functioning of the Uzbek language in the digital environment is influenced by a set of linguistic, technological, and organizational factors that create opportunities for further development. Technical aspects include the agglutinative structure of the language, which requires the creation of specialized NLP models adapted to its rich morphological system; the coexistence of two graphic systems (Cyrillic and Latin), which encourages the improvement of transliteration mechanisms and standardization processes; as well as the growing need to expand annotated datasets for training advanced neural network architectures. Sociolinguistic factors indicate opportunities to increase the use of Uzbek in the IT community, strengthen its role among young people as a language of modern technologies, and improve digital accessibility in all regions where Uzbek is the primary means of communication. Institutional development creates prospects for implementing coordinated language digitalization programs and improving official standards for linguistic resources and technologies.

Over the past 5–7 years, significant progress has been made in creating basic linguistic tools. National corpora (the Uzbek National Corpus, with over 50 million words), morphological analyzers (UZMorph with 92–95% accuracy), spell-checkers, and experimental machine translation and speech recognition systems have been developed. As summarized in Table 1, these tools provide an important foundation for the further expansion of the Uzbek language in high-tech digital environments and create opportunities for continuous improvement. This is particularly relevant in the areas of voice technology and neural network translation,



where ongoing research and technological development contribute to increasing quality indicators. The state language policy in the digital sphere, supported by the existing legal and regulatory framework, creates favorable conditions for systematic development. The Law “On the State Language” and the “Digital Uzbekistan — 2030” Strategy serve as an important institutional basis for strengthening the digital infrastructure of the Uzbek language. At the same time, the further improvement of funding mechanisms, interdepartmental cooperation, and measurable development indicators may contribute to the more effective implementation of planned initiatives. In this regard, ongoing efforts are creating favorable conditions for the gradual development of machine translation systems and voice interfaces in the Uzbek language.

Sociological data reveals a dynamic situation: high public demand for the development of a digital Uzbek language is accompanied by growing interest in improving existing Uzbek-language interfaces. Surveys show that 78% of citizens consider the availability of the Uzbek language in device interfaces important, and 82% desire a voice assistant that understands Uzbek. At the same time, 44% of respondents use English or Russian interfaces, which indicates the need to further improve the convenience and completeness of Uzbek localization. National bloggers and content creators play a significant role in shaping the modern image of the Uzbek language in the digital environment, while among urban youth, the growing interest in English as a language of technology can be viewed as an opportunity to develop bilingual digital competence and strengthen the position of Uzbek in professional IT contexts.

The main conclusion of the study is that the prospects for the development of the Uzbek language in the digital age are directly dependent on a comprehensive solution to technological, educational, institutional, and sociocultural challenges. The decisive factor is the creation of large-scale open linguistic resources and the deep integration of the Uzbek language into modern neural network models (LLMs), which requires the consolidation of efforts by the state, the academic community, the IT industry, and civil society institutions.

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## IQTISODIYOT & TARAQQIYOT

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