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A Methodological Model For Integrating Professional English Within A Dual Higher Education Framework

Shakhida Yusupova

docent, Bukhara State Technical University

Abstract

The article deals with the optimization of vocational language training for engineering and technical students within a dual education system. The author analyzes the structural challenges of aligning English for Specific Purposes (ESP) with hands-on enterprise training. To bridge the gap between academic theory and corporate application, a hybrid pedagogical model based on Content and Language Integrated Learning (CLIL) and the Bloom-Anderson taxonomy is proposed. The study demonstrates that the immediate pragmatic application of technical vocabulary within real-world corporate workflows significantly reduces the linguistic "forgetting curve" and enhances the international employability of graduates.

Keywords: Dual education, Professional English, ESP, CLIL methodology, Bloom's Taxonomy, communicative competence, work-integrated learning.

The contemporary globalized labor market demands that higher education graduates possess immediate operational readiness alongside fundamental theoretical knowledge. Within engineering and high-tech industries, proficiency in English for Specific Purposes (ESP) has transitioned from a supplementary skill to a critical tool for technology transfer, safety compliance, and cross-border corporate collaboration.

However, traditional academic models often isolate language acquisition from the professional environment, leading to a disconnect between classroom vocabulary and active workplace workflows. The dual education system - which splits student time between university lectures (theory) and partner enterprises (practice)—offers an ideal environment to remedy this. Yet, a systematic methodological framework for integrating professional language training into dual structures remains underdeveloped.

The objective of this article is to conceptualize and evaluate an integrated pedagogical model that transforms Professional English into an active tool for workplace problem-solving.

The research design synthesizes three distinct educational frameworks to structure language acquisition within a dual tract:

- **Dual Education Principles:** Structuring learning cycles around synchronized university and enterprise schedules.
- **CLIL Technology:** Using professional engineering and technical content as the vehicle for language production.
- **Bloom-Anderson Taxonomy:** Structuring language tasks sequentially, guiding students from lower-order thinking skills (memorizing technical terms) to higher-order production (authoring engineering reports).

Learning Environment	Primary Pedagogical Focus	Key Tools & Methods
University (Academic Track)	Cognitive processing, technical syntax, terminology acquisition	Case studies, reading technical manuals, glossaries, simulated presentations
Enterprise (Practical Track)	Pragmatic application, functional communication, reporting	Cross-functional team interaction, navigating software UI, workflow logs

The implementation of this integrated approach yields a three-dimensional model “The Smart-Dual English (S-DE) Model”, that restructures how professional language is consumed and evaluated.

Language modules at the university are directly mapped to the student’s concurrent rotation schedule at the enterprise. When a student is assigned to automated quality control on the factory floor, the corresponding university English module shifts away from general business grammar to focus exclusively on the specific nomenclature, diagnostic logs, and troubleshooting manuals of those automated systems.

To ensure cognitive processing deepens alongside technical familiarity, assignments are engineered using progressive cognitive tiers:



Linguistic evaluation is shifted out of the isolated classroom. Under this framework, oral and written deliverables are co-evaluated using a dual matrix: the university language instructor assesses formal linguistic precision, while the enterprise technical mentor measures functional efficacy and technical alignment within actual workplace operations.

The empirical integration of the S-DE model indicates prominent advantages over isolated ESP curricula:

- **Mitigation of the Forgetting Curve:** Because students actively apply classroom vocabulary to real-world software, manuals, and client communications within 24 to 48 hours, retention rates show exponential growth compared to standard semantic memorization.
- **Reduction of the Affective Filter:** Operating within the enterprise environment shifts the student's psychological focus from linguistic perfectionism ("how can I speak without mistakes?") to functional utility ("how do I solve this technical bottleneck?"). This drastically lowers the performance anxiety typically associated with foreign language production.

However, system maintenance requires ongoing resource allocation. High teacher-to-student coaching ratios, the continuous need to update reading materials to match fast-evolving industry tech stacks, and ensuring basic English capacity among workplace mentors remain critical obstacles.

Integrating Professional English into dual higher education converts language learning from a passive academic requirement into a dynamic operational asset. By synchronizing academic

CLIL strategies with localized enterprise demands, higher education institutions can effectively graduate highly specialized professionals capable of stepping immediately into international engineering and technical roles. Future research will explore the deployment of automated, AI-driven micro-learning platforms to deliver real-time vocabulary prompts directly to students via mobile devices while on the factory floor.

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Advantages of air dust collection system

Igamberdiev Anvarjon Uktamovich

Andijan State Technical Institute (PhD)

lgamberdiev@mail.ru

Abstract

The article presents the results of the operation of a dust collection system for production facilities and an air dust collection system in industrial complexes during the production of gases and atomized or other substances.

Keywords: Dust collection system, air flow, dust filter, container, mechanisms, blower, cleaning devices, cyclone dust collection systems, dust collection device.

Introduction. Every industry has different contaminants and harmful particles that need to be removed. Dust collectors must meet the needs of each industry to ensure optimal air purification. As clean air standards become more stringent, manufacturers of dust collection systems have developed air cleaners that meet and exceed the requirements. The dust collection system cleans by passing through a series of air-tight filters. After the air is cleaned, it is vented or recirculated. Dust collection systems include air intake ducts, an air cleaner, and a dust collection container. These basic elements are configured differently for each type of system. Simply put, a dust collection system is designed to remove airborne particles generated during operation. Dust collectors must meet the specific extraction needs required by each industry to ensure optimal air purification [1,2].

Cyclone dust collection systems are a form of separator that uses centrifugal force to separate particles. The cyclone is created in a self-built chamber, where the air is cleaned by the action of the cyclone. During operation, the circulating air stream pushes heavier pollutants to the walls of the chamber. After airborne dust is collected, it collects in a collection container on the sides of the chamber. They are used by lumber shops, paper mills, and grain mills.

Methodology. The most common form of dust collection system is a bag. This is the most efficient system and uses a vacuum to pull contaminants through a bag filter. The Shaker method shakes the filter to remove accumulated dust, while the pulse jet version uses a blast of air when the sensor detects that the filter is full. The reverse air method passes fresh air through a filter. The dust on the outside of the bags is brought down to the collection hoppers by compressed air or movement. They work continuously to collect particles of all sizes. The design of the system allows easy access for maintenance [3,4,5].

Results. The main parts of a dust collection system include a blower, a dust filter, a cleaning system, a container, a channel and a particle collection device. Common types of dust collection equipment include fabric filter bags, inertial separators—sometimes called mechanical cyclones, wet scrubbers, and electrostatic precipitators. The types of pollutants emitted vary by industry. Dust collector manufacturers design equipment to meet the needs of every environmental condition. Their task should be to control, reduce and reduce pollutants, harmful substances, gas vapors and dust and meet the needs of the industry in which they are used. They are designed to clean and filter air before it can be released into the environment or workplace. Every industry has different contaminants and harmful particles that need to be removed. After the particles have passed through the system and are removed from the filter, it will fall into a collection tank. Essentially, the blower draws air from the location to a filter that removes particles from the air. The air to fabric ratio is the amount of air that passes through a square meter of the filter. The lower this ratio, the higher the efficiency of the filtration system. The blower or dust collector is an important element of the dust collection system, as it is the mechanism that draws the polluted air from the workplace into the duct and sends it to the filtration and cleaning systems [6,7].

Discussions. With the increasing number of regulations and standards for air pollutants, dust collection systems are becoming a necessity, but they were once considered an afterthought. Besides the various regulations, there are practical reasons for installing a dust collection system. The first consideration is to protect the health of workers who are forced to work in gas-filled and dust-saturated environments. There are some factors to consider when deciding to install a dust collection system. Although less expensive systems may be attractive for financial reasons, the most important factor is the air quality in the workplace and the area around the facility [8].

One of the main areas of concern for the Centers for Disease Control is workplace safety for workers. As for dust and pollutants, they have special requirements for the permissible percentage of particles in the air. Violation of these standards may result in facility closure, requiring the installation of an acceptable dust collection system.

One of the major areas of concern for the Occupational Safety and Health Administration, the National Institute for Occupational Safety and Health, and the Centers for Disease Control is workplace safety for workers. As for dust and pollutants, they have special requirements regarding the allowable percentage of particles per cubic foot of air. Violation of these standards may result in the closure of the facility, which requires the installation of an acceptable dust collection system.

Dust collector PP-750/U is designed to remove abrasive dust and chips from the cutting zone of machines. It ensures compliance with labor protection standards, and also makes it convenient for the worker. As a standard, it is provided with connection elements for grinding machines (corrugations, adapters) shown in Fig.1.

It has a reusable dust bag that needs to be shaken from time to time during use. It has a power of 0.75 kW and is equipped with an electric vacuum cleaner. In addition, the advantages include compact size, so you don't need such a dust collector. PP-750/U, already installed without rearrangement, is designed for intensive operation [9].



Figure 1. Dust collection device PP-750/U.

Conclusion. Due to the increasing concern for the environment, dust collection systems have become necessary for industries that produce large amounts of dust particles and ambient gases. includes hazardous materials removal equipment. Every industry has a variety of pollutants and harmful particles that need to be removed. With increasing concern for the environment, dust collection systems are becoming essential to many industrial and manufacturing operations.

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Theoretical Foundations And Modern Directions Of The Study Of The Category Of Modality

Khayrulloeva Gulasal Fayzullo qizi

Bukhara State University basic doctoral student

E-mail: gulasalkhayrulloeva@gmail.com

Corporate e-mail: g.f.khayrulloeva@buxdu.uz

ORCID ID: <https://orcid.org/0000-0001-9891-967X>

Annotation

This article analyzes the history of the formation of the concept of modality, its philosophical and logical foundations, and its interpretations in modern linguistics. The semantic, pragmatic, communicative, and cognitive properties of the category of modality are highlighted, and the state of its research in Uzbek linguistics is also considered. Some comments are also made on the role of modality in computer linguistics and artificial intelligence technologies.

Keywords: modality, modal meaning, semantics, pragmatics, epistemic modality, deontic modality, dynamic modality, evidentiality, cognitive linguistics.

Annotatsiya

Ushbu maqolada modallik tushunchasining shakllanish tarixi, uning falsafiy-mantiqiy asoslari hamda zamonaviy tilshunoslikdagi talqinlari tahlil qilinadi. Modallik kategoriyasining semantik, pragmatik, kommunikativ va kognitiv xususiyatlari yoritilib, uning o'zbek tilshunosligidagi tadqiq etilish holati ham ko'rib chiqiladi. Shuningdek, modallikning kompyuter lingvistikasi va sun'iy intellekt texnologiyalaridagi o'rni yuzasidan ayrim mulohazalar bildiriladi.

Kalit so'zlar: modallik, modal ma'no, semantika, pragmatika, epistemik modallik, deontik modallik, dinamik modallik, evidensiallik, kognitiv tilshunoslik.

Har qanday tilning asosiy vazifalaridan biri voqelikni aks ettirish bilangina cheklanmay, balki so'zlovchining mazkur voqelikka bo'lgan munosabatini ham ifodalashdan iborat. Til vositasida berilayotgan axborotning ishonchlilik darajasi, ehtimolligi, zarurligi, majburiyligi, istak yoki imkoniyat sifatida baholanishi modallik kategoriyasi orqali namoyon bo'ladi. Shu jihatdan modallik til tizimining eng universal va murakkab kategoriyalaridan biri hisoblanadi. Tilshunoslik tarixida modallikka berilgan ta'riflarning xilma-xilligi uning ko'p qatlamli mohiyatidan dalolat beradi. Ayrim tadqiqotchilar modallikni grammatik kategoriya deb hisoblasalar, boshqalari uni semantik-pragmatik yoki kommunikativ hodisa sifatida talqin qiladilar. Zamonaviy tadqiqotlarda esa modallik ko'proq antropotsentrik paradigma doirasida, ya'ni inson tafakkuri, nutq faoliyati va kommunikativ maqsad bilan uzviy bog'liq holda o'rganilmoqda.

Modallik tushunchasining tarixiy shakllanishi. Modallik haqidagi dastlabki ilmiy qarashlar qadimgi yunon falsafasi va mantiq ilmi bilan bog'liq. Aristotel "Organon" asarlarida zaruriyat (necessity), imkoniyat (possibility), voqelik (actuality) kabi tushunchalarni hukmlar tizimida izohlab bergan. Keyinchalik stoik faylasuflar ushbu nazariyani rivojlantirib, modal hukmlarning mantiqiy tuzilishini ishlab chiqdilar.

O'rta asrlarda modallik diniy-falsafiy tafakkur bilan bog'liq holda o'rganildi. Faqat XIX asr oxiri va XX asr boshlarida tilshunoslikning mustaqil tadqiqot obyekti sifatida shakllana boshladi. Ayniqsa, struktur tilshunoslik vakillari modallikni gapning grammatik kategoriyasi sifatida tavsiflashga harakat qildilar.

Fransuz tilshunosi **Sharl Balli** modallikni so'zlovchining fikrga bo'lgan subyektiv munosabati sifatida izohlab, uni tilning emotsional-ekspressiv xususiyatlari bilan bog'laydi. Uning fikricha, har qanday gap diktum va modus qismlaridan tashkil topadi. Diktum voqelikni ifodalasa, modus aynan so'zlovchining bahosi va munosabatini aks ettiradi.

Rus tilshunosligida **V.V. Vinogradov** modallikni gapning eng muhim grammatik-semantik belgilaridan biri deb hisoblaydi. U modallikni obyektiv va subyektiv turlarga ajratib, obyektiv modallikni predikativlikning ajralmas belgisi sifatida ko'rsatadi.

Zamonaviy lingvistik yondashuvlar. XX asrning ikkinchi yarmidan boshlab modallik masalasi funksional grammatika, pragmatika va kognitiv tilshunoslik doirasida keng o'rganila boshladi. Bu davrda modallikning faqat grammatik emas, balki semantik va kommunikativ mohiyatiga alohida e'tibor qaratildi.

F.R. Palmer modallikni ikki asosiy turga ajratadi:

- epistemik modallik;
- deontik modallik.

Keyinchalik J. Bybee, J. Narrog, A. Kratzer kabi olimlar dinamik modallik, evidensiallik va volitiv modallikni ham mustaqil semantik maydon sifatida tavsifladilar.

Epistemik modallik

Epistemik modallik axborotning ishonchlilik darajasini bildiradi.

Masalan: U bugun kelgan bo'lsa kerak.

Bu yerda so'zlovchi fakti emas, balki taxminni ifodalamoqda.

Deontik modallik

Majburiyat, ruxsat va taqiqlarni bildiradi.

Masalan: Talaba topshiriqni o'z vaqtida topshirishi kerak.

Dinamik modallik

Subyektning ichki imkoniyati yoki qobiliyatini ifodalaydi.

Masalan: U besh tilda bimalol gaplasha oladi.

Evidensial modallik

Axborotning manbasini ko'rsatadi.

Masalan: Eshitishimcha, konferensiya sentabr oyida bo'lar ekan.

Modallikning pragmatik mohiyati

Bugungi kunda modallik pragmatikaning asosiy kategoriyalaridan biri sifatida qaralmoqda. Chunki modal ma'no nutq vaziyati, kommunikativ maqsad va adresat omili bilan chambarchas bog'liq.

Masalan, Siz derazani yopsangiz bo'ladimi?

Grammatik jihatdan bu so'roq gap bo'lsa-da, pragmatik nuqtayi nazardan iltimos ma'nosini anglatadi.

Shuning uchun modallikni faqat grammatik vositalar orqali emas, balki nutq aktlari nazariyasi asosida ham o'rganish muhimdir.

Kognitiv va kompyuter lingvistikasidagi modallik

So'nggi yillarda modallik sun'iy intellekt, tabiiy tilni qayta ishlash (NLP), semantik tarmoqlar va ontologiyalarni yaratishda muhim lingvistik parametr sifatida qaralmoqda.

Masalan, ChatGPT, Gemini yoki boshqa yirik til modellari matndagi:

- ishonch,
- gumon,
- ehtimollik,
- buyruq,
- tavsiya,
- taqiq

kabi modal ma'nolarni avtomatik aniqlashga harakat qiladi. Shu sababli modallik kompyuter lingvistikasida ham istiqbolli tadqiqot yo'nalishlaridan biri sanaladi. O'zbek tilida modal birliklarni avtomatik aniqlash, ularni semantik jihatdan tasniflash hamda korpus lingvistikasi asosida tahlil qilish bugungi kunning dolzarb ilmiy vazifalaridan biridir.

Tahlillar shuni ko'rsatadiki, modallik kategoriyasi tarixiy taraqqiyot davomida mantiqiy tushunchadan tilshunoslikning mustaqil ilmiy kategoriyasiga aylandi. Zamonaviy tadqiqotlar modallikni semantik, pragmatik, kommunikativ va kognitiv birlik sifatida talqin qilmoqda. O'zbek

tilshunosligida ham ushbu yo'nalish bo'yicha izlanishlar jadallashib borayotgan bo'lsa-da, modal ma'nolarning diskursiv va kompyuter lingvistikasi nuqtayi nazaridan tadqiq etilishi hali yetarli darajada amalga oshirilmagan. Mazkur yo'nalishdagi izlanishlar o'zbek tilining raqamli resurslarini yaratish hamda sun'iy intellekt tizimlarini takomillashtirish uchun muhim nazariy asos bo'lib xizmat qiladi.

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International School Founding Readiness Lab: A Stakeholder, Market, Curriculum, and Implementation Feasibility Study for Uzbekistan

Ibragimova Dilrabo

MAAB innovation

dilrabo.umbekgizi.ibragimova@gmail.com

Abstract

The proposed model positions the school as an English-medium, internationally oriented, locally embedded institution combining internationally benchmarked academic standards with Uzbek cultural and educational priorities. Three curriculum pathways are considered: International Baccalaureate, Cambridge International, and a hybrid international-national model. The analysis suggests that market viability depends primarily on differentiated educational value, teacher quality, affordability, university pathways, parental trust, and demonstrable student outcomes. The study concludes that a staged readiness process should precede major capital investment and that parental school choice should be incorporated as a central research and market-intelligence component.

Keywords: international schools; Uzbekistan; school choice; educational feasibility; curriculum; stakeholder analysis; private education

The development of international schooling in Uzbekistan should be understood within the broader transformation of the country's education system, demographic structure, labor market, and aspirations for international integration. During the past decade, Uzbekistan has expanded educational infrastructure, encouraged private-sector participation, increased attention to foreign-language competence, and pursued reforms intended to improve learning outcomes and human-capital development. Recent World Bank initiatives similarly emphasize improvements in foundational learning, teacher quality, and the capacity of the education system to respond to population growth and changing labor-market requirements. These developments create an important context for considering whether a new international school would represent a sustainable educational investment or merely another premium private-school offering. The central proposition of this feasibility study is that international-school development should begin with a structured "readiness laboratory" rather than with immediate construction. Such a laboratory would test the assumptions underlying the proposed school before substantial financial, institutional, and reputational commitments are made.

An international school in the Uzbek context should not be defined simply as a school where English is used as the language of instruction. International schooling involves a broader combination of internationally recognized curricula, multilingual and intercultural education, globally oriented university preparation, internationally benchmarked assessment, diverse pedagogical practices, and an institutional culture that prepares learners to operate across national and cultural boundaries. The International Baccalaureate (IB), for example, has established a presence in Uzbekistan since 2006, and the country currently has schools offering different IB programmes. Existing institutions demonstrate that there is already a recognizable market for internationally oriented education. Tashkent International School has operated as an IB World School since 2006 and provides English-medium education, while Oxbridge International School and Invento The Uzbek International School represent additional examples of international education providers operating in Uzbekistan. The recent authorization of an additional Oxbridge campus in Yashnobod in 2026 also indicates continuing institutional expansion within the international-school segment. Therefore, a new school would

enter an emerging but increasingly competitive market and would need a clearly differentiated value proposition.

The proposed International School Founding Readiness Lab is designed as a pre-investment research and development mechanism consisting of six interconnected analytical domains: stakeholder intelligence, market demand, educational needs, curriculum design, operational feasibility, and implementation risk. The stakeholder map places prospective students and parents at the center of the educational ecosystem while recognizing the influence of founders, investors, school leaders, teachers, government agencies, local communities, universities, employers, international curriculum organizations, education consultants, and competing schools. Parents constitute a particularly important stakeholder group because school choice is not determined exclusively by academic quality. Previous research on school choice demonstrates that families frequently evaluate schools through combinations of academic reputation, safety, location, school culture, teacher quality, peer environment, university pathways, cost, and perceived social mobility. Consequently, a feasibility study should investigate not only whether parents are interested in an international school but also which specific attributes they value sufficiently to change their current schooling arrangements.

The preliminary needs assessment suggests that a potential international school in Uzbekistan would need to respond simultaneously to local and international educational expectations. From the local perspective, families may expect strong English proficiency, mathematics and science achievement, preparation for competitive universities, discipline, parental communication, and recognizable qualifications. From the international perspective, the school would need to demonstrate student-centered learning, inquiry, critical thinking, research skills, academic integrity, intercultural competence, digital literacy, and internationally transferable credentials. The resulting educational model should therefore avoid a false opposition between “Uzbek” and “international” education. Instead, the proposed school could adopt an internationally benchmarked curriculum while maintaining systematic instruction in Uzbek language, Uzbek history, cultural heritage, and civic identity. Such localization would provide differentiation from schools that simply import an overseas curriculum without adequately adapting it to the national context.

The preliminary school concept proposed by the Readiness Lab is a K–12 day school with an English-medium academic environment, Uzbek and Russian language provision, internationally recognized qualifications, university counseling, technology-supported learning, extracurricular programmes, and structured parental engagement. The initial target market would consist of families seeking educational pathways that combine local cultural continuity with international university access. Rather than positioning the school exclusively as a luxury institution, the concept could adopt a tiered affordability model that combines standard tuition with scholarships, merit-based financial assistance, and limited need-sensitive support. Such a strategy would broaden the potential student base while also strengthening the school's social mission. The school could initially open with a smaller number of grades and expand progressively as enrollment, staffing, and financial sustainability become demonstrable.

Curriculum selection represents one of the most consequential strategic decisions. Three alternatives can be considered. The first is an IB-centered model, particularly attractive because of its established international recognition and emphasis on inquiry, conceptual understanding, intercultural awareness, and learner agency. Uzbekistan already has a growing IB ecosystem, providing evidence that the framework is institutionally viable in the country. The second alternative is Cambridge International, which may provide greater modular flexibility and strong subject-specific pathways, particularly at secondary level. The third is a hybrid model combining an internationally benchmarked curriculum with selected national requirements and locally contextualized courses. The hybrid approach may provide the greatest institutional flexibility because it could preserve international university pathways while allowing the school to respond directly to Uzbek regulatory and cultural requirements.

However, curriculum choice should ultimately follow market research, regulatory analysis, teacher availability, and university-admission requirements rather than institutional preference alone.

The project charter for the proposed school should define the founding objective as the creation of a financially sustainable, academically credible, internationally oriented school capable of producing measurable student outcomes. The project scope would include market research, stakeholder consultation, site assessment, regulatory due diligence, financial modeling, curriculum selection, governance design, staffing strategy, safeguarding systems, technology infrastructure, admissions procedures, branding, and phased school launch. Out-of-scope activities during the initial readiness stage would include irreversible construction commitments and large-scale recruitment before demand has been validated. Key success indicators should include validated parent demand, sufficient pre-enrollment interest, an achievable tuition model, recruitment of qualified school leadership, curriculum feasibility, regulatory compliance, and a realistic pathway to operational break-even. This approach is consistent with evidence that private-school expansion can generate educational opportunities but that apparent performance differences between private and public schools may partly reflect student and family selection effects rather than school effectiveness alone (Crawford et al., 2024).

A preliminary risk register identifies financial, academic, regulatory, human-resource, reputational, market, and operational risks. Financial risk may arise if tuition levels are too high for the target market or if enrollment grows more slowly than expected. Academic risk may emerge when internationally designed curricula are implemented without sufficient teacher preparation. Regulatory risk concerns licensing, accreditation, curriculum requirements, child safeguarding, employment regulations, and other national obligations. Human-resource risk is particularly significant because internationally experienced teachers and school leaders can be difficult and expensive to recruit and retain. Reputational risk could result from weak academic outcomes, poor communication with parents, high staff turnover, or a mismatch between marketing promises and actual educational provision. Market risk is created by competition from existing international and private schools. Operational risk includes transportation, school security, information systems, facilities management, and emergency preparedness. Each risk should be assigned an owner, probability score, impact score, mitigation strategy, and monitoring indicator before the project enters the implementation stage.

Teacher capacity should be treated as a strategic rather than administrative issue. An international curriculum cannot produce international learning outcomes if teachers rely predominantly on lecture-based instruction, textbook reproduction, or examination-oriented pedagogy. Recruitment should therefore evaluate not only qualifications and English proficiency but also pedagogical competence, assessment literacy, classroom inquiry, digital competence, intercultural communication, and willingness to engage in continuous professional development. A local-international staffing model may be particularly appropriate for Uzbekistan. International educators could contribute global pedagogical experience, while highly qualified Uzbek educators could provide contextual expertise, linguistic competence, cultural knowledge, and continuity. Professional development should be institutionalized through mentoring, peer observation, collaborative planning, action research, and data-informed instructional improvement. This emphasis is particularly relevant because national education reforms continue to place substantial attention on improving teacher capacity and learning quality.

The implementation roadmap should proceed through four broad phases. The first phase is readiness validation, during which stakeholder interviews, parent surveys, competitor analysis, demographic research, curriculum comparison, regulatory review, and financial modeling are conducted. The second phase is design, covering school governance, curriculum selection, facilities planning, recruitment, admissions, technology, safeguarding, assessment, and

institutional policies. The third phase is controlled launch, beginning with a limited number of grades and a carefully selected founding cohort. The fourth phase is scaling, during which additional grades, programmes, facilities, extracurricular activities, and university partnerships are introduced according to demonstrated demand and institutional capacity. The phased approach is preferable to immediate full-scale expansion because it creates opportunities to learn from actual student, teacher, and parent experiences before the organization becomes too complex to adjust.

Market research should combine quantitative and qualitative methods. A parent survey could measure willingness to enroll, preferred tuition range, desired grade level, language preferences, curriculum awareness, perceived weaknesses of existing schools, preferred extracurricular programmes, transportation expectations, and university ambitions. In-depth interviews could investigate how parents define “international education,” what they fear about private schooling, why they choose particular schools, and what would cause them to transfer their children. Focus groups could explore differences among parents with children at different educational stages. Competitor analysis should examine tuition, admissions requirements, class size, curriculum, language of instruction, teacher profile, facilities, extracurricular provision, university counseling, and perceived reputation. The analysis should avoid treating stated preferences as equivalent to actual purchasing behavior because families may express strong interest in international education while remaining highly sensitive to tuition and location. This leads to a potentially important secondary research agenda concerning parental school choice in Uzbekistan. A future empirical study could examine the relative importance of academic quality, English-medium instruction, international certification, tuition, location, school safety, teacher quality, university preparation, extracurricular opportunities, peer environment, and school reputation in parental decisions. A discrete-choice experiment could be particularly valuable because it would allow researchers to estimate the relative utility parents attach to different school attributes rather than simply asking respondents which characteristics they “like.” Such a study could provide direct evidence for school positioning, pricing, admissions strategy, and curriculum selection. It could also contribute to the international school-choice literature by examining how families in a rapidly transforming Central Asian education market negotiate local identity, global aspirations, economic constraints, and perceptions of educational quality.

The feasibility concept also requires careful consideration of equity. International schools frequently operate at tuition levels that make them inaccessible to a large proportion of families. If the proposed school is designed exclusively around high-income households, its educational impact may remain socially narrow. A scholarship fund, transparent admissions policy, outreach to talented students from different socioeconomic backgrounds, and partnerships with universities or philanthropic organizations could partially address this limitation. Equity should not be treated merely as a corporate-social-responsibility activity but as part of the school's educational mission. At the same time, financial sustainability must be protected because an institution that cannot maintain adequate teacher salaries, facilities, learning resources, and student services cannot deliver sustained educational quality.

The broader national context strengthens the rationale for rigorous feasibility planning. Uzbekistan continues to face pressure associated with population growth, internal migration, and the need to improve learning outcomes, while significant public investment is being directed toward educational development. National statistics also demonstrate substantial continuing investment in school capacity, with 293,344 school places reportedly commissioned in general and specialized schools during 2024, including significant numbers across regions such as Fergana, Kashkadarya, Samarkand, and Tashkent. These trends indicate both demand and opportunity, but they also demonstrate that a new school must be more than an additional physical facility. Its competitive advantage must derive from educational quality, trust, outcomes, student experience, and institutional credibility.

Overall, the International School Founding Readiness Lab provides a structured framework for determining whether a proposed international school should proceed from concept to investment. Its central contribution is the integration of market intelligence, stakeholder analysis, educational design, curriculum strategy, risk management, and implementation planning into a single decision-making architecture. The preliminary concept indicates that an English-medium, internationally benchmarked, locally contextualized K–12 school could be viable in Uzbekistan if it offers a distinctive combination of academic quality, university preparation, multilingual competence, student-centered pedagogy, strong teacher capacity, transparent governance, and credible affordability. Nevertheless, the present study should be understood as a conceptual feasibility framework rather than evidence of confirmed commercial viability. Before investment, the proposed model requires primary data from parents, students, teachers, education authorities, universities, employers, and potential investors. The most important methodological principle is therefore simple: the school should be designed from validated demand rather than assumed demand. A successful founding process would use the Readiness Lab to transform an attractive educational idea into an evidence-based school model, test its assumptions, identify its risks, and establish measurable conditions under which investment and implementation should proceed.

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Evolution Of Ideas Of Development Of The Personality Of The Head Of An Educational Institution In The History Of Pedagogical Teachings And Modern Interpretation

Abdurahimova Salomatposhsha

Call center operator of the PR-marketing department of Kokand University

e-mail: [salomatposhshaa@gmail.com](mailto:salamatposhshaa@gmail.com)

Annotation

The thesis analyzes the evolution of the requirements for the head of an educational institution in the history of pedagogical teachings using the historical-comparative method. The heritage of Eastern thinkers, European classical pedagogy, the experience of the 20th century and the views of modern educational management are divided into stages. At each stage, the leading function of the leader, the main requirements placed on him and the source of management are determined. As a result of the analysis, the historical roots and continuity of the modern competency approach with traditional views are substantiated.

Keywords: history of pedagogical teachings, head of an educational institution, leader, educational management, pedagogical leadership, historical-comparative analysis, competency approach.

Annotatsiya

Tezisda ta'lim muassasasi rahbari shaxsiga qo'yiladigan talablarning pedagogik ta'limotlar tarixidagi evolyutsiyasi tarixiy-qiyosiy metod asosida tahlil qilinadi. Sharq mutafakkirlari merosi, Yevropa klassik pedagogikasi, XX asr tajribasi va zamonaviy ta'lim menejmenti qarashlari bosqichlarga ajratib ko'rsatiladi. Har bir bosqichda rahbar shaxsining yetakchi funksiyasi, unga qo'yiladigan asosiy talab va boshqaruv manbai aniqlanadi. Tahlil natijasida zamonaviy kompetentlik yondashuvining tarixiy ildizlari va an'anaviy qarashlar bilan uzviyligi asoslanadi.

Kalit so'zlar: pedagogik ta'limotlar tarixi, ta'lim muassasasi rahbari, rahbar shaxsi, ta'lim menejmenti, pedagogik liderlik, tarixiy-qiyosiy tahlil, kompetentlik yondashuvi.

Ta'lim muassasasi rahbarining kim bo'lishi va qanday fazilatlarga ega bo'lishi kerakligi haqidagi qarashlar hech qachon o'zgarmas bo'lmagan. Har bir tarixiy davr ta'lim oldiga o'z talablarini qo'ygan va shu talablardan kelib chiqib rahbar shaxsining ideal qiyofasi qayta shakllangan. Ushbu evolyutsiyani kuzatish nafaqat tarixiy qiziqish uyg'otadi, balki bugungi kunda rahbar kadrlarni tayyorlash tizimini loyihalashda muhim metodologik asos beradi: zamonaviy kompetentlik modellari qaysi an'anaviy g'oyalarga tayanadi va nimani inkor etadi — shu savolga javob berish tayyorgarlik mazmunini asoslashga yordam beradi.

Tezisda tarixiy-qiyosiy va tizimli tahlil metodlaridan foydalanildi. Tahlil to'rt bosqich bo'yicha olib borildi va har bir bosqichda uch jihat aniqlandi: rahbarning yetakchi funksiyasi, unga qo'yiladigan asosiy talab va boshqaruv obro'sining manbai.

Sharq mutafakkirlari merosida rahbar shaxsi masalasi

Sharq pedagogik tafakkurida ta'lim beruvchi va uni tashkil etuvchi shaxsga qo'yilgan talablar avvalo axloqiy mezonlar bilan o'lgangan. Abu Nasr Forobiy o'zining fozil shahar haqidagi ta'limotida jamoani boshqaruvchi kishi uchun bilimdonlik, adolatlilik, mulohazakorlik, sog'lom fikr va odamlarni ishonтира olish qobiliyatini asosiy fazilat sifatida ko'rsatadi. Uning qarashlarida boshqaruvchi avvalo dono — ya'ni bilimi tufayli obro' topgan shaxs.

Abu Rayhon Beruniy va Abu Ali ibn Sino asarlarida ta'lim jarayonini tashkil etuvchi shaxsning bilim darajasi bilan bir qatorda o'quvchi tabiatini his qila olishi, uning qobiliyatiga mos yondashuv topishi zarurligi ta'kidlanadi. Ibn Sino bolalarni guruhlarda o'qitish, ular o'rtasidagi o'zaro ta'sirdan foydalanish g'oyasini ilgari surgan — bu bugungi kunda jamoa bilan ishlash tamoyilining ilk ko'rinishi sifatida qaralishi mumkin.

Kaykovusning "Qobusnoma" asarida boshqaruvchi kishi uchun sabr, o'z so'ziga egalik, odamlar bilan muomala madaniyati va vaziyatni to'g'ri baholash qobiliyati alohida ajratib ko'rsatiladi. Alisher Navoiy esa rahbarlik mas'uliyatini xalq oldidagi burch sifatida talqin qilib, boshqaruvchining shaxsiy namunasi uning so'zidan kuchliroq ta'sir ko'rsatishini ta'kidlaydi.

Umuman olganda, Sharq an'anasida rahbar avvalo ma'naviy namuna va ustoz sifatida qaraladi. Uning ma'muriy vakolati emas, aynan obro'si va axloqiy qiyofasi boshqaruvning asosiy manbai hisoblanadi. Bu qarashning zamonaviy talqindagi izi — rahbar kompetentligining motivatsion-qadriyatli komponenti.

Yevropa klassik pedagogikasida boshqaruv g'oyalari

Ya.A.Komenskiy maktabni yaxlit tizim sifatida tasavvur qilgan va uni boshqarishning aniq tartib-qoidalarini ishlab chiqqan birinchi mutafakkirlardan biri bo'ldi. U sinf-dars tizimini asoslab, o'quv yilini, dars jadvalini va o'qitish ketma-ketligini tartibga soldi. Uning qarashlarida maktab rahbari o'quv jarayonini rejalashtiruvchi va uning bir tekis borishini nazorat qiluvchi shaxs sifatida namoyon bo'ladi — ya'ni bu yerda birinchi marta rahbarning tashkiliy funksiyasi ilmiy asoslanadi.

I.G.Pestalotssi maktab boshqaruvida insonparvarlik tamoyilini ilgari surdi. Uning fikricha, muassasa rahbarining faoliyati samarasi bolalarga bo'lgan munosabati bilan o'lchanadi. A.Disterveg o'qituvchilar jamoasini rivojlantirish g'oyasini kiritdi: rahbar nafaqat buyruq beruvchi, balki jamoaning ustози, o'qituvchilarning kasbiy o'sishiga g'amxo'rlik qiluvchi shaxs bo'lishi kerak. Bu g'oya zamonaviy "xodimlarni rivojlantirish" rahbarlik amaliyotining bevosita o'tmishdoshi.

K.D.Ushinskiy maktab rahbarining pedagogik tayyorgarligi masalasini birinchilardan bo'lib ko'tardi. Uning qarashiga ko'ra, o'quv jarayonining ichki mantiqini bilmagan kishi maktabni boshqara olmaydi — boshqaruv qarorlari pedagogik jihatdan asoslangan bo'lishi shart. Bu tezis bugungi kunda ham "pedagogik liderlik" konsepsiyasining asosini tashkil etadi.

XX asr: ma'muriy boshqaruvdan pedagogik liderlikka

XX asr boshlarida sanoat menejmentining ilmiy maktablari ta'sirida maktab boshqaruviga ham ma'muriy-byurokratik yondashuv kirib keldi. Rejalashtirish, hisobot, nazorat va standartlashtirish ustuvor ahamiyat kasb etdi; rahbar esa asosan ma'mur — tizim talablarini bajarilishini ta'minlovchi shaxs sifatida qaraldi. Bu yondashuv ta'limni ommaviylashtirish sharoitida zarur bo'lgan, biroq pedagogik jarayonning ijodiy tabiatini hisobga olmagani uchun tanqidga uchradi.

A.S.Makarenko tajribasi jamoa orqali boshqaruv g'oyasini ilgari surdi. Uning konsepsiyasida rahbar jamoani shakllantiruvchi va uning ichki hayotini tashkil etuvchi shaxs; boshqaruv esa buyruq orqali emas, jamoada shakllangan an'analar va umumiy maqsad orqali amalga oshiriladi.

V.A.Suxomlinskiy maktab direktori faoliyatini avvalo pedagogik faoliyat deb baholadi. Uning qarashiga ko'ra, direktorning asosiy vazifasi — o'qituvchilarning kasbiy va shaxsiy o'sishiga sharoit yaratish; direktor o'zi ham o'qituvchi bo'lib qolishi, dars berishdan uzilmasligi kerak. Bu g'oya zamonaviy "o'rganuvchi tashkilot" tushunchasiga juda yaqin turadi.

Asr oxiriga kelib g'arb tadqiqotlarida boshqaruv (management) va liderlik (leadership) tushunchalari ajratila boshlandi: boshqaruv mavjud tartibni saqlash va samarali ishlashini ta'minlashga, liderlik esa o'zgarishlarni yuzaga keltirish va yo'nalish belgilashga qaratilgan faoliyat sifatida talqin qilindi. Shu davrda transformatsion liderlik, taqsimlangan liderlik va o'quv jarayoniga yo'naltirilgan liderlik konsepsiyalari shakllandi. Ayni paytda empirik tadqiqotlar rahbar faoliyatining o'quvchi natijalariga ta'sirini o'lchashga kirishdi.

Zamonaviy talqin

Bugungi kunda ta'lim muassasasi rahbari bir vaqtning o'zida bir necha rolni bajaradi: o'quv jarayonining pedagogik yetakchisi, resurslar menejeri, jamoaning ustози, o'zgarishlar tashabbuskori va tashqi muhit bilan aloqa o'rnatuvchi vakil. Zamonaviy yondashuvning asosiy o'ziga xosligi shundaki, rahbarlik faoliyati endi tug'ma shaxsiy fazilatlar to'plami sifatida emas,

balki o'lanadigan, o'rganiladigan va maqsadli rivojlantiriladigan kompetentliklar tizimi sifatida qaraladi. Bu esa rahbar kadrlarni oldindan, tizimli tayyorlash imkoniyatini nazariy jihatdan asoslaydi.

Yana bir muhim o'zgarish — liderlikning taqsimlanishi. Agar an'anaviy qarashda barcha mas'uliyat bir shaxsda to'plangan bo'lsa, zamonaviy konsepsiyalarda rahbarning vazifasi jamoada liderlik salohiyatini o'stirish, vakolatlarni taqsimlash va o'z-o'zini boshqaruvchi guruhlar shakllantirish sifatida talqin qilinadi.

Shu bilan birga, tarixiy tahlil ko'rsatadiki, zamonaviy talqin an'anaviy qarashlarni inkor etmaydi, balki ularni yangi shaklda o'ziga singdiradi. Sharq mutafakkirlari ta'kidlagan ma'naviy namunalik, Ushinskiy ilgari surgan pedagogik tayyorgarlik talabi, Disterveg va Suxomlinskiy asoslagan o'qituvchi o'sishiga g'amxo'rlik, Makarenko ochib bergan jamoa orqali boshqaruv — bularning barchasi bugungi kompetentlik modellarida o'z o'rnini topgan.

O'tkazilgan tahlil natijalari quyidagi jadvalda umumlashtirilgan.

Bosqich	Rahbarning yetakchi funksiyasi	Asosiy talab	Boshqaruv manbai
Sharq an'anasi	Ma'naviy yetakchi, ustoz	Axloqiy kamolot, bilimdonlik, adolat	Shaxsiy obro' va namuna
Klassik pedagogika	O'quv jarayonini tashkil etuvchi	Tartib-qoidani bilish, pedagogik tayyorgarlik	Kasbiy bilim
XX asr (ma'muriy davr)	Ma'mur, nazoratchi	Tizim talablarini bajarish	Lavozim vakolati
XX asr (jamoat yondashuvi)	Jamoat shakllantiruvchi	Jamoatni birlashtira olish	Jamoat an'analari
Zamonaviy davr	Pedagogik lider, o'zgarishlar menejeri	Kompetentlik profiliga muvofiqlik	Kompetentlik va natija

1-jadval. Rahbar shaxsiga qo'yilgan talablar evolyutsiyasi

Xulosa

O'tkazilgan tarixiy-qiyosiy tahlil quyidagi xulosalar chiqarish imkonini beradi.

1. Ta'lim muassasasi rahbari shaxsini rivojlantirish g'oyalari uch asosiy talqin bosqichini bosib o'tdi: ma'naviy-axloqiy namuna sifatidagi talqin (Sharq an'anasi va klassik pedagogika), ma'muriy-tashkiliy talqin (XX asr birinchi yarmi) hamda kompetentlikka asoslangan pedagogik liderlik talqini (zamonaviy davr).
2. Har bir yangi bosqich oldingisini to'liq inkor etmagan, balki uning yetakchi g'oyasini o'ziga singdirgan. Shu sababli zamonaviy kompetentlik modellarini tarixiy pedagogik merosdan uzilgan holda qarash metodologik jihatdan noto'g'ri bo'ladi.
3. Tarixiy tahlil zamonaviy tayyorgarlik tizimi uchun muhim xulosa beradi: rahbari faqat texnologiya va protseduralar bilan qurollantirish kifoya emas — uning qadriyatlar tizimi va axloqiy qiyofasi bilan ishlash ham tayyorgarlikning ajralmas qismi bo'lishi kerak.
4. Rahbar kadrlarni tayyorlash dasturlariga pedagogik ta'limotlar tarixi bo'yicha modul kiritish maqsadga muvofiq: bu bo'lajak rahbarda o'z faoliyatiga tarixiy va tanqidiy nazar bilan qarash malakasini shakllantiradi.

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Human-Centred AI Microcredential for English Teachers: Designing and Evaluating a Practice-Oriented Professional Development Model

Ibragimova Dilrabo

MAAB innovation

dilrabo.umbekgizi.ibragimova@gmail.com

Abstract

The rapid adoption of generative artificial intelligence (GenAI) is transforming English language teaching while creating new challenges related to teacher competence, assessment, academic integrity, verification, privacy, and student agency. This conceptual research article proposes a Human-Centred AI Microcredential for English Teachers designed as a four- to eight-week professional-development intervention. Unlike lecture-based technology training, the proposed model emphasizes practical experimentation, ethical decision-making, lesson redesign, AI-assisted feedback, output verification, and preservation of teacher and learner agency. Participants are expected to produce classroom-ready instructional artifacts and an individual implementation commitment. The proposed evaluation methodology combines pre- and post-course assessment, rubric-based evaluation of participant artifacts, semi-structured interviews, and a 30-day follow-up. The framework integrates technological, pedagogical, ethical, and reflective dimensions of AI literacy and positions teachers as informed decision-makers rather than passive technology users. The article argues that effective AI professional development should measure not only knowledge acquisition but also teachers' ability to critically evaluate AI outputs, redesign learning activities, establish appropriate boundaries for AI use, and translate professional learning into classroom practice.

Keywords: artificial intelligence literacy; English language teaching; teacher professional development; generative AI; microcredentials; human-centred AI; teacher agency

The emergence of generative artificial intelligence has created a significant transformation in the professional landscape of English language teaching. Tools capable of generating explanations, exercises, dialogues, reading passages, feedback, lesson plans, translations, and assessment materials are increasingly accessible to teachers and learners. Large language models can support teachers with routine instructional tasks and can provide students with new opportunities for language practice, individualized feedback, brainstorming, and interaction. At the same time, the availability of these technologies does not automatically produce effective educational innovation. Teachers need to understand what AI systems can and cannot do, how generated content should be evaluated, how prompts influence outputs, how bias and inaccuracies can emerge, and how AI-supported activities can be integrated without reducing student thinking or teacher professional judgment. The central challenge is therefore not simply whether English teachers use artificial intelligence, but whether they can use it critically, ethically, pedagogically, and intentionally. This creates a need for professional-development models that move beyond demonstrations of individual AI tools and instead develop transferable AI literacy.

The proposed Human-Centred AI Microcredential for English Teachers responds to this need by conceptualizing AI professional development as a practice-oriented, evidence-based learning intervention. The term "human-centred" is important because the objective is not to maximize technology adoption. Rather, the objective is to ensure that artificial intelligence remains subordinate to educational purposes, teacher judgment, learner development, and ethical principles. UNESCO's guidance on generative AI in education emphasizes a human-centred approach and highlights issues including data privacy, age-appropriate use, ethical

validation, and the need for educators to understand both opportunities and limitations of generative AI (UNESCO, 2023). Similarly, UNESCO's AI competency framework for teachers identifies competencies related to human-centred mindset, AI ethics, AI foundations and applications, AI pedagogy, and AI for professional learning (UNESCO, 2024). These principles provide a strong conceptual foundation for a microcredential specifically designed for English teachers.

Teacher professional development is most effective when it connects new knowledge to authentic classroom practice rather than treating professional learning as the passive acquisition of information. Traditional short workshops frequently introduce teachers to technological tools but provide limited opportunities to experiment, receive feedback, revise materials, and evaluate classroom consequences. A microcredential model offers an alternative because it can organize professional learning around clearly defined competencies and assess demonstrable outputs. In the proposed model, teachers would not complete the course merely by attending sessions. Instead, they would demonstrate competence through a sequence of practical artifacts, including an AI-supported lesson plan, an AI verification protocol, an ethical-use guideline, an AI-assisted feedback activity, and a classroom implementation plan. The final outcome would therefore be a portfolio of materials that teachers can use or adapt in their own classrooms. This approach aligns professional learning with observable performance and creates evidence that participation has produced practical capability.

The proposed microcredential would be delivered over approximately four to eight weeks, depending on institutional context and participant workload. A four-week intensive version could contain one major learning cycle per week, while an eight-week version could provide additional time for experimentation, peer feedback, classroom implementation, and reflection. The course would begin with AI literacy and conceptual foundations. Participants would examine how generative AI systems work at a functional level, including concepts such as training data, probabilistic generation, hallucination, context sensitivity, prompting, and model limitations. The purpose would not be to turn English teachers into computer scientists. Instead, teachers would develop sufficient conceptual understanding to make informed pedagogical decisions. They would learn why an AI-generated answer can appear convincing while still being inaccurate and why different prompts can produce substantially different outputs. This foundation would become essential for later modules on verification and assessment.

The second component would address ethical and responsible AI use in English-language classrooms. Teachers would investigate issues including student privacy, collection of personal information, intellectual property, bias, transparency, academic integrity, and appropriate disclosure of AI assistance. Ethical competence should be presented through classroom cases rather than abstract principles. For example, participants could analyze whether students should be allowed to use generative AI to brainstorm an essay, generate a first draft, receive language feedback, or rewrite an entire assignment. The objective would not be to establish a universal prohibition or universal permission. Instead, teachers would learn to distinguish between productive forms of assistance and forms of AI use that undermine the intended learning outcome. Such an approach recognizes that the pedagogical value of AI depends on the relationship between the technology and the learning objective.

The third component would focus on AI-supported lesson design. Participants would redesign an existing English lesson using a human-centred AI framework. Rather than asking an AI system to produce an entire lesson and then implementing the result unchanged, teachers would identify the learning objective first, determine which parts of the instructional sequence genuinely benefit from AI, and specify where human interaction remains essential. For example, AI could be used to generate alternative discussion prompts, create differentiated reading materials, simulate conversational partners, or provide examples of grammatical errors. However, students could then be required to critique the generated content, identify

inaccuracies, compare alternatives, justify linguistic choices, or revise AI-generated material. In this model, AI becomes an object of critical learning as well as a tool for learning. Such activities can potentially strengthen rather than weaken student agency because learners are required to evaluate and transform machine-generated content.

The fourth component would address AI-assisted feedback. Feedback is particularly relevant to English language teaching because teachers regularly respond to student writing, vocabulary, grammar, pronunciation, and communicative performance. Generative AI can provide rapid feedback, but speed should not be confused with pedagogical quality. Participants would therefore learn how to design prompts and workflows that encourage specific, comprehensible, and level-appropriate feedback. More importantly, teachers would examine how AI feedback should be checked before being provided to learners. Participants could compare teacher feedback with AI-generated feedback and classify differences in accuracy, relevance, tone, specificity, and pedagogical usefulness. The resulting artifact could be an AI-assisted feedback protocol specifying what AI may evaluate, what teachers must verify, and which feedback decisions should remain exclusively under teacher control.

Verification would constitute another central competency of the microcredential. Generative AI systems can produce incorrect factual information, invented references, misleading explanations, inappropriate language examples, and culturally insensitive content. In English teaching, even apparently minor inaccuracies can become problematic if students internalize them as correct language. Teachers therefore need a systematic verification process. The proposed course would teach participants to identify claims requiring external verification, compare AI-generated explanations with authoritative linguistic or educational resources, examine multiple outputs, and revise or reject unreliable material. A verification checklist could become part of every participant's portfolio. The emphasis would be on cultivating professional skepticism: AI output should be treated as a draft or suggestion rather than an unquestionable source of authority.

Student agency represents the final major pedagogical principle. An AI-rich classroom can easily become teacher-controlled and technology-dependent if students simply follow machine-generated instructions or accept generated answers. A human-centred model instead asks whether AI use increases students' ability to make decisions, formulate questions, evaluate information, communicate ideas, and take responsibility for learning. Participants would therefore design at least one activity in which students must explicitly exercise judgment over AI output. Examples could include evaluating two AI-generated explanations, correcting an AI-generated text, identifying weaknesses in an AI-produced argument, comparing human and AI feedback, or developing a prompt and explaining why it produces a desirable linguistic outcome. These activities reposition students from consumers of AI output to critical participants who can interrogate and reshape technology-mediated information.

The evaluation of the microcredential should combine quantitative and qualitative evidence. A pre-course and post-course assessment could measure changes in teachers' AI knowledge, confidence, ethical awareness, verification skills, and perceived pedagogical readiness. However, self-reported confidence should not be treated as evidence of actual competence. For this reason, the assessment should also include performance-based artifacts. Each participant could submit a small portfolio consisting of an AI-supported lesson plan, an ethical-use scenario analysis, an AI verification checklist, an AI-assisted feedback activity, and an implementation commitment. A standardized artifact rubric could assess pedagogical alignment, accuracy, ethical awareness, student agency, verification procedures, inclusivity, and practical usability. This combination would allow the study to distinguish between what teachers believe they can do and what they can demonstrably produce.

Participant interviews would provide additional evidence concerning the professional learning process. Semi-structured interviews could explore teachers' previous experiences with AI, changes in their perceptions, concerns about classroom implementation, perceived barriers,

and examples of intended practice. Interviews would also help identify contextual factors that quantitative measures may not capture. For example, teachers may demonstrate strong AI literacy but report that institutional policies, limited internet access, workload, examination requirements, or parental expectations make classroom implementation difficult. Such findings would be important because professional development cannot be evaluated independently of the organizational environment in which teachers work.

A 30-day follow-up would provide a particularly valuable measure of transfer. Many professional-development interventions produce positive immediate reactions that do not necessarily translate into sustained classroom practice. Thirty days after completion, participants could submit a brief implementation report describing which artifact they used, how students responded, what problems occurred, and what they changed. A follow-up interview or short survey could assess frequency of AI use, types of activities implemented, perceived student response, and continuing professional-learning needs. Comparing course completion artifacts with follow-up evidence would make it possible to examine whether participants actually moved from knowledge acquisition to classroom implementation.

The proposed research design could therefore employ a mixed-methods pre-post intervention framework. Quantitative data could include pre- and post-assessment scores and artifact-rubric scores, while qualitative data could consist of participant interviews and implementation reflections. Descriptive statistics and paired-sample comparisons could be used to examine changes in measured competencies, while qualitative thematic analysis could identify patterns in teacher experiences and implementation barriers. If the sample permits, researchers could further investigate whether factors such as teaching experience, previous AI exposure, institutional context, or baseline digital competence are associated with different levels of improvement. Inter-rater reliability should be established for artifact assessment when multiple evaluators use the rubric. This would strengthen the methodological credibility of the microcredential evaluation.

The project also has implications for institutional teacher-development strategy. Schools and universities frequently respond to emerging technologies through isolated workshops, but sustainable AI integration requires continuing professional learning. A microcredential can provide a scalable structure because its competencies, learning activities, assessment criteria, and artifacts can be standardized while allowing contextual adaptation. The course could be delivered through blended or fully online formats, supported by peer discussion groups and facilitator feedback. Cohort management would be important because teachers can learn from one another's classroom contexts and examples. Facilitators should therefore function not simply as lecturers but as instructional coaches who guide experimentation, challenge assumptions, and help participants translate AI capabilities into pedagogically meaningful practices.

Several limitations should nevertheless be recognized. A short microcredential cannot provide comprehensive AI expertise, particularly because AI systems and institutional policies change rapidly. Pre-post improvements may also partly reflect familiarity with the assessment rather than genuine development. Participants who volunteer for an AI-focused course may already be more motivated or technologically confident than the broader teacher population. Self-reported implementation data may contain social-desirability bias. A 30-day follow-up is useful but insufficient for determining long-term changes in teaching practice. Future research should therefore consider longer follow-up periods, comparison groups, classroom observations, student learning outcomes, and repeated artifact analysis. These limitations do not undermine the model; rather, they indicate the need to treat the microcredential as a testable professional-development intervention rather than assuming that participation automatically produces educational improvement.

The Human-Centred AI Microcredential ultimately proposes a shift from tool-centered AI training toward competency-centered teacher development. Its purpose is not to persuade

English teachers to use as much AI as possible, but to help them determine when, why, and how AI should be used. The most meaningful outcome is therefore not the number of AI tools participants can operate but their capacity to exercise professional judgment in AI-mediated educational environments. By combining AI literacy, ethical reasoning, lesson design, feedback, verification, student agency, practical artifacts, and implementation reflection, the proposed model offers a structured pathway for preparing English teachers for increasingly AI-rich classrooms. Its empirical evaluation through pre- and post-assessment, artifact rubrics, participant interviews, and 30-day follow-up could generate evidence about whether short, practice-oriented microcredentials can produce meaningful changes in teacher competence and classroom implementation. More broadly, the model positions professional development as an ongoing process of critical adaptation in which teachers remain responsible for educational decisions while artificial intelligence serves as a potentially powerful but fallible instructional resource.

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Conceptual Model Of Training Educational Managers: Theory And Practice

Abdurahimova Salomatposhsha

Call center operator of the PR-marketing department of Kokand University

e-mail: salomatposhsha@gmail.com

Annotation.

The thesis proposes a conceptual model of training educational managers. The model consists of a methodological basis, target, content, technological, diagnostic and result components, and is aimed at bridging the gap between theoretical training and practical management activities. The central element of the model is the "theory - case - project - defense - reflection" cycle. The criteria for assessing the results of training and directions for applying the model in practice are also indicated.

Keywords: educational manager, conceptual model, competency approach, andragogy, practice-oriented education, mentoring, managerial personnel reserve, individual development trajectory.

Annotatsiya.

Tezisda ta'lim menejerlarini tayyorlashning konseptual modeli taklif etiladi. Model metodologik asos, maqsadli, mazmuniy, texnologik, diagnostik va natijaviy komponentlardan iborat bo'lib, nazariy tayyorgarlik bilan amaliy boshqaruv faoliyati o'rtasidagi uzilishni bartaraf etishga qaratilgan. Modelning markaziy elementi sifatida "nazariya – keys – loyiha – himoya – refleksiya" sikli asoslanadi. Shuningdek tayyorgarlik natijasini baholash mezonlari va modelni amaliyotga tatbiq etish yo'nalishlari ko'rsatiladi.

Kalit so'zlar: ta'lim menejeri, konseptual model, kompetentlik yondashuvi, andragogika, amaliyotga yo'naltirilgan ta'lim, mentorlik, rahbar kadrlar zaxirasi, individual rivojlanish trayektoriyasi.

Muammoning dolzarbligi

Ta'lim muassasalarini boshqarishda hozirgacha keng tarqalgan amaliyot shundan iborat: rahbarlik lavozimiga eng tajribali yoki eng obro'li o'qituvchi tayinlanadi. Bu yondashuvning mantiqi tushunarli — pedagogik jarayonni bilgan kishi uni boshqarishi ham kerak. Biroq o'qituvchilik mahorati boshqaruv kompetentligini avtomatik ta'minlamaydi. Strategik rejalashtirish, moliyaviy resurslarni taqsimlash, kadrlar bilan ishlash, nizolarni hal etish, o'zgarishlarni boshqarish va tashqi muhit bilan muzokara olib borish — bularning har biri mutlaqo boshqa ko'nikmalarni talab qiladi va ular pedagogik faoliyat jarayonida o'z-o'zidan shakllanmaydi.

Natijada yangi tayinlangan rahbar lavozimni "sinov va xato" yo'li bilan o'zlashtiradi. Bu jarayon bir-ikki yil davom etadi va shu davrda qabul qilingan asossiz qarorlar butun muassasa faoliyatiga ta'sir ko'rsatadi. Shu sababli ta'lim menejerlarini lavozimga tayinlashdan oldin, maqsadli va tizimli tayyorlash zarurati yuzaga keladi. Buning uchun esa yaxlit konseptual model kerak — ayrim kurslar yoki treninglar to'plami emas.

Modelning metodologik asoslari

Taklif etilayotgan model quyidagi yondashuvlar uyg'unligiga tayanadi:

- tizimli yondashuv — tayyorgarlikni o'zaro bog'liq komponentlar majmui sifatida qarash; bir komponentdagi o'zgarish boshqalarga ta'sir qilishini hisobga olish;
- kompetentlik yondashuvi — natijani o'zlashtirilgan bilim hajmi bilan emas, real boshqaruv vazifalarini hal eta olish qobiliyati bilan o'lchash;

– andragogik yondashuv — kattalar ta’limining o’ziga xosligini hisobga olish: tinglovchining mavjud tajribasiga tayanish, o’qishning amaliy foydasini ko’rsatish, o’quv jarayoniga mas’uliyat berish;

– amaliyotga yo’naltirilgan yondashuv — o’quv mazmunini nazariy bo’limlar emas, real boshqaruv vaziyatlari atrofida qurish;

– shaxsga yo’naltirilgan yondashuv — har bir tinglovchi uchun individual rivojlanish trayektoriyasini loyihalash.

Model quyidagi tamoyillarga amal qiladi: nazariya va amaliyot birligi; uzluksizlik va bosqichmalik; individuallashtirish; refleksivlik; moslashuvchanlik; natijaga yo’naltirilganlik.

Modelning tarkibiy komponentlari

Model besh komponentdan iborat bo’lib, ular yopiq sikl tashkil etadi: diagnostika natijalari maqsad va mazmunni qayta aniqlashtirishga xizmat qiladi.

Komponent	Mazmuni	Vositalari
Maqsadli	Ijtimoiy buyurtma va davlat talablari asosida shakllangan kompetentlik profili	Me’yoriy hujjatlar tahlili, professiogramma, ekspert so’rovi
Mazmuniy	Modulli dastur: huquqiy asoslar, strategik boshqaruv, moliya, kadrlar, pedagogik liderlik, kommunikatsiya, raqamli boshqaruv	O’quv-uslubiy majmua, keys-to’plam, elektron resurslar
Texnologik	Interaktiv va amaliyotga yo’naltirilgan o’qitish shakllari	Keys-stadi, ishbilarmonlik va rolli o’yin, trening, loyiha ishi, stajirovka, mentorlik, kouching, peer learning
Diagnostik	Kirish, oraliq va yakuniy baholash; jarayon monitoringi	Boshqaruv keysi yechimi, portfolio, ekspert baholash, refleksiv karta
Natijaviy	Kompetentlik profiliga muvofiqlikni qayd etish va keyingi o’sishni rejalashtirish	Mezonlar tizimi, individual rivojlanish trayektoriyasi

1-jadval. Konseptual modelning tarkibiy komponentlari

Nazariyani amaliyot bilan bog’lash mexanizmi

Modelning markaziy g’oyasi shundan iboratki, har bir nazariy modul albatta amaliy sinovga ega bo’ladi. Bu quyidagi besh qadamli sikl orqali amalga oshiriladi va har bir modul bo’yicha takrorlanadi:

- 1) nazariy bilim berish — modulning kalit tushunchalari va yondashuvlari bilan tanishtirish;
- 2) real boshqaruv keysini tahlil qilish — nazariyani boshqa muassasa tajribasi misolida ko’rish;
- 3) o’z muassasasi misolida loyiha ishlab chiqish — bilimni o’z sharoitiga ko’chirish;
- 4) loyihani himoya qilish — hamkasblar va ekspertlar tanqidiy fikrini olish;
- 5) mentor bilan refleksiv suhbat — nima o’zlashtirildi, nima qiyin bo’ldi, keyingi qadam nima — shu savollarga javob shakllantirish.

Ushbu sikl tinglovchida bilimni faoliyatga aylantirish ko’nikmasini shakllantiradi va an’anaviy dasturlarning asosiy kamchiligini — nazariya bilan amaliyot o’rtasidagi uzilishni bartaraf etadi.

Tayyorgarlik natijasini baholash

Model natijasi to’rt yo’nalishda baholanadi:

Baholash yo’nalishi	Ko’rsatkichlar
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Bilim darajasi	Menejment nazariyasi, ta'lim huquqi, moliyaviy va kadrlar boshqaruvi bo'yicha test natijalari
Amaliy ko'nikma	Boshqaruv keysini hal etish sifati, loyiha ishi natijasi, ishbilarmonlik o'yinidagi faoliyat
Refleksiv qobiliyat	O'z-o'zini baholashning adekvatligi, refleksiv kartalar mazmuni, kasbiy o'sish rejasining asoslanganligi
Kasbiy pozitsiya	Rahbarlik faoliyatiga motivatsiya, qadriyatlar tizimi, mas'uliyat hissi

2-jadval. Tayyorgarlik natijasini baholash yo'nalishlari

Modelni amaliyotga tatbiq etish yo'nalishlari

- ta'lim menejmenti yo'nalishi magistratura dasturlari mazmunini loyihalash;
- malaka oshirish va qayta tayyorlash kurslari dasturlarini yangilash;
- rahbar kadrlar zaxirasini shakllantirish va u bilan tizimli ishlash;
- muassasa ichida rahbar o'rinbosarlarini tayyorlash;
- rahbar faoliyatini attestatsiyadan o'tkazishda mezoniy asos sifatida foydalanish.

Xulosa

Ta'lim menejerlarini tayyorlash nazariy tayyorgarlikni amaliy faoliyat bilan uzviy bog'lagan holda tashkil etilganda samarali bo'ladi. Taklif etilgan konseptual model shu bog'lanishni ta'minlovchi aniq mexanizmni — besh qadamli siklni — o'z ichiga oladi. Modelning amaliy qiymati uni magistratura dasturlarini loyihalashda, malaka oshirish mazmunini yangilashda va rahbar kadrlar zaxirasini shakllantirishda qo'llash imkoniyatidadir.

Keyingi tadqiqot bosqichida modelning samaradorligini tajriba-sinov yo'li bilan tekshirish, har bir modul uchun keys-to'plam ishlab chiqish va baholash vositalarini standartlashtirish rejalashtirilgan.

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Improving Economic Mechanisms Of Small Business Development On The Basis Of Green Entrepreneurship

Umarov Sardor

Head of the Department of Youth Affairs, Kokand University

Annotation.

The paper examines the economic mechanisms for developing small business on the basis of green entrepreneurship. The essence of green entrepreneurship is clarified through its distinctions from conventional entrepreneurship. The mechanisms are classified into four groups: financial-credit, fiscal-budgetary, institutional, and infrastructural. Barriers to the green transition faced by small businesses are systematised and directions for overcoming them are proposed. The study substantiates an integrated approach to improving these mechanisms.

Keywords: green entrepreneurship, green economy, small business, economic mechanism, green investment, resource efficiency, sustainable development, tax incentives.

Annotatsiya

Tezisda yashil tadbirkorlik asosida kichik biznesni rivojlantirishning iqtisodiy mexanizmlari tadqiq etiladi. Yashil tadbirkorlikning mohiyati an'anaviy tadbirkorlikdan farqli jihatlari orqali aniqlashtiriladi. Iqtisodiy mexanizmlar to'rt guruhga — moliyaviy-kredit, soliq-budjet, institutsional va infratuzilma mexanizmlariga tasniflanadi. Kichik biznes subyektlarining yashil o'tishga to'sqinlik qiluvchi to'siqlari tizimlashtiriladi va ularni bartaraf etish yo'nalishlari taklif etiladi. Tadqiqot natijasida mexanizmlarni takomillashtirishning majmual yondashuvi asoslanadi.

Kalit so'zlar: yashil tadbirkorlik, yashil iqtisodiyot, kichik biznes, iqtisodiy mexanizm, yashil investitsiya, resurs samaradorligi, barqaror rivojlanish, soliq rag'batlari.

Kirish

Yashil iqtisodiyotga o'tish jarayoni bugungi kunda global iqtisodiy siyosatning ustuvor yo'nalishiga aylandi [4, 8]. O'zbekiston Respublikasi 2018-yilda Parij bitimini ratifikatsiya qilib, issiqxona gazlarining yalpi ichki mahsulot birligiga solishtirma ajratmalarini qisqartirish bo'yicha miqdoriy majburiyatni qabul qildi. Ushbu majburiyatni bajarish maqsadida O'zbekiston Respublikasi Prezidentining 2019-yil 4-oktabrdagi PQ-4477-son qarori bilan 2019–2030-yillar davrida yashil iqtisodiyotga o'tish strategiyasi tasdiqlangan [1]; keyinchalik strategiyaning maqsadli ko'rsatkichlari 2022-yil 2-dekabrda PQ-436-son qarori bilan yangilanib, 2030-yilga qadar issiqxona gazlari solishtirma ajratmalarini 2010-yil darajasidan 35 foizga qisqartirish, qayta tiklanuvchi energiya manbalarining ulushini 30 foizdan oshirish, sanoatda energiya samaradorligini kamida 20 foizga oshirish vazifalari belgilangan [2].

Muhim jihat shundaki, Strategiyaning o'zida yashil iqtisodiyotni rivojlantirish uchun innovatsion yechimlarni joriy etishda kichik biznesning faol ishtirok etmayotgani milliy iqtisodiyotni barqaror rivojlantirishning ustuvor maqsadlariga erishishga to'sqinlik qilayotgan omillardan biri sifatida qayd etilgan [1]. Ya'ni muammo me'yoriy darajada tan olingan, biroq uni hal etishning yaxlit iqtisodiy mexanizmi hali shakllanmagan.

Kichik biznesning bu jarayondagi o'рни ikki jihatdan qaraladi. Bir tomondan, kichik korxonalar soni ko'p bo'lgani uchun ularning jamlangan ekologik yuki sezilarli; ikkinchi tomondan, kichik biznes moslashuvchanligi tufayli yangi yashil texnologiyalarni tez o'zlashtirish, ekologik innovatsiyalarni sinovdan o'tkazish va yangi bozor nishlarini egallash imkoniyatiga ega [6]. Shu sababli yashil tadbirkorlikni rag'batlantirishning iqtisodiy mexanizmlarini takomillashtirish dolzarb ilmiy-amaliy vazifa hisoblanadi.

Yashil tadbirkorlikning mohiyati

Yashil tadbirkorlik — foyda olish maqsadi bilan bir qatorda atrof-muhitga salbiy ta'sirni kamaytirish yoki ekologik muammolarni hal etish maqsadini ham o'z ichiga olgan tadbirkorlik faoliyati turi [6, 7]. Uning an'anaviy tadbirkorlikdan asosiy farqlari 1-jadvalda keltirilgan.

Taqqoslash mezon	An'anaviy tadbirkorlik	Yashil tadbirkorlik
Asosiy maqsad	Foydani maksimallashtirish	Foyda va ekologik samara uyg'unligi
Resurslarga munosabat	Resurs — xarajat elementi	Resurs — tejash va qayta ishlash obyekti
Chiqindilarga munosabat	Chiqindi — yo'qotish	Chiqindi — potensial xomashyo
Vaqt ufqi	Qisqa va o'rta muddat	Uzoq muddat
Samaradorlik mezon	Rentabellik, foyda normasi	Rentabellik va resurs sig'imi, uglerod izi
Raqobat ustunligi manbai	Narx, sifat	Ekologik sertifikat, brend, resurs tejamkorligi

1-jadval. An'anaviy va yashil tadbirkorlikning qiyosiy tahlili

Iqtisodiy nazariyada yashil tadbirkorlikning maqsadga muvofiqligi bo'yicha munozara mavjud. An'anaviy qarashga ko'ra, ekologik talablarni kuchaytirish korxona xarajatlari oshiradi va raqobatbardoshlikni pasaytiradi. Muqobil yondashuv — M.Porter va K.van der Linde tomonidan asoslangan gipoteza [5] — oqilona ishlab chiqilgan ekologik me'yorlar innovatsiyaga undashi, resurs samaradorligini oshirishi va oqibatda korxona raqobatbardoshligini kuchaytirishi mumkinligini ko'rsatadi. Kichik biznes sharoitida ikkinchi yondashuvning amal qilishi mexanizmlarning to'g'ri loyihalanganiga bevosita bog'liq.

Iqtisodiy mexanizmlarning tasnifi

Ilmiy adabiyotlar va xalqaro tashkilotlar tavsiyalari tahliliga tayangan holda [8, 9] yashil tadbirkorlikni rag'batlantirishning iqtisodiy mexanizmlarini to'rt guruhga tasniflash taklif etiladi (2-jadval).

Mexanizm guruhi	Asosiy vositalari	Kutilayotgan iqtisodiy samara
Moliyaviy-kredit	Imtiyozli yashil kreditlar, foiz stavkasi subsidiyasi, lizing, kafolat fondlari, yashil obligatsiyalar	Boshlang'ich investitsiya to'sig'ini pasaytirish, qaytarilish muddatini qisqartirish
Soliq-budjet	Ekologik uskuna uchun soliq imtiyozlari, tezlashtirilgan amortizatsiya, ifloslantirish uchun to'lovlar, grantlar	Yashil investitsiyaning nisbiy foydaliligini oshirish
Institutsional	Ekologik sertifikatlash, yashil standartlar, davlat xaridlarida ustunlik, klaster va kooperatsiya	Bozorga chiqish imkoniyatini kengaytirish, tranzaksiya xarajatlari kamaytirish
Infratuzilma va bilim	Konsalting xizmatlari, biznes-inkubatorlar, texnoparklar, kadrlar tayyorlash, ma'lumot bazalari	Ma'lumot assimetriyasini kamaytirish, kompetentlik yetishmovchiligini bartaraf etish

2-jadval. Yashil tadbirkorlikni rag'batlantirishning iqtisodiy mexanizmlari

Ushbu mexanizmlar alohida qo'llanilganda samarasi cheklangan bo'ladi. Masalan, imtiyozli kredit berilsa-da, tadbirkor yashil texnologiyalar haqida ma'lumotga ega bo'lmasa yoki mahsulotini sotish bozori shakllanmagan bo'lsa, investitsiya qaytmaydi. Shu sababli mexanizmlarni majmual — bir-birini to'ldiruvchi tarzda qo'llash tamoyili muhim ahamiyat kasb etadi.

Kichik biznes uchun to'siqlar va ularni bartaraf etish

Ilmiy adabiyotlar va xorijiy tajriba tahlili [8, 9] kichik biznes subyektlarining yashil o'tishga to'sqinlik qiluvchi asosiy to'siqlarini tizimlashtirish imkonini beradi (3-jadval).

To'siq turi	Namoyon bo'lishi	Bartaraf etish yo'nalishi
Moliyaviy	Yuqori boshlang'ich investitsiya, uzoq qaytarilish muddati, garov yetishmasligi	Imtiyozli kreditlash, kafolat fondi, lizing, ulushli moliyalashtirish
Informatsion	Texnologiyalar va imtiyozlar haqida ma'lumot yetishmasligi	Yagona ma'lumot platformasi, konsalting markazlari
Kadrlar	Yashil texnologiyalar bilan ishlash ko'nikmasining yo'qligi	Maqsadli o'qitish dasturlari, malaka oshirish
Bozor	Ekologik mahsulotga to'lovga qodir talabning pastligi	Davlat xaridlarida ustunlik, iste'molchi ongini oshirish, markirovka
Institutsional	Standartlar va sertifikatlash tartibining murakkabligi	Kichik biznes uchun soddalashtirilgan sertifikatlash tartibi

3-jadval. Yashil o'tish to'siqlari va ularni bartaraf etish yo'nalishlari

Xulosa va takliflar

O'tkazilgan nazariy tahlil asosida quyidagi xulosalarga kelindi:

1. Yashil tadbirkorlik an'anaviy tadbirkorlikdan maqsadlar tizimi, resurslarga munosabat, vaqt ufqi va samaradorlik mezonlari bilan farqlanadi; bu farqlar rag'batlantirish mexanizmlarini loyihalashda hisobga olinishi lozim.
2. Iqtisodiy mexanizmlarni moliyaviy-kredit, soliq-budjet, institutsional hamda infratuzilma va bilim guruhlariga tasniflash mexanizmlar tizimini yaxlit ko'rish va ular o'rtasidagi bo'shliqlarni aniqlash imkonini beradi.
3. Mexanizmlarning samarasi ular majmual qo'llanilganda ortadi: moliyaviy qo'llab-quvvatlash bozor talabini shakllantirish va kadrlar tayyorlash bilan uyg'unlashtirilishi kerak.
4. Kichik biznes uchun eng sezilarli to'siq moliyaviy va informatsion xarakterga ega, shu sababli imtiyozli moliyalashtirish va konsalting infratuzilmasini rivojlantirish ustuvor yo'nalish hisoblanadi.
5. Yashil tadbirkorlikni rag'batlantirish samaradorligini baholash uchun faqat moliyaviy ko'rsatkichlar emas, resurs sig'imi va uglerod izi kabi ekologik indikatorlarni ham o'z ichiga olgan mezonlar tizimi zarur.

Foydalanilgan adabiyotlar

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Improvement Of Organizational And Economic Mechanisms For Small Business Development In Remote Areas (On The Example Of Fergana Region)

Nazirov Xusanjon Saydullaxon o'g'li

Kokand University

xnazirov910@gmail.com

Annotation

This article examines the improvement of organizational and economic mechanisms for developing small business in remote regions, using the Fergana region as an example. It analyzes state policy and the regulatory framework, the region's demographic and resource potential, existing infrastructure challenges, and the experience of foreign countries such as China and Turkey. Directions for reducing territorial inequality are substantiated on the basis of small industrial zones, financial and credit support, tax incentives, and a cluster-based approach.

Keywords: Small business, organizational-economic mechanism, remote regions, Fergana region, small industrial zone, clustering, public-private partnership, regional development, tax incentives, entrepreneurial infrastructure.

Annotatsiya

Mazkur maqolada chekka hududlarda, xususan Farg'ona viloyatida, kichik biznesni rivojlantirishning tashkiliy-iqtisodiy mexanizmlarini takomillashtirish masalalari yoritilgan. Maqolada davlat siyosati va me'yoriy-huquqiy baza tahlil qilinib, viloyatning demografik va resurs salohiyati, mavjud infratuzilma muammolari hamda xorijiy davlatlar (Xitoy, Turkiya) tajribasi ko'rib chiqilgan. Kichik sanoat zonalari, moliyaviy-kredit qo'llab-quvvatlash, soliq imtiyozlari va klaster yondashuvi asosida hududiy tengsizlikni kamaytirish yo'nalishlari asoslangan.

Kalit so'zlar: Kichik biznes, tashkiliy-iqtisodiy mexanizm, chekka hududlar, Farg'ona viloyati, kichik sanoat zonasi, klasterlashtirish, davlat-xususiy sheriklik, hududiy rivojlantirish, soliq imtiyozlari, tadbirkorlik infratuzilmasi.

Bugungi kunda O'zbekiston Respublikasida iqtisodiy islohotlarning muhim yo'nalishlaridan biri hududlar o'rtasidagi rivojlanish darajasidagi tafovutlarni kamaytirish va chekka tumanlarda kichik biznesni jadal rivojlantirishdan iborat. "Yangi O'zbekiston - 2030" strategiyasi hamda Prezidentning 2023-yil 14-sentabrdagi PQ-306-son "Kichik biznesni rivojlantirishni moliyaviy va institutsional qo'llab-quvvatlash chora-tadbirlari to'g'risida"gi qarori bilan kichik biznes subyektlarini har tomonlama qo'llab-quvvatlash tizimi mustahkamlanmoqda¹. Ushbu chora-tadbirlar doirasida "Biznesni rivojlantirish banki" orqali kichik biznesni uzluksiz qo'llab-quvvatlash dasturi joriy etilgan bo'lib, u kredit resurslariga tengroq kirish imkoniyatini yaratishga xizmat qiladi.

Kichik tadbirkorlikning huquqiy asosini "Tadbirkorlik faoliyati erkinligining kafolatlari to'g'risida"gi Qonun tashkil etadi, unga ko'ra tadbirkorlik subyektlarining tengligi, mulk daxlsizligi va qonunchilik barqarorligi asosiy prinsiplar sifatida belgilangan. Shu bilan birga, so'nggi yillarda "Surxondaryo viloyatida qulay investitsiya muhitini yaratish... to'g'risida"gi PQ-5228-son qarori va mahallabay ishlash asosida oilaviy tadbirkorlikni rivojlantirish chora-tadbirlari kabi hujjatlar aynan chekka va mehnat resurslariga boy hududlarni nishonga olgan alohida siyosat mavjudligini ko'rsatadi. Farg'ona viloyati O'zbekistonning eng zich aholi joylashgan, ammo yer resurslari cheklangan hududlaridan biri bo'lib, uning qulay geografik o'рни, boy mehnat resurslari va tarixiy hunarmandchilik an'analari kichik biznesni rivojlantirish uchun mustahkam asos yaratadi, ammo hududiy rivojlantirishda sanoat infratuzilmasining

yetarli emasligi, elektr energiyasi va logistika xarajatlarining yuqoriligi kabi muammolar ham saqlanib qolmoqda. Bu holat aynan tashkiliy-iqtisodiy mexanizmlarni takomillashtirishni dolzarb ilmiy-amaliy masalaga aylantiradi.

Kichik biznesni davlat tomonidan qo'llab-quvvatlashning institutsional shakllari.

Farg'ona viloyatida kichik sanoat zonalar (QSZ) tizimi muhim mexanizm sifatida shakllangan: viloyat hokimligining qarori bilan Farg'ona shahri, Furqat, Quva, O'zbekiston, Oltiariq, Yozyovon va Qo'shtepa tumanlarida QSZlar tashkil etilib, hududdagi davlat ko'chmas mulki tadbirkorlarga keyinchalik mulk huquqi berilgan holda 10 yil muddatga eng kam ijara stavkasida beriladi³. Bunday yondashuv yer va mulk resurslariga kirishni yengillashtirish orqali tashkiliy to'siqlarni kamaytiradi. Moliyaviy mexanizmlar orasida soliq siyosati alohida o'rin tutadi. Hozirgi amaldagi tartibga ko'ra, iqtisodiy rivojlanish darajasi past bo'lgan (5-toifa) tumanlarda ro'yxatdan o'tgan va real faoliyat yurituvchi tadbirkorlar uchun aylanma solig'i, foyda solig'i va ijtimoiy soliq atigi 1 foiz miqdorida belgilangan, bu hududiy tengsizlikni kamaytirishga qaratilgan maqsadli soliq siyosatining namunasidir, biroq imtiyozdan foydalanish uchun faqat hududda ro'yxatdan o'tishning o'zi yetarli emas - ishchilarga kamida ikki baravar minimal ish haqi to'lash talab etiladi. Farg'ona viloyatining bir qator tog' oldi va chekka tumanlari aynan shunday toifaga kiradi, bu esa yerli tadbirkorlik faolligini rag'batlantirish uchun qo'shimcha imkoniyat yaratadi.

Mavjud muammolar. Ilmiy adabiyotlar tahlili shuni ko'rsatadiki, kichik biznesni rivojlantirishda moliya-kredit resurslariga kirish, ularni samarali sarflash muammosi hamon dolzarbligicha qolmoqda - xorijiy tajriba bilan qiyoslash mahalliy moliyalashtirish mexanizmlarini takomillashtirish zaruratini ko'rsatadi. Shuningdek, xizmat ko'rsatish sohasidagi kichik biznes subyektlari moliyaviy, tashkiliy va huquqiy qiyinchiliklarga duch kelmoqda, bu esa davlat va bozor mexanizmlarini uyg'unlashtirgan holda qo'llab-quvvatlash zarurligini asoslaydi. Farg'ona kabi mehnat resursi mo'l hududlarda bu muammolar yanada keskin namoyon bo'ladi, chunki yer taqchilligi va qishloq joylardagi infratuzilma zaifligi yangi biznes tashabbuslarining paydo bo'lishini cheklaydi.

Xorijiy tajriba. Xitoy va Turkiyaning hududlarda tadbirkorlik infratuzilmasini rivojlantirish tajribasi shuni ko'rsatadiki, mahalliy resurslarga asoslangan ixtisoslashtirilgan hududiy zonalar va davlat-xususiy sheriklik mexanizmlari kichik biznesning barqaror o'sishiga xizmat qiladi, bunday tajribani milliy sharoitga moslashtirish orqali qo'llash mumkin. Xususan, har bir tumanning o'ziga xos resurs salohiyatiga (paxta xomashyosi, hunarmandchilik, mevachilik) mos ixtisoslashtirilgan zonalarini tashkil etish g'oyasi Farg'ona viloyati uchun ham dolzarb hisoblanadi, chunki paxtani chuqur qayta ishlash asosida qo'shilgan qiymatli mahsulotlar ulushini oshirish istiqboldagi ustuvor yo'nalishlardan biri sifatida qaralmoqda.

Takomillashtirish yo'nalishlari. O'tkazilgan tahlil asosida quyidagi tashkiliy-iqtisodiy mexanizmlarni takomillashtirish yo'nalishlarini taklif etish mumkin:

1. Farg'ona viloyatining har bir tumani uchun resurs va mehnat salohiyatiga mos ixtisoslashtirilgan kichik sanoat zonalarini kengaytirish, ayniqsa tog' oldi va chekka tumanlarni qamrab olgan holda;
2. "Biznesni rivojlantirish banki" orqali amalga oshirilayotgan moliyaviy-kredit dasturlarini hududiy filiallar tarmog'i orqali qishloq joylarga yaqinlashtirish;
3. Klaster tizimini fermer xo'jaliklari, qayta ishlash kichik korxonalari va eksport tashkilotlari o'rtasida shakllantirish, bu orqali xomashyoni yerlik joyda qo'shilgan qiymatga aylantirish;
4. Raqamli platformalar va elektron savdo infratuzilmasini rivojlantirish orqali chekka hududlardagi kichik biznesning bozorga chiqish imkoniyatlarini kengaytirish, zero chekka hududlarda internet tezligi va sifatining pastligi hamda logistika tarmoqlarining to'liq qamrab olinmaganligi bu boradagi asosiy cheklovlardan biri hisoblanadi;
5. Biznes-inkubatorlar va maslahat markazlari tarmog'ini kengaytirish orqali yangi tadbirkorlarni huquqiy va moliyaviy savodxonlik bilan qo'llab-quvvatlash.

Xulosa. Xulosa qilib aytganda, Farg'ona viloyatida kichik biznesni rivojlantirish milliy iqtisodiy siyosatning ustuvor yo'nalishlaridan biri bo'lib, uning samaradorligi ko'p jihatdan tashkiliy-

iqtisodiy mexanizmlarning izchilligiga bog'liq. Kichik sanoat zonalari, maqsadli soliq imtiyozlari va moliyaviy qo'llab-quvvatlash dasturlari muhim asos yaratgan bo'lsa-da, infratuzilma, moliyaga kirish va bozorga chiqish borasidagi muammolar hali to'liq bartaraf etilmagan. Xorijiy tajribani mahalliyashtirish, klasterlashtirish va raqamli infratuzilmani rivojlantirish orqali ushbu mexanizmlarni takomillashtirish viloyatning ijtimoiy-iqtisodiy salohiyatini to'liqroq ro'yobga chiqarishga xizmat qiladi.

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Mechanisms For Financing Green Investments In Small Businesses And Assessment Of Their Efficiency

Umarov Sardor

Head of the Department of Youth Affairs, Kokand University

Abstract

The paper examines the mechanisms for financing green investments in small business entities. Funding sources are classified into internal, debt, equity and state support groups, and the constraints of each for small business are analysed. A multi-criteria system for assessing the effectiveness of green investments is proposed, combining financial, resource, environmental and social indicators. An algorithm for selecting a financing mechanism is also substantiated.

Keywords: green investment, small business, financing mechanism, green credit, effectiveness assessment, resource intensity, payback period, environmental indicator.

Annotatsiya

Tezisda kichik biznes subyektlarida yashil investitsiyalarni moliyalashtirish mexanizmlari tadqiq etiladi. Moliyalashtirish manbalari ichki, qarz, ulushli va davlat qo'llab-quvvatlash guruhlariga tasniflanib, har birining kichik biznes uchun cheklovlari tahlil qilinadi. Yashil investitsiyalar samaradorligini baholashning ko'p mezonli tizimi taklif etiladi: unda moliyaviy, resurs, ekologik va ijtimoiy indikatorlar birlashtiriladi. Shuningdek moliyalashtirish mexanizmini tanlash algoritmi asoslanadi.

Kalit so'zlar: yashil investitsiya, kichik biznes, moliyalashtirish mexanizmi, yashil kredit, samaradorlikni baholash, resurs sig'imi, qaytarilish muddati, ekologik indikator.

Muammoning qo'yilishi

Yashil investitsiyalar odatda an'anaviy investitsiyalarga nisbatan yuqori boshlang'ich xarajat va uzoqroq qaytarilish muddati bilan tavsiflanadi [8]. Yirik korxonalar bu xususiyatga o'z moliyaviy zaxiralari hisobiga bardosh bera oladi. Kichik biznes subyektlari esa aylanma mablag' tanqisligi, garov ta'minotining yetishmasligi va kredit tarixining qisqaligi sharoitida ishlaydi [4] — shu sababli ular uchun moliyalashtirish masalasi yashil o'tishning asosiy to'sig'i bo'lib qoladi. Muammoning ikkinchi jihatida baholash bilan bog'liq. Yashil investitsiya loyihasini faqat an'anaviy moliyaviy mezonlar (qaytarilish muddati, ichki rentabellik normasi) bilan baholash uning ekologik va ijtimoiy samarasini hisobga olmaydi va natijada loyiha noqulay ko'rinadi. Bu esa moliyalashtirish qarorining asossiz rad etilishiga olib keladi. Ekologik samarani iqtisodiy baholashga kiritish zarurligi tabiiy resurslar iqtisodiyoti nazariyasida ham asoslangan [7]. Demak, baholashning ko'p mezonli tizimi zarur.

Milliy me'yoriy baza bu yo'nalishda zarur asosni yaratgan. 2019–2030-yillar davrida yashil iqtisodiyotga o'tish strategiyasining "Yashil investitsiyalarni qo'llab-quvvatlash" bo'limida yashil kreditlash va venchur moliyalashtirish tizimini joriy etish, yashil fondlar hamda energiya tejamkorligining maxsus fondlarini yaratish, banklarni yashil investitsiyalarga rag'batlantirish va fiskal siyosat orqali davlat ko'magini ta'minlash vazifalari belgilangan [1]. Shu bilan birga, ushbu vositalarni kichik biznes sharoitiga moslashtirish va ularning samaradorligini baholash metodikasi ilmiy jihatdan yetarli ishlab chiqilmagan.

Moliyalashtirish manbalarining tasnifi

Kichik biznesda yashil investitsiyalarni moliyalashtirish manbalari to'rt guruhga ajratiladi. Har bir manbaning kichik biznes uchun cheklovlari 1-jadvalda tahlil qilingan.

Manba guruhi	Asosiy shakllari	Kichik biznes uchun cheklovlari

Ichki manbalar	Foyda hisobidan qayta investitsiya, amortizatsiya fondi	Hajmi cheklangan; aylanma mablag'dan chetlanish riski
Qarz manbalari	Bank krediti, yashil kredit liniyalari, lizing, mikrokredit	Garov talabi, yuqori foiz, qisqa muddat
Ulushli manbalar	Venchur kapitali, biznes-angellar, kraudfanding	Boshqaruv ulushini berish; bozorning shakllanmaganligi
Davlat qo'llab-quvvatlashi	Grant, subsidiya, foiz qoplash, kafolat, soliq imtiyozi	Murakkab tanlov tartibi; ma'lumot yetishmasligi

1-jadval. Yashil investitsiyalarni moliyalashtirish manbalari

Xorijiy tajriba tahlili shuni ko'rsatadi [3, 4]: kichik biznes uchun eng samarali yechim manbalarni birlashtirish — aralash moliyalashtirish modelidir. Bunda davlat qo'llab-quvvatlash vositalari (kafolat, foiz subsidiyasi) tijorat kreditining ochilishi uchun sharoit yaratadi, ichki manbalar esa loyihaning o'z ulushini ta'minlaydi.

Samaradorlikni baholashning ko'p mezonli tizimi

Yashil investitsiya loyihasi samaradorligini baholash uchun to'rt guruh indikatorlarini o'z ichiga olgan tizim taklif etiladi (2-jadval).

Indikator guruhi	Asosiy ko'rsatkichlar	Hisoblash asosi
Moliyaviy	Sof joriy qiymat, ichki rentabellik normasi, qaytarilish muddati, rentabellik	Pul oqimlari prognozi
Resurs samaradorligi	Mahsulot birligiga energiya sarfi, suv sarfi, xomashyo sig'imi	Ishlab chiqarish hisobi ma'lumotlari
Ekologik	Chiqindi hajmi kamayishi, uglerod izi, qayta ishlash ulushi	Ekologik hisobot, o'lchov ma'lumotlari
Ijtimoiy	Yangi ish o'rinlari, mehnat sharoiti, mahalliy hamjamiyatga ta'sir	Kadrlar hisobi, so'rov ma'lumotlari

2-jadval. Yashil investitsiya samaradorligini baholash indikatorlari

Baholashda indikator guruhlari teng ahamiyatga ega emas. Ular uchun ekspert usulida vazn koeffitsiyentlari belgilanadi. Kichik biznes sharoiti uchun quyidagi vaznlar taklif etiladi: moliyaviy guruhga eng yuqori vazn beriladi, chunki korxonaning moliyaviy barqarorligi loyihani amalga oshirishning zaruriy sharti; resurs va ekologik guruhlar teng vaznga ega, zero ular loyihaning yashil maqsadini bevosita ifodalaydi; ijtimoiy guruhga nisbatan past vazn beriladi, chunki kichik biznes miqyosida bu samara cheklangan bo'ladi. Integral ko'rsatkich vaznlangan baholar yig'indisi sifatida hisoblanadi.

Hisoblash usulini ko'rsatish uchun shartli misol keltiriladi: kichik ishlab chiqarish korxonasi quyosh panellari o'rnatish va suvni qayta ishlatish tizimini joriy etish loyihasini ko'rib chiqmoqda. Baholar besh balli shkalada berilgan (3-jadval).

Indikator guruhi	Vazn koeffitsiyenti	Baho (1–5)	Vaznlangan baho
Moliyaviy	0,35	3	1,05
Resurs samaradorligi	0,25	5	1,25
Ekologik	0,25	4	1,00
Ijtimoiy	0,15	3	0,45
JAMI (integral ko'rsatkich)	1,00	—	3,75

3-jadval. Integral samaradorlik ko'rsatkichini hisoblash (shartli misol)

Misoldan ko'rinadiki, loyihaning moliyaviy ko'rsatkichlari o'rtacha (qaytarilish muddati uzoq) bo'lishiga qaramay, resurs tejash va ekologik samara bo'yicha yuqori baho olgani hisobiga integral ko'rsatkich 3,75 ga teng bo'ldi. Faqat moliyaviy mezonlar bilan baholanganda bu loyiha rad etilishi mumkin edi — bu ko'p mezonli yondashuvning amaliy afzalligini ko'rsatadi.

Integral ko'rsatkich natijasini izohlash uchun quyidagi shkala taklif etiladi (4-jadval).

Integral ko'rsatkich	Baholash	Moliyalashtirish bo'yicha tavsiya
1,00 – 2,49	Past	Loyiha qayta ko'rib chiqilishi lozim; moliyalashtirish tavsiya etilmaydi
2,50 – 3,49	O'rtadan past	Shartli maqbul; faqat davlat qo'llab-quvvatlash vositalari bilan birga
3,50 – 4,24	Yuqori	Moliyalashtirish tavsiya etiladi; aralash model maqbul
4,25 – 5,00	Juda yuqori	Ustuvor loyiha; imtiyozli shartlarda moliyalashtirish

4-jadval. Integral ko'rsatkich natijasini izohlash shkalasi

Metodik izoh: yuqoridagi vazn koeffitsiyentlari va shkala chegaralari mualliflik taklifi bo'lib, ular ekspert baholash usuli asosida aniqlanadi. Aniq tadqiqot yoki loyihada ular ekspertlar guruhi fikri, soha xususiyatlari va davlat qo'llab-quvvatlash siyosati ustuvorliklaridan kelib chiqib qayta ko'rib chiqilishi mumkin. Baholarni belgilashda har bir indikator guruhi uchun quyidagi mantiq qo'llaniladi: 1 — ko'rsatkich juda past, 3 — soha o'rtacha darajasida, 5 — eng yaxshi natija.

Moliyalashtirish mexanizmini tanlash algoritmi

Kichik biznes subyekti uchun moliyalashtirish mexanizmini tanlash quyidagi ketma-ketlikda amalga oshirilishi taklif etiladi:

- 1) loyiha turini aniqlash — resurs tejash, chiqindini qayta ishlash, muqobil energiya yoki ekologik mahsulot ishlab chiqarish;
- 2) investitsiya hajmi va qaytarilish muddatini baholash;
- 3) korxonaning moliyaviy holatini va garov salohiyatini tahlil qilish;
- 4) mavjud davlat qo'llab-quvvatlash vositalarini aniqlash va ularga muvofiqlikni tekshirish;

5) manbalarni birlashtirish variantlarini shakllantirish va ularni integral ko'rsatkich bo'yicha taqqoslash;

6) tanlangan variant bo'yicha risklarni baholash va zaxira variantni belgilash.

Xulosa va takliflar

1. Kichik biznesda yashil investitsiyalarni moliyalashtirishning yagona universal manbasi mavjud emas; eng samarali yechim — davlat qo'llab-quvvatlash vositalari bilan tijorat moliyalashtirishni birlashtirgan aralash model.

2. Yashil investitsiya loyihasini faqat moliyaviy mezonlar bilan baholash uning haqiqiy qiymatini kamaytirib ko'rsatadi; baholash tizimi resurs, ekologik va ijtimoiy indikatorlarni ham o'z ichiga olishi kerak.

3. Integral ko'rsatkichga asoslangan baholash usuli turli loyihalarni bir asosda taqqoslash va moliyalashtirish qarorini asoslash imkonini beradi. Keltirilgan shartli misol shuni ko'rsatdi: moliyaviy ko'rsatkichlari o'rtacha bo'lgan loyiha ekologik va resurs samarasi hisobiga maqbul darajaga chiqishi mumkin.

4. Kafolat fondlari va foiz stavkasini qoplash mexanizmlari kichik biznes uchun eng ta'sirchan vositalar hisoblanadi, chunki ular garov yetishmovchiligi muammosini bevosita hal qiladi.

5. Moliyalashtirish mexanizmlari samaradorligini oshirish uchun ularni ma'lumot va konsalting infratuzilmasi bilan birga joriy etish zarur.

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Enhancing Organizational and Economic Mechanisms for Small Business Development in Remote Areas: A Case Study of the Fergana Region, Uzbekistan

Nazirov Xusanjon Saydullaxon o'g'li

Kokand University

xnazirov910@gmail.com

Abstract

Using the Fergana region as a case study, this article analyzes the organizational and economic mechanisms of small business development from the standpoint of institutional economic theory. Based on official statistical data, it shows the share of small business in the region's gross regional product, industry, trade, and services. The effectiveness of existing institutional, financial, and infrastructural mechanisms is assessed, and a table of concrete measures for their improvement is proposed.

Keywords: Small business, institutional economics, organizational-economic mechanism, Fergana region, gross regional product, clustering, statistical analysis, regional development.

Annotatsiya

Maqolada Farg'ona viloyati misolida kichik biznesni rivojlantirishning tashkiliy-iqtisodiy mexanizmlari institutsional iqtisodiyot nazariyasi nuqtayi nazaridan tahlil qilingan. Rasmiy statistik ma'lumotlar asosida viloyatda kichik tadbirkorlikning yalpi hududiy mahsulot, sanoat, savdo va xizmat sohasidagi ulushi ko'rsatib berilgan. Mavjud institutsional, moliyaviy va infratuzilmaviy mexanizmlarning samaradorligi baholanib, ularni takomillashtirishning aniq chora-tadbirlar jadvali taklif etilgan.

Kalit so'zlar: Kichik biznes, institutsional iqtisodiyot, tashkiliy-iqtisodiy mexanizm, Farg'ona viloyati, yalpi hududiy mahsulot, klasterlashtirish, statistik tahlil, mintaqaviy rivojlantirish.

Kirish. Kichik biznesni rivojlantirish muammosini faqat huquqiy-me'yoriy nuqtayi nazardan emas, balki institutsional iqtisodiyot nazariyasi asosida ham tahlil qilish maqsadga muvofiqdir. Amerikalik iqtisodchi Duglas Nort ta'kidlaganidek, iqtisodiy o'sish sur'ati ko'p jihatdan "oyin qoidalari" - ya'ni institutlarning sifati va ularning bir-biriga mos kelishi bilan belgilanadi. Bu nazariya kichik biznesni qo'llab-quvvatlashning turli mexanizmlari (huquqiy, moliyaviy, infratuzilmaviy) alohida-alohida emas, balki yaxlit tizim sifatida ishlashi zarurligini ko'rsatadi. Jozef Shumpeterning "innovatsion tadbirkorlik" nazariyasi esa kichik biznesning iqtisodiy rivojlanishning asosiy "dvigateli" ekanligini asoslaydi - ayniqsa resurslarga boy, biroq sanoatlashuv darajasi past bo'lgan hududlarda.

Farg'ona viloyati mamlakatning eng zich joylashgan mintaqasi bo'lib, aholining yer resursiga nisbati past, biroq mehnat resurslari mo'l hududlardan biridir. Shu sababli kichik biznes bu yerda nafaqat qo'shimcha, balki asosiy bandlik va daromad manbai vazifasini bajaradi.

Viloyatning statistik-iqtisodiy tavsifi. Rasmiy statistik ma'lumotlarga ko'ra, Farg'ona viloyatida kichik tadbirkorlik iqtisodiyotning deyarli barcha tarmoqlarida ustuvor o'rin egallaydi. Buni quyidagi ko'rsatkichlarda ko'rish mumkin:

Ko'rsatkich	Davr	Qiymat
Kichik tadbirkorlikning YaHMDagi ulushi	2020-yil	67,9 %
Sanoat mahsulotlari ishlab chiqarishidagi ulushi	2025-y. yanv.-iyun	55,4 %
Ulgurji savdo aylanmasidagi ulushi	2025-y. yanv.-may	95,2 %

Xizmatlar (bozor xizmatlari) hajmidagi ulushi	2024-y. yanv.-fev.	63,9 %
Yangi tashkil etilgan kichik korxona va mikrofirmalar	2019–2023-y.	6 200 ta
Kichik tadbirkorlik subyektlari zichligi	2020-yil	13,9 / 1000 aholi

Keltirilgan ma'lumotlar shuni ko'rsatadiki, kichik biznes viloyat iqtisodiyotining tarmoqlar bo'yicha aksariyat qismini shakllantiradi. Shu bilan birga, yangi tashkil etilgan korxonalar sonining barqaror o'sishi hududda tadbirkorlik muhitining nisbatan qulayligini ko'rsatsa-da, subyektlar zichligi ko'rsatkichi mamlakat o'rtacha darajasidan sezilarli farq qilmasligi hududiy salohiyat hali to'liq ishga tushirilmaganidan dalolat beradi.

Amaldagi tashkiliy-iqtisodiy mexanizmlar tahlili. Farg'ona viloyatida kichik biznesni qo'llab-quvvatlashning uch asosiy institutsional shakli mavjud: birinchidan, kichik sanoat zonalarini orqali yer va mulk resurslariga imtiyozli kirish; ikkinchidan, "Biznesni rivojlantirish banki" orqali amalga oshirilayotgan moliyaviy-kredit dasturlari; uchinchidan, iqtisodiy rivojlanish darajasi past (5-toifa) tumanlarda amal qiluvchi soliq imtiyozlari tizimi⁸. Institutsional iqtisodiyot nuqtayi nazaridan, bu uchala mexanizm alohida-alohida emas, balki bir-birini to'ldiruvchi yaxlit tizim sifatida ishlagandagina yuqori samara berishi mumkin - biroq amaliyotda ular ko'pincha turli idoralar tomonidan mustaqil ravishda amalga oshirilib, o'zaro muvofiqlashtirilmagan holatlar uchraydi.

Muammolar. O'tkazilgan tahlil quyidagi asosiy muammolarni aniqladi:

- hududlararo infratuzilma tengsizligi: elektr energiyasi va logistika xarajatlarining yuqoriligi tog' oldi tumanlarida tekislik tumanlariga nisbatan kichik biznes rentabelligini pasaytiradi⁹;
- moliyaviy resurslarga kirish murakkabligi: kichik va yangi tashkil etilgan korxonalar uchun kredit garov ta'minoti va hujjat aylanmasi og'ir bo'lib qolmoqda;
- institutlar o'rtasidagi muvofiqlashtirish yetishmovchiligi: soliq, moliya va hududiy hokimiyat organlari tomonidan qo'llaniladigan chora-tadbirlarning bir-biriga bog'liqligi zaif.

Takomillashtirish bo'yicha takliflar. Institutsional yondashuv asosida quyidagi kompleks chora-tadbirlar tizimi taklif etiladi:

Mexanizm turi	Amaliy chora	Kutilayotgan natija
Institutsional	Tuman darajasida "bir oyna" tadbirkorlik xizmati va monitoring markazlarini kengaytirish	Ro'yxatdan o'tish va litsenziyalash muddatining qisqarishi
Moliyaviy	Tog' oldi tumanlari uchun subsidiyalangan kredit va kafolat fondlarini kengaytirish	Kreditga kirish narxining pasayishi
Ishlab chiqarish-klaster	Fermer, qayta ishlash va eksport tashkilotlarini yagona klasterga birlashtirish	Qo'shilgan qiymat ulushining oshishi
Infratuzilmaviy	Kichik sanoat zonalarini elektr va yo'l tarmog'i bilan ta'minlash	Ishlab chiqarish xarajatlarining kamayishi
Raqamli	Elektron savdo va onlayn moliyaviy xizmatlar platformalarini joriy etish	Bozorga chiqish imkoniyatining kengayishi

Xulosa. Farg'ona viloyati misolida o'tkazilgan tahlil shuni ko'rsatadiki, kichik biznes hududiy iqtisodiyotning tayanch tarmog'iga aylangan bo'lsa-da, uni qo'llab-quvvatlovchi tashkiliy-iqtisodiy mexanizmlar hali yaxlit tizim sifatida ishlamayapti. Institutsional iqtisodiyot nazariyasidan kelib chiqib, mexanizmlarni alohida chora-tadbirlar emas, balki bir-biriga bog'liq va bir-birini to'ldiruvchi yaxlit tizim sifatida takomillashtirish zarur. Bunday yondashuv Farg'ona viloyatining mehnat va resurs salohiyatini to'liqroq ishga solish, hududiy tengsizlikni kamaytirish hamda barqaror iqtisodiy o'sishga erishish imkonini beradi.

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Production Of Extraction Phosphoric Acid And Increasing Its Concentration

Yunuskhon Olimjonov

3rd-year student, Namangan Branch of
Tashkent Kimyo International University

Abstract

This article presents methods for producing extraction phosphoric acid (EPA) and technologies for obtaining high-quality fertilizers with high nutrient content from the resulting extraction phosphoric acid. Methods for reducing the fluorine content in the produced EPA are also considered.

Keywords: extraction phosphoric acid (EPA), sulfuric acid, dihydrate process, gypsum, Cajir, washing, yield.

Annotatsiya

Ushbu maqolada ekstraksiya fosfat kislotasi olinish usullari, hosil bo'lgan ekstraksiya fosfat kislotadan ozuqa miqdori yuqori bo'lgan sifatli o'g'it olinish texnologiyalari keltirilgan. Hosil bo'lgan EFKdagi ftor miqdorini kamaytirish usullari ko'rilgan.

Kalit so'zlar: EFK, sulfat kislotasi, digidrat usuli, gips, K_{ajr} , K_{yuvish} , K_{unum} .

Adabiyotlar sharhi. Fosforitlardan ekstraksiya fosfat kislotasi (EFK) olish uchun 93% li sulfat kislotasi ishlatish afzaldir. Bunda texnologik jarayondagi suv balansi yaxshilanadi – gipsning yuvilishini ko'p miqdordagi suv bilan amalga oshirish imkoniyati yaratiladi. Natijada chiqindiga chiqariluvchi fosfogips bilan yo'qotiladigan fosfat kislotasi va zararsizlantirish lozim bo'lgan oqava suvlar miqdori kamayadi.

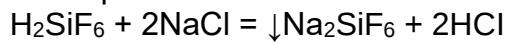
Kislotasi konsentratsiyasining oshirilishi olinadigan fosfat kislotadagi P_2O_5 miqdorini o'zgartirmaydi, gips kristallanishining maqbul sharoiti orqali oldindan belgilanadi. Yanada yuqoriroq konsentratsiyali sulfat kislotasi ishlatilganda issiqlik ajralishi (suyultirish issiqligini ortishi hisobiga) keskin ortadi, uni esa sistemadan ajratib olish talab etiladi.

Digidratli usulda fosfat kislotasi olishda fosfat xom ashyosi tarkibidagi barcha ftorning (asosan SiF_4 tarzida) 3-5% igina gazli faza bilan ajraladi, taxminan 80%i EFKga, 15-17%i esa fosfogipsga o'tadi. Sovutish usuli va ventilyatorning uzatishga bog'liq holda ekstraktordan ajratib olinadigan gaz tarkibidagi ftoridlar konsentratsiyasi, ftor hisobida 0,2-2,5 g/m³ ni tashkil etadi. Ekstraksiya sexida o'rnatilgan absorptsiya sistemalari, asosan, chiqindi gazlarini tozalash uchun mo'ljallangan, bunda hosil bo'ladigan H_2SiF_6 ning kuchsiz eritmaları neytrallashtirish stansiyalariga yuboriladi yoki fosfogipsni yuvish uchun ishlatiladi.

Amaliy qism. Tabiiy fosfatlardan ekstraksiya fosfat kislotasi ishlab chiqarish ko'rsatkichlari analitik ma'lumotlar bo'yicha aniqlanadi: P_2O_5 ning texnologik unumi (K_{unum} , %), ya'ni P_2O_5 ning xom ashyodan fosfat kislotaga o'tish darajasi apatitni qayta ishlashda – 95-96% ni va turli fosforitlar uchun – 71-94% ni tashkil qiladi. U P_2O_5 ning eritmaga ajralish koeffitsienti (K_{ajr} , %) dan 2-3% ga kichikdir. Buni fosfogipsni fosfat kislotadan yuvilishining to'la bo'lmasligi bilan izohlanadi: yuvilish koeffitsienti (K_{yuvish} , %) odatda 97-99% ni tashkil etadi. Vaholanki: $K_{unum} = K_{ajr} \cdot K_{yuvish} / 100$ ga teng. Ekstraksiyalashning digidratli usulida kislotaga P_2O_5 ning mahsulotli (xo'jalik) unumi 93-95% ni tashkil etadi, shunga mos ravishda 1 t P_2O_5 li mahsulotga 2,73-2,65 t apatit (1075-1045 kg P_2O_5) va 2,48-2,45 t (CaO ni bog'lash uchun stexiometrik me'yordagi, ya'ni 1 t apatitga 0,915 t) 100% li sulfat kislotasi sarflanadi. Fosforitlarni qayta ishlashdagi sarf koeffitsientlari apatitlarni qayta ishlashdagiga nisbatan: fosfat bo'yicha 1,5-2,3 marta; fosfat tarkibidagi P_2O_5 bo'yicha 1,02-1,27 marta; sulfat kislotasi bo'yicha 1,2-1,7 marta kattaroqdir. Xom ashyo harajatlari EFK ishlab chiqarish umumiy harajatlarining 70-80% ni tashkil etadi.

Apatitdan digidratli usulda olinadigan EFK tarkibida: 25-32% P_2O_5 ; 1,8-2,8% SO_3 ; 0,1-0,4% CaO ; 0,3-0,4% Al_2O_3 ; 0,3-0,5% Fe_2O_3 ; 1,7-2% F bo'ladi.

EFK tarkibidagi ftor asosan H_2SiF_6 shaklida bo'ladi. Kislotalarni ftordan tozalash, H_2SiF_6 ni natriy, kaliy, bariy tuzlari bilan cho'ktirish orqali o'tkazilishi mumkin. Odatda 1 l fosfat kilotaga 30-40 g NaCl qo'shiladi.



Reaksiya bo'yicha hosil bo'ladigan kam eruvchan natriy kremneftorid cho'kmaga tushadi va dastlab tindirilib, so'ngra tsentrifugalash va filtrlash yo'li bilan ajratib olinadi. Shunday qilib 75-85% gacha ftorni ajratiladi va fosfat kislotalarining miqdori 0,2-0,3% gacha kamayadi. Natriy xlorid bilan ftorsizlantirilgan fosfat kislota, ayniqsa, harorat oshirilganda jihozlarning kuchli korroziyalanishiga sabab bo'ladi. Shuning uchun kislotalarni bug'latish yo'li bilan kontsentratsiyaga zarurat tug'ilganda, ftorsizlantirish soda yoki natriy fosfat yordamida amalga oshiriladi.

Qo'shaloq superfosfat, ammosfos, nitroammosfoska ishlab chiqarish uchun 45-55% P_2O_5 tutgan fosfat kislota, ammoniy polifosfatlari va suyuq o'g'itlar olish uchun esa – 72-83% P_2O_5 li fosfat kislotalari talab etiladi. Bunday hollarda ekstraksiya fosfat kislota bug'latiladi. Ma'lumki, har qanday (98% li H_3PO_4 gacha) konsentratsiyadagi toza fosfat kislotalarining bug'i faqat suvdan iborat, nazariy olganda uni bug'latish orqali yuqori konsentratsiyali eritmalarini olish mumkin. Amalda esa jihozlar materiallarining korroziyalanishi hisobiga bug'latish qiyinchilik tug'diradi. Harorat va kislota konsentratsiyasining ortishi bilan korroziyalanish tezlashadi. Bundan tashqari, konsentratsiya ortishi bilan kislota tarkibidagi qo'shimchalarni eruvchanliklarini keskin kamayishi hisobiga cho'kmaga tushadi. Cho'kmali qoldiqlar qizdiriluvchi yuzasining ichki sirtga o'tirib qolib, issiqlik almashinuvini yomonlashtiradi.

Ekstraksiya fosfat kislotalarining konsentratsiyasi ortishi bilan unda erigan geksafosfor kislotalarining bug' bosimi ham ortadi. Shu tufayli fosfat kislotalarining 52-57% P_2O_5 gacha bug'latishda boshlang'ich kislotalarining ftorning 80-90%i gazli fazaga ajralib chiqadi va bunda EFK dagi ftorning miqdori 0,5-0,8 % gacha kamayadi.

EFKni bug'latish uchun barbotajli konsentratorlar – kislotalardosh materialli kameralar ham ishlatiladi, ularda bug'latish kislotalarining yuza qatlami orqali yoqilgan qaynoq gaz berish orqali amalga oshiriladi. Bu yerda issiqlik uzatuvchi yuza bo'lmaydi, issiqlik almashinish qaynoq gaz bilan kislotalarining to'g'ridan-to'g'ri to'qnashishidan amalga oshadi; bunda hosil bo'ladigan cho'kma muallaq holatda qoladi va apparatdan kislota bilan birgalikda chiqadi, so'ngra uni tindirish orqali tozalanadi. Kameraga o'choq gazlari 650-900°C haroratda beriladi. Ayniqsa, tabiiy gaz yondiriladigan grafitli botirma yondirgichli konsentratorlar samarali ishlaydi. Barbotajli konsentrator va botirma yondirgichli jihozlarda gaz o'zi bilan birga anchagina miqdordagi fosfat kislota bug'ini olib chiqadi, uni esa elektrofiltarlarda tutib qolish lozim bo'ladi. Tarkibida 8,5-9 g/m³ ftor (elektrofiltr ga kirishdan oldin havo bilan aralashishi hisobiga – 3 g/m³) bo'lgan chiqindi gazlarini tozalashda ko'p miqdordagi P_2O_5 tutgan H_2SiF_6 eritmasi olinadi; ularni ishlatish qiyinchilik tug'diradi. Tuman hosil bo'lishi – P_2O_5 yo'qotilishini orshiradi, bundan tashqari atrof-muhit ifloslanishiga sabab bo'ladi. Bunday jihozlar ko'proq superfosfat kislotalar olish uchun qo'llaniladi. Bu holda bug'latishga tarkibida 54-55% P_2O_5 tutgan eritmalar (vakuum-bug'latgichdan so'ng) beriladi. Bunday maqsadlar uchun qizdiruvchi kameraga yuqori bosimdagi bug' (~3 MPa) uzatiladigan vakuum-bug'latgichli jihozlar ham ishlatilishi mumkin.

Xulosa. Hozirgi paytda barbotajli konsentratorlar o'rnida yanada takomillashgan, yuqori darajada issiqlikdan foydalanuvchi aeroliftli jihozlar qo'llanilmoqda. Ular ichki qismi grafitli quvur bilan muhofazalangan vertikal po'lat quvurdan iborat. Uning bug'latiladigan kislota kiritiladigan pastki qismidan qaynoq gaz oqimi yuboriladi, hosil bo'ladigan gaz-suyuqlik aralashma yuqori qismidan chiqariladi. Suyuqlikni ajratilgandan keyin va issiqligidan bug'latiladigan kislotalarni isitishda foydalanilgandan so'ng, chiqindi gazi, absorptsiya qurilmalarida kislota tumani, SiF_4 va HF dan tozalanadi. Suyuq kompleks o'g'itlar ishlab chiqarish uchun mo'ljallangan, tarkibida 68-70% P_2O_5 tutgan kislota olish uchun

konsentrlashni ikkita ketma-ket bosqichda: 1-chisida 52-54 dan 64% gacha, 2-chisida esa 68-70% P_2O_5 gacha o'tkaziladi.

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The Effect Of The Sulfuric Acid Dosage On The Degree Of Phosphorus Recovery In The Production Of Phosphoric Acid From Ordinary Phosphorite Flour By The Clinker Process

Alisher Avazjonovich Nodirov

PhD, Academic Lyceum No. 2,

Tashkent State Medical University

Оддий Фосфорит Унидан Клинкер Усулида Фосфат Кислота Олишда Сульфат Кислота Меъёрининг Фосфорни Ажратиб Олиш Даражасига Таъсири

Ҳозирги пайтда фосфат кислота икки хил усулда ишлаб чиқарилмоқда. Биринчи усул фосфат хом ашёларидаги фосфорни қайтариб, фосфор ҳолига келтирилади, олинган фосфор оксидланиб фосфат ангидридга айлантирилади ва ҳосил бўлган фосфат ангидрид сувга юттирилади. Фосфат кислота ишлаб чиқаришнинг ушбу усули куруқ (электропечли) усул ва олинган фосфат кислота термик фосфат кислота (ТФК) деб аталади. Фосфат кислота ишлаб чиқаришнинг иккинчи усули бу фосфат хом ашёларини кучли минерал кислоталар (нитрат, хлорид ва сульфат кислоталар) ёрдамида қайта ишлаб уни ажратиб олишдир. Бундай усул ҳўл (экстракцион) усул ва олинган фосфат кислота экстракцион фосфат кислота (ЭФК) деб аталади.

Ҳозирги вақтда ЭФК ишлаб чиқаришнинг иккита усули мавжуд бўлиб, улар фосфат хом ашёларини аввал ЭФК билан парчалаб кейин сульфат кислотали экстракция қилиш (ҳўл усул) ва фосфат хом ашёни аввал 93-98%-ли сульфат кислота билан таъсирлаштириб кейин ундан фосфат кислотани сув билан ажратиб олишдир (клинкер усул).

Биринчи усул, яъни ҳўл усул дунё бўйлаб жуда кенг тарқалган. Деярли фосфат хом ашёси бор мамлакатларда ушбу усул қўлланилади. Ушбу жараёнларда кальций сульфат чўкма сифатида ҳосил бўлади ва у асосий суспензиядан ажратилади. Ҳарорат ҳамда эритмадаги P_2O_5 ва SO_4^{2-} ларнинг миқдорларига қараб, кальций сульфат дигидрат ($CaSO_4 \cdot 2H_2O$), ярим гидрат ($CaSO_4 \cdot 0,5H_2O$) ва ангидрид ($CaSO_4$) кўринишида ҳосил бўлади. ЭФК ишлаб чиқаришнинг асосий усули бизнинг мамлакатда ҳам ва бошқа мамлакатларда ҳам нисбатан оддий ва ишончли бўлган асосий усули бу дигидратли усулдир.

Ҳозирда бутун дунёда ЭФК ишлаб чиқаришнинг клинкер усули, яъни иккинчи усул амалда қўлланилмайди. Лекин шундай бўлсада, бу усул ҳам чет мамлакатларда ўрганилган. Айниқса АҚШ олимлари томонидан келтирилган ихтиро диққатга сазовордир. Бунда фосфат хом ашёси 98%-ли сульфат кислотаси билан аралаштирилади ва донадорланади, доналарни фтордан тозалаш мақсадида 200-240°C ёки 350-400°C да қиздирилади ва ҳосил бўлган аралашмадан фосфат кислота сув ёрдамида ажратиб олинади. Ушбу усулда ЭФК олишни бир қатор афзалликлари мавжуд: ЭФК таркибидаги P_2O_5 ни концентрациясини юқорилиги ва ундаги фтор миқдорини камлиги.

Ҳозирги вақтда мамлакатимиз олимлари томонидан фосфат хом ашёларидан бундай усулда ЭФК олиш бўйича илмий тадқиқотлар олиб борилмаган. Аммо сўнгги пайтда биз томонимиздан паст навли юқори карбонатли Марказий Қизилқум (МҚ) фосфоритларидан ЭФК олишнинг клинкер усули бўйича дастлабки илмий тадқиқотлар ишлари олиб борилган [3]. Ушбу тадқиқот ишида Марказий Қизилқум (МҚ) фосфорити бўлган оддий фосфорит унидан (ОФУ) клинкер усулда экстракцион фосфат кислота олиш ва унинг сифат кўрсаткичларига ОФУни парчаланиш вақти давомийлигини таъсири, ҳамда

фосфат кислотагипсли пульпадан сув ва фосфат кислота эритмаси орқали ЭФКни ажратиб олиш жараёнлари ўрганилган. Келтирилган парчаланиш вақтларида таркибида 8,19-9,37% P_2O_5 тутган ЭФК (сув билан ажратиб олинганда) ва 16,57-17,39% P_2O_5 тутган ЭФК (10% ли ЭФК билан ажратиб олинганда) ҳосил бўлиши кўрсатилган. Сув ва ЭФК билан ажратиб олишда фосфаткислота гипсли пульпаларнинг филтрланиш тезликлари ўрганилган.

Ушбу мақолада эса ЭФК нинг сифат кўрсаткичларига сульфат кислота меъёрлари ва концентрацияларини таъсири ўрганилган. Тажрибалар учун оддий фосфорит ундан (ОФУ) дан фойдаланилди. Унинг кимёвий таркиби ва тажрибаларни бажариш тартибида батафсил келтирилган. Сульфат кислота меъёрлари: 95, 100, 103, 105 ва 110% (Фосфорит хом ашёсидаги СаО га нисбатан) деб олинди. Сульфат кислота концентрацияси-93%. Парчаланиш вақти 30 дақиқа. Ҳосил бўлган клинкердан фосфат кислота қайноқ (80-90°C) сув билан ФХА: $H_2O=1,0:2,5$ нисбатда 5-10 дақиқа давомида аралаштирилди ва вакуум остида филтрлаб ажратиб олинди. ОФУ ни юқори концентрацияли сульфат кислота билан парчаланиши туфайли катта ҳажмдаги кўпиклар ҳосил бўлиши кузатилмади. ОФУ ни парчаланиш коэффициенти ($K_{парч.}$), P_2O_5 ни эритмага ажралиш коэффициенти ($K_{ажрал.}$) ва фосфат кислотали гипсли пульпаларни (бўтқа) филтрланиш тезликлари ҳисобланди. Олинган ЭФК ва фосфогипсдаги асосий моддалар аниқ бўлган усулларда таҳлил қилинди. Олинган натижалар 1-жадвалда келтирилган. Ушбу келтирилган натижалардан кўриниб турибдики, сульфат кислота меъёрини 95 дан 110% гача ортиши билан олинган ЭФК таркибидаги P_2O_5 нинг миқдори 8,46 дан 9,22% гача ортиши, СаО нинг миқдори 1,19 дан 1,15% гача камайиши ва SO_3 нинг миқдори эса 3,05 дан 4,25% гача ортиши кузатилади. Қуруқ фосфогипсдаги $P_2O_{5ум.}$ ва $P_{2O_{5сув.}}$ нинг миқдорлари мос равишда 3,08 дан 2,47% гача ва 0,49 дан 0,20% гача камайиши кузатилади. СаО ва SO_3 ларнинг миқдорлари эса мос равишда 29,61 дан 30,01% гача ва 40,19 дан 40,46% гача ортиши кузатилади. Худди шу меъёрларда $K_{парч.}$ ва $K_{ажр.}$ мос равишда 90,15 дан 94,02% гача ва 88,52 дан 92,18% гача ортади. Бунда филтрланиш тезлиги нам фосфогипс бўйича 859 дан 981 $кг/м^2 \cdot с$ гача бўлган ораликда ётади.

1-жадвал. Олинган ЭФК ва фосфогипснинг асосий кимёвий таркиби кислота меъёрини таъсири.

Моддаларни миқдори, %							K _{парч.} , %	K _{ажрал.} , %	Филтрланиш тезлиги, кг/м ² с
ЭФК			Қуруқ фосфогипс						
P ₂ O ₅	Са О	SO ₃	P ₂ O ₅ _{ум.}	P ₂ O ₅ _{сув.}	CaO	SO ₃			
H ₂ SO ₄ меъёри- 95 %									
8,46	1,19	3,05	3,08	0,49	29,61	40,19	90,15	88,52	859
H ₂ SO ₄ меъёри- 100 %									
8,78	1,18	3,21	2,89	0,35	29,72	40,26	91,36	89,64	885
H ₂ SO ₄ меъёри- 103 %									
9,21	1,17	3,39	2,58	0,24	29,84	40,35	93,73	91,70	948
H ₂ SO ₄ меъёри- 105 %									
9,29	1,17	3,87	2,52	0,21	29,95	40,42	93,89	92,05	969
H ₂ SO ₄ меъёри- 110%									

9,2 2	1,1 5	4,2 5	2,47	0,20	30,0 1	40,4 6	94,0 2	92,18	981
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Келтирилган жадвал натижаларидан яна шу нарса кўринадики, сульфат кислота меъёрлари 103, 105 ва 110% бўлганда олинadиган ЭФК ва қуруқ фосфогипсларнинг асосий кимёвий таркиблари бир-бирига жуда яқин. Бу ҳолат шундан далолат берадики, сульфат кислотани мақбул меъёрини 103-110% деб олиш мумкин, аммо сульфат кислота миқдорини тежаш нуқтаи-назаридан қараладиган бўлса ушбу миқдорларни 103-105% деб олиш мумкин. Кейинги тажрибаларда юқоридаги кўрсаткичларга сульфат кислота концентрацияларини таъсири ўрганилди. Бунда кислота концентрациялари эса 70, 75, 80, 85, 90 ва 93%, меъёри 103% га тенг. Тажрибаларни бажариш тартиби юқоридагилар билан бир хил. Олинган натижалар 2-жадвалда келтирилган.

2-жадвал. Олинган ЭФК ва фосфогипснинг асосий кимёвий таркибига кислота концентрациясини таъсири.

Моддаларни миқдори, %							K _{парч.} , %	K _{ажрал.} , %	Фильтрланиш тезлиги, кг/м ² с
ЭФК			Қуруқ фосфогипс						
P ₂ O ₅	CaO	SO ₃	P ₂ O ₅ _{ум.}	P ₂ O ₅ _{ув.}	CaO	SO ₃			
H ₂ SO ₄ концентрацияси- 70 %									
8,0 2	1,0 3	3,1 2	2,40	0,12	29,4 8	40,51	92,31	90,34	1095
H ₂ SO ₄ концентрацияси- 75 %									
8,2 5	1,0 7	3,1 6	2,45	0,14	29,5 2	40,48	92,76	90,45	1064
H ₂ SO ₄ концентрацияси- 80 %									
8,4 1	1,1 0	3,2 1	2,49	0,16	29,5 7	40,45	93,20	90,84	1011
H ₂ SO ₄ концентрацияси - 85 %									
8,7 5	1,1 3	3,2 9	2,53	0,19	29,6 5	40,42	93,38	91,23	985
H ₂ SO ₄ концентрацияси - 90 %									
9,1 2	1,1 5	3,3 5	2,56	0,22	29,7 3	40,38	93,61	91,62	964
H ₂ SO ₄ концентрацияси - 93 %									
9,2 1	1,1 7	3,3 9	2,58	0,24	29,8 4	40,35	93,73	91,70	948

Жадвалда келтирилган натижалардан кўриниб турибдики, сульфат кислота концентрацияси 70 дан 93% гача кўтарилганда олинган ЭФК таркибидagi P₂O₅ нинг миқдори 8,02 дан 9,21% гача ортиши, CaO нинг миқдори 1,03 дан 1,17% гача кўтарилиши ва SO₃ нинг миқдори эса 3,12 дан 3,39% гача ортиши кузатилади. Қуруқ фосфогипсдаги P₂O₅умум. ва P₂O₅с. нинг миқдорлари мос равишда 2,40 дан 2,58% гача ва 0,12 дан 0,24% гача ортиши кузатилади. CaO ва SO₃ ларнинг миқдорлари эса мос равишда 29,48 дан 29,84% гача ортиши ва 40,51 дан 40,35% гача камайиши кузатилади. Худди шу меъёрларда K_{парч.} ва K_{ажр.} мос равишда 92,31 дан 93,73% гача ва 90,34 дан 91,70% гача ортади. Бунда фильтрланиш тезлиги нам фосфогипс бўйича 1095 дан 948 кг/м²·с гача бўлган ораликда ётади. Албатта бунда фильтрланиш тезлигини сезиларли даражада камайиши содир бўлади. Жадвал натижаларидан яна шу нарса маълум бўладики, сульфат кислота концентрациялари 90 ва 93% бўлганда олинadиган ЭФК ва қуруқ

фосфогипсларнинг асосий кимёвий таркиблари бир-бирига жуда яқин. Демак, бунда сульфат кислотани мақбул концентрацияларини 90 ва 93% деб олиш мумкин.

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Contents of Vol. 2 No. 7 (2026)

Paper No.	Full Names	Title	Page Numbers
1	Shakhida Yusupova	A Methodological Model For Integrating Professional English Within A Dual Higher Education Framework	4–6
2	Anvarjon Uktamovich Igamberdiev	Advantages of Air Dust Collection System	7–9
3	Gulasal Khayrulloeva	Theoretical Foundations And Modern Directions Of The Study Of The Category Of Modality	10–12
4	Dilrabo Ibragimova	International School Founding Readiness Lab: A Stakeholder, Market, Curriculum, and Implementation Feasibility Study for Uzbekistan	13–17
5	Salomatposhsha Abdurahimova	Evolution Of Ideas Of Development Of The Personality Of The Head Of An Educational Institution In The History Of Pedagogical Teachings And Modern Interpretation	18–21
6	Dilrabo Ibragimova	Human-Centred AI Microcredential for English Teachers: Designing and Evaluating a Practice-Oriented Professional Development Model	22–26
7	Salomatposhsha Abdurahimova	Conceptual Model Of Training Educational Managers: Theory And Practice	27–29
8	Sardor Umarov	Improving Economic Mechanisms Of Small Business Development On The Basis Of Green Entrepreneurship	30–33
9	Xusanjon Nazirov	Improvement Of Organizational And Economic Mechanisms For Small Business Development In Remote Areas (On The Example Of Fergana Region)	34–36
10	Sardor Umarov	Mechanisms For Financing Green Investments In Small Businesses And Assessment Of Their Efficiency	37–40
11	Xusanjon Nazirov	Enhancing Organizational and Economic Mechanisms for Small Business Development in Remote Areas: A Case Study of the Fergana Region, Uzbekistan	41–43
12	Yunuskhon Olimjonov	Production Of Extraction Phosphoric Acid And Increasing Its Concentration	44–46
13	Alisher Avazjonovich Nodirov	The Effect Of The Sulfuric Acid Dosage On The Degree Of Phosphorus Recovery In The Production Of Phosphoric Acid From Ordinary Phosphorite Flour By The Clinker Process	47–50