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Economic Sciences

Проблемы и перспективы модернизации лифтового оборудования в Казахстане

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По данным Национальной Ассоциации Лифтовиков Казахстана (НАЛК), около четверти всех лифтов в стране требуют проведения ремонта либо полной замены [51]. Большая часть из них — это устаревшие устройства, срок эксплуатации которых превышает 25 лет. Согласно нормативным требованиям, такие лифты допускается использовать только после проведения модернизации либо замены. Инциденты, связанные с эксплуатацией лифтов в Казахстане, встречаются достаточно часто. По данным Министерства по чрезвычайным ситуациям, в 2023 году в стране зарегистрировано четыре подобных случая, а в 2024 году — три, из которых два произошли в Абайской области, в результате чего пострадали восемь человек. Один из инцидентов случился в апреле 2024 года в доме, построенном в конце 1990-х годов: лифт с шестью пассажирами упал с высоты. По предварительным данным, причиной стала перегрузка подъемника. Кроме того, аварии с лифтами фиксируются и в новостройках. Жительница Астаны сообщила о регулярных поломках лифта в своем новом жилом комплексе, что вызывает значительные неудобства у жителей, особенно у проживающих на верхних этажах. Представители обслуживающей организации не смогли установить причины неисправностей и направили запрос производителю лифтового оборудования. Эксперты связывают подобные проблемы с приобретением лифтов у ненадежных поставщиков, зачастую обходящих официальных дистрибьюторов. Президент Национальной ассоциации лифтовиков Ержан Игибаев [51] поясняет, что для новых жилых комплексов рекомендуется закупать оборудование исключительно у официальных дистрибьюторов заводов-изготовителей. Это обеспечивает возможность оперативного устранения неисправностей и доступ к качественным комплектующим. Тем не менее, многие застройщики приобретают лифты напрямую на китайском рынке у непроверенных производителей, что затрудняет дальнейшее обслуживание и ремонт. По данным Ассоциации, в жилом фонде Казахстана установлено около 30 тысяч лифтов, а в коммерческих и государственных учреждениях — еще почти 15 тысяч. В мае 2025 года Ассоциация провела исследование, выявившее около 6700 устаревших лифтов, эксплуатация которых продолжается сверх установленного срока. Эти подъемники требуют либо модернизации, либо полной замены. Ответственность за проведение соответствующих мероприятий возлагается на местные исполнительные органы и жильцов многоквартирных домов. В Алматы обновление лифтового парка прошло в течение двух лет, в то время как в других регионах — например, в Усть-Каменогорске, Атырау и Павлодаре — работы выполняются значительно медленнее.

Согласно установленному порядку, акимат формирует бюджетную заявку на замену лифтов, исходя из решений общего собрания жильцов, где необходим минимум две трети голосов. После утверждения протокола заявление направляется в профильные органы для выделения средств в рамках программ обновления жилищно-коммунального хозяйства. Средства выделяются на возвратной основе сроком до 7 лет и распределяются между собственниками квартир. Ержан Игибаев отмечает, что многие жители регионов не осведомлены о существовании такой программы, а информирование и разъяснительную работу должны вести местные власти. Эксперт подчеркивает важность правильного использования терминологии: большинство происшествий с лифтами являются нестандартными ситуациями, а не падениями. За последние годы в Казахстане не зарегистрировано ни одного случая срыва лифта. Нестандартные ситуации часто связаны с перебоями электропитания или сбоями программного обеспечения, создающими иллюзию падения. Единственный трагический случай с летальным исходом произошел в Актобе, где в результате несанкционированного движения лифта погибла женщина — известный журналист. Также за последние два года в стране погибли четыре монтажника лифтов из-за нарушений техники безопасности. Качество работы лифтов напрямую зависит не только от технических характеристик оборудования, но и от профессионализма монтажа. По словам Ержана Игибаева [51], на рынке присутствуют недобросовестные подрядчики, которые не обладают необходимой квалификацией и оборудованием, что приводит к частым поломкам и неисправностям. Ранее деятельность в этой сфере была лицензирована, однако после отмены лицензирования участники рынка с низкими стандартами стали активнее работать. Для обслуживания лифтов организации должны иметь аттестаты в области промышленной безопасности и соответствовать национальным стандартам. Местные исполнительные органы обязаны контролировать деятельность таких организаций, однако на практике данный контроль ведется недостаточно активно из-за нехватки кадров и специалистов. Ассоциация предлагает правительству разделить полномочия по контролю за лифтами для повышения эффективности. В некоторых зарубежных странах функции контроля возложены на профильные ассоциации, обладающие экспертными знаниями и ресурсами.

Согласно расчетам Национальной ассоциации лифтовиков, для модернизации устаревших лифтов в Казахстане потребуется порядка 80 миллиардов тенге. Средняя стоимость замены одного лифта оценивается в 12 миллионов тенге, включая демонтаж старого оборудования и установку нового. При этом рынок преимущественно представлен китайскими лифтами, также импортируются подъемники из Беларуси и России. Турецкие лифты занимают незначительную долю рынка и характеризуются отрицательными отзывами. В Министерстве промышленности и строительства уточнили, что в стране подлежат замене 3937 лифтов, капитальному ремонту 2407 [51]. Общая доля изношенного лифтового оборудования превышает 18%. На отечественном рынке функционируют 150 организаций, специализирующихся на сервисном обслуживании лифтов, а также три предприятия по производству лифтового оборудования с проектной мощностью от 200 до 1000 единиц в год. С 2017 года отечественные производители выпустили 3278 лифтов. Специализированные компании обязаны иметь квалифицированный персонал и соответствующую аттестацию. Из примерно 250 компаний, предоставляющих услуги по обслуживанию лифтов в Казахстане, лишь около 50 обладают необходимыми аттестатами и соответствуют национальным стандартам [52]. «В среднем стоимость замены лифта, включающая закупку, доставку и монтаж, составляет от 13 до 15 миллионов тенге. Все затраты ложатся на плечи жильцов, что для многих является неподъемной суммой. Из-за этого люди продолжают эксплуатировать устаревшее оборудование, несмотря на риски», — отметили в одной из девяти лифтовых компаний [52]. По информации профильного министерства, с 2019 года за счет местных бюджетов в стране заменили 1724 лифта, а в 2025 году планируется обновить подъемники в

234 многоэтажных домах при поддержке республиканского бюджета. Заявки на финансирование поступают из областных бюджетов. Ержан Игибаев, президент Национальной ассоциации лифтовиков Казахстана, отмечает [53] что акиматы не справляются с контролем за состоянием лифтов в многоквартирных домах из-за недостатка кадров и отсутствия квалифицированных специалистов. По его словам, это является одной из ключевых проблем в сфере эксплуатации подъемных механизмов. Вторая существенная проблема связана с появлением на рынке неаттестованных и неквалифицированных лифтовых компаний, которые работают с нарушением действующих нормативных требований. По словам Игибаева, на тендерах выигрывают компании из других городов, зачастую не имеющие необходимой технической базы и официального аттестата. Депутаты, изучив проблему, предложили установить высокие стандарты безопасности для компаний, обслуживающих лифты, а также вернуть ведомственный контроль над состоянием подъемников. Ирина Смирнова [54], 55депутат Мажилиса Парламента Республики Казахстан, подчеркивает, что отсутствие контроля ведет к постоянным авариям с лифтами. По её мнению, необходимы не только сертификация самих лифтов и аккредитация компаний-обслуживающих, но и подготовка квалифицированных специалистов. Этот комплекс задач, по её словам, должен находиться в компетенции Министерства строительства и промышленности, которое несет ответственность за безопасность в этой сфере. На текущий момент за безопасность лифтов отвечает местная власть, а техническим обслуживанием занимаются нанятые частные компании, работающие по договорам с объединениями собственников имущества (ОСИ). Национальная ассоциация лифтовиков Казахстана (НАЛК) сообщила, что с 15 февраля 2025 года лифты в стране должны полностью соответствовать обновленному Техническому регламенту Таможенного союза [55]. В противном случае их эксплуатация будет признана незаконной. В странах Евразийского экономического союза (ЕАЭС), за исключением Казахстана, переходный период продлен до 2030 года. Однако отечественные власти, опираясь на рекомендации профессионального сообщества, приняли более жесткие сроки, что связано с тем, что значительная часть устаревших лифтов уже не обслуживается заводами-изготовителями, а необходимые запасные части к ним недоступны.

Директор лифтовой компании "ЛифтКурылыс" Рысдаулет Арын [55] пояснил: "Это очень хорошая тенденция, поскольку сегодня в Казахстане около 7 тысяч лифтов требуют замены или модернизации — это лифты, срок эксплуатации которых превышает нормативные 25 лет. По нормам технического регламента до 15 февраля 2025 года их необходимо было заменить, так как они не соответствуют требованиям безопасности. В связи с этим опасность представляет дальнейшая эксплуатация таких лифтов, которая может угрожать жизни и здоровью граждан." По его данным, в Алматы на сегодня насчитывается около 50 устаревших лифтов, планируемых к замене в текущем году за счет средств акимата. Однако в регионах жители часто не осведомлены о существовании программ модернизации лифтового оборудования. "Основная проблема в том, что отсутствует должная информационная работа в регионах, и многие жители просто остаются один на один с проблемой старых лифтов. Местным исполнительным органам следует активизировать информирование населения. Понимаю, что отключение лифтов вызовет общественный резонанс, но на весах — жизнь и здоровье людей. Жители должны осознавать, что пользуются оборудованием, выведенным из срока эксплуатации и имеющим ненадлежащее техническое обслуживание," — добавил Рысдаулет Арын [55]. Президент Национальной ассоциации лифтовиков Казахстана Ержан Игибаев [51] отметил, что точное количество лифтов, подлежащих замене, остается неизвестным из-за потери части данных при передаче контроля за их состоянием акиматам. Ассоциация призывает местные власти активизировать

информирование населения и ускорить замену оборудования в рамках государственных программ.

В настоящее время этот вопрос обсуждается на уровне Комитета по делам строительства, чтобы при установке лифтов строительные компании сотрудничали исключительно с подрядчиками, имеющими квалифицированный персонал, сертификаты по промышленной безопасности, защитное оборудование и страхование работников. Ассоциация готова оказать помощь акиматам в подготовке и обучении специалистов для снижения рисков и предотвращения новых несчастных случаев.

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The role of clusterization and digitalization in promoting innovative tourism based on free economic zones

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Introduction

In the modern world, the tourism industry is becoming one of the drivers of economic growth, especially for regions seeking economic diversification and investment inflows. Innovative tourism is a concept involving the introduction of new technologies, products, and business models into the tourism sector to enhance its competitiveness and sustainability. Clustering (the creation of geographically concentrated groups of interconnected enterprises and institutions) and digitalization (the active use of digital technologies and data) of the industry are becoming increasingly important factors for the successful development of innovative tourism. Of particular interest are special economic zones (SEZs) – territories with special business conditions – as platforms on the basis of which tourist clusters can be formed and advanced digital solutions can be implemented.

The relevance of the topic is due to global trends, because tourism is recognized as one of the leading industries contributing to economic development, attracting investment and creating jobs in developing countries. Following the turmoil of the COVID-19 pandemic, the need for innovation in tourism has increased as the industry has faced security challenges, changing consumer behavior, and digital inequality. Governments in many countries have begun to pay more attention to the development of tourism clusters – associations of business, science and government – and the promotion of digital technologies in tourism to increase the efficiency and adaptability of the industry. At the same time, free economic zones are considered as convenient “testing grounds” for testing such initiatives due to special taxation regimes, benefits and concentrated infrastructure.

The purpose of this article is to explore the role of clusterization and digitalization in promoting innovative tourism using the example of international cases based in free economic zones (for example, China, the United Arab Emirates, Singapore, etc.), summarize the results and formulate recommendations for the further development of innovative tourism through clusters and digitalization in special zones.

Theoretical overview

The concept of a tourism cluster goes back to Michael Porter's theories of competitive advantage, adapted to the service sector. A cluster is a geographical concentration of interconnected companies, specialized suppliers, service firms, scientific and educational institutions, and other organizations in a particular field that compete but cooperate at the same time. In tourism, a cluster can include hotels, tour operators, transportation companies, entertainment facilities, tourism management authorities, etc., concentrated in one destination [1]. According to research, the cluster approach in the tourism business has proven its

effectiveness as a tool to increase the competitiveness of the industry at both the national and regional levels. The European Commission considers clustering to be a key factor in successful innovation and competitiveness growth, as combining the efforts of different stakeholders within a cluster contributes to faster innovation, knowledge and technology transfer, the development of joint marketing strategies and the creation of synergies. Many countries with a developed tourism sector (Spain, Italy, France, etc.) are characterized by the presence of well-established tourism clusters (for example, wine and gastronomic clusters, wellness clusters, etc.), which confirms the practical value of this development model. It is also important to note the role of clusters as agents of innovation. In conditions where it is difficult for individual enterprises to introduce new products and services due to lack of resources or knowledge, cluster cooperation facilitates this process. Joint activity in clusters – participation in common exhibitions, the use of common data centers, laboratories, educational platforms – increases innovation activity. The study shows that in order to stimulate innovation in the country's tourism industry, it is necessary to rely on the formation of new clusters and the development of existing ones, which will overcome the fragmentation of enterprises and increase the efficiency of the region's economy [2]. Thus, clusterization serves as an organizational basis for the formation of an ecosystem of innovative tourism, where innovations arise and diffuse faster.

Digital transformation is a global trend affecting all industries, and tourism is no exception. Digitalization in tourism covers a wide range of areas: from the use of big data and online booking systems to the introduction of mobile applications, virtual and augmented reality, artificial intelligence, IoT devices and sharing economy platforms like Airbnb. According to recent research, digital solutions are becoming a key element of tourism development at all stages of the value chain. Digital tools make it possible to increase the efficiency of services, improve their quality, personalize the tourist experience, and mitigate the negative impact on the environment by optimizing flows and resources. Moreover, COVID-19 has accelerated the introduction of contactless and online services - from virtual tours to electronic visas – making digitalization a condition for business survival.

Digital transformation is considered as a critical element for maintaining the competitive advantages of tourism enterprises and ensuring their sustainable development. This is confirmed by numerous studies showing that digitalization increases business sustainability, enhances customer value, and opens up new profit opportunities. The introduction of new technologies entails the emergence of new tourism products and services, the transformation of organizational structures and business models. For example, the proliferation of smartphones and mobile apps has radically changed the behavior of tourists, from travel planning to on-site navigation and post-factum reviews. The concepts of "smart tourist destinations" have emerged, where tourists receive interactive information through unified urban management platforms, and management bodies receive data for flow analysis. Electronic tourism (e-tourism) and smart tourism are becoming the object of close attention of researchers who identify their impact on the behavior of travelers and the strategy of destinations. It should be emphasized that the digital transformation of tourism is not only a matter of technology, but also of managerial innovation. It requires an integrated approach, including staff training, organizational changes, and supportive government policies. Previous studies have noted that successful digitalization in tourism is possible with an optimal combination of internal factors (business readiness for innovation, human resources) and external conditions (communications infrastructure, government support, regulatory framework) [4]. In particular, an analysis of the factors of digital innovation in Chinese tourism has shown that among the key drivers are government policy and regulatory support, the level of development of technological and Internet infrastructure, the general economic level, as well as competition within the industry. This indicates the importance of developing the digital ecosystem at the state level and creating incentives for businesses to innovate.

Special economic zones are specially designated territories where special economic conditions apply to attract investment, export development and technology, they provide tax incentives, simplified administrative procedures, special customs regime and developed infrastructure. Initially, SEZs were created with an emphasis on industry and trade, but in recent decades many countries have begun to use this model for the development of tourism. The idea of tourist special economic zones is to concentrate tourist facilities and enterprises in a certain location, create a cluster with a favorable regime and thereby accelerate the development of the tourism industry in the region. Based on international experience, we can cite several examples of the successful development of SEZ in tourism. In 2016, the Indonesian government announced the creation of ten special economic zones for tourism, designed to become new centers of attraction for tourists in addition to the already popular Bali. The goal was to attract investments in infrastructure and raise the standard of living in the regions through tourism. Each of the ten tourist SEZs received its own profile (eco-tourism, cultural tourism, etc.), and the government expected these zones to attract a comparable flow of foreign visitors to Bali. Similar zones are being created in other countries: for example, in China, Hainan Island has been declared a pilot free zone focused on international tourism and consumption, in the UAE there are free zones supporting the development of the hotel business and entertainment (for example, Dubai Parks and Resorts zones), and tourism clusters have been established in a number of countries in the Middle East and Central Asia. with preferential treatment for investors [5].

Special economic zones can serve as an ideal platform for tourism clusterization, because thanks to the benefits, it is easier to attract anchor investors there (for example, the construction of a theme park or resort), which then attract small and medium-sized enterprises (restaurants, tour companies, souvenir industries, etc.), forming a cluster. In addition, the government often invests in infrastructure in the SEZ (roads, airports, communications), which creates the basis for the development of tourism. SEZs are also convenient for experimenting with digital innovations – for example, electronic visa control systems, smart tourist flow management systems, and unified information platforms for businesses and tourists can be implemented. Within a separate zone, it is easier to establish data exchange between participants and government agencies and to work out new regulatory approaches (for example, tax-free mode, electronic payments in national currency, etc.).

Thus, the intersection of clusterization, digitalization, and SEZ regimes opens up synergetic opportunities for innovative tourism. Theoretically, a tourist cluster based on special preferential conditions and saturated with digital technologies is able to ensure high competitiveness of the destination in the global market.

Methodology

To achieve the research objectives, a qualitative method was applied based on several case studies of international experience and an analysis of scientific literature from the Scopus and Web of Science databases, as well as official statistical reports and press releases related to the development of tourism, innovation and free economic zones.

The most striking example of international experience demonstrating the potential of integrating clustering and digitalization for innovative tourism based on special economic zones is the Chinese province of Hainan, which has received the status of an International Center for Tourism and Consumption with a special tax regime and visa-free entry for citizens of 59 countries. As a result of the implementation of the cluster approach and the introduction of digital technologies, the number of tourists on the island increased from 83 million in 2019 to more than 90 million in 2023, and tourism revenues exceeded 181 billion yuan (about 25.5 billion US dollars). The development of integrated tourism products (beach, medical, cruise, and ecotourism), government support for international hotel chains, and the creation of duty-free zones have become strategically important areas. Digitalization also contributed to the successful

development: the introduction of QR codes, electronic payments, a smart tourism system using big data, as well as experiments with digital yuan and unmanned vehicles.

Another important case is the Emirate of Dubai (UAE), where the state has formed a diversified cluster model, including aviation transport, hotel infrastructure and entertainment (Emirates, Burj Khalifa, Palm Jumeirah). Thanks to the active use of free economic zones such as the World Trade Centre, Dubai has become one of the world leaders in the number of tourist arrivals – 17.15 million people in 2023 compared to 16.73 million in pre-crisis 2019. The basis for the digitalization of tourism is the Smart Dubai strategy, which implements mobile applications, keyless entry systems to hotels and startup platforms such as the Dubai Tourism Innovation Hub. Thus, digital technologies have contributed to the rapid recovery and steady growth of tourist flows, strengthening Dubai's position as a leading innovative tourist destination.

Singapore represents a model of an integrated approach to clustering and digitalization of tourism at the national level. Despite the absence of formal SEZs, the country's tourism sector operates according to a cluster model with the integration of aviation transport (Singapore Airlines), Changi Airport infrastructure and large theme parks (Sentosa). After falling from 19.1 million in 2019 to 330,000 in 2021, the number of tourists recovered to 13.61 million in 2023 and reached 16.53 million in 2024. The Singapore Administration (STB) is actively implementing digital technologies and platform solutions (Tourism Technology Transformation Cube), implementing personalized approaches and working closely with global technology partners (Mastercard, Fever) to increase the sustainability and adaptability of the tourism sector.



Figure 1. Comparative assessment of clustering and digitalization in tourism by countries (China, UAE and Singapore)

The radar chart presented above provides a comparative assessment of clustering and digitalization processes in the tourism sector, specifically within special economic zones, based on empirical analysis of three prominent international cases: Hainan (China), Dubai (United Arab Emirates), and Singapore. Each destination is evaluated across five integral dimensions:

1. Level of Digitalization, representing the degree of integration and application of digital technologies in the management, operation, and delivery of tourism services.
2. Cluster Infrastructure, reflecting the extent and maturity of the tourism cluster infrastructure, encompassing interconnected hospitality, recreational, and logistical facilities.
3. Government Support, indicating the scope and effectiveness of governmental policy interventions, regulatory incentives, and public investment aimed at stimulating innovative tourism development.

4. Sustainability and Innovation, evaluating the destinations' commitment to sustainable practices and incorporation of innovative approaches in tourism services, operations, and product offerings.

5. Growth of Tourist Arrivals, measured by the rate of increase in inbound tourist flows from 2019 to 2024, signifying the effectiveness of strategies implemented to foster tourism sector growth.

The analysis highlights Singapore's leadership position, exhibiting superior performance in digitalization, sustainability, and innovation, underpinned by comprehensive strategic planning and robust public-private partnerships. Dubai demonstrates notable strengths, particularly in government support mechanisms and the substantial growth of tourist arrivals, reflecting effective cluster-based development and digital tourism initiatives. Hainan demonstrates consistent progress, especially in digitalization and infrastructural expansion, supported by targeted governmental policies promoting cluster synergy within its tourism-focused special economic zone.

Collectively, this comparative visualization underscores distinct strategic advantages and reveals potential areas for further institutional and infrastructural enhancement within the context of innovative tourism development on the basis of special economic zones.

Conclusions

As a result of the research, the authors found that clustering and digitalization play complementary and reinforcing roles in promoting innovative tourism, especially when they are implemented on the basis of free economic zones or similar special regimes. The cluster approach ensures the concentration of resources, coordination of market participants and favorable conditions for generating innovations. Digital technologies, in turn, serve as a tool for improving the efficiency of interaction within the cluster, creating new value propositions for tourists and adapting to changes in demand.

Summarizing, we can identify several key mechanisms through which clusterization and digitalization jointly influence innovative tourism.

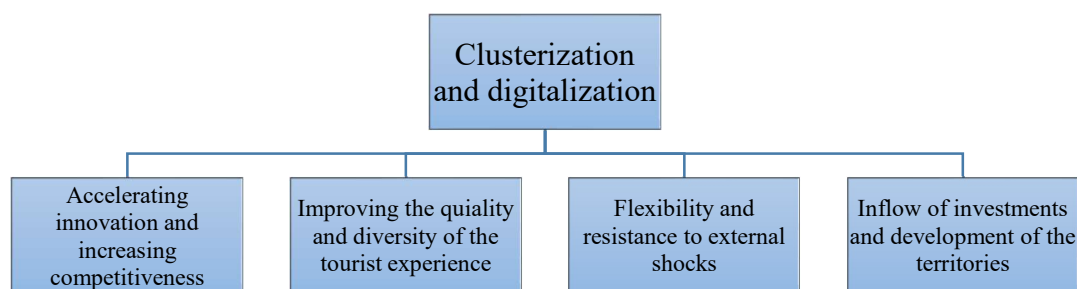


Figure 2. Mechanisms of influence of clusterization and digitalization on innovative tourism

This diagram illustrates the key mechanisms of the mutual influence of clustering and digitalization on the innovative development of the tourism industry. First, clusters promote the simultaneous development of cooperative and competitive ties between entities, creating favorable conditions for the emergence and implementation of innovative products and services. Digitalization, in turn, provides enterprises with modern tools for analytics, communications and automation, which accelerates the process of commercialization of innovations and increases the competitiveness of a tourist destination at the international level. Secondly, the integration of digital technologies makes it possible to form comprehensive tourist offers combining various services (accommodation, gastronomy, entertainment), which increases the quality and diversity

of the tourist experience, as well as meets the individual preferences of consumers. The third aspect is to increase the resilience of the tourism industry to external economic and social shocks, which is implemented through cluster connections, government support, and digital solutions that ensure business continuity and adaptability of marketing strategies. Finally, the combination of the cluster approach and digitalization contributes to attracting investment, reducing business risks and integrated territorial development, which is reflected in improving the economic, social and infrastructural indicators of the region.

Nevertheless, it is necessary to take into account a number of significant challenges related to the implementation of cluster and digital strategies in the tourism sector. Firstly, effective coordination of the actions of various market participants, including small and medium-sized enterprises, is a difficult task, since not all entities are ready to quickly master and implement modern technologies. In this context, professional training and exchange of best practices programs are becoming critically important. Secondly, without qualified management and adequate support, clusters risk internal competition and duplication of efforts, which reduces their overall innovation potential. Thirdly, digitalization is accompanied by risks associated with ensuring cybersecurity and protecting personal data of tourists, and also requires significant investments in the development of information technology infrastructure. In this regard, public policy should be aimed at developing balanced measures that promote innovation activity while minimizing possible negative consequences.

In conclusion, clusterization and digitalization within the framework of special zones have proven their effectiveness as a strategy for the development of innovative tourism, which is confirmed by the examples of China, the United Arab Emirates, Singapore and other countries. For regions seeking to develop tourism, the combination of these approaches can become a “double accelerator” of growth. It is recommended at the state level to encourage the creation of tourism clusters (or subclusters in existing SEZs), invest in digital infrastructure (high-speed Internet, open data, platform solutions) and promote a culture of innovation among market participants. Scientific publications and world practice show that it is the integrated approach – when spatial concentration is combined with technological advancement – that allows the tourism industry to make a qualitative leap and ensure sustainable development in the long term.

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ЗАВДАННЯ ФІНАНСОВОЇ РЕСТРУКТУРИЗАЦІЇ КАПІТАЛУ ПІДПРИЄМСТВ

TASK OF FINANCIAL RESTRUCTURING OF CAPITAL PROCESSING ENTERPRISES

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Фінансова реструктуризація полягає у оптимізації фінансової структури компанії з метою мінімізації сукупних витрат і покращення координації фінансових потоків, що обумовлює необхідність вирішення проблем, пов'язаних з підвищенням ефективності прийняття управлінських рішень. Основними загальноприйнятими критеріями оптимізації структури капіталу підприємств є: політика фінансування капіталу, вартість підприємства, вартість акцій підприємства, середньозважена вартість капіталу та ін. Застосування методу фінансового левериджу у вирішенні питання щодо управління структурою капіталу дозволяє визначити доцільність залучення того чи іншого виду капіталу, проводити комплексну оцінку оптимальності структури капіталу та здійснювати її оптимізацію з метою досягнення стратегічних і тактичних цілей розвитку підприємства. Відсутність комплексного підходу до визначення оптимального співвідношення між власним і залученим капіталом стає на перешкоді до прийняття ефективних управлінських рішень щодо адаптації підприємств до динамічних умов ринкового середовища в аспекті фінансової реструктуризації капіталу.

Ключові слова: фінансова реструктуризація, управління структурою капіталу, оптимізація структури капіталу

National legislation of different states plays a significant role in the formation of financial restructuring. Various legal regulations on foreign investment, financial transactions, financial markets, taxation, and export-import operations may cause conflicts between the interests of international corporations and the relevant government authorities. In addition, governments may restrict the international corporations' actions, and this, in turn, influences the conditions for exporting profits, foreign operations, and employment of local labor. Issues related to foreign currency are also becoming a significant component for companies operating in the global market. Risks of foreign currency exchange and constant fluctuations in the value of foreign currencies are becoming essential aspects of financial restructuring in the conditions of the global business environment. We agree with the such statement, because her research deeply analyzes the impact of globalization on the enterprises' financial stability and provides specific strategies of financial restructuring to ensure this stability in the context of globalization. It is noted that globalization can have both a positive and negative impact on the financial restructuring of companies, and it is essential to take these aspects into account when developing strategies for financial restructuring. This publication provides a detailed discussion of the key factors

influencing globalization, such as diversification of activities, creation of reserve funds, cost optimization, development of long-term strategies and investment in innovation. Practical recommendations for effective partnership cooperation are provided, including building trust, optimizing communications and developing mutually beneficial agreements. We partially agree with the statement about financial restructuring since studying the state of investment activity in the fintech industry in global regions is an important step in understanding the dynamics of this sector. However, it is important to keep in mind that investment activity can be driven by various factors, such as regulatory policy, technological readiness, and the innovation environment.

Keywords: financial restructuring, investment activity, globalization

Постановка проблеми. Дослідження сутності фінансової реструктуризації виявило, що, незважаючи на різні підходи щодо визначення поняття, ролі, механізмів та інструментів, критеріїв її ефективності існують спільні характерні риси, а саме: фінансова реструктуризація реалізується в зміні структури капіталу, розмірів та умов залучення коштів і власного капіталу, а особливо в перегляді наявних боргів; фінансова реструктуризація направлена на формування оптимального співвідношення різних джерел фінансування діяльності підприємства, при якому максимізується вартість самого підприємства; до фінансової реструктуризації відносять зміни, направлені на покращення структури балансу: оптимізацію структури пасивів та підвищення ефективності використання активів; фінансову реструктуризацію пов'язують з попередженням та усуненням кризових явищ, необхідністю вирішення поточних проблем неліквідності, фінансової залежності та неплатоспроможності, низької інвестиційної привабливості та конкурентоздатності; фінансова реструктуризація полягає у оптимізації фінансової структури компанії з метою мінімізації сукупних витрат і покращення координації фінансових потоків; до фінансової реструктуризації відносять зміни, направлені на покращення структури балансу: оптимізацію структури пасивів та підвищення ефективності використання активів; фінансову реструктуризацію пов'язують з попередженням та усуненням кризових явищ, необхідністю вирішення поточних проблем неліквідності, фінансової залежності та неплатоспроможності, низької інвестиційної привабливості та конкурентоздатності.

Аналіз останніх досліджень і публікацій. Вивчення економічної літератури по досліджуваному питанню показує відсутність єдиного підходу серед науковців щодо ролі та особливостей здійснення фінансової реструктуризації капіталу. Але важливість формування, довгострокового оптимального співвідношення власної та позикової складових капіталу дозволяє орієнтуватись у пріоритетах фінансової реструктуризації капіталу підприємств.

Виділення невирішених раніше частин загальної проблеми. Фінансова реструктуризація полягає у оптимізації фінансової структури компанії з метою мінімізації сукупних витрат і покращення координації фінансових потоків, що обумовлює необхідність вирішення проблем, пов'язаних з підвищенням ефективності прийняття управлінських рішень, пов'язаних з реструктуризацією капіталу, потребує дослідження різних критеріїв оптимальності структури капіталу для розробки заходів щодо її оптимізації з урахуванням факторів та ризиків, що пов'язані з управлінням капіталом відповідно до специфіки діяльності підприємств, що дозволить розробити та реалізувати ефективну стратегію фінансування виробничої та операційної діяльності, центральне місце в якій посідає проблема ефективного управління формуванням та використанням капіталу.

Виклад основного матеріалу. Однією з найважливіших рис, що характеризують фінансову реструктуризацію у контексті діяльності підприємств, на нашу думку, є її спрямованість на здійснення змін у структурі капіталу з метою підвищення ефективності формування і використання фінансових ресурсів підприємства, що обумовлює необхідність вирішення проблем, пов'язаних з підвищенням ефективності прийняття управлінських

рішень, пов'язаних з реструктуризацією капіталу, потребує дослідження різних критеріїв оптимальності структури капіталу для розробки заходів щодо її оптимізації з урахуванням факторів та ризиків, що пов'язані з управлінням капіталом відповідно до специфіки діяльності підприємств, що дозволить розробити та реалізувати ефективну стратегію фінансування виробничої та операційної діяльності, центральне місце в якій посідає проблема ефективного управління формуванням та використанням капіталу. Основними загальноприйнятими критеріями оптимізації структури капіталу підприємств є: політика фінансування капіталу, вартість підприємства, вартість акцій підприємства, середньозважена вартість капіталу, ризики, пов'язані із сезонністю накопичення ресурсів, тенденції споживання готової продукції та прогнозована рентабельність. Політика фінансування капіталу пов'язана з системою фінансування підприємства та напрямками їх вкладання, яку за класичним підходом поділяють на фінансування оборотних активів та необоротних активів, які, в свою чергу, пов'язують з фінансовими рішеннями короткострокового та довгострокового характеру. При цьому цілі політик фінансування оборотних та необоротних активів можуть співпадати, ґрунтуючись на оптимізації об'єму та складу фінансових джерел формування активів з позиції забезпечення ефективного використання власного капіталу та достатньої фінансової стійкості підприємства. Проте, політику фінансування капіталу підприємств необхідно розглядати не лише в розрізі управління оборотними та необоротними активами, а й з точки зору прогнозування потреби обсягу додаткового капіталу з урахуванням зовнішніх чинників, що впливають його формування та використання (інфляція, можливого збільшення відсотків за користування кредитами) та специфічних, що пов'язані з характером виробничої діяльності підприємств, тривалістю виробничого циклу та ін., що дозволить спрогнозувати зміни основних показників використання капіталу підприємствами. Структура капіталу перебуває у тісному взаємозв'язку з вартістю підприємства, до чинників формування якої відносять: темпи зростання, рентабельність реалізації, ставки оподаткування прибутку, інвестиції в нові необігові активи, інвестиції в обігові активи, ставки оподаткування, зростання обігу та здійснених підприємством інвестицій, ринкові умови (рівень та тип конкуренції, макроекономічне середовище, нові конкуренти, інтенсивність нововведень, впливовість споживача, впливовість постачальника, промислова політика держави) та внутрішні чинники (розроблення нових видів продукції, розвиток (вдосконалення) видів продукції, які виготовляються, закупівля та постачання, виробництво. Формування концепції оцінки й управління вартістю підприємства у процесі фінансової реструктуризації повинне базуватися на оцінці можливості підприємства генерувати більше цінностей для споживачів і значно ефективніше, ніж конкуренти. Таким чином, цінність реструктуризованого підприємства показує не тільки фінансові економічні показники функціонування, а й характеризує роль у соціально-економічному розвитку держави, суспільства у цілому. Вартість капіталу з точки зору мінімізації його вартості обумовлює необхідність дослідження підходів до вартісного виміру капіталу, що дозволить вирішити питання інформаційного забезпечення щодо формування і використання капіталу підприємства для достовірності визначення фінансового результату функціонування підприємства. Основу традиційної концепції структури капіталу складає твердження про його можливу оптимізацію шляхом врахування вартості окремих його складових частин. Причому вартість власного капіталу є завжди вищою за вартість позиченого, враховуючи ризик його використання, та визначається рівнем фінансових результатів діяльності суб'єкта господарювання за попередній період. Оптимізація структури капіталу за критерієм мінімізації її вартості ґрунтується на попередній оцінці власного і позиченого капіталів за різних умов їх формування, обслуговування та здійснення багатоваріантних розрахунків середньозваженої вартості капіталу і, таким чином, пошуку найбільш реальної ринкової вартості підприємства. Оцінка вартості залученого капіталу має ряд особливостей, а саме:

- залучення додаткового капіталу завжди супроводжується збільшенням вихідних грошових потоків на підприємстві. Це збільшення пов'язане зі сплатою процентів за обслуговування позикового капіталу і з погашенням основного боргу. Крім того, це пов'язано з кредитним і процентним ризиком;

- вартість позикового капіталу пов'язана з оцінкою кредитоспроможності позичальника з боку банку. Чим вища кредитоспроможність підприємства за оцінкою кредитора, тим нижча вартість залученого капіталу, оскільки кредит під мінімальну процентну ставку надається тільки першокласним позичальникам;

- урахування впливу суми, пов'язаної з обслуговуванням боргу (проценти за кредит), впливає на розмір оподаткованого прибутку і податку на є врахування впливу прибутку.

Оптимізація фінансової структури капіталу за критерієм ефективності його використання здійснюється також на основі методики розрахунку ефекту фінансового левириджу, яка базується на обчисленні показника нетто-результату від експлуатації інвестицій підприємства (HPEI), який визначається як сума прибутку до оподаткування і відсотків за кредитами банків та дозволяє оцінити фінансовий результат здійснення операційної діяльності підприємства без урахування впливу на нього структури капіталу та податкових платежів з прибутку. Для розширення поняття прибуток до сплати податків і відсотків під час дослідження компонентів, які слід включити до розрахунку нетто-результату від експлуатації інвестицій (окрім витрат на залучення фінансових кредитів, витрат і непрямого доходу від кредиторської заборгованості товарного характеру), включаються витрати на оренду майна.

Висновки. Фінансовий аспект реструктуризації капіталу підприємств полягає у використанні різноманітних методів та інструментів щодо підвищення ефективності формування та використання власного капіталу та отримання оптимальних умов залучення позикового капіталу, зокрема, при реалізації взаємовідносин із банком та іншими кредиторами з метою уникнення або мінімізації потреби у додатковому капіталі. Варто застосувати алгоритм проведення фінансової реструктуризації капіталу підприємств. Відсутність комплексного підходу до визначення оптимального співвідношення між власним і залученим капіталом стає на перешкоді до прийняття ефективних управлінських рішень щодо адаптації підприємств до динамічних умов ринкового середовища в аспекті фінансової реструктуризації капіталу.

Observation of Georgia's Macroeconomic Policy of late 90-s as the Grounding of the Country's Economic Advance

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Abstract

The article discusses the macroeconomic stabilization policy implemented in Georgia in the late 1990s, privatization methods, problems, the 1998 financial crisis and its impact. The economic situation in the mid-1990s and the situation at the end of the 1990s are compared, and a forecast for the future is made.

Keywords: Macroeconomy policy, stabilization policy, economic crisis, reforms, privatization

Georgia is situated in the middle of the Euro – Asian Corridor, the factor being a major favorable pre – condition for its economic progress and its integration into an international economic system.

However, the transportation and communication services in Georgia today are significantly below the accepted standards.

There are two trade sea – ports in Georgia: Poti and Batumi, with the loads designed for the entire Caucasus and Central Asia being shipped in and out. These two seas – ports will have to be upgraded to meet the international standards.

Two international rail – lines also run through Georgia: one a traditional route towards Russia and the other – from the capital Tbilisi towards the South – East.

The Georgian railways, along with the other means of transportation, will have to be repaired and updated. An international oil pipe – line and the Silk Road enlargement prospects are of a foremost importance.

Quite a few international organizations have got involved in Georgia since 1991, with their chief goals being bringing the country out of the economic crisis and its engagement in the international economic relationships. Among those the IMF, The World Bank, The Technical Assistance Agency, the UN agencies etc. are the most significant.

A keen interest paid to Georgia by the countries, such as the USA, Turkey, Germany and the UN is also noteworthy.

In June, 1996 Georgia had applied for a WTO membership. The necessary legislation involving the Civil, Taxation and Customs, Maritime and Aviation Codes, along with the Law on Privatization had been adopted ever since. An open trade regime and equal tariff – rates had been established.

These and other steps led to Georgia's WTO membership in 1999 making a development of market economy mechanisms and an access to international markets more possible than ever.

The Country's Potential Incomes and a Social Area.

The 1st stage of a macroeconomic stabilization program had been carried out in Georgia. The incomes of 1995 – 1999 were 5 times as much as earlier – from 15 up to 75 Lari, but a devaluation of Lari makes the growth look modest to the extent of an insignificance.

The State program envisaged an average monthly wage of 200 – 230 Lari – a challenge hardly met between 2000 – 2003. The government had pledged to maintain the National Currency at its present level and to turn it into a strong and a trustworthy one.

The collapse of the 90's made care about the future generation and a security of the elderly practically impossible. An entire social system and its leverages had been disrupted. Situation was unfavorable enough, albeit, a much better one than in 1993. Low wages and a social assistance, however, could hardly meet physiological requirements. The debts of the years past and delayed pensions formed an acute problem. A robust social system was incredible without a budget income increase and its completion calling for efficient payments and Customs services. A budget income success of the latter Services had to do with a business and an overall economic development of the country, as well as solvency of the enterprises and a corruption – combat.

It should be said also that the government program involving the country's economic prospects, provided for tripling an old age pension and a free school education as the ultimate goals of the reform carried out at that time.

Employment

An alarming unemployment and a job shortage were one of Georgia's most acute problems. The best way it could be tackled with was a medium and a small private business development and a foreign investment attraction.

Since 1995 up to 1999 over 48000 LTD and joint – stock companies had been set up, with 638,000 people employed therein.

1,248 NGO's, with an approximately 40,000 staff were functioned in Georgia in 1999. Over 350,000 households were going to be given private lots as a result of a land privatization underway now. The employment numbers between 1995 – 1999 went up from 1.7 mln. up to 2.4 mln (The Georgian Statistics Department, the 1999 government account).

An electricity shortage remained a formidable problem. A halt of a natural gas supply in the early 90's left the population in cold and darkness. The energy crisis was one of Georgia's huge problems. An absence of minimal living conditions at the end of the 20th century created an unendurable psychological atmosphere. Positive indications were detectable, though, the "TELASI" privatization and a certain order brought into the electricity system had shortened the blackouts, a gas – supply had resumed in many regions, that holding promised of a halt to a deforestation of the country. A round – the – clock electricity supply and a gasification of the towns had been held out as a short – term prospect. The hope was generated by the privatization of the energy producing facilities, an involvement of foreign capital and a general improvement of the situation inside the country.

Transportation

A civil war and a general tumult brought the Georgian transportation routes and an infrastructure into a virtual devastation. Georgia, meanwhile, is a transit country, with the roads being vital for its welfare. There was a time when the roads were not repaired at all.

The international routes have been restored recently, and many new sectors have become operational. A natural road communication program has been drawn up and many central roads and bridges were being restored, with a renovation of local roads necessary in the immediate future. A more comfortable environment is likely to give an impetus to the business development,

enhance passenger trafficking and be conducive to a formation of a well-shaped – out road infrastructure and a tourism industry.

The roads in Georgia are still in rather a bad shape, though. The wages of those employed in the field are small enough. A shadow economy involvement is significant, with these factors placing obstacles on the way to a successful consummation of the reform, since a macro – economic development and a stable economic environment are inseparable from a satisfaction of popular requirements.

Fiscal Policies

Fiscal policies of the Georgian government in 90-s was stringent enough, that accounting for a budget deficit cut to the 4,5% of GDP. Budget deficit in 1996 diminished to 2,3% reflected in the 1999 draft budget. The diminution had resulted from a halt of subsidies into gas and bread and staff cuts in the budget – financed areas. A tax base broadened and a tax administration improved. Tax collection shortcomings remain evident, though. A tax – evasion emerged clearly in 1998, resulting in a sequester of the 1998 budget. A 200 mln. Lari internal debt in 1998 placed an extra burden upon the 1999 budget.

According to the 1999 forecast, an economic growth was to carry on, that allowing an employment of extra 85000 to 170000 people. An official unemployment rate was low enough, that being an indicator of an inefficient employment market. More accurate employment numbers were hardly available, because of a substantial (45% GDP) shadow economy involvement. The same factor complicates a tax – collection and an economy growth prognosis.

A meager budget – income posed a grave threat to a number of branches and the vulnerable social groups. Wage and pension delays were a regular occurrence. Education and healthcare were insufficiently financed. Although the 1999 budget was 3.5 times larger than the 1995 one, it still remained modest enough. The situation called for the state regulations that, incidentally, had been resorted to:

- excise stamps had been introduced for the sake of an import – control. As against 1998, when an excise – tax brought 100,000 Lari per month, in 1999 the amount went up to approximately 9 mln. Lari;
- a tougher Customs control, a cut – off of smuggling channels and an international control over the Georgian Customs hold promise of a 50% Customs – income increased in 2000;
- a tax control became more stringent. A shadow economy part that in 1995 equaled 80%, had curbed by half;

International experts suggested that if carried out consistently, the foregoing measures might bring about double as much budget income.

Basic Economic Indicators

	1996	1997	1998 forecast	1999 forecast
a nominal GDP (mln. Lari)	5300	6431	7750	8374
an actual GDP (mln.Lari)	5788	6431	7123	7859
an actual GDP of (last year's %)	11.0	11.1	10.8	10.3
a consumer price index (last year's % an end of the period)	13.8	7.3	6.5	5.5
a current account balance net of the official transfers (mln Lari)	481.8	- 869.6	-905.7	-996.9
a current account deficit net of the official transfers	9.1	3.5	11.7	11.9
a nominal exchange – rate (Lari/USD)	1.27	1.30	1.33	1.36
the number of the unemployed	11.6(IV quarter)	10.4	8.5-8.8	7.6-8.1

Source: Chief Directions of the Georgian 1999 Budget

Due to the idea of Government, a larger – scale privatization in 1999 could result in a larger private sector contribution into the country's economy. A revitalization of the agricultural sector being evident enough, a replacement of the imported food – products with the local ones could be anticipated.

A global crisis of 1998, especially its impact on Russia, made a negative impact upon direct foreign investments into Georgia. It should be marked also, that a share of the foreign Legal entity persons in the Georgian Treasury Bills was 10% in 1999, as against 30% in 1998.

An attraction of customers to the Georgian government security market and a compensation of risk by the banks formed a chief precondition of higher interest rates in Georgia. The Georgian government intends to carry on with its stringent monetary policy.

Idea was, that budget should become a distinctly investment one, that implying channeling both local and external finances into the vitally important branches.

Production and Agriculture

Quite a few enterprises were at a standstill. A lot of branches and an expensive machinery were unexploded. The Georgian market had been inundated by a cheap low – quality imported produce and not ready for a competition. The situation was gradually improving, though. The liberal economic reforms had put a lot of enterprises back into action, the biggest ones an aircraft factory, a manganese plant in the town of Chiatura, the factory of Ferro – alloys in the town of Zestaphoni, a chemical plant in Rustavi, the aircraft and machinery factories in Kutaisi, a Space Technology Institute with its unique space aerials – among those.

As against the other former Soviet Republics, Georgia made an unprecedented step by proclaiming a private ownership on land and 186,000 perennial plants had been given free to about a million households.

The results were at hand – a growing interest to Georgia's agricultural produce. A high – quality produce and an adulteration – combat was at the top of the agenda.

In 1995 a private farmer used to sell a 1 kg of grapes at merely 0.10 to 0.15 Lari, while in 1999 the price ranged between 0.6 Lari and 1.2 Lari.

30 mln. Lari had been invested into the wine – cultivation. The Tea – cultivation has survived through the state investments amounting to 3 mln – in 1998 and 5 mln – in 1999. An overall state and private investment into the tea industry has amounted to 40 mln. Lari.

The Georgian wine and tea have once again found an access to international markets. A lot of new brands of the Georgian products meeting international standards had been produced. Local production called for Support to reduce Georgia's dependence upon import.

Conclusion

Based on analysis of socio – economic situation in Georgia of late 90-s, in my view the successful macro – economic policy during that time was based on the following issues:

1. Georgia's economic advance and an application of modern macro – economic regulation leverages was hardly attainable without an elimination of the red tape and corruption in Tax and Tariff collection, which remained below the mark, budget policies and management were inefficient enough, that resulted in the external and internal debts mounting from year to year, fluctuations of the Lari exchange – rates and an overall economic misbalance. The settlement of the problem called for a political determination on part of those in charge of the field and, also, a close observance of the corresponding legal provisions.
2. An economic policy pursued in Georgia looked like an economic management in a chaotic environment because of an inconsistency inherent to it. Not a single economic economy recovery conception had been carried out properly, with the outcome. Understandingly, being bad, indeed. Deviations from a selected course and its replacement of a radically

different one in line with short – term requirements, were frequent enough. These tactics, meanwhile, generated an instability and an economic vulnerability.

3. Another decision at that time promptly involved the kind of market economy that might be most appropriate to Georgia and finding the leverages of protection of the local market. It's significant that Georgia had become a WTO member – state, with an abolition of the protection leverages and a creation of a single free trade system being a World Trade Organization goal. The latter, meanwhile, is in the interests of the well – developed market economy countries. The Georgian economy, however, could not and cannot possibly compete with those, that, understandingly, opening up bleak prospects of a kind of "a political hostage".
4. Georgia's higher regional profile calls for an enlargement of its economic potential to safeguard its external economic safety. To this end, a thorough consideration of the country's economic safety conception was and will be necessary. An analysis of the conception that, incidentally, had been drawn up by the Georgian economic experts would make it possible to protect the country's internal and external economic interests.
5. An impact made by an overwhelming and a lasting economic crisis upon the national mentality will have to be assessed, with a focus to be placed upon such aspects as a psychological reflection of the situation and a likely reaction to the results thereof. An absence of the research complicates an implementation of the macro – economic policies and even a planning thereof.
6. A shortage of a qualified staff and a virtual absence of the management leverages formed an acute problem. Mergers and break – ups of the ministries and other ruling bodies are frequent enough, as well as the leadership changes thereof. No tradition has formed where the regional or state economic policies are concerned, i.e. every next leader attempt to launch a course different from the one his predecessor one.
7. Given the circumstances, it should be said that Georgia's monetary and credit policies give but a slight impetus to an economic recovery. Impressive results however, have been achieved in the areas, such as an inflation regulation or a stability of the national currency Lari. It should be said, though, that stringent monetary and credit policies do not fit a revitalization of the country's production potential, that having resulted in a striking dissonance – the chief factor of the economic crisis and a current economic stagnation – the monetary credit policies pursued in Georgia have failed to turn into a financial indicator, as made evident by a limited circulation area of Lari and, subsequently, a foreign currency domination at Georgia's internal currency market. The fluctuations of Lari exchange – rates per month or per year make it clear that the Georgian economy of today has many of the features inherent to the so – called "seasonal economy". The situation is further aggravated by the National Bank, that prefers to keep a low profile where a rectification of the national currency dynamics is concerned. The result of the above – mentioned National Bank impassivity is alternative devaluation and revaluation of Lari. These are the factors hampering a recovery of the Georgian economy. More realistic currency policies are necessary, as well as an enlargement of Lari circulation area and a close attention to the export – related branches.
8. Georgia's recreational resources, unique as they are, remain mostly latent. Given the fact of Georgia's modest natural resources and an economic potential, the service and tourism industries will have to be developed, all the more so, that the country has significant geographic and a transit position. To this end, a formation of a state tourism, transportation and service program is necessary, as well as a creation an investment encouraging environment and a simple taxation regime.

9. Social protection is in particularly poor shape, with pensions and a social assistance being merely symbolic. Thus, radical changes are absolutely indispensable. Delayed payments of the social assistance and pensions provide an accurate reflection of a vulnerability of the country's economic policies, as well as of the regulation factors that cannot possibly be evaluated as sound enough. What is necessary is targeted, and not an overwhelming social policy involving an accurate definition of a socially vulnerable social groups and their ranking. Apart from this, quite a few mediator links will have to be phased out and be replaced by a single, uncomplicated on the one hand, social assistance pattern, that will narrow down bureaucracy and, on the other, increase an amount of the social assistance.
10. A poor shape of the country's industrial potential has been resulted from an inherited stagnation of the Soviet industrial potential and the disrupted economic links. Dispute the changes taking place over the last decade, Georgia's industrial potential has not been restored as yet. The situation in the country's energy sector is grave indeed. A recovery of the field should be achieved through large investments, a replacement of an old – style managerial staff and a realistic assessment of the market. Oil and gas shipments via Georgia, along with its own oil resources form a solid ground for overcoming the energy crisis, so much so, that the country may turn into an exporter instead of its present importer status. It may happen that owing to Georgia's geographic position, its energy assignment function within a regional context, will grow.
11. The Georgian agriculture is significant for its rather speedy and a less costly recovery from the stagnation. A consistent policy will be necessary, though, for a protection of a local produce interests both inside and outside the country.
12. Georgia should have a standing body for an establishment of an economic collaboration and a protection of the country's interests within the system of an overall economic equilibrium and a global balance. The body should involve some of the prominent public and business figures. there is an economic council functioning at the Presidential Office, but its power and responsibilities will have to be made more viable for its turning into a body defining the country's economic strategies and priorities. A scarcity of the measures thereby is noticeable enough.
13. A severe economic crisis and an increasing budget deficit have made subsidizing unprofitable enterprises virtually impossible. It may be said that the market economy has played a positive part. Meanwhile, a withdrawal of a financial support has led to the labor cuts in those enterprises, that adding up to the social burden of the budget. A creation of new jobs and an employment of the country's labor force is a precondition of a macro – economic success. Two problems are involved here: operational enterprises and a shortage of finances. These two can possibly be solved through foreign investments, a business-friendly environment and a simplified legislation.
14. The 1999 budget did not envisage investment resources, this being the reason behind Georgia's backwardness as to not merely Europe's industrial democracies but to the countries, such as Latvia, Lithuania, Estonia or Slovakia.

		Estonia	Latvia	Lithuania	Slovakia	Georgia
<i>Thousand USD</i>						
Macroeconomic indicators						
GNP	1998	5,200	6,400	10,700	20,200	3,676
(mln. USD)	1999	5,210	6,410	10,710	20,220	3,643
The GNP growth	1998	4.0%	3.6%	5.1%	4.4%	2.9%
%	1999	0.5%	1.0%	0.5%	1.5%	2.4%
a Trade Balance	1998	(1,503)	(1,247)	(2,084)	(2,301)	(1,184)
(mln. USD)	1999	(560)	(445)	(875)	(670)	(274.60)
per capita GNP	1998	3,447	2,560	2,892	3,741	694
the international currency reserves	1998	700	1,100	1,200	2,800	124
(mln. USD)						
INFLATION	1998	10.6%	4.7%	5.1%	6.8%	10.7%
	1999	4.4%	2.0%	2.0%	9.0%	6.5%
the bank sector						
the bank assets (mln. USD)	1998	2,553	2,010	2,581	12,779	243
(according to 10 largest banks)						
the bank capital (mln. USD)	1998	463	176	321	347	55
credit investments of the banks	1998	1,415	917	1,151	5,656	124
	1999					
the per capita credit assets.	1998	1,702	804	698	2,366	46
	1999					
Population (mln people)	1999	1.5	2.5	3.7	5.4	5.3

(Source: "The Eastern European Countries Economy 1998, 1999", own calculations)

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Outcomes of Stabilization program and Investment Opportunities in Georgia as of 1998

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Abstract

In this article was presented the first signs of investment attractiveness of Georgia, based on economic reforms and currency stabilization. At the same time, high interest rate and lack of funding was the most challenging problems as of 1998. It is shown the progress in economy, culture, science and international relations.

Keywords: Stabilization program, economic reforms, investment opportunities, credit rate, foreign investments.

Successful implementation of economic reforms in Georgia created the founding principle for the future step – Investment opportunities. Due to the lack of own investment resources, it was clear that stimulation of foreign investments was the key to succeed in that field. The factors conducive to foreign investments into a country are as follows:

1. a political and an economic stability in and around it;
2. an investment – conducive legislation;
3. knowledgeability in modern business – making methods and entrepreneurial skills;
4. natural resources of a country;
5. high – level banking and service industries.

A world – wide competition targeted at an investment attraction is another significant factor. An economic policy pursued in Georgia can be assessed as "stringent fiscal policies" making a strong impact upon an interest rate growth, given the low incomes of the population and the National Bank reserve demands. A limited foreign capital, an unstable situation in the region, non-operational exchange instruments and the Stock Exchange, underdeveloped leading branches and their halt add up to the complexity of the situation.

A credit interest – rate level in Georgia, as in other countries, had been determined by many factors. Chief of those is:

- the economic, monetary and credit policies of the country;
- the National Bank loan provision requirements (reserve standards and terms);
- an amount of credit resources at the country's money market and a demand curve thereof;
- a risk – factor and a profitability of individual businesses and branches;
- an interest rate formed at the Stock Exchange;
- a credit resource – rate formed in and around the country;
- a population income level;
- a foreign capital influx.

As a result of the foregoing parameters, a credit interest rate in Georgia was high enough – ranging between 30% to 36% USD annually. Although, in case of financing major and relatively low – risk projects, it went down to 24% USD annually.

An environment in and around Georgia, a recently achieved stability, legal bills and the reform, the first – stage business, entrepreneurial and service development - these were the factors accounting for meager foreign investments into the country's economy.

Since 1994 to 1998, a stabilization program had been implemented in Georgia. The program aims at:

1. a reduction of budget deficit;
2. a formation of a monetary credit system;
3. a liquidation and a reform of the subsidized enterprises;
4. an introduction of a modern taxation and bank supervision system;
5. an abolition of a state supervision system;
6. a liberalization of trade and exchange rates.

The foregoing guidelines had been taken on board, the reform ensued, giving an impetus to business development in Georgia.

Direct foreign investments into Georgia that in 1996 amounted to 54 mln. USD, had built up and in 1997 equaled 189 mln. USD. Two – thirds thereof had been placed into the areas, such as gas and oil exploitation, banking, agriculture, telecommunications and electricity. Among the biggest investors were the UK, Turkey, Russia and the USA.

An overall number of foreign investments and credits in this country was over 2.5 billion USD. Nevertheless, a genuine investment boom had not started for:

- an oil pipe – line project had been implemented, an oil – terminal in Supsa, unique of its kind, had been set up, those allowing Georgia to advance as an economic entity on its own right. A major Silk Road project was being launched. By adopting "A silk Road" bill, the US Senate had confirmed the West's strategic interests in Georgia;
- Georgia's unique scholarly potential ought to be taken into account, since it was going to be a powerful investor attraction into Georgia;
- a stable and an investment – friendly environment was absolutely indispensable, along with Georgia's international and regional image – also a significant factor in an investment - related decision – making process.

Culture and Science

A severe economic crisis and a tumultuous situation inside the country had brought the Georgian culture, its national values and a scholarly potential to the brink of a devastation.

Despite all the difficulties, however, not a single theatre or a museum had closed down. On the contrary, some new ones had opened. Nearly 200 opening nights had taken place, over 300 exhibitions had been arranged, 13 monuments had been set up etc.

The Uniqueness of Georgia and a Prognosis of 90-s

The developments of 1994-1998 years testified to Georgia's uniqueness. A severe food – shortage a disastrous law – and – order situation, war, freezing temperatures, bread – lines, devaluated coupons, a devastated production and agriculture. The problems were still acute enough, but an advance was striking, too.

Georgia was a European Council member – state, its borders were patrolled by the Georgian border's troops, a large scale gangsterism had been eliminated. Formidable international projects had been implemented, with the oil pipe – line and the oil – terminal in Supsa played a major part in Georgia's coming through into the open. The country's Constitution was in effect.

There was no doubt that Georgia was a state proper, with solid grounds had been laid for a further economic progress, with the indications thereof being unmistakable.

Georgia was a country of paradoxes, for no other country with unsettled conflicts, not quite clear economic order prospects and directions, with quite a few monopoly enterprises had so far managed to make such a stride towards market economy. It was challenge to all the macro – economic standards that had roused plenty of the donor organizations' attention.

A structure of the Georgian budget and stringent monetary policies, meanwhile, kept the wages low, with the bulk of the expenditure went into the defense and law – and – order bodies.

Low wages give a green light to a large – scale corruption, particularly so, among the public servants. The situation could be improved by public management cuts and larger wages. A contrary trend was bound to bring all the achievements to nothing.

A reserve of a budget – income growth was formidable enough, for its indicator (3 to 5% of the GNP) was one of the lowest in the world. It means that the country could have a larger budget. But the present circumstances ought to be kept in mind – a bigger part of the labor force was either unemployed or getting merely symbolic wages. It, however, did not imply higher taxes or a reduction of the number of those working in enterprises, for those were few enough.

A creation of new jobs, a development of a small and a medium – sized business was to bring about a breakthrough.

The Georgian science was now in a near – devastation. A low – level education resulted in a scarcity of experts and a brain outflow abroad, with an eventual outcome – a major blow to the country's potential looming clearly. The Georgian science had found itself in a particularly unpromising situation. It can be said even that in some fields, such as Hi – Tec, heavy industry and the science – related branches Georgia had already fallen behind, leaving room for a mere import of ready – made products and materials to throw a glance at the accomplishments in the rest of the world.

The positive changes in education were worth mentioning, through: new business and entrepreneurial methods had been introduced, a modern managerial instruction was underway, with quite a few manager trainings, seminars and re – qualification courses had been arranged.

A significant number of a younger generation Georgians were on probation at some of the prestigious universities and scholarly centers abroad.

As no priorities had been set out in the regions, a research into the Georgian provinces and individual sectors as to the step to be made in that direction was a free economic zone, with its affect being promising enough.

Georgia's natural and geographic position was another favorable factor, for the country was the gateway between Asia and Europe and was situated in the region possessing a necessary potential for the country's joining the front – runners.

A stability achieved in and around Georgia was unlikely to make a significant impact upon the macro – economic processes underway in the Caucasus. What was necessary is close economic associations of the Caucasian countries to result in a higher international profile of the region.

Owing to the foregoing and other factors, Georgia as of 1998/1999 could not merely overcome the crisis but achieve a speedy build – up of its potential as well.

Georgia and The World Community

For all its problems and difficulties, Georgia was already a member of a single European family. The western democratic values appealed to the Georgian mentality. But for the Georgians long – standing strive for Europe, a western – style court reform was not yet possible. The court reform and up – to – date legal bills, such as the new Civil Law, Administrative and Penalties Codes had all been the accomplishments of that period.

It was clear that Georgia's territorial integrity and a restoration of control over its entire territory could not possibly be achieved without close ties with the West. A restoration of the country's territorial integrity called for well – equipped and well – trained armed forces. The US government had assigned 100 mln. USD for an upgrading and a re-equipment of the Georgian army. Regardless of all the problems, a withdrawal of a foreign military contingent was underway, that serving as a formidable pre – condition of the country's genuine sovereignty.

A well – developed economy and a strong army, understandingly formed a guarantee of Georgia's territorial integrity. These all involved a maintenance and an advance of the strategic course targeted at Europe and an integration into the Euro – Atlantic area.

Georgia already had been a CE member – state, that creating prospects of it joining the world's most advanced elite organization – The European Union.

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The Impact of Heritage and Culture to Fashion and Luxury Industry: LVMH Case

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Introduction

Since decades, the definition of luxury has been prominently changed its definition for a number of reasons counting diverseness, complexity, status and rapid and constant evolvement of luxury brands. Given the subjective nature of the term and etymological point of view, the word luxury comes from the Latin “luxus”, which means “overabundance, excess in the way of life”. Luxury was first only subjected for the monarchy and aristocracy and revolved around lavish parties, golden plates, big mansions, caviar, champagne and servants. The first notions of luxury began with French monarchy living lavish lives of luxury, which set standards for luxury, being reserved only to a selected few. In our current age and daily life luxury is a term, which can mean differently to different individuals based on their status, taste and preferences. It is, as a completely superfluous, based on the attainment of desires and is not considered a need to our daily life. Luxury is more a psychological need to fill our satisfaction and inferiority. “Luxury is about pleasure and satisfaction of the senses” (Okonkwo, 2010). Setting the definition of the term is the responsibility of brands and consumers, considering the heritage, legacy and history of the brands. As the consumption of luxury is rapidly changing, the trendsetters are having challenges to play on consumers taste and demand. The biggest conglomerate LVMH (Louis Vuitton and Moët Hennessy) operating in 5 different sectors within 75 Maisons, in 2021 with a valuation of \$329 billion became the most valuable company in Europe.

The aim of this research is to analyze the evolutionary context of the luxury sector and investigate what the primary strategies are underlying the exponential growth of luxury brands registered until 2021. The analysis of LVMH Group’s history and strategic choices aims to highlight differences and similarities in the management of the brands and identify those actions that have allowed the brands to differentiate and reinvent themselves. Moreover, it will show how the heritage of these brands has been influencing for the development of the brands.

In the first part of my writing, I want to highlight the challenges and

strategic management of the group in corporate level with focus on how Bernard Arnault became the owner of LVMH and discussing his early takeovers. Following there will be a focus on unique operating model anchored by six pillars approach and fundamental values strategy underling in deep in each of the pillars and values of the company. In the last part, there will be an overview of the group’s supply chain and digitalization following the Covid 19 pandemic.

The second part of the thesis mainly focuses on how the inherited value and culture of the brands can be transferred into business strategy. The heritage will be the main concept of the chapter, following the art of “Savoir Faire” and it’s transmission. Additionally there will be a deep dive into Ethics and Compliance of LVMH group.

Chapter 1: The Group's Strategy

1.1 Early Takeovers of Bernard Arnault

LVMH Louis Vuitton Moët Hennessy – is the world's most valuable fashion luxury goods conglomerate, which encompasses more than seventy maisons operating in six different sectors, currently under control majority of the Arnault's family. The sectors in which the group operates are:

- Wines and Spirits
- Fashion and Leather goods
- Perfumes and Cosmetics
- Watches and Jewelry
- Selective Distribution.
- The sector defined as "others activity" is the combination of

investments on culture, art and lifestyle.

Being spanned in different sector of business, one thing has remained constant: the resolute and even ruthless drive to bring a multitude of brands under one single roof.

In this first part, there will be a historical excursus starting from the birth of the group to subsequent development through the acquisition of new brands in the various sectors.

1.1.1 Acquisition of Christian Dior as a Start

It all began in 1984 when Bernard Arnault, a 35-year-old real estate developer, set his eyes on the Paris-based fashion house Christian Dior, whose parent company Boussac Saint-Frères had filed for bankruptcy and was looking for a buyer with portfolio including other luxury brands.(FashionLaw, 2021)

With no expertise in the luxury segment, he took \$15 million from his family and \$45 million from French financial institution Lazard Frères to acquire

Financière Agache, a luxury goods company. Shortly thereafter, he won the bidding war for Boussac and spared no time in starting his quest for rapid expansion. The objective was crystal-clear from the very beginning, as revealed by this quote: "The goal I have fixed for myself was to make our group the leading luxury group in the world," said Mr. Arnault, a formal, soft-spoken executive, in his pastel gray office at Christian Dior's headquarters. "I'd say we're well on our way." Indeed, within two years he had turned the company around by laying off 9000 workers and selling off its disposable-diaper division and most of its textile operations for \$500 million.

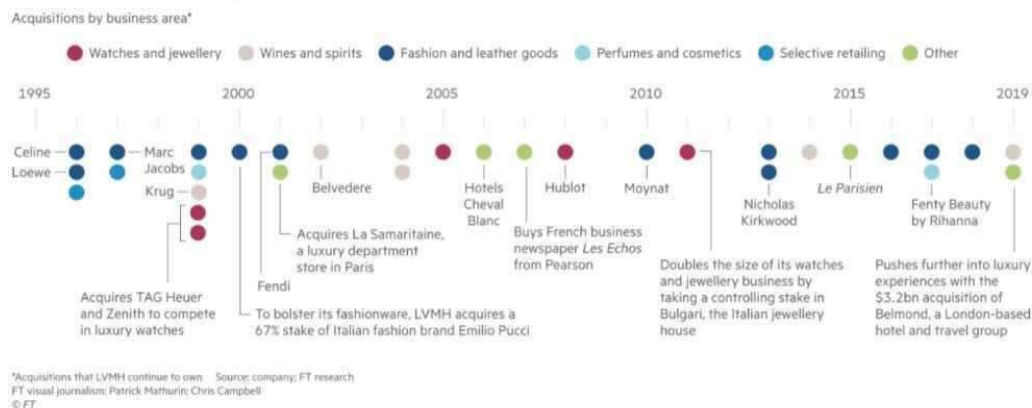
While Arnault was bringing the newly acquired company back to profitability, Moët Chandon and Hennessy merged with Louis Vuitton in 1987 to form LVMH. The creation of LVMH and the various prestigious families that stood behind it is a fascinating story by itself. Suffice to say that a conflict soon broke out between Louis Vuitton's Henry Racamier and Moët Hennessy's Alain Chevalier. The four families (or better yet, clans) – the Moëts, Chandons, Hennessys and Vuittons – had organized the merger such that they would control 51% of the new company's stock. However, fears of raiders had not subsided, and the conflicting views of Chevalier and Racamier did not help much. Chevalier, a friend of Guinness' chairman, proposed that the British beer and spirits colossus be allowed to increase its LVMH holdings from 3.5% to 20%. Herein comes the shrewd Arnault, who was selected to be an ally against Guinness by a disgruntled Racamier, who suggested that Arnault bid for 25% of LVMH's stock. However, things did not go Racamier's way when Arnault

followed his investment banker's advice and joined forces with Guinness to form a holding company that bought 24% of LVMH's stock. There followed an intense battle of share-buying assaults from which the young industrialist emerged victorious over Racamier. After Chevalier and Racamier seemed to have reached a truce, the Arnault-Guinness coalition increased their holdings of LVMH's shares to 43.5%. On 13 January 1989, the 40-year-old Arnault was elected chairman of LVMH. Eventually, Arnault stripped Racamier of his power. As for how Arnault saw himself in this battle with the old guard of industrialists, this is what he had to say: "Some people

say I'm a wolf," he says now. "That's not at all true. Wolves break up companies into pieces. It was Racamier who wanted to cut the company into pieces. I was the only one who did not want to dismantle it."

Following his strong potentials on his dreams and interests Arnault continued acquiring maisons to his go growing conglomerate. He went on to conquer leading European luxury brands, including couture-brand Givenchy (1988), French perfume, makeup and skincare giant Guerlain (1994), French leather luxury goods brand Céline (1996), the Italian jewelry brand Bulgari (2011), American luxury jewelry and accessory brand Tiffany & Co. (2020) and Italian luxury label Off-White (2021), bringing the total to 75 stellar brands

LVMH has a diverse range of brands



Source: Financial Times, (November, 2019)

1.2 Six Pillars Model

LVMH's goal is to make sure that the growth of each of its Maisons should consider the respect towards their identity and autonomy, making sure that all the resources they need efficient to design, produce and market goods and services defined by excellence, the highest quality and savoir faire. It has developed six pillars models, which stands as a solid success driving business model for an organic growth:

1.2.1 Decentralized Organization

LVMH adopts a decentralized organization. It means that each LVMH house operates autonomously across functions, with most of the decisions taken by mid or low-level managers. This model presents several advantages. First, it increases expertise. Rather than having one or more managers to decide for 70+ brands, through decentralized organizations, LVMH ensures to put in charge managers who have expertise in specific areas. For example, the competencies required for managing Kenzo are different from those needed for Loro Piana since the buyers of the two brands are entirely different. Second, it speeds up the decision-making process, essential in a business sector where fashion and trends change every day.

1.2.2 Organic Growth

To increase its organic long-term growth, LVMH invests heavily into its Maisons to encourage product innovation and boost creativity among the teams, using partnerships with external companies. One of the last relevant examples is the collaboration between Louis Vuitton and Supreme. In 2017, the companies announced the launch of unique products available only at selected Vuitton stores. The main reason for this collaboration is that thanks to this partnership, Louis Vuitton had the opportunity to up its “cool factor” among the young generation, which is not only the customers of today but is, more importantly, the customers of tomorrow. This collaboration was fundamental for Louis Vuitton because the company was losing ground among millennial from Gucci, Balmain, and Saint Laurent. The partnership is precisely aligned with the objective of LVMH’s organic growth strategy: to increase its long-term organic growth.

1.2.3 Vertical Integration

LVMH’s Vertical Integration deals with controlling every value chain link, from sourcing and production facilities to selective retailing. The interview of Yves Carcelle, who had been the chairman and CEO of LVMH’s principal subsidiary Louis Vuitton for 22 years, provides more details about Vertical Integration. He said that the more unique are the assets and the greater the control is needed to exercise over the value chain to extract competitive advantage from these assets, the more vertical integration makes sense.¹²

1.2.4 Creating Synergies

“Synergy” means that the combined return of two or more units together is greater than the sum of the returns of each unit individually. In the research “Developing Luxury Brands Within Luxury Groups - Synergies Without Dilution?”, the authors have divided and analyzed synergies into operative, market power, financial and corporate management synergies.¹³ Synergies related to resources required for production and resources associated with supporting activities are included in operative synergies. Regarding the former synergies, they are not fully achievable in the luxury industry since the brands want to maintain their identity and therefore integrating production within brands is not optimal. However, LVMH can still generate synergies in this field, such as in R&D in fragrances and purchasing leather. The latter synergies are obtained by sharing costs in activities that are not intrinsic to the luxury product.

Market power synergies are obtained by LVMH thanks to its several leading brands within the portfolio, which guarantees that LVMH has bargaining power over various stakeholders such as department stores, mall managers, and advertising agencies. All luxury groups adopt financial

synergies. In particular, each multinational has grouped the financial resources. That allows each Mason not to negotiate for a credit line but to receive financing from the group based on budgets and objectives. This process helps LVMH lower its financing costs since LVMH as a group is considered less risky than each Mason within the group thanks to LVMH diversified portfolio. Corporate management synergies are extracted by

corporate initiatives, corporate capabilities, corporate planning and control and corporate development. For example, LVMH creates value for its Maisons thanks to specific expertise in distribution, licensing and market intelligence.

1.2.5 Sustaining Savoir-Faire

As Mr Arnault said, LVMH' spirit has to be "optimistic long term" but "pessimistic short-term".¹⁴ It means that LVMH has to be ready to survive in the worst-case scenario, but, at the same time, it has to take advantage of unfavorable economic conditions to ensure the company's success in the long term. Mr Arnault stressed his long-term vision for LVMH in his speech at Oxford, saying that LVMH tries to do in the luxury segment what Warren Buffett has done throughout all his careers: invest when everyone is thinking that the world is falling apart. For example, in 2009, LVMH bought back its shares at approximately € 39 per share (12 years later, the share price is around € 700, a CAGR of 85%). "Sustaining Savoir-Faire" is not only having a long-term vision, but it also means that LVMH has to ensure that young generations value craftsmanship and creative métiers. In this regard, Mr Arnault said that luxury is a combination of "timelessness" and "modernity", which is the message that Mr Arnault wants the young generation to get.¹⁵

1.2.6 Balance Across Business Segments and Geographies

Given the wide range of Masons and the different business segments, it is clear that LVMH focuses on a corporate strategy based on business diversification. Operating in more than 70 countries and having different business segments, LVMH minimizes its downtrend business resulting from economic factors.¹⁶ To understand this point, two years in the recent past are relevant. In 2020, the year characterized by the severe health crises, LVMH's revenues fell by only 17%, and in 2008, the year of the global financial crisis, LVMH's revenue grew by 4%.

1.3 Fundamental Values

Moreover, the structure of such a giant group is diverse and underlined by the figures that each of them speak for themselves, they share common fundamental values. Mr Arnault says: "Each of the Group's 75 Maisons must cultivate the highest level of quality, not simply to maintain it year after year, but also to elevate it as we continually set even higher standards."

1.3.1 Creativity and Innovation

Group's Maisons are built on a foundation of creativity and innovation. This is what allows them to strike the delicate balance required to constantly renew the offer, looking to the future while respecting their distinct heritage. Modernity and history collide to create timeless products. Creativity and innovation are instilled in the DNA of LVMH. They have always been critical to the success of the Maisons over the years, and they encourage the exploration of the infinite possibilities offered by new technologies, which is a major growth path for the Group. (LVMH)

1.3.2 Deliver Excellence

Quality is a cornerstone of LVMH's success. Each of the Group's 75 Maisons cultivates the highest level of quality in their products and services, not just to maintain it year after year, but also to elevate it as we set even higher standards. Because of our artisans' exceptional savoir-faire, there is an offer of the highest quality products, with example of everything noble and accomplished about artisanship, paying meticulous attention to detail and striving for perfection. (LVMH)

1.3.3 Cultivate an Entrepreneurial Spirit

The dynamic momentum of LVMH is driven by an entrepreneurial spirit at all levels of the organization. It's entrusted with the legacy of the exceptional

entrepreneurs and creative talents who founded Maisons and maintained a decentralized organization to encourage pragmatic agility and quick response. While LVMH is the world leader, with the spirit of a startup, entrepreneurial challenges are inextricably linked to creativity and a never-ending quest for the highest quality. (LVMH)

1.3.4 Commitment to Positive Impact

Every action taken by the Group and its employees reflects the dedication to ethics, corporate social responsibility, and environmental stewardship. It's commitments drive the performance of the Maisons and ensure their long-term success. With the commitment to ensure the way they products are made have a positive impact on the entire ecosystem as well as the places and communities where group operates, and with the active work to build a better future. (LVMH)

1.4 Managing Creativity

Companies working with creativity always have an undeniable peculiarity and in need of managerial skills for particular professionals working for them, like creative directors or designers. They need particular organizational structure to facilitate their work without getting disturbed and falling into the trap of relaxed flow of management. The management created by companies should always be in charge of analyzing the market need, quantity and quality. It can be seen by point of view of merchandising, supply chain, product and production management. The smooth organizational control over creativity should always consider the common language and boundaries to understand each other. Finding a data of quantity about sales to show the creativity or driving a marketing strategy cannot always be understandable for creative people, but managers should find a way to communicate the creative community of the company with reciprocal approach and respect to underline the strategic value. Non-clear communication with

creativity can crash the culture and the heritage of the brands, which leads to creative crisis and damage the performance of the brand.

1.4.1 Storytelling

A major feature of luxury and fashion goods is the discrepancy between the production cost of the merchandise and its sales price. The process of creating economic value results mostly from a marketing strategy that emphasizes the uniqueness of the goods and differentiates them from common consumer goods. Qualities such as craft processes, the high quality of the materials, and traditional know-how are evoked in marketing and advertising campaigns to stimulate consumer longing. Since the early 1990s, storytelling has become one of the major techniques to build brands and to add economic value to goods. Based on the idea that telling a story is much more profitable than having a discourse based on facts. Storytelling isn't a showcasing system arranged towards a simple product, yet towards the brand and its universe: the objective is to recount a story, convey the brand values, history and inherent elements, improving brand picture and raising clients' consideration, mindfulness and dependability. Storytelling likewise permits to further develop the brand picture and to make an inclination to clients, recounting to a story, an account. It is important to make clients dream, to make a relationship with them in light of the fact that introducing an item is not any more adequate. Luxury brands have quickly shared these ideas and included storytelling in their correspondence systems. In fact, the association among storytelling and luxury is clear: luxury brands are keen on utilizing this procedure since they lean toward imparting their set of experiences and values and their purchasers need to have insight and feelings rather than a straightforward belonging, be happy with themselves and feel exceptional.



Source: Milano Free, (November 2018)

Louis Vuitton Men FW19 by Virgil Abloh, The Idea of the Show and Collection was the Streets of New York City

1.5 Supply Chain Management

Supply Chain Management is the next term that has to be defined (SCM). The main goal of SCM is to keep track of every step of a company's product from conception to final sale. A effective SCM may assist businesses in increasing revenues, lowering expenses, and gaining market share. SCM's major purpose is to create and implement supply chains that are as efficient and cost-effective as feasible. Costs are decreased and production cycles are shortened as a result of good SCM. (Investopedia, 2019).

SCM is primarily concerned with the management of flows in commodities, services, and information. Coordination inside and across firms is required in order to successfully address these issues. As a result, the major goals of SCM are value creation, increased efficiency, and improved overall supply chain performance. (Ahi & Searcy. 2012). In the following section of this thesis, we will discuss how

luxury firms outsource their production and how different sorts of outsourcing function. When premium firms decide to outsource their production, they often use one of three methods. Licensing, subcontracting, and co-branding are the three categories.

1.5.1 Subcontracting

Subcontracting is the most popular form of outsourcing. Subcontracting is a type of outsourcing in which a premium brand outsources a portion of its manufacturing to one or more vendors. It can be utilized to expand production capacity, get access to new markets, and obtain supplementary resources. The following is a list of some of the most heavily outsourced industries by luxury companies:

- Clothing: manufacturing (textiles, garment), ennoblement distribution
- Eyewear: manufacturing (components, lenses), surface treatment
- Jewelry: stone size manufacturing
- Shoes: raw materials components, manufacturing distribution

Subcontracting is not limited to the relationship between the primary company and its suppliers. It happens among suppliers as well, in order to increase manufacturing output. Another advantage of subcontracting is the cost savings. As a result, many luxury firms choose to manufacture their goods in low-wage countries. Cost optimization and value creation/brand image will always be a trade-off for luxury brands. Because they can cut costs by producing in low-wage countries, but their products will lose exclusivity as a result, that their products are not manufactured in the luxury brand's home country. Therefore, certain activities have been reintegrated in-house by brands such as Gucci, Louis Vuitton, and Burberry. (Depeyre et al., 2018).

1.5.2 Licensing

Licensing is the second most common type of outsourcing. A licensing agreement is a business arrangement in which one company grants another company permission to manufacture its product in exchange for a fee (Entrepreneur, 2019)

This type of outsourcing was almost certainly used in the past. However, a recent trend has seen many licensing agreements terminated by luxury brands and conglomerates in order to reclaim control of their own brands. Some well-known brands maintained licensing agreements in specific areas, such as eyewear. Others chose to build their own expertise in these fields. (Depeyre et al.,

2018).

1.5.3 Co-branding

Co-branding is a third, less common type of outsourcing. Co-branding is a marketing strategy in which multiple brand names are used in conjunction on a single product or service. This one-of-a-kind collaboration is only possible if the collaboration of two (or more) brands results in the co-creation and co-signature of a product conceived through a shared vision and shared values. The brand that initiates the partnership is typically looking for a collaboration with a brand that will add value to its operations. It is usually the 'initiating' brand that is in charge of actually creating and producing the end product.

1.6 Covid -19 Pandemic and Ecommerce Business Transformation

The global economy and international trade in general have suffered and continue to suffer massive losses from the coronavirus pandemic and it has had a significant impact on the fashion and luxury industry as well . We are living in unprecedented times, with harsh government restrictions, income decline, cross- border travel restrictions, shifting consumer demand and the changing behavior of consumers and market actors. Luxury market have suffered greatly, and as a result,

this sector has quickly adapted to digital transformation and the rollout of new digital operations. This part of the thesis investigates the impact of a pandemic and the dynamics of digital transformation in the luxury industry, in particular to fashion retail sectors of LVMH group.

1.6.1 Pandemic Results

In 2020 the group, reported revenue of 44.7 billion euros, a 17 percent decrease from the previous year. Organic revenue fell by 16% in compared to the previous year. In 2020, LVMH demonstrated good resilience in an economic environment severely disrupted by a serious health crisis, which resulted in the suspension of international travel and the closure of the Group's stores and manufacturing sites in most countries for several months.

The Group saw a significant improvement in trends across all of its activities in the fourth quarter, with an organic revenue decline of only 3% compared to the first nine months of 2020. Fashion & Leather Goods, in particular, outperformed expectations, growing by double digits in both the third and fourth quarters. While Europe is still reeling from the effects of the crisis, the United States has made a strong comeback, and Asia has expanded rapidly.

Profit from recurring operations, which totaled 8.3 billion euros in 2020, fell only 28 percent year on year, thanks to a 7 percent increase in the second half. In 2020, the operating margin was 18.6 percent. The group's share of net profit was

4.7 billion euros, a 34% decrease.

The CEO of LVMH, Bernard Arnault has stated the results of 2019: *"LVMH showed remarkable resilience against the unprecedented health crisis the world experienced in 2020. Our priority has been to protect the health and safety of our employees and our clients and we have provided direct support in the fight against the pandemic. Our Maisons have shown great agility and creative energy in continuing to bring to life our customers' dreams through a unique digital experience thereby further strengthening their desirability. Our focus on dynamic innovation was accompanied by strong commitments to the environment,*

sustainability and inclusion. ... we are confident that LVMH is in an excellent position to build upon the recovery for which the world wishes in 2021 and to further strengthen our lead in the global luxury market.”

Key figures:

Euro millions	2019	2020	% change
Revenue	53 670	44 651	– 17 %
Profit from recurring operations	11 504	8 305	– 28 %
Group share of net profit	7 171	4 702	– 34 %
Operating free cash flow	6 167	6 117	– 1 %
Net financial debt	6 206	4 241	– 32 %
Total equity	38 365	38 829	+ 1 %

Source: LVMH Press Release – Annual Results 2020 (January,2021)

Revenue by business group:

Euro millions	2019	2020	Change 2020/2019		Change Q4 2020 / Q4 2019 Organic*
			Reported	Organic*	
Wines & Spirits	5 576	4 755	– 15 %	– 14 %	– 11%
Fashion & Leather Goods	22 237	21 207	– 5 %	– 3 %	+ 18%
Perfumes & Cosmetics	6 835	5 248	– 23 %	– 22 %	– 15%
Watches & Jewelry	4 405	3 356	– 24 %	– 23 %	– 2%
Selective Retailing	14 791	10 155	– 31 %	– 30 %	– 26%
Other activities and eliminations	(174)	(70)	–	–	–
Total LVMH	53 670	44 651	– 17 %	– 16 %	– 3%

Source: LVMH Press Release – Annual Results 2020 (January,2021)

1.6.2 Digital Transformation

Luxury has long been associated with product excellence, exclusivity, and long-established heritage, with a value proposition centered on distinctive knowledge, prestigious boutiques, and bespoke communication aimed at the development of long-term relationships with upmarket

clientele. However the tragedy behind the pandemic boosted digital transformation in a variety of ways, serving as a positive lever and a vast source of opportunities not only from a strategic but also from an operational standpoint.

Online business models have continued to flourish over the past year, in line with a longer-term trend that accelerated during the pandemic. Fashion brands that are pushing the boundaries of fashion invest in hyper-interactive digital environments and e-commerce increasingly. The use of nontangible tokens, gaming skins, and virtual fashion is expected to become mainstream in 2022. This past year, some brands diversified into the digital "metaverse," with virtual stores, games, and online events. As in-app social commerce plays an increasingly important role, these efforts will gain momentum in the next 12 months.

Outperforming brands either appealed to the preferences of the moment - comfort, outdoor activities and online shopping - or attracted more wealthy consumers who could withstand the effects of the crisis better. These market features proved challenging for companies that could not match them, and as the pandemic continued through 2021, the list of casualties grew longer. As demonstrated by the rising number of takeovers and bankruptcies, the fashion C-suite has been an uncomfortable place to reside for much of the past year.

Increasing user comfort with social commerce and new functionality are enabling seamless shopping experiences that enable brands, consumers and investors to engage with social commerce. As use cases vary among different countries, brands should take advantage of the opportunities afforded by live streaming and augmented reality try-on technologies, which can be tailored to different markets

It can be seen in the example of Gucci case. Gucci's chief marketing officer

Robert Triefus explained the growth of second worlds as a way to express oneself, citing the 19 million visitors to the Gucci Garden within the Roblox gaming metaverse. He noted that there is no indication of the value attached to individuals who want to express themselves in a virtual world with a virtual product. (McKinsey, 2022)

1.6.3 Engagement of Local Clients and Young Clientele

While international tourism has traditionally driven luxury spending, it will not fully recover until between 2023 and 2024. As shopping patterns change in the year ahead, luxury brands should compete more aggressively with domestic consumers, invest in their local e-commerce channels and rebalance their global footprint and duty free networks.

As well, the governments have cut local consumption taxes, lowered import duties and pushed duty-free zones so that luxury shoppers would spend more in their own countries.

The rise of the metaverse and the surge in sales of virtual goods will enable fashion leaders to engage with younger cohorts in new ways as consumers spend more time online. The potential of non-fungible tokens, gaming, and virtual fashion - all of which provide a new road to creative expression, community building, and commerce - should be explored by players to obtain untapped value streams. (McKinsey, 2022)

Chapter 2. The Impact of Culture and Heritage

2.1. Brand Heritage

In spite of its relevance, brand heritage is still seen as a valid concept, and brand DNA is built on each firm's heritage (Beverland 2004; Moore and Birtwistles 2005). Luxury products should convey

the idea of something precious and refined to the consumer by telling a story and respecting a tradition. Louis Vuitton or Dior are examples of luxury brands that have a long history, and their success is based on being able to build products based on their iconic designs, such as Louis Vuitton's monogram logo or travel suits, or Dior's structured midi dresses. Culture and spirit are an integral part of the brand of a luxury firm.

There is a spirited debate going on today about this topic. It seems that technology and new generations are challenging the ability of products based on a company's heritage to satisfy rapidly changing needs and lifestyles. People wear sneakers to work nowadays. Are these choices in keeping with Dior's heritage, vision, and brand image?

2.1.1 Re-branding

There is a re-branding phase being experienced by luxury brands, which signifies the need to fundamentally restructure the brand image to meet the expectations and needs of 'Millennials'.

As such, many interviews with CEOs and managers suggest a different interpretation of the "re-branding" phenomenon. Several new designers and brands have disengaged from the past in such a way that they are rewriting the brands' DNA, including Alessandro di Michele in Gucci, Virgil Abloh in Louis Vuitton, and Demna Gvasalia for Balenciaga.

Many other brand names undergo radical changes, such as Yves Saint Laurent becoming simply Saint Laurent. The relevance of street style and the

timing of collections are seen as the two most significant aspects of the content of collections.

As the "re-branding" process changes in response to the rise of talented young designers, the question arises as to whether the brand should take precedence over the designer. Luxury history is replete with such questions. Although the Maison is going forward, the continuity of the brand is guaranteed: no matter how innovative the design changes, each designer has to incorporate the heritage of the brand and adapt to what it represented before and would represent after them. Despite this, however, it appears that balance has already been overlooked in advance. The 2018 fashion shows Hedi Slimane at Céline is a notable example. Through bold tactics on social networks, colorful outdoor sponsorships, or, as in Saint Laurent's case, disruptive logo changes that replaced what had preceded, both led the catwalk with messages of "zeroing" what had come before.

Zeroing, therefore, is a necessary and essential step. Alessandro Michele ushered in an approach when he joined Gucci, a brand in which he imposed a new strategic paradigm with a creative mark of rupture that could meet the imaginative (and technological) needs of Millennials. It is fact that, almost all of Kering's brands are now at zero, even Bottega Veneta's Tomas Maier era is over with replacement of Daniel Lee creativity and since 2022 Matthieu Blazy (Shamsher 2011).

2.1.2 Why Brand Heritage?

Patrick Thomas, former CEO of Hermès, said this: "The luxury industry is built on a paradox: the more sought-after a product is, the more it sells; but the more it sells, the less valuable it is".

Luxury brands engage us in enrichment, such as storytelling, to take us to our destinations of desire. Our everyday lives are rarely characterized by the desire for what we can immediately acquire. Almost impossible things are what people strive for, what they have to work for. Luxury brands position themselves within

an extraordinary world, and that is where they differ from premium brands.

Brands use luxury as a symbol of value by creating desire, a defining characteristic of luxury. This

is perhaps the point of brand story seduction, to pull us into a state of desire and imagining. Brand strength perception can be directly influenced by story-of-origin marketing, which has been traditionally used by luxury brands to convey value. Heritage imparts the perception of brand depth, authenticity, and credibility, which contributes to increased loyalty and acceptance of premium pricing.

Modern luxury brands must appear both historical and contemporary at the same time. For brands to remain competitive, global awareness, excellence, uniqueness, and innovation will be key components as luxury continues to be redefined and become more accessible. (Pohli, 2020)

2.1.3 How Does It Work?

Building emotional connections with consumers requires brands to actively engage them. The value and leverage of brand heritage has grown rapidly in recent years, especially in times of global market volatility. Heritage commodification implies national, historic, and cultural values as brands use longevity to demonstrate reliability and performance.

A marketing strategy that utilizes exclusive elements, and emphasizes traditional elements, is effective for starting a dialogue and creating engagement. The packaging, campaigns, corporate museums, and returns to past designs and productions are just a few examples of how companies and brands communicate a structured memory to consumers without sacrificing their emotions. It is important not to confuse brand heritage with nostalgic marketing. Historically-based brands gain their positioning and value by relying directly on their history for their identity. In a global market where tradition and identity present themselves as key competitive advantages, a few historically significant brands are able to draw upon this strength as an asset. (Pohli, 2020)

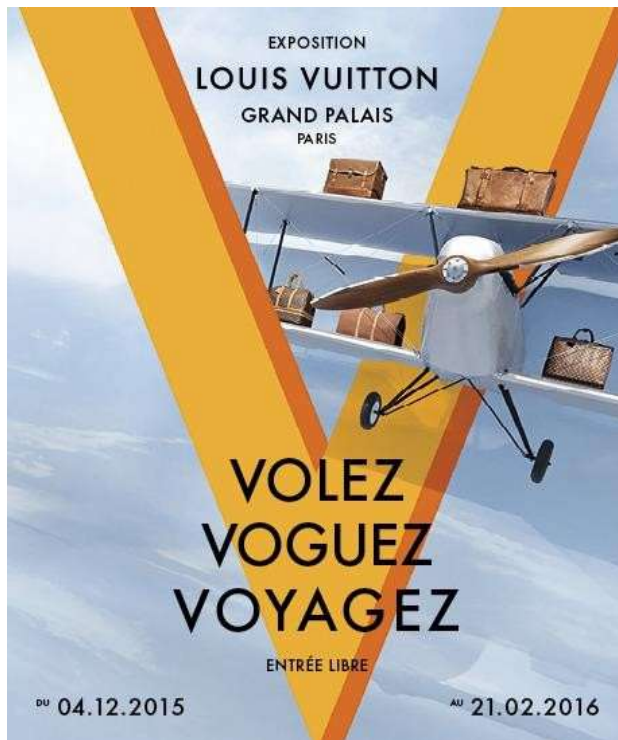
The objective of heritage marketing is to build brand equity by using

technology to connect culturally relevantly with the audience. Luxury brands often wade into political and cause-based discourse, potentially a risky move, according to a panel at the New York Times International Luxury Conference. According to Cédric Charbit, CEO of Balenciaga, "there is a new way to be a luxury brand today," with consumers looking for relevance in values as much as craftsmanship and heritage. Luxury brands today are about not only heritage, craftsmanship, and creativity, but also values, what matters to us, and what we stand for."

2.1.4. Bringing Heritage Into the Future

The allure of luxury brands can be influenced by history, but prestigious pasts are no longer the be-all and end-all for today's consumers. According to a 2017 Deloitte study of Millennials in the United States, the United Kingdom, Italy, and China, "quality and uniqueness" are the most important factors attracting them to luxury products. As a result, some of the most successful luxury brands are those that use innovation to keep traditional craftsmanship relevant.

Great branding is created through storytelling, and balancing heritage with innovation is critical. Many heritage stories will be untold to people under the age of 35 and can be communicated "fresh" to a brand's advantage. With a focus on heritage exploration, Louis Vuitton created "Voyagez," an exhibition displaying iconic pieces and detailing the brand's history from 1854 to the present. Following stops in Paris, Tokyo, Seoul, and New York, the exhibition made its way to Shanghai, where additional pieces with a special connection to China were added. Young global consumers value knowing how, when, and where a product was made, with the brand's backstory emphasizing uniqueness and value. Louis Vuitton reinvents classic pieces with modern applications, such as the Louis Vuitton Echo, a smartphone-controlled luggage tracker, and the Tambour Horizon smart watch, in addition to bringing its past to life for a new generation. (Pohli, 2020)



Source: Grand Palais, “Volez, Voguez, Voyagez – Louis Vuitton” (2015)

2.1.5 New Opportunities

What was once the domain of the very rich is now available to the global, educated audience. How are companies wooing a younger and more diverse customer base if they rely on heritage? Brands that demonstrate relevance must remain innovative in how they tell their stories. Integrating Brand history into contemporary contexts creates long-term value.

In order to remain competitive with changing times, luxury brands must keep their hallmarks of exclusivity and prestige. However, losing these traits might mean losing their identity. Luxury brands with a rich history and a strong future can have by both reframing heritage as brand values and applying data-driven strategies. (Pohli, 2020)

2.2. Transmission and Savoir Faire

The French expression “savoir faire” is defined as knowing (savoir) how to do (faire). “It means competence, experience, the knowledge of what to do and say and when and how to do so” (Giuliano, 2009). LVMH and its Maisons are the custodians of an unparalleled heritage of time-honored craftsmanship and creative skills, and they take great care in protecting and developing savoir-faire that has been passed down for centuries in some cases. The preservation of these métiers and their traditions is critical to LVMH's long-term success. The artisans' skills ensure the excellence with which the products are crafted. This savoir-faire is a one-of-a-kind, intangible heritage that is central to the global appeal and aura.

However, preservation does not imply stagnation, and nothing can be preserved in the absence of renewal and modernity. This is why LVMH continues to support its various sectors in order to ensure that future generations learn traditional artisanal and creative skills. LVMH The Group also encourages its suppliers to innovate and renew their own exceptional savoir-faire on a regular

basis. The availability of high-quality raw materials stand for, to ensure the quality of products, which are frequently scarce or in short supply.

2.2.1. Initiatives to Support Transmission and Savoir Faire

“Sustaining Savoir-Faire” is not only having a long-term vision, but it also means that LVMH has to ensure that young generations value craftsmanship and creative métiers. In this regard, Mr Arnault said that luxury is a combination of “timelessness” and “modernity”. To support the transmission of Savoir Faire the group has launched several initiatives through different institutions and projects:

- “LVMH’s Métiers d’Excellence” – encompass of over 280 Creative, Craft and Customer Experience métiers, practiced by some 80,000 talented people around the world.
- “Excellent!” - program to raise awareness among junior high school age children in Clichy-sous-Bois and Montfermeil, suburbs on the northern edge of Paris in the Seine-Saint-Denis conurbation.
- “Le Village des Métiers d’Excellence” - created in 2015, vocational trade fair promoting work-study programs offered by the Institut des Métiers d’Excellence.
- “INSIDE LVMH” – acceleration program to attract and develop early career professionals throughout their career path within LVMH and its Maisons.
- “LVMH Métiers d’Art” – strategy that implements a comprehensive sustainable development: in the sourcing of quality, raw materials (often rare or increasingly scarce) and in enriching the transmission of savoir-faire (at times traditional, unique and specific to our industry).
- “L’Institut des Métiers d’Excellence” - vocational training program with a work-study format that enables LVMH to pass on this savoir-faire to young generations, thus enhancing their employability.

2.3 Ethics and Compliance

The LVMH group has always been deeply committed to exemplary integrity and ethics in its business operations and interactions with all stakeholders. To establish the behavior required of the Group's executives and employees, as well as our suppliers and partners, rules of conduct, principles, and guidelines governing ethics and environmental and social responsibility have been defined. As Bernard Arnault states:

“The success of LVMH depends on respect for the shared rules, practices and principles that guide the day-to-day conduct of our business activities everywhere in the world in terms of ethics, social responsibility and respect for the environment.”

2.3.1 LVMH Code of Conduct

The LVMH Code of Conduct is a cornerstone of it’s ethics and compliance policy. It serves as a common ethical framework for the Group and its Maisons,

bringing together the rules that each employee must follow in the performance of their duties:

- acting responsibly and with social awareness;
- providing a fulfilling work environment and valuing talents;
- commitment to protect the environment;
- winning the trust of customers;

- winning the confidence of shareholders;
- acting with and commitment to integrity in the conduct of business.

The Code has been translated into more than 10 languages and is widely disseminated across the Group.

2.3.2 Suppliers Code of Conduct

The LVMH group places a high value on ensuring that its Maisons and their partners adhere to a set of common rules, practices, and principles in terms of ethics, social responsibility, and environmental protection.

As a result, each LVMH Group Maison expects its suppliers to adhere to the ethical principles outlined in the Supplier Code of Conduct, as well as to ensure that their own suppliers and subcontractors do the same in the course of their activities for the Group.

2.3.3 LVMH Alert Line

LVMH encourages open communication and dialogue within the Group as well as with its external partners and clients ("stakeholders"), which is why the Group established the LVMH Alert Line, an online interface that provides a fully confidential and secure way of reporting in good faith violations of laws, regulations, or internal conduct principles.

Conclusion

The luxury industry proved a particularly insightful sector due to its enduring history and legacy. The aim of this writing was directed at examining the role of corporate structure of LVMH Group across its Maisons and the impact of its culture and heritage on luxury industry, and its relevance in a long-term perspective to build a strong brand identity.

In the first part of my writing I have shown how group like an LVMH has built a multidimensional, complex structure with its investments on 6 sectors of luxury business and reached the highest level of success. Taking everything into consideration it can be seen that such a big decentralized organization highly focuses on organic growth through the investments on future. It shows that well structured and goal oriented corporate strategy can always stand for positive results of the performance. Moreover, pandemic has forced to improve the immunity of the group on digitalization and raise the .com business revenue. By engaging digital consumers, they were able to build a strong clientele relationship. Perspective of diverse types of supply chain management forms stands as a

The second part of the writing shows that group, having a rich history and heritage of the brands, can stand as a good example of excellent embodiment of eternal business organization. Continues affords to promote the excellence "Savoir Faire", they try to give a knowledge to younger generation to discover the true value of the artisans, handcraft and quality. Promoting young professionals, they are making sure that the future of the luxury business is getting transferred to the hands of new generations, who will continue to prosper its codes and origins.

Finally, I strongly believe that LVMH's financial success will be largely explained by strong managerial capabilities, innovative managerial constructions and clever brand management techniques.

КӘСІПОРЫННЫҢ БИЗНЕС ПРОЦЕСТЕРІН ОҢТАЙЛАНДЫРУДАҒЫ ЖАСАНДЫ ИНТЕЛЛЕКТІҢ РӨЛІ

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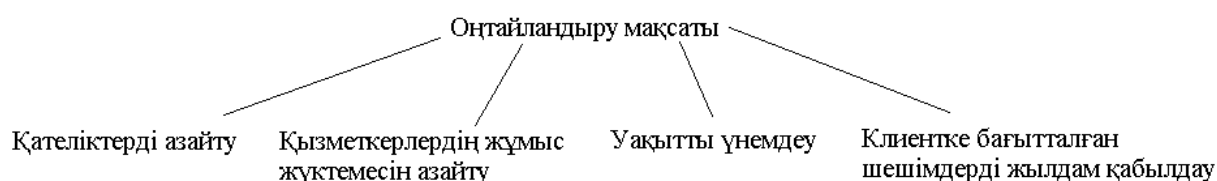
Қарағанды Е.А.Бөкетов атындағы университетінің 3 курс студенттері

Технология дәуірінің шарықтау кезеңінде кәсіпорындардың тиімді жұмыс істеуі мен нарықтағы бәсекеге қабілеттілігін сақтау — автоматтандыру мен интеллектуалды жүйелерді енгізусіз мүмкін емес. Осы тұрғыда жасанды интеллект (ЖИ) — бизнес процестерді оңтайландыруда шешуші құралға айналып келеді. ЖИ арқылы компаниялар операциялық шығындарды қысқартып, жұмыс жылдамдығын арттырып, адами фактор әсерін азайтып, деректерге негізделген шешім қабылдауға қол жеткізуде.

Жасанды интеллект — адамның когнитивті қабілеттерін имитациялайтын, деректерді талдап, болжам жасап, шешім қабылдай алатын алгоритмдер мен жүйелер жиынтығы.[1] Осы технологиялардың көмегімен кәсіпорындар қайталанатын процестерді автоматтандырып, үлкен деректерді тиімді сараптай алады.

Бизнес процесі — кәсіпорын ішіндегі өнім немесе қызметті жасауға бағытталған бірізді әрекеттер тізбегі. Бұл процестердің тиімді жұмыс істеуі табыстың, бәсекеге қабілеттіліктің және тұтынушы қанағаттануының негізгі факторы болып табылады.[1]

Бизнес процесін оңтайландыру — бұл кәсіпорын ішіндегі жұмыстарды тиімді әрі нәтижелі етуге бағытталған шаралар жиынтығы.[1] Бұл процесте ресурстарды үнемдеу, уақытты қысқарту және өнім сапасын арттыру басты мақсаттар болып табылады.



Сурет 1. — ЖИ арқылы бизнес процестерді оңтайландыру мақсаттары

ЖИ шешімдері адам қателіктерін азайтуға көмектеседі. Бұл әсіресе деректермен, құжаттармен және қаржы есебі сияқты дәлдікті қажет ететін жұмыстарда маңызды.

Рутиналық және ауыр тапсырмаларды ЖИ-ге тапсыру арқылы қызметкерлер маңыздырақ, шығармашылық немесе күрделі мәселелерге көңіл бөле алады.

ЖИ қайталанатын, рутиналық тапсырмаларды автоматтандыру арқылы қызметкерлердің уақытын үнемдейді.

ЖИ тұтынушылардың мінез-құлқын, қалауын және қажеттіліктерін талдау арқылы бизнеске жедел әрі дәл шешім қабылдауға көмектеседі.

ЖИ көмегімен оңтайландырылатын бизнес процестер:

1. Құжат айналымы және деректерді өңдеу. Кәсіпорындарда үлкен көлемдегі деректермен жұмыс істейтін бөлімдерге (бухгалтерия, HR, сату) жасанды интеллект деректерді автоматты түрде өңдеп, есеп беруді жеңілдетеді. Мысалы, «ҚазМұнайГаз» ұлттық компаниясы құжаттарды автоматты түрде тану және өңдеу үшін нейрондық желілер негізіндегі жүйелер

енгізілді. Бұл жүйе құжаттардың мәтінін талдай отырып, қажетті деректерді шығарып, оларды құрылымданған форматта сақтайды. Нәтижесінде құжат айналымының жылдамдығы 30%-ға артты, адами қателіктер саны 20%-ға төмендеді.[2]

2. Клиенттермен жұмыс (CRM). ЖИ арқылы тұтынушылармен қарым-қатынас автоматтандырылып, әр клиентке жеке ұсыныс беру мүмкіндігі артады. Мысалы, «Kaspi Bank» клиенттердің мінез-құлқын талдау үшін машиналық оқыту алгоритмдері қолданылды. Бұл банктің маркетингтік ұсыныстарын жеке тұлғаға бейімдеуге мүмкіндік берді. Нәтижесінде клиенттердің қанағаттану деңгейі 15%-ға артты, кросс-сату көлемі 25%-ға өсті.[3]

3. Жабдықтау тізбегін басқару. Логистика және жабдықтау процесстерінде ЖИ нақты уақыттағы мәліметтерге сүйене отырып, тауар қозғалысын тиімді басқаруға көмектеседі. Мысалы, «Қазақстан темір жолы» ұлттық компаниясы жабдықтау тізбегін оңтайландыру үшін болжау модельдері мен деректерді талдау құралдары енгізілді. Бұл жүйе сұраныс пен ұсынысты алдын ала болжауға, қойма қорларын тиімді басқаруға мүмкіндік береді. Нәтижесінде қойма қорларының деңгейі 10%-ға төмендеді, жеткізу уақыттары 20%-ға қысқарды.[2]

4. Өндірісті бақылау және сапаны басқару. Компьютерлік көру жүйелері өнім сапасын автоматты түрде бақылап, ақауларды ерте кезеңде анықтай алады. Мысалы, «RG Brands» компаниясы — Қазақстандағы ірі сусындар мен шырындар өндірушісі Алматы қаласындағы зауытында компьютерлік көру жүйесін өндіріске енгізді. Жүйе бөтелкелердің көлемін, қақпағының тығыз жабылғанын және жапсырманың дұрыстығын тексереді. Нәтижесінде ақаулы өнімдердің саны 25%-ға азайды, қолмен тексеруге кететін уақыт 40%-ға қысқарды, өнім сапасын бақылау тиімділігі 90% деңгейге жетті.[4]

Жасанды интеллект жүйелерін кәсіпорындарға енгізу бүгінгі күні үлкен мүмкіндіктермен қатар бірқатар қиындықтар мен шектеулерді де тудырады.

Кесте 1. – ЖИ енгізу қиындықтары мен шектеулер және оларды шешу жолдары.

Қиындықтар мен шектеулер	Шешу жолдары
1. Қаржылық шығындар. ЖИ жүйелерін әзірлеу, енгізу және қызмет көрсету қымбатқа түседі.	1. Бюджеттеу және кезең-кезеңмен енгізу. - Пилоттық жобалар арқылы технологияны сынау; - Бастапқыда бизнес-процестердің тек бір бөлігінде енгізу.
2. Квалификацияланған мамандардың жетіспеуі. ЖИ жүйелерін құру және басқару үшін жоғары білікті мамандар қажет.	2. Кадрларды даярлау және біліктілікті арттыру. - Ішкі оқыту бағдарламаларын ұйымдастыру; - Университеттермен және оқу орталықтарымен серіктестік орнату.
3. Деректердің жеткіліксіздігі немесе сапасыздығы. ЖИ жүйелері үлкен көлемдегі сапалы деректерге сүйенеді. Нақты шешімдер қабылдау қиындайды, модельдер қате жұмыс істеуі мүмкін.	3. Деректермен жүйелі жұмыс жүргізу. - Деректерді жинау, өңдеу және сақтау үшін дұрыс құрылым жасау; - Қолжетімді деректерді дұрыс анонимдеу және сапасын бақылау.
4. Инфрақұрылымның жеткіліксіздігі. Жоғары есептеу қуаты, заманауи серверлер қажет.	4. Инфрақұрылымды жаңғырту. - Бұлтты қызметтер (cloud computing) пайдалану – шығынды азайтады; - Серіктес ІТ-компаниялармен жұмыс істеу.
5. Қызметкерлердің қарсылығы мен мәдени кедергілер. Жаңа технологияларға үйрену қиын, кейде жұмысшылар ЖИ-ды жұмыс орнын жоғалту қаупі ретінде қабылдайды.	5. Ішкі коммуникацияны жақсарту. - Қызметкерлерге ЖИ енгізудің пайдасын түсіндіру; - Адам мен ЖИ арасындағы серіктестікті насихаттау.
6. Құқықтық және этикалық мәселелер. ЖИ шешімдеріне жауапкершілік, деректердің құпиялығы және этикалық нормалар мәселелері.	6. Заң және ережелерді сақтау. - ЖИ жүйелерін енгізуде қолданыстағы заңдарды ескеру; - Заңгерлер мен этика мамандарын тарту.

Кестеде көрсетілген қиындықтар мен шектеулер қазіргі таңда көптеген кәсіпорындарға ортақ проблемалар болып табылады. Ең алдымен, қаржылық шығындар – ЖИ жүйелерін енгізудің басты кедергелерінің бірі. Бұл технологияларды әзірлеу мен ендіру көп жағдайда инвестициялық тұрғыдан күрделі, әсіресе шағын және орта бизнес үшін. Сондықтан бұл топтағы кәсіпорындарға пилоттық жобалар жасап көру немесе бастапқыда шағын масштабта іске асыру ұсынылады.

Екінші үлкен мәселе – кадр тапшылығы. ЖИ-мен жұмыс істей алатын мамандар саны шектеулі, әрі олар еңбек нарығында жоғары сұранысқа ие. Осыны ескеріп, ұйымдар оқыту бағдарламаларын қолға алып, университеттермен ынтымақтастық орнатуы қажет.

Сонымен қатар, ЖИ технологиялары тиімді жұмыс істеуі үшін сапалы және құрылымдалған деректер қажет. Алайда көп жағдайда деректер жетіспейді немесе ретсіз жиналған. Бұл мәселені шешу үшін компаниялар деректермен жүйелі түрде жұмыс істеуі, яғни оларды жинау, өңдеу және сақтау жүйелерін жетілдіруі керек.

Инфрақұрылым мәселесі де елеулі орын алады. Ескі техникалық база ЖИ жүйелерінің толыққанды жұмыс істеуіне кедергі келтіреді. Мұндай жағдайда бұлтты технологияларды пайдалану немесе сыртқы IT-серіктестермен жұмыс жасау тиімді болады.

Көп жағдайда қызметкерлердің қарсылығы мен ұйым ішіндегі мәдени кедергілер де прогресті тежейді. Бұл — адамдардың ЖИ-ды өздерінің орнын басатын қауіп ретінде қабылдауынан туындайды. Сол себепті ұйым басшылығы ішкі коммуникацияны жақсартып, ЖИ-дың жұмысты жеңілдететін құрал екенін ұжымға нақты түсіндіруі керек.

Ақыр соңында, құқықтық және этикалық мәселелер — ЖИ шешімдерінің заңды және моральдық жағын қамтиды. ЖИ енгізу барысында қолданыстағы заңдарды сақтау, деректер құпиялығын қамтамасыз ету және этикалық стандарттарға сәйкес әрекет ету — табысты енгізудің маңызды шарты.

Кесте 2. — ЖИ енгізу артықшылықтары.

Артықшылықтар	Сипаттамасы
Өнімділік артады.	Адамға қарағанда әлдеқайда жылдам және дәл жұмыс істейді.
Шығын азаяды.	Еңбекақы, қателіктер және материалдық шығындар қысқарады.
Шешім қабылдау жақсарады.	Нақты деректерге негізделген жылдам және дәл шешімдер.
Бәсекеге қабілеттілік артады.	Нарықтағы өзгерістерге жедел бейімделу.

ЖИ адам еңбегін автоматтандыру арқылы көптеген операцияларды жылдам әрі тиімді орындай алады. Бұл әсіресе қайталанатын, рутиналық тапсырмаларда көрініс табады.

ЖИ шешімдері адам қателігін азайтып, ресурстарды үнемдеуге мүмкіндік береді. Автоматтандырылған жүйелер жұмыс уақытын, еңбек шығындарын және материалдық ресурстарды оңтайлы пайдалануға көмектеседі.

ЖИ үлкен деректерді (Big Data) жылдам өңдеп, нақты әрі дәл аналитика ұсына алады. Бұл деректер негізінде басшылар стратегиялық шешімдерді тез әрі негізді қабылдай алады. Сонымен қатар, болжау модельдері арқылы нарықтағы өзгерістер мен тұтынушы сұранысын алдын ала көруге болады.

ЖИ қолданатын кәсіпорындар нарықтағы өзгерістерге тез бейімделіп, инновациялық өнімдер мен қызметтер ұсына алады. Бұл компанияның тиімділігін арттырып қана қоймай, бәсекелестерден озық болуға көмектеседі. Сондай-ақ, тұтынушыға бағытталған сервисті жақсарту арқылы бренд беделі нығаяды.

Жасанды интеллект (ЖИ) технологиялары қазіргі таңда кәсіпорындар үшін стратегиялық маңызға ие құралға айналып отыр. Болашақта ЖИ кәсіпорындардың жұмыс істеу тәсілін түбегейлі өзгертеді деп күтілуде. Ең алдымен, ЖИ арқылы бизнес-процестерді автоматтандыру кеңінен дамиды. Бұл дегеніміз — өндірістегі, логистикадағы, сату мен клиенттерге қызмет көрсету салаларындағы қайталанатын және рутиналық міндеттерді алгоритмдерге тапсыру мүмкін болады. Нәтижесінде адам ресурстары күрделі, шығармашылықты талап ететін тапсырмаларға көбірек жұмсалады. Сонымен қатар, ЖИ деректерді талдауда ерекше маңызды рөл атқарады. Ол үлкен көлемдегі ақпаратты жылдам өңдеп, тұтынушылардың мінез-құлқын болжауға, нарықтық үрдістерді алдын ала анықтауға, бизнеске тиімді шешім қабылдауға көмектеседі. ЖИ-дің көмегімен кәсіпорындар жекелендірілген өнімдер мен қызметтер ұсына алады, бұл клиенттердің сенімін арттырып, нарықтағы бәсекеге қабілеттілікті жоғарылатады. Өндірісте ЖИ жабдықтардың тозуын болжау, ақауларды ерте анықтау сияқты функцияларды атқарып, техникалық қызмет көрсетуге кететін шығындарды азайтады және қауіпсіздікті арттырады. Қаржы саласында ЖИ

қаржылық операцияларды бақылау, алаяқтықты анықтау, инвестициялық шешімдерді оңтайландыруда қолданылады. Сонымен қатар, ЖИ басқарушылық деңгейде де шешім қабылдауға әсер етіп, стратегиялық жоспарлау, тәуекелдерді бағалау, кадрлық саясат сияқты маңызды салаларда нақты әрі уақтылы ақпарат беріп отырады. Кәсіпорындар арасындағы бәсекелестік ЖИ технологияларын тиімді қолдануға байланысты күрделене түседі, сондықтан ЖИ-ді енгізу мен дамыту бизнес-стратегияның маңызды бөлігіне айналады. Болашақта ЖИ-дің жетілдірілуі нәтижесінде кәсіпорындарда адам мен машинаның бірлесе жұмыс істеуі кеңінен таралып, бұл симбиоз жаңа мүмкіндіктерге жол ашады. Алайда бұл технологияны енгізу кезінде деректер қауіпсіздігі, этикалық нормалар мен кадрларды қайта даярлау сияқты мәселелер де туындайды, сондықтан ЖИ-дің болашағы тек технологиялық емес, әлеуметтік және құқықтық тұрғыдан да жан-жақты ойластырылуы тиіс. Жалпы алғанда, ЖИ кәсіпорындардың тиімділігін арттырып, инновациялық әлеуетін кеңейту арқылы олардың ұзақ мерзімді табысты дамуына жол ашады. [5]

Қазіргі заманда жасанды интеллект (ЖИ) — жай ғана технологиялық жетістік емес, кәсіпорындар үшін стратегиялық басымдыққа айналды. ЖИ көмегімен бизнес-процестерді автоматтандыру, деректерді жылдам әрі дәл талдау, шешім қабылдау сапасын арттыру және тұтынушымен қарым-қатынасты жекелендіру мүмкіндігі артып келеді. Бұл — кәсіпорындардың шығындарын азайтып, тиімділікті көтеруге, сонымен қатар бәсекелестік артықшылыққа ие болуына мүмкіндік береді.

Дегенмен, ЖИ-ды енгізу барысында қаржылық шығындар, білікті кадр тапшылығы, инфрақұрылым жеткіліксіздігі мен деректердің сапасыздығы сынды қиындықтар да кездеседі. Бұған қоса, қызметкерлердің қарсылығы мен құқықтық-этикалық мәселелер де елеулі кедергілердің қатарында. Алайда бұл мәселелер — уақытша. Жүйелі тәсіл, дұрыс стратегия және жан-жақты дайындық арқылы оларды еңсеруге болады.

Ең бастысы, ЖИ — адамды алмастырушы емес, оның мүмкіндіктерін кеңейтетін құрал. ЖИ мен адам еңбегінің үйлесімі арқылы кәсіпорындар шығармашылық, инновация және стратегияға көбірек көңіл бөліп, болашақтың нарығында өз орнын нығайта алады.

Сондықтан да ЖИ технологияларын уақытында және саналы түрде енгізу — тек бүгінгі күннің қажеттілігі ғана емес, ертеңгі күнге жасалған инвестиция. ЖИ-ді дұрыс пайдалану кәсіпорындарды тек қана сандық тұрғыда емес, сапалық тұрғыда да жаңа деңгейге көтереді.

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Enhancing Project Risk Management in Construction: Integrated Approach and Practical Recommendations

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Abstract

The growing complexity of construction projects creates increasing demands for advanced risk management systems in construction companies. This study examines the current state of project risk management in a large construction company operating in Kazakhstan and international markets, and develops a comprehensive set of organizational, methodological, digital, and cultural recommendations for enhancing its maturity level. Using a mixed-method approach combining literature review, internal document analysis, expert interviews, employee surveys, and case studies, the research identifies key deficiencies and opportunities for improvement. The proposed solutions target formalization of responsibilities, integration of quantitative risk analysis, digitalization of risk registers, and development of risk-oriented corporate culture.

1. Introduction

In the construction sector, the scale of investments, technological complexity, and long project cycles expose companies to numerous internal and external risks. Effective project risk management (PRM) has become a crucial factor for successful project delivery and organizational resilience. The construction company under study implements large-scale social, industrial, and infrastructure projects across Kazakhstan and other international locations. Despite having certain risk management regulations in place, the existing system requires modernization and alignment with global best practices such as PMBOK, ISO 31000 and PRINCE2.

The purpose of this study is to develop practical recommendations for improving the maturity and efficiency of project risk management within the organization, using a comprehensive diagnostic approach.

2. Literature Review

2.1 Evolution of Project Risk Management

Theoretical foundations of risk management have evolved from early financial models (Markowitz, 1952) toward more comprehensive approaches that integrate organizational, technical, legal, environmental, and social dimensions. In project management, PMBOK defines risk as an "uncertain event or condition that, if it occurs, has a positive or negative effect on project objectives." Modern models emphasize both threats and opportunities.

2.2 International Standards and Frameworks

- **PMBOK (2017):** systematizes risk management into planning, identification, qualitative and quantitative analysis, response planning, implementation, and monitoring.
- **ISO 31000 (2018):** provides universal risk management principles emphasizing integration with organizational processes, transparency, inclusiveness, continuous improvement, and stakeholder engagement.

- **PRINCE2 (2017):** integrates risk management across project stages, including mandatory risk registers, designated risk owners, and response plans.

2.3 Empirical Research in Construction

Construction projects are highly exposed to risks due to capital intensity, technological complexity, regulatory variability, and multi-stakeholder involvement. Studies (Zou et al., 2010; Loosemore et al., 2012; Bryde & Volm, 2009) highlight key risk categories such as organizational, contractual, economic, environmental, and coordination risks. Empirical evidence confirms that formalized risk management improves project cost and schedule performance.

2.4 Emerging Trends in PRM

Recent developments include:

- **BIM and 4D/5D modeling** for scenario-based risk simulations.
- **ERP-based risk modules** for integrated monitoring (e.g., SAP, Oracle Primavera).
- **Agile Risk Management** for iterative reassessment in volatile contexts.
- **Big Data & Machine Learning** for predictive risk analytics and proactive mitigation.

2.5 Challenges in Emerging Markets

While international standards offer robust frameworks, their direct transfer to emerging economies (Turner & Keegan, 2001; Dinsmore & Cooke-Davies, 2006) faces institutional, regulatory, and cultural barriers requiring context-specific adaptation.

3. Research Methodology

The study employed a mixed-method approach:

- **Primary data:**
 - Analysis of internal regulations and risk registers.
 - 6 expert interviews with project managers, engineers and risk officers.
 - Surveys with 54 employees at various organizational levels.
 - Case studies of 3 completed projects.
- **Secondary data:**
 - Academic literature, global standards (ISO 31000, PMBOK, PRINCE2), and industry reports on construction risk management.

Triangulation of data ensured validity and comprehensiveness of findings.

4. Research Results

4.1 Organizational Assessment

- Partial formalization of risk processes exists through internal regulations.
- Risk ownership and role distribution remain unclear.
- Weak horizontal and vertical coordination in risk identification and monitoring.

4.2 Employee Survey Insights

- 48% are familiar with risk procedures; 46% have limited awareness.
- Only 26% report clear role definitions.
- 48% address risks regularly; 46% do so only in response to problems.
- Main identification methods include brainstorming and lessons learned.
- 77% apply qualitative risk matrices; only 17% use quantitative models.
- 60% rely on Excel-based risk tracking; limited IT integration exists.
- Only one-third received formal risk management training.

4.3 Case Study Findings

- Projects with regular risk register updates showed minimal deviations.
- Ad hoc risk management led to significant overruns.
- Proactive identification and ownership correlated with better outcomes.

4.4 SWOT Analysis Summary

Strengths

- Formalized regulations exist
- Use of risk matrices
- Appointed risk owners
- ISO 31000 elements integrated

Weaknesses

- Lack of digital tools
- Inconsistent register updates
- Low staff involvement
- Limited training programs

Opportunities

- Digital platforms
- Staff training programs
- Quantitative methods adoption
- Cross-project knowledge sharing

Threats

- Change resistance
- Knowledge loss due to staff turnover
- Reputational damage from unmanaged risks
- Absence of centralized risk policy

5. Recommendations

5.1 Organizational Enhancements

- Establish a Risk Management Competency Center within the Project Management Office.
- Formalize roles: risk owner, risk analyst, session moderator.
- Integrate risk management into project charters, control meetings, and performance KPIs.

5.2 Methodological Improvements

- Expand risk taxonomies to include strategic, reputational, environmental categories.
- Enforce periodic risk register reviews (e.g., monthly).
- Introduce checklists for each project phase.
- Apply quantitative analysis:
 - Monte Carlo simulations for complex projects.
 - Sensitivity analysis for prioritization.
 - Expected Monetary Value (EMV) for financial decisions.

5.3 Digitalization Strategy

- Implement integrated IT solutions:
 - Oracle Primavera Risk Analysis or similar platforms.
 - Centralized digital risk registers with project-level filters.
 - Interactive dashboards for management oversight.
- Introduce predictive analytics and machine learning for risk forecasting.

5.4 Training and Cultural Development

- Formalize onboarding risk management modules for all new hires.
- Deliver targeted training programs for various staff categories.
- Encourage leadership involvement in promoting risk dialogue.
- Organize internal workshops, seminars, and "Risk Awareness Days."

6. Conclusion

The study confirms that while the organization possesses a baseline risk management framework, significant improvements are required in system integration, digitalization, analytical rigor and staff competencies. The proposed comprehensive strategy aims to strengthen project delivery performance, organizational resilience, and competitive advantage amid growing complexity in regional and global construction markets.

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Современные подходы к формированию системы развития персонала

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В условиях ускоренной цифровизации, глобализации и трансформации форм занятости концепция развития персонала приобрела новое содержание и масштабы. Современные подходы к формированию систем развития персонала опираются на стратегическое мышление, гибкость, непрерывность, персонализацию и цифровые инструменты. В данном литературном обзоре систематизированы наиболее значимые теоретические и практико-ориентированные подходы, нашедшие отражение в трудах отечественных и зарубежных исследователей [14].

Современные исследователи подчёркивают, что система развития персонала должна быть неотъемлемой частью стратегии компании. Многими исследователями подчёркивается, что развитие должно строиться с учётом долгосрочных целей бизнеса, обеспечивая соответствие между организационными приоритетами и кадровыми возможностями. Такой подход предполагает активную интеграцию HR-политики с корпоративной стратегией, в том числе на уровне показателей эффективности [15].

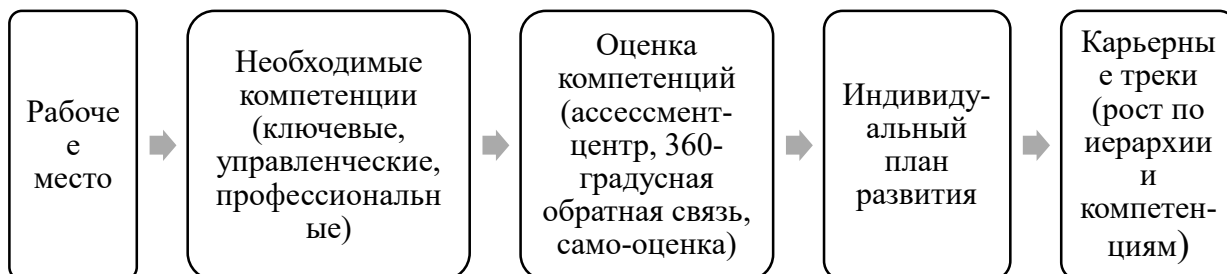
Более того, авторы акцентируют внимание на необходимости выстраивания вертикали целей: от стратегических задач до индивидуальных планов развития сотрудников. Это позволяет не только выравнивать мотивацию персонала с целями организации, но и формировать устойчивую культуру профессионального роста [16].

Современные подходы к развитию персонала формируются под влиянием множества факторов, таких как цифровизации экономики, усиления конкуренции за таланты, глобализации и быстрого устаревания знаний. Компании стремятся выстроить такие системы обучения и развития, которые были бы не только эффективными с точки зрения освоения новых компетенций, но и гибкими, персонализированными и тесно интегрированными с бизнес-целями. Основные современные подходы к развитию персонала включают компетентностный и личностно-ориентированный, интерактивные и практико-ориентированные методы обучения, использование цифровых технологий, интеграцию развития с управлением эффективностью, и другие [17].

Компетентностный подход основывается на идее, что каждое рабочее место требует набора специфических компетенций, то есть знаний, умений, навыков и поведенческих характеристик, которые необходимы для эффективного выполнения задач (График 3). Этот подход получил широкое распространение с конца XX века, когда компании стали разрабатывать модели компетенций для различных уровней должностей. Компетенции делятся на ключевые (универсальные), управленческие и профессиональные. Преимущество данного подхода включает возможность выстраивания логики развития на основе разрывов между текущим уровнем компетенций сотрудника и требуемым. Компании разрабатывают индивидуальные планы развития, основанные на оценке компетенций (ассессмент-центры, 360-градусная обратная связь и др.). В BI Group такая модель может

быть реализована в рамках карьерных треков, где продвижение по иерархии сопровождается ростом уровня ключевых и профессиональных компетенций [18].

График 3. Компетентностный подход к развитию персонала [18].



Личностно-ориентированный подход акцентирует внимание на индивидуальных особенностях сотрудников, то есть их ценностях, мотивах, стилях обучения и профессиональных амбициях. Он предполагает персонализацию развития, гибкость в выборе форматов обучения и адаптацию программ под потребности конкретного человека [19].

Теория самоопределения (Self-Determination Theory, SDT) была разработана американскими психологами Эдвардом Л. Деси и Ричардом М. Райаном в 1985 году. Основной тезис теории заключается в том, что наилучшее обучение, развитие и функционирование личности происходят в тех условиях, где преобладает внутренняя мотивация. Внутренняя мотивация возникает тогда, когда деятельность воспринимается человеком как значимая, интересная и соответствующая его внутренним убеждениям, а не как результат внешнего давления, вознаграждения или наказания [20].

Центральным элементом теории является утверждение, что для оптимального развития личности необходимо удовлетворение трёх базовых психологических потребностей: автономии, компетентности и принадлежности. Потребность в автономии означает стремление человека к контролю над своей жизнью, возможности выбора и реализации собственных решений. Потребность в компетентности выражается в стремлении чувствовать себя способным, эффективно справляться с поставленными задачами и достигать успеха. Потребность в принадлежности (или связанности) проявляется в стремлении быть принятым, связанным с другими людьми и чувствовать поддержку со стороны значимых социальных групп.

В условиях, где эти потребности удовлетворяются, у человека формируется устойчивый интерес к обучению, высокий уровень вовлечённости и внутренняя мотивация. Напротив, когда внешние факторы (например, авторитарный стиль руководства, жёсткие регламенты, система наказаний) подавляют автономию или создают ощущение некомпетентности, это приводит к снижению мотивации, выученной беспомощности и выгоранию.

В образовательных и организационных контекстах теория самоопределения получила широкое применение. Компании и образовательные учреждения, ориентированные на развитие сотрудников или учащихся, создают условия для выбора и самоуправления, предоставляют конструктивную обратную связь и поддерживают благоприятный психологический климат. Таким образом, теория Деси и Райана подчёркивает, что развитие и обучение наиболее эффективно в тех условиях, где человек

ощущает свободу, поддержку и признание, а сам процесс воспринимается как возможность для самореализации и роста.

Компании, применяющие этот подход, проводят диагностику мотивационных профилей сотрудников, разрабатывают индивидуальные планы развития, коучинг-программы и карьерные консультации. Внедрение личностно-ориентированного подхода позволяет повысить вовлечённость и удержание персонала, а также содействует построению культуры доверия и развития [20].

Интерактивные и практико-ориентированные методы обучения включают современные системы развития, которые отходят от традиционных лекционных форматов в пользу активных методов. Кейс-стади, симуляции, деловые игры, проектное обучение, action learning — все эти методы направлены на развитие навыков через практическую деятельность и рефлексию. Они позволяют лучше закреплять знания, развивать критическое мышление, командную работу и адаптацию к нестандартным ситуациям. В рамках проектного обучения участники решают реальные задачи компании, что позволяет объединить процесс развития с бизнес-целями. BI Group может применять данные методы при подготовке менеджеров проектов, руководителей направлений и инженерно-технического персонала, включая кейсы из строительной практики [21].

Цифровизация коренным образом меняет парадигму развития персонала. В фокусе данной парадигмы находятся доступность, гибкость, персонализация и масштабируемость. Компании внедряют Learning Management Systems (LMS), платформы корпоративного обучения, мобильные приложения, видеокурсы и адаптивные цифровые модули, формируя единую цифровую экосистему [22].

E-learning позволяет сотрудникам самостоятельно выбирать время и темп обучения, отслеживать прогресс и возвращаться к материалам при необходимости. Развитие микролёрнинга (коротких образовательных модулей) и обучающих видеоформатов делает процесс обучения удобным и непрерывным. BI Group может использовать цифровые платформы для обучения инженерных специалистов, административного персонала и молодых сотрудников в формате blended learning (смешанного обучения) [23].

Применение технологий искусственного интеллекта и аналитики big data позволяет создавать персонализированные обучающие маршруты, рекомендовать контент и анализировать результаты в реальном времени. Интеграция с HR-системами помогает связывать развитие с карьерным ростом и бизнес-результатами [24].

Современные компании всё чаще интегрируют систему развития персонала с системой оценки эффективности (performance management). Это означает, что цели развития увязываются с показателями KPI, результатами оценки компетенций и потребностями бизнеса. Такая интеграция позволяет превратить обучение из абстрактной задачи в инструмент достижения конкретных бизнес-результатов. Например, если отдел продаж показывает снижение эффективности, могут быть запущены краткосрочные программы обучения по переговорам, работе с возражениями или CRM. После прохождения курса оцениваются не только знания сотрудников, но и фактическое изменение в бизнес-результатах: рост выручки, конверсии, снижение текучести клиентов [25].

Кроме того, компании внедряют «культуру обратной связи», основанной на регулярной практике давать обратную связь по результатам обучения и работе, что усиливает связь между обучением и повседневной деятельностью. Таким образом, современные подходы к развитию персонала предполагают переход от единообразных программ к адаптивным, гибким и ориентированным на конкретного сотрудника решениям. Использование компетентностных моделей, активных методов, цифровых инструментов и связи с бизнес-целями формирует устойчивую и стратегически значимую систему развития

человеческого капитала, которая особенно актуальна для динамичных отраслей, таких как строительство [26].

Также, многие авторы подчёркивают необходимость учёта индивидуальных особенностей обучающихся. Современные системы развития персонала всё чаще отходят от универсальных программ в пользу персонализированных планов обучения. Использование Learning Management Systems (LMS), искусственного интеллекта и big data позволяет строить индивидуальные траектории обучения, адаптированные под потребности и стиль обучения конкретного сотрудника [27].

По мере развития технологий трансформируются формы, методы и инструменты обучения. Например, более эффективные компании переходят от традиционных форм обучения к цифровым экосистемам: виртуальным академиям, симуляциям, онлайн-платформам и мобильным приложениям. Концепция Digital Learning включает в себя использование следующих практик: корпоративных LMS; e-learning курсов и модулей; микролёрнинга; адаптивных курсов с ИИ; цифровой аналитики для оценки прогресса. Это позволяет не только расширить доступ к обучению, но и снизить затраты, обеспечить гибкость и повысить вовлечённость сотрудников [28].

В современной HR-практике особое внимание уделяется таким форматам, как коучинг, менторство и peer learning, которые повышают эффективность этих методов как в развитии лидерских компетенций, так и в повышении личной ответственности сотрудников за собственное развитие. Также, рассматривается развитие персонала в тесной связи с управлением талантами. Создание индивидуальных карьерных треков, систем преемственности и программ удержания позволяет не только формировать кадровый резерв, но и снижать уровень текучести [29].

Компании, уделяющие внимание карьерному развитию, демонстрируют более высокие показатели вовлеченности, инновационности и устойчивости. Это особенно важно в контексте строительной отрасли, где квалифицированные кадры – это дефицитный ресурс [30].

В целом, современные подходы к формированию системы развития персонала отражают переход от административного к стратегическому управлению человеческими ресурсами. Они строятся на интеграции технологий, ориентации на человека, гибкости, непрерывности и измеримости. Эти принципы находят широкое применение в компаниях, стремящихся к лидерству в условиях VUCA-среды (Volatility - изменчивость, Uncertainty - неопределенность, Complexity - сложность, Ambiguity - двусмысленность) [31].

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INTRODUCTION OF INFORMATION TECHNOLOGIES IN HEALTHCARE: THE EXPERIENCE OF KAZAKHSTAN

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Abstract

The article is devoted to assessing the impact of information technology implementation on the management of medical organizations. It examines the theoretical foundations of healthcare digitalization and international and Kazakhstani experience. Using the example of a city polyclinic in the Republic of Kazakhstan, changes in management processes following the implementation of a medical information system are analyzed. Positive results are noted: increased management efficiency, improved quality of patient care, and a reduction in the number of errors. Current problems are highlighted and recommendations are made for the further development of digital infrastructure in medical institutions. The data obtained confirm the effectiveness of IT as a tool for improving management performance in healthcare. The introduction of information technology in healthcare: the experience of Kazakhstan

Keywords: information technology, healthcare, healthcare organization management, medical information system, digitalization, polyclinic, e-health, Kazakhstan, management efficiency, digital transformation.

In the context of rapid development of digital technologies and digitalization of all spheres of public life, issues related to the introduction of information technologies (IT) into the healthcare system are becoming particularly relevant. Improving the efficiency of healthcare organization management, optimizing healthcare service delivery processes, and improving the quality of patient care are all becoming possible thanks to the use of modern IT solutions.

As a socially significant structure, medical organizations face challenges related to the need to process large amounts of information, manage human and material resources, and ensure timely management decisions. The introduction of information systems allows these tasks to be asolved more efficiently, which is especially important in conditions of limited resources.

The purpose of this article is to assess the impact of information technology on the management process of a medical organization.

Information technology in healthcare is a set of software, hardware, and telecommunications solutions aimed at automating the processes of collecting, storing, processing, and transmitting medical information. The main areas of IT implementation in medical institutions are:

- Electronic medical records;
- Information systems for resource management (human resources, finances, equipment);
- Telemedicine;
- Remote patient monitoring platforms;
- Integration with government databases and electronic healthcare systems.

The use of IT helps improve the quality of management decisions, reduce the time needed to process information, and increase the transparency of healthcare institutions' activities.

In developed countries, IT has become an integral part of healthcare management. For example:

- Estonia has one of the most advanced e-health systems, where virtually all medical records are kept digitally and are accessible to both patients and doctors.
- In the Netherlands, electronic prescription and clinical data integration systems are widely used, reducing errors and improving treatment effectiveness.
- In the United States, EHR (Electronic Health Records) systems are integrated as part of the Meaningful Use program, which encourages healthcare institutions to use IT to improve treatment outcomes.

Global practice shows that the successful implementation of IT requires not only technical equipment, but also a well-thought-out policy, staff training and a regulatory framework.

Kazakhstan is actively introducing IT into the healthcare sector, particularly as part of the implementation of the state digitalization program. The country has a unified integrated healthcare information system, which includes:

- Electronic outpatient records;
- A system for registering and accounting for medical workers and organizations;
- Modules for automating the work of doctors and administrators.

Since 2020, telemedicine has been actively developing, especially in remote regions, which helps to reduce inequality in access to medical services.

Despite significant progress, there are still challenges: insufficient IT literacy among staff, the need to modernize infrastructure, and the need to improve legal regulation in the field of e-health.

Currently, the following IT solutions have been implemented in medical institutions in Kazakhstan:

- Medical information system — a unified digital platform that includes electronic medical records, appointment schedules, and a system for tracking medications and laboratory tests;
- Electronic queue and appointment scheduling — patients can make appointments via the eGov.kz portal or mobile app;
- Automated personnel and financial accounting — through integration with the 'Accounting for Healthcare' module;
- Real-time reporting — report generation for the ministry and local government is automated.

After the implementation of IT solutions in the management of medical institutions, the following was recorded:

- A reduction in report generation time by more than 60%;
- An increase in patient satisfaction (according to an internal survey) by 23%;
- A decrease in the number of cases of data loss or errors in records;
- An increase in the proportion of electronic referrals for laboratory tests and consultations (more than 80% of all requests).

Table 1. Changes in key indicators after IT implementation

Indicator	Before implementation	After implementation
Report generation time	10 days	4 days
Patient satisfaction	65%	88%
Errors in documents	High level	Low level
Share of electronic referrals	30%	80%

The results of the analysis of the implementation of information technologies in the management of the city polyclinic confirm the effectiveness of digital solutions for improving the productivity and quality of management activities. The automation of routine processes, such as documentation, reporting, personnel and financial administration, has allowed management to focus on strategic tasks and operational decision-making.

One of the key effects has been increased transparency of processes, which is particularly important in the context of government institutions. In addition, digitalization has improved interaction between structural units and simplified data collection and processing, which is especially valuable in the context of pandemics and limited resources.

The analysis shows that Kazakhstan is moving in line with global trends in the digital transformation of healthcare. However, there are also differences: in a number of Western countries, the emphasis is on integrating IT with artificial intelligence and machine learning, while in Kazakhstan, the priority remains basic process automation and the creation of a unified state platform.

Existing problems and limitations should also be taken into account, including:

- Insufficient IT literacy among some staff;
- Limited technical resources in rural areas;
- Uneven implementation of systems in different regions of the country;
- The need to improve information security and personal data protection.

Nevertheless, the successes achieved so far prove that with targeted state policy and sustainable funding, IT can become a powerful management tool in the medical field.

The digitization of healthcare organization management is an integral part of the modern healthcare model. The introduction of information technology in the polyclinic examined in this study has significantly improved the efficiency of management activities, improved the accessibility and quality of medical services, and reduced the costs associated with document flow and reporting.

The experience of the Republic of Kazakhstan, especially within the framework of the state digital healthcare program, demonstrates that even with limited resources, it is possible to achieve significant results with a clear strategy and support from the state.

Based on the analysis, the following recommendations can be formulated:

- Continue to develop IT infrastructure in medicine, with an emphasis on uniform digitalization across regions;
- Implement programs to improve the digital literacy of medical and administrative staff;
- Strengthen measures to protect medical information;
- Study and adapt best international practices (particularly in the field of telemedicine and AI analytics) to local conditions.

Prospects for further research include a more in-depth analysis of the impact of IT on specific management functions, such as strategic planning, cost optimization and human resources policy, as well as studying the impact of digitalization on patient satisfaction.

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Philological Sciences

Orijinal dinləmə materiallarının gücü: BBC sənədli filmləri ilə passiv dil bacarıqlarından aktiv istifadəyə keçid

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Dilçilik və onun aktual problemləri

Xülasə

Bu məqalədə BBC sənədli filmlərinin transkriptləri ilə birlikdə istifadəsinin xarici dil tədrisindəki effektivliyi araşdırılır. Dərsin başlanğıcında effektiv giriş mərhələsinin təşkili şagirdlərin motivasiyasını artırmaqla və dərs prosesinə fokuslanmanı təmin etməklə yanaşı istər tarix, istər biologiya, istərsə də mədəniyyətlərarası integrasiyaya xidmət edən mövzular tələbələrin əvvəlki bilgilərinin canlandırılmasında və onları ilkin müzakirəyə təşviq etməkdə əsaslı rol oynayır. Multimodal kontekst – vizual və audio elementlərin sintezi – öyrənənlərin leksik çətinlikləri aşaraq məzmunu başa düşməsinə və aktiv müzakirələrə cəlb olunmasına şərait yaradırdı. Yeni lüğətin idarə olunması üçün dərs zamanı istifadə olunan videolardan dəstəkləyici alıntılar, vizual lüğətin yadda saxlanılmasına və sonrakı istifadəsinə əsaslı töhvə verirdi. Bu strateji yanaşma ilə birinci kurs A2 dil səviyyəli şagirdlərlə aparılan bir aylıq eksperiment nəticəsində dinləmə və oxu kimi passiv bacarıqlarda 20%, yazı və danışq kimi aktiv bacarıqlarında 15% artım qeydə alındı.

Summary

This article examines the effectiveness of using BBC documentaries along with their transcripts in foreign language teaching. Organizing an effective lead-in stage at the beginning of the lesson not only increased students' motivation and helped them focus on the lesson process, but also played a significant role in activating their prior knowledge and encouraging initial discussions on topics related to history, biology, and intercultural integration. The multimodal context — a synthesis of visual and audio elements — facilitated learners' comprehension of the content by helping them overcome lexical difficulties and engage in active discussions. Supportive excerpts from the videos used during the lesson significantly contributed to the retention and subsequent use of visual vocabulary. As a result of this strategic approach, a one-month experiment conducted with I grade students at the A2 level recorded a 20% improvement in receptive skills such as listening and reading, and a 15% improvement in productive skills such as writing and speaking.

Açar sözlər: autentik materiallar, multimodal kontekst, transkript istifadəsi, bacarıqların integrasiyası, lüğətin idarə olunması

Key words: Authentic materials, multimodal context, transcription use, skills integration, vocabulary management

Dörd əsas dil bacarığının – dinləmə, oxu, danışq və yazının – integrasiyası müasir dil tədrisində əsas prinsip kimi qəbul edilir (3, s. 272). Xüsusilə orijinal materiallarla işləyərkən, bu bacarıqların sinxron inkişafı şagirdlərin dili həm passiv, həm də aktiv şəkildə mənimsəməsinə təmin edir (2, s. 100). BBC sənədli filmlərinin audio materialları ilə birlikdə təqdim olunan transkriptlər şagirdlərə dinləmə zamanı və ya sonra mətnin oxunması yolu ilə başa düşməni artırmağa kömək edir (9, s.

122). Transkriptlərin reading kimi tətbiqi şagirdlərin passiv dinləmə bacarığını oxu ilə gücləndirərək, yeni söz və ifadələrin daha yaxşı qavranmasını təmin edir. Bu metod sayəsində şagirdlər dinləmədə qarşılaşdıqları çətin sözləri yazılı şəkildə də görür, təkrar edir və nəticədə həmin leksik vahidlər danışq və yazı fəaliyyətlərində də istifadəyə keçərək aktivləşir (6, s. 78).

BBC sənədli filmləri kimi multimodal orijinal materiallar dil öyrənmə prosesində müxtəlif duyğu kanallarını – vizual, eşitmə və yazı – eyni zamanda işə salır (4, 2009, s. 14). Mayer-in multimedia öyrənmə nəzəriyyəsinə görə, məlumatın eyni anda vizual və eşitmə kanalı ilə qəbulu onun beyində möhkəmlənməsini artırır (5, s. 31). Multimodal kontekst xüsusilə yeni lüğət tərkibinin yüngülləşdirilməsi üçün vacibdir, çünki vizual input – şəkillər, altyazılar, qrafiklər – öyrənenlərin başa düşmədikləri sözlərin mənasına kontekstual işıq tutur (11, s. 64). Bu problemi azaltmaq üçün dərslərdə vizual inputun idarə olunması, uyğun zamanlama və seçilmiş multimodal elementlərin tətbiqi tələbələrin yeni leksikani daha asan qavramasına, qorxmadan müzakirəyə cəlb olunmasına şərait yaradır (7, s. 56).

Dil dərslərində mövzunun başlanğıcında şagirdlərin diqqətini cəlb etmək, onları dərse hazırlamaq üçün effektiv giriş mərhələsi təşkil edilməlidir (8, s. 21). İkici dil dərslərində xüsusi yeri olan "giriş" özündə effektiv dərslər üçün gözdə tutulmuş edilə bilməyən bir çox əsasları birləşdirir. Düşünülmüş, uyğun və mövzu ilə birbaşa əlaqəli olan bir "giriş" ilk növbədə tələbələrin diqqətini özünə çəkir. Marağın formalaşmasında əvəzlənmə hesab olunan "giriş" öz bərabərində tələbələrin mövzu ilə əlaqəli əvvəlki bilik bazasını aktivləşdirərək yeni materialı əvvəlki biliklə birləşdirməyə və əlaqəli şəkildə yadda saxlanmasına şərait yaradır. Mövzu ilə əlaqəli mühitin yaradılması sayəsində tələbələrin özünü həmin mühitin içərisində hiss etmələri dərslərini daha mənalı və məqsədyönlü edir ki, bu da dərslər boyu iştirak, interaktivlik, kommunikativlik, öz güvən, hədəf dil və ondan istifadəyə istək, narahatçılığın aradan qalxması kimi əsaslı anlayışları öz bərabərində formalaşdırır. (10, səh.42). Multimodal autentik materialların istifadəsində giriş mərhələsi qısa video fraqmentləri, vizual qrafiklər və suallarla zənginləşdirilir ki, bu da şagirdlərin dərslərin əsas mövzusuna emosional və intellektual bağlılığını gücləndirir (1, s. 310). BBC sənədli filmlərindən seçilmiş qısa kliplər mövzunun ilkin təqdimatında istifadə olunaraq şagirdlərin dərse olan marağını artırır, onlarda mövzu ilə bağlı ilkin biliklər və müzakirə üçün motivasiya yaradır.

Bu metodun effektivliyini yoxlamaq məqsədilə ADPU-nun Şəki filialı birinci kurs tələbələri- A2 dil səviyyəli 14 tələbə ilə bir aylıq eksperiment aparıldı. Eksperiment müddətində hər həftə iki BBC sənədli filmi seçildi hər biri transkript sualları ilə müşayiət olundu. Dərslər zamanı videoya baxış, transkript üzrə sual-cavab, müzakirə və danışq tapşırıqları həyata keçirildi.

Eksperimentin əvvəlində və sonunda şagirdlərin dinləmə və danışq bacarıqları Common European Framework (CEFR) standartlarına uyğun testlərlə ölçüldü. Qiymətləndirmək üçün meyarlar standartlar üzrə qətiləşdirildi. (Cədvəl1) Nəticələrə əsasən, şagirdlərin dinləmə və danışq səviyyələrində 15–20% arası artım qeydə alındı. (Cədvəl 2) Şagirdlər yeni sözləri daha rahat mənimsəməyə başladılar və dərslər zamanı müzakirələrdə fəallıqları nəzərəcərpacaq dərəcədə artdı.

Cədvəl 1

Bacarıq Sahəsi	Qiymətləndirmə Kriteriyası	A2 Səviyyəsi (Əvvəl)	B1 Hədəfi (Sonra)	Bal Aralığı
Dinləmə	Aydın və sadə danışılan məlumatı başa düşmək	Yalnız tanış sözləri anlayır	Tanış mövzularda əsas fikirləri anlayır	0–25
Dinləmə	Vizual/audio dəstəklərlə anlamı artırmaq	Vizual dəstəyə çox ehtiyac duyur	Vizual kontekstə uyğun istifadə edir	0–25
Oxu	Qısa və sadə mətnləri anlamaq	Yalnız tanış söz və frazalara əsaslanır	Əsas fikirləri və bəzi detalları anlayır	0–25
Oxu	Oxu strategiyalarından istifadə (skan etmə və s.)	Strategiya istifadəsi zəifdir	Əsas oxu strategiyalarına başlayır	0–25
Danışiq	Sual cavab və şəxsi məlumat ifadəsi	Ayrı-ayrı söz və ifadələrdən ibarətdir	Cümlələri sadə vasitələrlə birləşdirir	0–25
Danışiq	Sadə dialoqlarda iştirak	Cüzi iştirak, tez-tez təkrara ehtiyac duyur	Tanış mövzularda dialoqlarda iştirak edir	0–25
Yazı	Sadə cümlələr və qeydlər yazmaq	Səhvlərlə dolu sadə cümlələr	Əlaqəli, qısa mətnlər yazır	0–25
Yazı	Uyğun lüğət istifadəsi	Məhdud söz ehtiyatı	Genişlənmiş lüğət, az səhv	0–25

Cədvəl 2

Bacarıq Növü	Əvvəlki Orta Bal (%)	Sonrakı Orta Bal (%)	Təkmilləşmə (%)
Passiv Bacarıqlar (Dinləmə və Oxu)	60.0	72.0	+20%
Aktiv Bacarıqlar (Danışiq və Yazı)	58.0	66.7	+15%

Nəticə

BBC sənədli filmlərinin transkriptləri ilə birlikdə istifadəsi dil öyrənmə prosesində bacarıqların integrasiyasını təmin edir, leksik çətinliklərin aradan qaldırılmasında multimodal kontekstin gücündən istifadə edir. Vizual və audio inputun sintezi şagirdlərin məzmunu daha yaxşı başa düşməsinə, bilinməyən lüğət tərkibinin təsirini azaltmasına və dərslərdə aktiv iştirakına şərait yaradır. Dərsin başlanğıcında təşkil olunan effektiv giriş mərhələsi şagirdlərin motivasiyasını artıraraq dərsin fokuslanmasını təmin edir. Eksperiment nəticəsində şagirdlərin dinləmə və danışiq bacarıqları güclənmiş, öyrənməyə qarşı motivasiyaları yüksəlmişdir.

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Sociological Sciences

THE EVOLUTION OF THE THEORY OF SOCIAL IDENTITY IN THE CONTEXT OF GLOBALIZATION

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Abstract

This article explores the evolution of the theory of social identity in the context of globalization. The phenomenon of identity has become central to modern sociology and social theory due to increasing pressures on personal and collective identity across the globe. The study examines classical and contemporary approaches to identity, including psychodynamic, sociological, and integrative frameworks, and outlines how Western, Soviet, Russian, and Kazakhstani scholars have contributed to identity discourse. Special attention is paid to the Kazakh context, including post-Soviet transformations, repatriation, diaspora relations, and the semantic and political implications of the term *oralman*. The article demonstrates the importance of rethinking identity theory in relation to nation-building and social integration in a multiethnic society.

Keywords: social identity, globalization, nationalism, Kazakhstan, repatriates, diaspora, kandas, integration, sociological theory, post-Soviet transformation

Introduction

In the context of globalization, questions of identity have become increasingly urgent, as individuals and communities navigate rapid changes in cultural, political, and socio-economic environments. Identity crises are now prevalent, marked by uncertainty, social alienation, and the search for belonging. Theoretical reflections on identity span multiple disciplines—psychology, sociology, philosophy, and anthropology—underscoring its complex and multidimensional nature.

In Kazakhstan, these discussions have practical relevance, particularly in light of post-Soviet transitions, evolving national policies, and demographic shifts. This article aims to trace the theoretical development of identity studies, especially social identity, and analyze its application to Kazakhstan's unique societal structure. The paper also investigates how repatriated ethnic Kazakhs (referred to as *oralman*) are perceived and integrated within national identity discourse.

Theoretical Foundations of Social Identity

Kazakhstan's society today is making concrete steps toward establishing a solid position among developed and competitive countries by defining its strategic goals. The range of topics addressed by national sociology in the era of globalization is broad and diverse. Among the most pressing issues in contemporary Kazakhstan is that of social identity.

In the era of globalization, identity has entered a period of crisis: people experience self-doubt, stress, aggression, various forms of dependency, detachment from real life, excessive

dominance, and other social phenomena. Identity has become a key issue in contemporary sociology and a central phenomenon in modern society.

Identity (Latin: *idem* – sameness, continuity) refers to an individual's awareness of belonging to a particular group, enabling them to define their place in the social space—whether in terms of political affiliation, ethnicity, religion, or race. It is a broad concept encompassing biological, psychological, social, and cultural dimensions.

Identity is widely studied across disciplines such as psychology (especially ego psychology), psychoanalysis, sociology (including symbolic interactionism and social anthropology), philosophy (phenomenology), ethnology, and political science.

The first major theorist to comprehensively analyze identity was E. Erikson, who introduced the concepts of «identity» and «identity crisis» in the 1940s. His key works—*Childhood and Society* (1950) and *Young Man Luther* (1958)—solidified the term's usage in academic psychology and sociology. The work of E. Erikson, who first studied identity in detail: using various methods such as social and psychological analysis, created its own context and content for this concept.

The concept of identity has gained wide popularity in scientific circles with its introduction into the doctrine. According to Erikson, identity is a personal balance and historical continuity, which is the perception of oneself as a balance and the awareness of the continuity of one's own existence in time and space. The famous American futurologist A. Toffler wrote in the 1980s: «millions of individuals find their own identity and seek their own identity, overcoming chaos, in order to establish order throughout the process».

Erikson's legacy has been expanded by numerous scholars, including Sigmund Freud, Jacques Lacan, Karl Popper, Jürgen Habermas, Anthony Giddens, Michel de Certeau, Carl Jung, Jean Piaget, Alvin Toffler, Mikhail Bakhtin, and Lev Vygotsky, among others.

Identity in scientific discourse can be divided into two traditional approaches: **psychodynamic** (rooted in Freud's theories) and **social**. Freud identified identity as central to both socialization and adaptation, emphasizing both biological and social processes. He described the lack of identity formation as a form of social alienation and psychological impoverishment. The phenomenon of alienation of a person from the layer of identity, changes his actions in the social world, as a result of which he undergoes a state of alienation, alienation, Z. Freud explains this situation as «psychological absorption of the majority». In the development of identity, Freud highlights two important processes: biological and social [5].

Various methodological approaches to the study of identity include: **Functionalism and structural functionalism** (Émile Durkheim, Talcott Parsons), **Symbolic interactionism** (Charles Cooley, Erving Goffman), **Phenomenological sociology** (Peter Berger and Thomas Luckmann), **Integrative approaches** (Pierre Bourdieu, Anthony Giddens).

In these traditions:

- Functionalists see identity as a structural element formed through socialization. In functionalism and structural functionalism, identity is considered as a structural character of an individual, formed in the process of social ideals and values, transmitted through socialization to the next generation.
- Interactionists focus on the reflexive nature of identity in relationships with «others».
- Phenomenologists highlight subjective interpretations. Proponents of the phenomenological method consider interpretative differences and individuals as the essence of a particular social environment. The Integrative method is considered the starting point of the multiplicity of self-consciousness with individual, social aspects that are interconnected.
- Integrative methods emphasize multidimensional self-awareness that connects personal and social dimensions.

Social Identity and Nationalism

Among the founders of the problem of social identity on the basis of such a theory of nationality are Western European and American scientists-authors: M. Weber, H. Cohn, K. Deutsch, E. Keduri, E. Smith, D. Breilly and E. Gellner «nationality and nationalism», B. Anderson «amazing communities», E. Hosbaum «nationality and nationalism after 1970».

In the late 19th and early 20th centuries, the national question was interpreted through a Marxist-Leninist lens. K. Marx, F. Engels, and V.I. Lenin evaluated the issue in the context of class struggle and social justice, striving to construct a «Soviet identity» based on the principles of internationalism (Marx and Engels 1970; Lenin 1972).

During the Soviet period, scholars such as M.Zhuniso, N.Shitov, A.Tursunbayev, A.Bagramov, and G.Dakhshleiger studied ethnic and interethnic relations within the framework of a socialist society, focusing on socio-economic, historical-political, and cultural-technical aspects (Shitov 1975). However, their conclusions require critical re-evaluation in light of contemporary social science perspectives.

Soviet and Russian Approaches to Identity

In Russian sociology, identity theory has been actively developed. Researchers such as I.Kon, K.Abulkhanova-Slavskaya, M.Bakhtin, L.Drobizheva, V.Ilyenkov, A.Leontiev, M.Lotman, V.Merlin, B.Porshnev, A.Spirkin, L.Schneider, and V.Yadov have analyzed identity from various perspectives (Kon 1984; Yadov 1997). In the post-Soviet era, scholars like Lukov, Gorshkov, and Smakotina introduced new methodological models (Lukov 2010; Gorshkov 2011; Smakotina 2014). For example, I.Kon, as the first Russian scientist, in the analysis of identity considers the internal and external contradiction in personality as a conditional construct that balances it. V.Lukov reveals the relationship between social identity and the socialization of personality in the context of culture. The work of M. K. Gorshkov is devoted to the analysis of the dynamics (pace) of social identity in a reformed society, N.Smakotina considers identity as a form of stabilization of a person in conditions of instability.

In defining national identity, three main approaches have become widespread: **Primordialism** (Radcliffe-Brown 1952; E.Smith 1986; L.Gumilev 1990), **Instrumentalism** (D.Nagel 1994; S.Olzak 1983; F.Barth 1969), and **Constructivism** (B.Anderson 1983; V.Malakhov 2001; V.Tishkov 2002).

Identity in Kazakhstan: National and Civic Dimensions

In Kazakhstan, identity is explored within philosophical-social, historical-ethnological, psychological, and pedagogical research. Prominent scholars include U.Bromley, T.Sarsenbayev, M.Tatimov, B.Ayagan, A.Nysanbayev, K.Syroyezhkin, N.Nazarbayev, Z.Shaukenova, and C.Borbasov (Tatimov 1993; Syroyezhkin 2005; Nazarbayev 1999).

A key state-funded project in this field is «Studying the Aspects of Civil Identity Formation among Ethnic Groups in Kazakhstan», conducted in 2009 under the supervision of Artemyev (Artemyev 2009). It is known that the root changes in National relations in Kazakhstan associated with the collapse of the Soviet state yesterday deepened the symbols of the crisis in the consciousness of the national, socio-political identity of citizens of the Republic of Kazakhstan. In this current situation, to prevent contradictions in national relations that have arisen for objective and subjective reasons, the state has put on the agenda the creation of prerequisites for the free development of different ethnic and different language-speaking communities living within its framework on the basis of mutual interethnic harmony, the formation of a sense of identity through the process of integration, the formation of a single consolidated people, citizen of the Republic of Kazakhstan.

Western scholars have also addressed identity in Kazakhstan. During the Soviet era, studies by Bacon, Bennigsen, Lubin, and Olcott laid the foundation for understanding Central Asia (Olcott 1987). In the post-Soviet period, researchers such as A.Akiner, M.Beissinger, P.Kolsto, R.Wolfel, S.Buckley, and S.Werner have offered broader analyses (Akiner 1995; Kolst 1998; Wolfel 2002).

For example, E. Bacon (1958) provided one of the first English-language accounts of Kazakh tribal genealogy; Bennigsen and Carrère studied Muslim ethnic groups; and Olcott's *The Kazakhs* is considered a seminal work in Kazakh studies (Olcott 1987). Akiner's *From Tribe to Nation* systematically examines Kazakh ethnogenesis, attributing national identity largely to the Soviet period (Akiner 1995).

In his book *In the Stream of History*, N. Nazarbayev (1999) described identity formation under totalitarian conditions, distinguishing between the civic identity of the population and the ethnic identity of Kazakhs, including the diaspora.

Today, about 5 million ethnic Kazakhs live in over 40 countries, maintaining language and cultural ties and viewing Kazakhstan as their historical homeland. Diaspora members have enriched national arts and literature abroad.

Repatriates and the «Oralman» Discourse

Most of the Kazakh diaspora living abroad is considered an integral part of the Kazakh nation. They speak their native language, observe national traditions and consider Kazakhstan as their historical homeland. In some countries, the Kazakhs were educated in the Kazakh language and had the opportunity to develop national culture and traditions. The results of the study showed that representatives of the diaspora were able to form Kazakh culture, literature and art abroad.

The social adaptation and identity of repatriates are actively discussed in academic and public discourse. For instance, the term *oralman* has been criticized as stigmatizing, with alternatives such as *qandas*, *agayin*, and *otan-zhan* proposed (Shaukenova 2013). However, critics argue that these lack scientific clarity and legal recognition.

Conclusion

The concept of identity is multifaceted and deeply embedded in historical, cultural, and political contexts. In Kazakhstan, identity plays a pivotal role in managing ethnic diversity, supporting social cohesion, and fostering a unified national consciousness. As globalization intensifies and demographic dynamics evolve, identity remains a central issue for both theoretical inquiry and practical governance. Addressing the challenges of repatriation, integration, and national self-definition requires an inclusive and adaptive identity model that resonates with Kazakhstan's pluralistic society.

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Geographic Sciences

Тозған ауылшаруашылық жерлерін картаға түсіруде ГАЖ жүйесінің рөлі

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Аңдатпа. Ауылшаруашылық жерлерінің тозуы – адамзаттың азық-түлік қауіпсіздігіне, экологиялық тепе-теңдікке және әлеуметтік тұрақтылыққа тікелей қауіп төндіретін жаһандық мәселе. Тозу үдерістері – топырақтың физикалық, химиялық және биологиялық қасиеттерінің нашарлауына әкелетін ұзақ мерзімді процестер. Қазақстанда, әсіресе, құрғақшылық пен су тапшылығы байқалатын оңтүстік және батыс өңірлерде бұл мәселе ерекше өзекті. Тозған жерлерді анықтау, қадағалау және қалпына келтіру үшін қазіргі заманғы цифрлық құралдар қажет. Солардың ішіндегі ең тиімдісі – геоақпараттық жүйелер (ГАЖ).

ГАЖ технологиялары жер ресурстарын кешенді басқаруға, олардың жай-күйін картаға түсіруге, уақыт бойынша өзгерістерді бақылауға мүмкіндік береді. Бұл мақалада ГАЖ жүйесінің тозған ауылшаруашылық жерлерін зерттеудегі және картаға түсірудегі рөлі қарастырылады.

Түйін сөз. ГАЖ технологиясы, ауылшаруашылық жерлер, жер тозуы, картаға түсіру, деградация, қашықтан зондтау, NDVI, топырақ эрозиясы, экологиялық мониторинг, жер ресурстарын басқару, Қазақстан, спутниктік деректер.

ГАЖ технологияларының мәні мен маңызы

ГАЖ – бұл кеңістіктік (географиялық) ақпаратты жинау, сақтау, өңдеу және визуализациялауға арналған ақпараттық жүйе. Ол әртүрлі дереккөздерден алынған ақпаратты (спутниктік суреттер, аэротүсірілім, топырақ сипаттамалары, климаттық мәліметтер) біріктіріп, зерттеліп отырған аумақтың толық бейнесін алуға мүмкіндік береді.

ГАЖ жүйелері арқылы:

Тозған аумақтарды дәл және кеңістіктік жағынан көрсету;

Экологиялық қауіп деңгейін сандық бағалау;

Топырақ эрозиясын, тұздану, батпақтану, жел және су әсерінен болатын тозу түрлерін анықтау;

Қалпына келтіру шараларын географиялық жағынан нақты жоспарлау жүзеге асады.

2. Тозған ауылшаруашылық жерлерін картаға түсіру әдістері

а) Қашықтан зондтау деректері (ЖҚЗ)

Спутниктік суреттер (Landsat, Sentinel, MODIS, т.б.) арқылы жердің беткі қабатын визуалды және сандық түрде зерттеуге болады. Мысалы, NDVI (Normalized Difference Vegetation Index) индекстері арқылы өсімдік жамылғысының денсаулығы бағаланып, деградацияға ұшыраған аумақтар анықталады.

ә) Топырақ және жер бедері деректері

Топырақтың механикалық құрамы, гумус мөлшері, ылғалдылығы және бедердің (рельефтің) ерекшеліктері картаға түсіріледі. Бұл деректерді пайдалана отырып, эрозия қаупі жоғары аумақтар айқындалады.

б) Уақыттық салыстырмалы талдау

Уақыт бойынша (мысалы, 2000, 2010, 2020 жылдар) ЖҚЗ суреттерін салыстыра отырып, жер тозуының динамикасы анықталады. Бұл тәсіл әсіресе антропогендік әсердің (шамадан тыс жырту, жайылымдық жүктеме, ирригация жүйелерінің бұзылуы) нәтижелерін бағалауға тиімді.

3. ГАЖ технологиясының артықшылықтары

Жоғары дәлдік: Жергілікті және өңірлік деңгейде нақты координаттар арқылы тозу дәрежесі анықталады.

Үнемділік: Кең аумақты аз шығынмен зерттеуге болады.

Болжам жасау мүмкіндігі: Математикалық модельдер негізінде тозудың болашақ бағыттарын болжауға болады.

Қабылданған шешімдердің негізділігі: ГАЖ арқылы алынған деректер басқару шешімдерін дәлелді етеді.

4. Қазақстан өңірлерінен мысалдар

Қызылорда облысы

Арал теңізінің тартылуы нәтижесінде бұл аймақта миллиондаған гектар жер тұзданған. ГАЖ және ЖҚЗ деректері арқылы Арал маңындағы тозу карталары жасалды. Бұл деректер аймақта орман белдеулерін отырғызу және жайылымдарды қалпына келтіру шараларын жоспарлауда қолданылуда.

Жамбыл облысы

Таулы және жазық аймақтардағы су эрозиясы мәселесі өзекті. ГАЖ көмегімен эрозияға бейім аймақтар картаға түсіріліп, агротехникалық шаралар (контурлық жырту, өсімдіктер белдеулері) енгізілуде.

Батыс Қазақстан облысы

Климаттың құрғақтануы және шөп жамылғысының сиреуі жайылымдардың тозуына әкелуде. Спутниктік NDVI карталары арқылы жайылымдардың өнімділігі зерттеліп, олардың қалпына келу мүмкіндігі бағалануда.

Қорытынды

ГАЖ технологияларын қолдану – тозған ауылшаруашылық жерлерді зерттеудегі ең заманауи әрі тиімді әдіс. Бұл жүйе нақты кеңістіктік деректер негізінде деградация дәрежесін картаға түсіруге, себеп-салдарын талдауға және қалпына келтіру шараларын жоспарлауға мүмкіндік береді.

Қазақстан жағдайында ГАЖ – жер ресурстарын тиімді басқаруға бағытталған агроэкологиялық саясаттың негізгі құралы ретінде қалыптасуы тиіс. Осыған орай, мемлекеттік деңгейде ГАЖ деректер қорын жаңарту, жергілікті мамандарды даярлау және ГАЖ технологияларын ауылшаруашылығы мен экология саласына кеңінен енгізу маңызды.

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Қазақстан экономикасын дамытудың өзекті мәселелері: туризмді дамыту жолдары

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Аңдатпа

Мақалада Қазақстан Республикасының экономикалық жағдайын дамытуда туризмнің маңызы қарастырылған. Экономиканың маңызды салаларының бірі- туризм. Туризм жаңа жұмыс орындарын ашуға, инвестиция тартуға және аймақтық дамуды ынталандыруға мүмкіндік береді. Зерттеу бойынша осы жағдайлар талданып, туризмді дамыту тетіктері ұсынылды.

В статье рассматривается значение туризма в развитии экономического состояния Республики Казахстан. Туризм является одной из важных отраслей экономики. Он способствует созданию новых рабочих мест, привлечению инвестиций и стимулированию регионального развития. В рамках исследования проанализированы данные аспекты, а также предложены механизмы развития туризма.

The article examines the importance of tourism in the development of the economic situation of the Republic of Kazakhstan. Tourism is one of the important sectors of the economy. It helps create new jobs, attract investment and stimulate regional development. The study analyzes these aspects and proposes mechanisms for tourism development.

Қазақстан Республикасының экономикалық жағдайын әртараптандыру - бүгінгі күннің басты талаптарының бірі болып отыр. Осы тұрғыдан туризм саласын дамыту елдің ішкі өнімін арттырып, жұмыс орындарын көбейтіп, халықаралық имиджді арттыруға бағытталған стратегиялық бағыттардың бірі болып табылады.

Қазақстанда туризмнің түрлері дамып келеді, атап айтсақ, экотуризм, тарихи-мәдени туризм, іскерлік және спорт туризмдері. Сонымен қатар ұлттық парктер, мемлекеттік қорықтар, тарихи-мәдени мұра объектілері бар.

Экономиканы дамыту бұл халықтың тұрақты өмір сүруін қамтамасыз ету мен елдің әл-ауқатын жақсартудың басты шарты болып табылады. Біздің еліміз табиғи ресурстарға бай, тарихи және мәдени мұрасы терең ел болсада қазіргі әлемге сай экономиканы әртараптандыру мен тұрақты дамыту басты міндет болып тұр. Осыған сай елдің туризм саласына назар аударып оны жоғарыға көтеру маңызды бағыттардың бірі.

Туризм кең мағыналы ұғым ол тек саяхатты ғана білдірмейді, сонымен қатар елдің экономикасын жандандыруға өз үлесін қосады. Біріншіден туризм халықты жаңа жұмыс орындармен қамтамасыз етеді. Қонақүйлер, мейрамханалар, гид қызмет орындарының бәрі қаржы көздері болып табылады, әсіресе ауылдық аймақтар үшін өте маңызды. Екіншіден инфрақұрылым осы туризм арқылы жақсарады, туристтердің келуіне байланысты жолдар, әуежайлар, демалыс орындары салынып, жаңартылады. Үшіншіден туризм шағын және орта

бизнестің кеңеюіне алып келеді. Бұлда мемлекеттің экономикасына өзінің оң ықпалын тигізеді.

Туризм мен экономика үшін тиімділік мына жағдайларға байланысты.

1. Экономиканы әртараптандыру және кіріс көздерін арттыру. Туризм саласы әлемдік жалпы ішкі өнімнің шамамен 10%-ын құрайды, ал қызмет көрсету экспортының 30%-ы осы салаға тиесілі. Қазақстанда туризмді дамыту арқылы экономиканы әртараптандырып, жаңа кіріс көздерін қалыптастыруға мүмкіндік бар. Мысалы, 2024 жылдың 10 айында туризмге салынған инвестициялар көлемі 33,6%-ға артып, 668,1 млрд теңгені құрады.

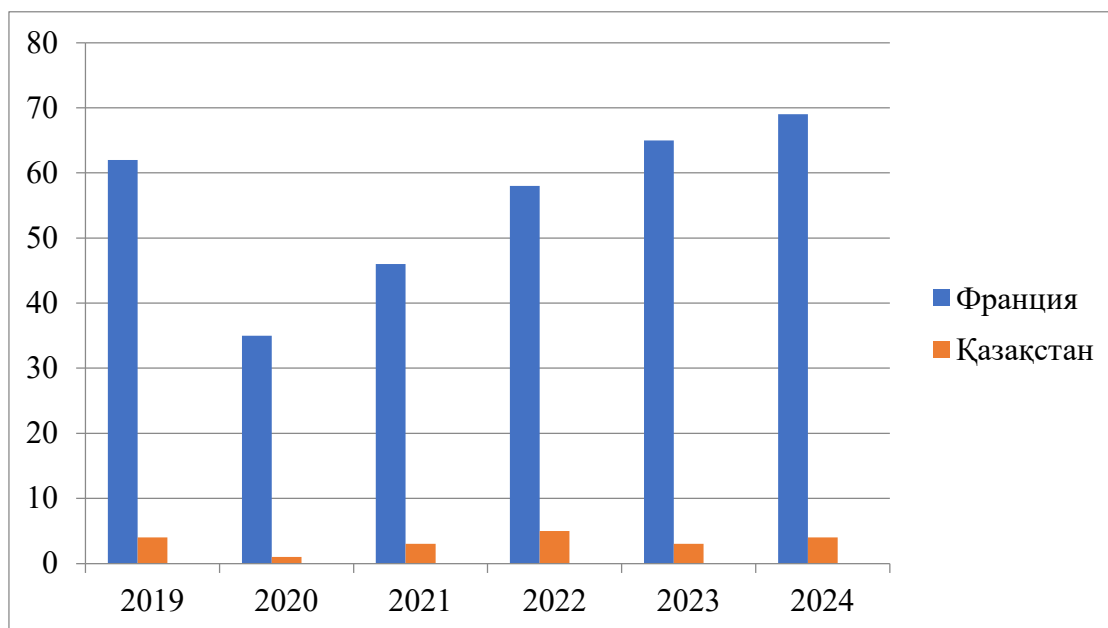
2. Жаңа жұмыс орындарын құру. Туризм саласының дамуы жаңа жұмыс орындарын ашуға ықпал етеді. Мысалы, Алматы облысында 301, ал Шығыс Қазақстан облысында 361 ауыл тұрғыны туризм саласында жұмысқа орналасты. Бұл ауылдық жерлердегі жұмыссыздықты азайтуға және халықтың әл-ауқатын арттыруға септігін тигізеді.

3. Мәдени мұраны сақтау және таныту. Ұлы Жібек жолы бойындағы тарихи-мәдени ескерткіштерді сақтау және оларды туристерге таныстыру арқылы ұлттық мәдениетті насихаттауға мүмкіндік туады. Бұл өз кезегінде елдің халықаралық аренадағы имиджін жақсартады.

Қазақстанның туризм саласына келетін болсақ ең алдымен табиғи туризм болып табылады. Қазақстанның кең байтақ аумағында әр-түрлі табиғи көріністер бар, оның ішінде ең ерекшелері: Іле Алатауы, Алтай таулары бұнда тау шаңғысын ұйымдастыруға, жаяу туризм жүргізуге сонымен қатар кемпингтер; атпен серуендеуге болады.

Табиғи туризммен қатар елімізде мәдени- тарихи туризмді айтуға болады. Туристер тарихи ескерткіштерді, кесенелерді тамашалап, олардың тарихымен танысуға болады. Бәйтерек монументінің аңыз әңгімесі, Түркістан қаласындағы кесенелер сол кездегі халықтың шеберлігін бейнелейді. Бұның бәрі туристтерді қызықтырады. Қазақстанда туризмнің әлеуеті жоғары болғанымен оны дамыту үшін әліде көптеген шаралар қолдану керек.

Төменде Франция мен Қазақстанның 2019-2024 жылдар аралығында туризм саласынан келген кірістер диаграммасы берілген, бұл диаграммаға қарасақ Францияда туризмнен келген кіріс Қазақстанмен салыстырғанда 20 есе жоғары болды.



1сурет-Қазақстан мен Францияның туристік кірістерінің динамикасы (2019-2024ж)

Мұнда туристік кіріс млрд АҚШ долларымен есептеледі. Бұның себебіне келетін болсақ Франция өзінің бай мәдени мұрасы, табиғи ресурстары мен аймақтарын дұрыс пайдалана алады және осы туризм саласы үшін инфрақұрылымды жоғарға деңгейде дамытқан болатын, сол себептен Франция әлемдегі туристер тартатын бірінші мемлекет болды. Қазақстанда дәл осылай инфрақұрылымды дамытса болашақта бізде Франция сияқты биік жетістіктерге жете аламыз. Сонымен қатар қазіргі таңда тик ток, инстаграм сияқты бағдарламаларды қолданушылар саны өте көп, осы бағдарламаларда еліміздің әсем жерлерін шығарсақ онда келушілердің саныда артады.

Туризм саласының дамуы еліміздің экономикасына оң әсерін тигізеді. Мысалы, 2024 жылы Қазақстанда ішкі туристер саны 10,5 миллион адамға жетіп, 2023 жылмен салыстырғанда 900 мыңға артты. Жалпы, 2024 жылы Қазақстанға 15 миллионнан астам шетелдік қонақ келді. Бұл көрсеткіштер туризмнің ел экономикасына қосатын үлесінің артып келе жатқанын көрсетеді. Сонымен қатар, туризм саласының дамуы жаңа жұмыс орындарын құруға, инфрақұрылымды жақсартуға және мәдени мұраны сақтауға ықпал етеді. Бұл өз кезегінде халықтың өмір сүру сапасын арттырып, еліміздің халықаралық аренадағы беделін көтереді.

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Pedagogical Sciences

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THE USE OF INTERACTIVE METHODS AND TECHNIQUES IN TEACHING A FOREIGN LANGUAGE

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Annotation: this article presents a method of brainstorming to attract students ' interest to the lesson. It is said that this approach can reveal the topic of a new lesson by asking questions before starting a new lesson, and if we can choose new methods based on their meaning and characteristics, we will achieve certain success in Language Teaching.

Keywords: brainstorming, professional level, teamwork, improvement, creative thinking, method, activity.

The new socio – cultural conditions of Kazakhstan, the tasks of economic and political development require updating the system of higher and additional professional education in the country. Vocational education has entered the era of globalization, the penetration of technologies into all spheres of life, which requires adaptation to new life conditions.

The system of higher and additional professional education has always played a huge role in educating the intelligentsia, training personnel capable of modernizing and developing social experience, expanding professional activities, creating new knowledge and values.

The system of higher and additional professional education plays a huge role in the life of society, since it is education that is the main value of the state and the main resource for its development.

The development of knowledge contributes to the development of Science, which, in turn, leads to the development of new technologies, an increase in the production of goods and the well-being of the state.

All links of this chain should be provided with economic and personnel support. Economic support is the prerogative of the state, the function of the personnel and education system. From the foregoing, it follows that special attention should be paid to the training of the teaching staff of a comprehensive school, and in some cases to retraining, since the quality of Personnel Support in Kazakhstan and, as a result, its future directly depends on the quality of their training.

Today, the main goal of education is considered to be the formation of the ability to actively work, work in all its manifestations, in particular, to do professional creative work.

The education received within the walls of the university turns from the main and only goal of higher education into a means of developing the personality of students through advanced training courses. In the modern world, there is an objective need to constantly improve the training of workers. One of the types of professional development of employees is professional development of personnel. According to A. S. Afonina, K. Yu. Belaya, «professional development of employees is training of personnel in order to improve knowledge, skills, skills and ways of

communication in connection with the growth of requirements for the profession or an increase in the position» [1, p. 45].

From the point of view of E. A. Vlasova, «advanced training is the training of an employee in order to deepen and improve his professional knowledge necessary for his work» [2, p.149].

We consider the concept of «advanced training» from different points of view. According to the definition of I. I. Kelperis, «professional development is a mutually conditioned process that affects both labor efficiency and the personnel quality of the Company» [4, p.78].

V. M. Maslova believes that «advanced training is the provision of employees with the knowledge and skills necessary to work in accordance with established standards; preparing employees for more complex work» [5, p.101].

Analyzing the scientific literature, one can single out the general situation: the purpose of advanced training is to increase the level of practical skills, theoretical knowledge and skills of the employee, the possibility of professional growth for him; also, advanced training serves as a means of achieving strategic goals for the organization.

Professional development can be carried out: «I don't know», he said;

- with partial withdrawal from production, such as a business trip;
- by individual types of training.

The organization of training without interruption from production (External) has its advantages, since teachers «from the outside» can share knowledge and skills that go beyond the specifics of this enterprise. This feature creates a deeper vision of the problems and ways to solve them.

A significant disadvantage is the high cost. Training without breaking away from production (internal) has some advantages and is popular. Unlike external training, it does not require large costs and is focused on the specifics and policies of this organization. Training within the organization must be organized:

- 1) employees had access to understanding the training material with which they acquired knowledge and skills;
- 2) the atmosphere of the lesson, contributed to the acquisition and implementation of the acquired knowledge and skills;
- 3) advanced training stimulated the use of new knowledge and skills by employees.

The opportunity to travel differs from theoretical training by immersion in new working conditions, familiarization with new production and management technologies.

Individual forms of training are reminiscent of interaction with the mentor, he demonstrates his own experience on the example of his actions. According to their organization, various forms of professional development of personnel are used: passive (the student receives information from the mentor passively) and active (workshops, role-playing games), individual (one trainee) and Group (A group of employees), without breaking away from production (mentoring) and breaking away (removing personnel from working conditions).

The classification of forms of professional development of employees includes:

1. Passive and active-the difference in the degree of activity shown by the employee.
2. Individual and group. The personal method goes to emphasize the knowledge of a real person. Group-professional development in the group, respectively, it requires less financial costs.
3. Without breaking and breaking from production.

The knowledge gained during the method of professional development without leaving the workplace is applied in practice. At the same time, both passive and active methods of professional development of personnel change. When the student receives information from the teacher, that is, passive, this is no longer relevant. Passive methods are being replaced by active ones. Active methods are seminars, the case study method (case study), role-playing games, fashion lyrics, etc.

An important condition for advanced training is a temporary factor, since the training of personnel is carried out in several forms: short-term training (at least 72 hours), theoretical and problem-based training (from 72 to 100 hours), long-term training (more than 100 hours). The organization determines the most suitable option for a particular moment and in the current situation, since the choice of form and method depends on the period of study, the target audience and the amount of new knowledge.

Employee training can be organized by concluding contracts with educational institutions, the forces of the enterprise itself, or firms engaged in personnel training. A tripartite agreement is concluded if the enterprise applies to specialized organizations for Personnel Training (enterprise-employee - educational institution).

Professional development of employees is the basis for the effective performance of their functional duties and helps the organization flexibly respond to changes in the internal and external environment.

Therefore, the success of the company depends on the organization of timely and high-quality professional development of personnel. All actions related to increasing the qualification of personnel should support the strategic mission of the company, develop labor skills, respond to the needs of employees and organizations, contribute to the repayment of invested funds.

To do this, it is necessary to determine which training methods will be most effective in a particular situation and take into account the qualitative (what needs to be taught, what skills need to be developed) and quantitative (number of employees) needs about training, which are determined in different ways, for example: employees' own recommendations, certification of employees, analysis of work results, expert assessment of an independent consultant.

Methods of professional development of employees-means and methods by which the acquisition of professional knowledge, skills is achieved with their help. Many forms and methods of increasing qualification contribute to the development of personnel.

There are the following methods of professional development of Personnel (see photo below)

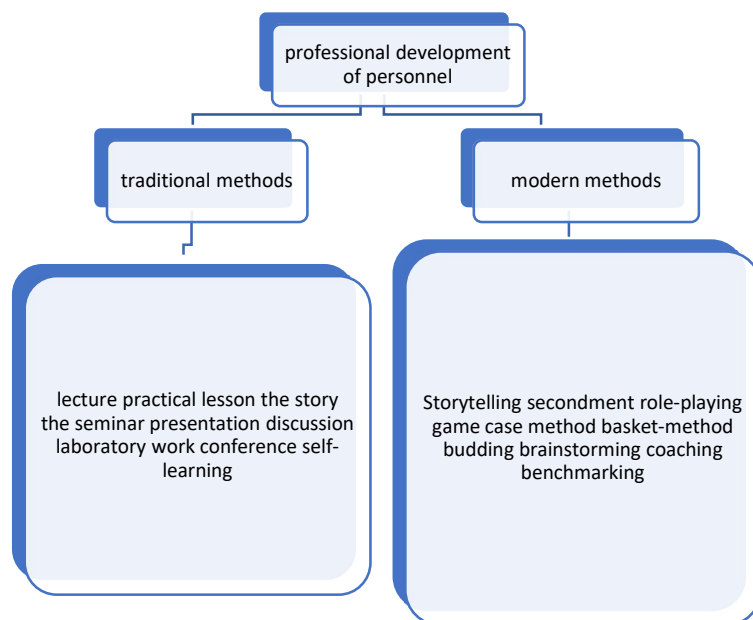


Figure 2 methods of professional development of Personnel

We give a description of modern (real) methods of professional development of personnel.

– Storytelling – informing new employees about the traditions and features of activities in the organization using stories and anecdotes from the life of the team.

- Business game-immersion in the game, a technique reminiscent of real professional actions.

- Training on the secondment method (second ment-dosl. translation «business trip»). The secondment involves the temporary transfer of an employee in the form of a transfer to another place to a new place with the separation of the organization, and then the return to the performance of their previous duties [7, p.36].

- Modeling-project development, models with clearly defined indicators and calculation of the necessary results.

- Role-playing game-a method in which real or typical production situations are created, identifying specific roles of participants in order to find a solution in a problem situation.

- Case study method – specific tasks in the form of a case-a method of active problem-situational analysis based on learning by solving situations [3, p.65].

- Basket method (in the form of an exercise)

- A method of collecting information for a limited period to assess the most common situations in the conditions of practical activity (for example, analysis of business papers). [8, p.19]

- Training by the Budding method-the essence of this method lies in the fact that a partner (buddy) is attached to the employee, interaction with which contributes to the identification of weaknesses in the work and the formation of stable feedback [6, p.124].

- Coaching – training through activities under the supervision of a coach-mentor, in which specific practical problems taking place at the enterprise are solved. – Brainstorming – finding the right solution in a group discussion process.

- Benchmarking-applying the experience of existing results in the development of new actions.

Currently, in the specialized literature, new approaches to teaching can be found, which are called «second generation» methods. These include: Merlin training, dialogue training, scenario planning, training in action, zones for training, knowledge management project. We will consider each method in more detail. The Merlin exercise is an exercise in which participants create a combination of free form based on modeling and planning a scenario at a certain point in the future (5-10 years). In a simulated scenario, they assume that their enterprise will be leading in the country (or in the world), successfully competing in the market.

Participants describe the analysis points (landmarks) of current and future development, then return to the present, and these temporary indicators are used in the formation of development strategies so that the success they imagined becomes a reality. «Analysis points» are indicated, Yes, groups evaluate them from strengths and weaknesses, evaluate how they will compete for the realization of their future.

Using such modern methods, we can achieve professional development of personnel at the University.

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Pedagogical Innovation in Flight Instruction: Personalizing Pilot Training for Safer Skies

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Abstract

This paper explores the application of pedagogical innovation in modern flight instruction. Drawing from real-world examples, it emphasizes the effectiveness of personalized teaching strategies, simulator integration, and human-centered approaches to improve pilot training outcomes. With a focus on enhancing aviation safety, the study presents methodologies that align with educational sciences and offers insight into how adaptive instruction can produce more capable and responsible pilots. Furthermore, the paper suggests reforms for instructor development based on proven pedagogical frameworks.

Keywords

aviation pedagogy, flight instruction, simulator training, human factors, individualized teaching, CFI, pilot safety

Student Case Studies: Real-World Application of Personalized Methods

The effectiveness of pedagogical innovation in flight instruction becomes most vivid through student success stories. One particularly notable case involved a student who had already accumulated a substantial number of flight hours with another instructor but was unable to land the aircraft safely. Upon evaluation, it was discovered that the root of the issue was a visual perception error caused by incorrect seat height and reference alignment. The student had developed incorrect visual habits, misjudging his landing approach due to improper perspective. By correcting his seating position and retraining his external reference techniques, I helped him quickly overcome the issue. Within a few weeks, his landing performance improved dramatically. That student is now a Certified Flight Instructor himself, sharing the same visual alignment lesson with his own students.

Another case involved a student with a background as a flight engineer in the military, having served for 21 years. Despite his technical knowledge, he initially struggled with adopting a student mindset and adapting to civil aviation procedures. Recognizing his strong pride and analytical mindset, I shifted my instructional approach to emphasize practical flying tips and tactical efficiency. For instance, we focused on simplifying instrument approaches by prioritizing checklist flow, anticipating ATC commands, and optimizing scan patterns. During commercial maneuvers, we emphasized strategic outside visual reference points and power management. As a result, his flying became smoother and more confident. He passed his FAA checkride on the first attempt and expressed deep appreciation for the tailored instruction that respected his experience while guiding him toward success.

Assessment and Feedback in Flight Training

Feedback in aviation training must be both immediate and constructive. According to pedagogical best practices, assessment should be formative and iterative, providing students with clear direction and motivation. Traditional grading systems are insufficient in high-stakes flight environments. Instead, structured post-flight debriefings and student self-assessments foster reflective practice. Instructors should ask probing questions such as, “What went well today?” or “If you had to fly that maneuver again, what would you change?” This Socratic approach enhances metacognition and empowers students to own their learning journey.

Another effective technique involves video review from cockpit recording systems or simulator sessions. When students watch their own flights, they gain an external perspective that enhances awareness and retention. This method is supported by cognitive science, which shows that visual review strengthens memory consolidation and error recognition. Furthermore, a balance between positive reinforcement and focused correction is essential. Overly critical feedback discourages risk-taking, while overly vague praise can lead to complacency. A pedagogically sound instructor builds trust through transparency, consistency, and a shared commitment to safety and mastery.

Educational Recommendations for Instructor Development

Given the demonstrable benefits of personalized instruction and pedagogical integration, it is imperative that aviation institutions formalize these practices in instructor development programs. Too often, new CFIs rely on the teaching methods they experienced as students, which may not be effective across diverse learner profiles. Introducing pedagogical modules into CFI training—covering adult learning theory, differentiated instruction, human factors, and assessment methodology—would professionalize the instructional role and lead to better training outcomes.

Flight schools should also consider collaborative teaching environments where instructors share case studies and instructional experiments. Reflective practice journals, peer observation, and mentorship programs can help instructors refine their style and stay aligned with evolving student needs. Accrediting bodies might also revise curriculum standards to require demonstrated competency in teaching, not just technical knowledge. These reforms align with the broader movement in education toward evidence-based practice and learner-centered design.

Conclusion

Pedagogical innovation in flight instruction is not merely an enhancement—it is a necessity. As aviation grows more complex and diverse, the methods used to train pilots must evolve accordingly. By embracing individualized instruction, simulator-based learning, psychological insight, and structured feedback, instructors can significantly improve student outcomes and aviation safety. Real-world cases demonstrate how flexible and empathetic instruction transforms struggling students into confident pilots. To sustain this progress, aviation institutions must elevate the pedagogical training of CFIs and embed educational theory into flight curricula. In doing so, we ensure that the next generation of pilots is not only technically skilled but intellectually agile, emotionally resilient, and deeply committed to safe skies.

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Shaping Safer Pilots: The Psychological Impact of Human Factors Training in Early Flight Instruction

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Abstract

This paper explores the crucial psychological dimension of flight training, emphasizing how early exposure to human factors principles influences long-term pilot safety and professionalism. The study highlights the instructor's role in shaping a pilot's decision-making mindset, emotional resilience, and communication patterns. It argues for integrating psychological training as a foundational aspect of flight instruction, rather than a procedural afterthought at the airline level.

Keywords

Human factors, flight instruction, safety culture, instructor psychology, CRM, pilot mindset, training psychology

Introduction

As the aviation industry continues to advance technologically, the human element remains the most complex and vital component of flight safety. While aircraft systems are becoming more automated, the psychology of pilots—how they think, communicate, and respond to stress—remains central to preventing accidents. Human factors training is often introduced late in a pilot's career, typically during airline transition or crew resource management (CRM) courses. However, by this point, psychological patterns are already deeply ingrained. This paper contends that human factors must be introduced from the very beginning of flight instruction, where they can be internalized through guided practice and mentorship.

The Instructor's Role in Shaping Pilot Psychology

From the first flight lesson, instructors model behavior that students are likely to adopt permanently. This includes attitudes toward safety, communication, authority, and personal responsibility. An instructor who encourages reflective thinking, assertive communication, and stress management is not just teaching maneuvers—they are building a mindset. Through small interactions, such as how feedback is delivered or how checklists are respected, students learn what aviation professionalism looks like.

Cognitive Load and Early Decision-Making Habits

Students in flight training are frequently under cognitive stress, managing new tasks while also facing performance pressure. How they are coached through this stress determines whether they develop constructive coping mechanisms or harmful shortcuts. For example, if a student struggles with crosswind landings, the instructor can either create a psychologically safe space for repeated attempts or unintentionally induce performance anxiety through criticism. These experiences form the basis of future behavior under pressure.

Emotional Regulation and Stress Management

Flight instruction must also address emotional regulation. Panic, frustration, and anxiety can all impair pilot performance. When instructors model calm problem-solving, offer structured breathing or mental resets, and normalize mistakes as part of learning, students gain tools to

manage their emotional responses. These habits become especially critical in real-world scenarios like system malfunctions or ATC miscommunication.

Cultural Sensitivity and Student Mindset

In today's globalized aviation environment, flight training often involves students from diverse cultural backgrounds. These students may interpret authority, assertiveness, and feedback differently. Instructors aware of these differences can adjust their communication style, ensuring that safety principles are universally understood and respected. This psychological flexibility strengthens both safety and inclusivity.

Simulator Training and Psychological Immersion

Simulators are often underutilized from a psychological standpoint. While technical proficiency is practiced, instructors should also use simulators to rehearse decision-making, stress response, and CRM scenarios. After-action reviews should focus not only on flight path deviations but also on the emotional reactions and mental workload of the student. This practice bridges the gap between technical skill and psychological readiness.

Case Studies: Lasting Effects of Early Training

The impact of early human factors training is evident in real-world instructional outcomes. One student came to me after flying many hours with another instructor but still struggled with landings. We discovered the issue was a misaligned eye-level reference caused by incorrect seat adjustment. After correcting the visual reference and retraining the landing sight picture, the student improved rapidly. He is now a Certified Flight Instructor himself.

Another student, a former military flight engineer, carried a strong sense of pride and procedural rigidity. By presenting practical pilot tips—such as scan prioritization during instrument approaches and outside reference cues during commercial maneuvers—I helped him shift from a checklist-only mindset to one of adaptive decision-making. He passed his FAA checkride on the first attempt.

The Illusion of Human Factors "Training" in Airlines

Ironically, by the time pilots reach airline training, human factors and CRM are often presented as slogans rather than skills. Students may hear, "If the captain makes the wrong decision, you must speak up," but receive no practical instruction in assertiveness or conflict navigation. Without psychological modeling or scenario-based practice, this is not training—it is compliance messaging. True psychological readiness must be cultivated from the beginning.

Toward Systemic Change: Instructor Education

Flight instructor training must include pedagogy and applied psychology. Many CFIs simply mimic their own instructors without understanding cognitive load theory, adult learning principles, or emotional regulation strategies. Institutions should integrate modules on instructional psychology, reflective practice, and human factors into the CFI certification process. Instructors must learn to adapt to the psychological needs of each student, not just their technical skill level.

Conclusion

Human factors must not be treated as an advanced topic reserved for airline seminars—it is foundational. By embedding psychological awareness, stress management, and communication principles into primary training, we shape safer pilots from the beginning. Instructors play a decisive role in this process. Their influence is not limited to teaching maneuvers but extends to how students think, feel, and react. If we want CRM principles to truly work in the cockpit, they must be lived in the training aircraft first. When human factors are trained—not just talked about—from day one, the skies become safer for all.

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Bridging Real and Simulated Environments: Maximizing Flight Simulator Effectiveness in Modern Pilot Training

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Abstract

This paper explores the critical role of flight simulators in modern aviation training. As aircraft operation relies heavily on procedural accuracy, simulators provide an affordable and efficient platform for mastering procedural discipline, instrument proficiency, and checklist flow. Although they lack the physical fidelity of real aircraft in terms of maneuver sensation and landing feel, simulators like AATD, Redbird, and Frasca offer significant advantages in repetition, scenario training, and UPRT (Upset Prevention and Recovery Training). This study emphasizes how integrating simulation early in flight instruction strengthens pilot decision-making and enhances overall aviation safety.

Keywords

flight simulation, procedural training, UPRT, aviation safety, instrument flight, checklist discipline, AATD, Redbird, Frasca

Introduction

In contemporary pilot education, simulators are no longer supplementary tools—they are essential components of a structured and efficient training curriculum. With the rapid expansion of flight training demands and rising operational costs, simulation technologies such as AATD, Redbird, and Frasca offer unmatched value in accelerating student proficiency while minimizing expense. This paper explores how simulators reinforce procedural knowledge, enhance safety awareness, and prepare pilots for complex operations such as instrument flight and upset recovery.

Procedural Mastery Through Simulation

A significant portion of flight training is centered not around free-hand flying, but rather on following standard operating procedures (SOPs) and checklists with precision. In this regard, simulators are ideal platforms. They allow for repetitive, structured rehearsal of normal, abnormal, and emergency procedures. Unlike actual aircraft, simulators can be paused to provide real-time feedback or reset to repeat maneuvers multiple times within a single session. This efficiency allows instructors to focus on the fine details of cockpit flow, checklist discipline, and aircraft systems management—elements that directly translate into safer, more confident pilots.

Cost and Time Efficiency in Simulator Use

Training in real aircraft is expensive and often constrained by factors like weather, aircraft availability, and airspace traffic. Simulators remove these constraints while offering considerable financial savings. More importantly, simulators enable concentrated procedural training without wasting time on repositioning flights or delays. For example, a student struggling with engine failure procedures can practice the exact moment of failure repeatedly in a simulator until mastery is achieved—something not feasible or safe in a real aircraft.

Instrument Flight Training and Simulation

When it comes to instrument flight training, the advantages of simulators are especially profound. IFR flying requires disciplined scanning, precise navigation, and the ability to interpret multiple instruments simultaneously under pressure. Simulators provide a stable, controlled environment for introducing these skills before applying them in the air. They allow students to develop situational awareness and instrument flow logic without the risk and distraction of real-world flying. FAA-approved simulators also log valuable flight time, accelerating progress toward ratings.

Simulation and UPRT (Upset Prevention and Recovery Training)

UPRT is an increasingly emphasized component in flight safety initiatives. Simulators, although limited in replicating the full physical sensations of upset conditions, are highly effective in teaching the recognition and recovery logic behind unusual attitudes. Students can experience complex failure scenarios, such as spatial disorientation or unusual pitch/yaw conditions, and practice recovery steps in a safe environment. These repetitions develop instinctive reactions that can make the difference in real-world emergencies.

Limitations of Simulators and Realistic Expectations

Despite their many strengths, simulators have inherent limitations. They cannot fully replicate the tactile feedback of flight controls, visual motion cues, or landing sensations. Crosswind landings, aircraft ground handling, and precise pitch inputs during takeoff and landing remain areas where real flight experience is irreplaceable. A balanced curriculum must therefore combine simulator use with real flight time, ensuring that students transfer cognitive skills to physical execution.

Industry Implications and Curriculum Integration

Flight schools and training programs must integrate simulators not as optional tools, but as central components of the training pipeline. Curriculum designers should align simulation modules with learning objectives such as checklist discipline, emergency response, and CRM. Regular scenario-based assessments in simulators can uncover decision-making weaknesses early and provide focused remediation. Instructors must also be trained specifically on how to leverage simulator advantages and bridge the gap between simulated and real experiences.

Conclusion

Flight simulators are more than economical tools—they are pedagogical amplifiers. When used thoughtfully, they accelerate procedural mastery, enhance IFR capabilities, and provide a secure venue for high-stakes training like UPRT. By integrating simulators early and consistently into training, instructors can produce pilots who are not only technically competent but also prepared to manage real-world complexity with confidence. To build a safer future in aviation, simulator-based learning must become foundational, not supplementary.

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Влияние углеродных точек на фотовольтаические свойства сенсibilизированных красителями солнечных ячеек

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Аннотация

В работе представлены результаты влияния углеродных точек (УТ) на эффективность сенсibilизации полупроводника молекулами красителей и фотовольтаические свойства солнечных ячеек. Добавлении УТ в рабочий электрод позволяет добиться почти двукратного прироста КПД солнечных ячеек. При этом наиболее оптимальным является использование O,N - допированных УТ, синтезированных из лимонной кислоты и мочевины. Увеличение эффективности солнечных ячеек с УТ является результатом роста поглощательной способности полупроводника и улучшения зарядо-транспортных параметров солнечных ячеек.

Ключевые слова: углеродные точки; фотовольтаика; DSSC; TiO_2 ; N719.

Введение.

Применение углеродных точек в солнечных ячейках является одним из достаточно новых направлений, где необходимо изучение как механизмов трансформации световой энергии в электрическую в солнечных ячейках с УТ, так и более эффективное их использование в различных видах солнечных ячеек.

Одной из первых работ, по использованию УТ в солнечных ячейках (DSSC) является [1], где УТ были использованы в качестве сенсibilизатора. Но из-за их низкого КПД, в дальнейшем УТ использовались как со-сенсibilизатор в DSSC [2], [3] или как дополнительный светорассеивающий слой для увеличения светосбора в ячейках [4]. Как показано в [5], добавление УТ в DSSC приводит к более эффективному разделению носителей заряда на границе раздела $\text{TiO}_2/\text{УТ}$. Также предлагается использовать УТ в качестве слоя с дырочной [6], [7] или электронной [8] проводимостью в перовскитных [6], полимерных солнечных ячейках [8] и неорганических солнечных ячейках [7]. Возможно использование слоя УТ, в качестве трансформатора УФ-излучения в излучение зеленой части спектра [9].

Экспериментальный метод.

Углеродные точки были получены с применением микроволнового синтеза. В качестве источника углерода была использована лимонная кислота, для допирования атомами азота и кислорода была использована мочевины, также для получения S,N- допированных УТ был взят L цистеин. Исходные вещества были взяты в молярных соотношениях 1:4 и 1:0,5 соответственно.

Подготовка и сборка солнечных ячеек проводилась следующим образом. На поверхность стеклянных подложек, покрытых проводящим слоем FTO ($8 \text{ M}\Omega/\text{sq}$, Sigma Aldrich) методом осаждения наносили нанометровый блокинг-слой TiO_2 по методике работы [10]. Паста из наночастиц TiO_2 (Sigma-Aldrich, $d \sim 25 \text{ nm}$) была приготовлена по ранее опубликованным нами методикам [11], [12]: 0,96 г TiO_2 и 2 мл этиленгликоля перемешивали с помощью магнитной мешалки в течении 24 часов, затем добавляли 0,2 г полимера и оставляли на сутки при постоянном перемешивании при 120°C . Пасту TiO_2 наносили на поверхность FTO методом доктор-блейдинг. Пленки оставляли для релаксации на воздухе на 3 минуты, сушили при 125°C – 6 минут и ступенчато (с шагом 175°C) отжигали в диапазоне температур от 175 до 500°C . Полученные СЭМ изображения показали, что толщина полученных пленок составляет 10-12 мкм. Электроды съема готовили методом электролитического осаждения Pt из этанольного раствора H_2PtCl_6 (SigmaAldrich). На завершающей стадии производилась сборка ячеек по стандартной методике [12], [13].

Результаты и обсуждение

На основании данных, полученных нами было выяснено, что использование УТ в качестве сенситизаторов в солнечных ячейках является неоптимальным. Однако, как показано в работах [2], [5], [16], [17] добавление углеродсодержащих наноструктур и УТ в полупроводник улучшает его адсорбционные и зарядо-транспортные характеристики. В этой связи нами были проведены исследования, где УТ добавляли непосредственно в пасту TiO_2 . Концентрация УТ по отношению к массе полупроводника составляла 5 мас%. Это соотношение было выбрано на основании данных, полученных в работе [18]. Подготовка и сборка солнечных ячеек осуществляли по методике, описанной выше. В качестве сенситизатора был использован раствор красителя N719 с концентрацией $5 \cdot 10^{-4}$ моль/л.

С целью поиска УТ с оптимальным составом были использованы как S, N- допированные УТ 1:0,5, так и O, N-содержащие УТ 1:4, т.к. именно эти точки показали наилучшую люминесцентную способность. Измерения фотовольтаических характеристик DSSC с добавлением таких УТ в пасту показали, что ячейки с S,N- допированными УТ имеют $\eta = 0,3\%$, тогда как для O,N- содержащих УТ $\eta = 2,7\%$. Поэтому дальнейшие исследования были продолжены с использованием O,N- содержащих УТ. С целью выяснения влияния состава УТ на процесс сенситизации полупроводника нами были выбраны O,N- содержащих УТ следующего состава: 1:1, 1:2, 1:3, 1:4, 1:5.

Измерения фотовольтаических параметров солнечных ячеек с добавлением O,N- содержащих УТ показали (таблица 1), что ячейки с УТ состава 1:4 демонстрируют наилучшие значения КПД. При этом эффективность почти в 2 раза выше, чем у ячейки, где в качестве рабочих электродов используется чистый TiO_2 .

Таблица 1 – Влияние состава O,N-допированных УТ, добавленных в рабочий электрод, на фотовольтаические параметры солнечных ячеек

Состав рабочего электрода	U_{xx} , мВ	I_{K3} , мА/см ²	FF	η , %
TiO ₂	674	3,86	0,56	1,42
1:1	619	2,91	0,47	0,85
1:2	635	3,74	0,49	1,09
1:3	575	1,53	0,53	0,47
1:4	667	6,66	0,59	2,72
1:5	595	1,8	0,55	0,59

Одной из причин зарегистрированного прироста производительности солнечных ячеек может быть изменение эффективности их светосбора. Как показали измеренные спектры поглощения (Cary-300, Agilent), в присутствии УТ наблюдается рост оптической плотности TiO₂ в области 400 – 800 нм (рисунок 1 (а)).

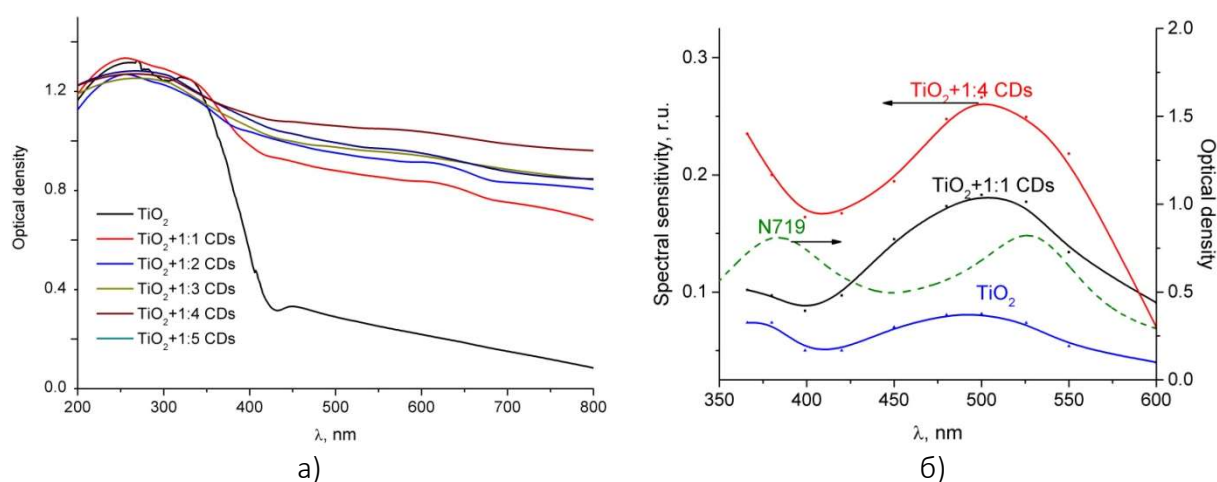


Рисунок 1 – (а) спектры поглощения пленок TiO₂ с добавлением O,N-допированных УТ различного состава; (б) спектральная чувствительность солнечных ячеек с пленками TiO₂ с добавлением O,N- допированных УТ 1:1 и 1:4. Пунктиром – спектр поглощения красителя N719 в этанольном растворе

Прирост оптической плотности почти равен 3. Оценка ширины запрещенной зоны полупроводника по методике [19] показала, что этот параметр уменьшается с 2,8 эВ до 1,5 эВ для чистого TiO₂ и TiO₂+УТ 1:4, соответственно. Это, в свою очередь, должно вызвать изменения в эффективности сенсibilизации полупроводника, так и к модификации электрофизических характеристик солнечной ячейки.

Для оценки спектральной сенсibilизации нами была измерена спектральная чувствительность DSSC ячеек с УТ. Эффект сенсibilизации полупроводниковых пленок оценивался по величине КПД ячеек на определенной длине волны. Для этого измеряли ВАХ ячеек при освещении ячеек светом ксеноновой лампы с мощностью излучения 100 мВт/см² на измерительном комплексе Cell Tester Model # CT50AAA (Photo Emission Tech., Inc., США). Измерения проводились в фотовольтаическом режиме при комнатной температуре. При этом спектральный диапазон от 350 до 800 нм был разделен на несколько регионов с помощью комбинирования отрезающих оптических фильтров. Мощность пропущенного света после каждого фильтра измерялась и калибровалась на максимальное пропускание. Измерения показали (рисунок 1 (б)), что на кривых спектральной чувствительности проявляются максимумы в области 520–530 нм и на коротковолновом краю около 360 нм. Длинноволновый максимум связан с проявлением поглощения красителя N719 в данной

области спектра. Коротковолновый подъем кривой является результатом сочетания собственного поглощения пленки TiO_2 и поглощения красителя около 380 нм. Необходимо отметить, что спектральная чувствительность пленки TiO_2 +УТ 1:4 выше, чем у остальных образцов, что согласуется с данными рисунка 1 (а).

Электрофизические характеристики солнечных ячеек были методом импедансной спектроскопии. Амплитуда прикладываемого сигнала составляла 15 мВ, а диапазон частот от 1 МГц до 100МГц. Для анализа годографов импеданса использована эквивалентная схема (рисунок 2), состоящая из последовательного (R_s) и параллельного (R_p) сопротивлений.

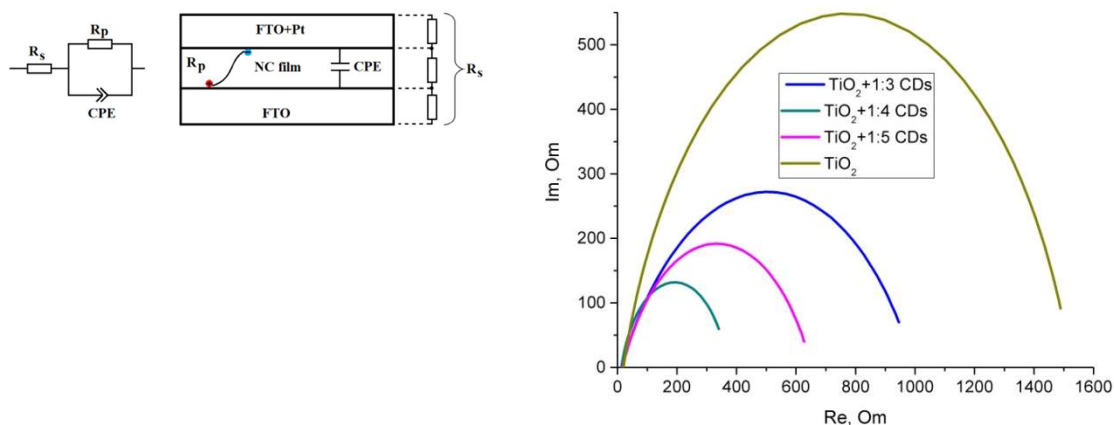


Рисунок 2 – Эквивалентная схема и годографы импеданса для солнечных ячеек с пленками TiO_2 с добавлением O,N- допированных УТ различного состава

Здесь параметр R_s характеризует эквивалентное сопротивление пленки и контактов (FTO+Pt), параметр R_p обозначает сопротивление переноса носителей заряда на границе раздела исследуемого слоя с электродом. Эффективная константа скорости рекомбинации определяется формулой:

$$\omega_{\max} = k_{\text{eff}} = 2 N_s k_r, \quad (1)$$

где $\omega_{\max}$ – точка соответствующая максимальной частоте спектра импеданса (Гц), k_{eff} – эффективная константа скорости рекомбинации (с^{-1}), N_s – плотность электронов в ловушечном состоянии (см^{-3}), k_r – константа скорости рекомбинации с ловушек ($\text{см}^3 \text{с}^{-1}$).

Эффективное время жизни электрона (τ_{eff}) в пленках определяется как:

$$\tau_{\text{eff}} = 1 / k_{\text{eff}} \quad (2)$$

Результаты измерений показаны на рисунке 2 и в таблице 2.

Таблица 2 – Расчет зарядо-транспортных параметров солнечной ячейки на основе данных импеданса

Состав рабочего электрода	R_s , Ом	R_p , Ом	k_{eff} , с^{-1}	τ_{eff} , с
TiO_2	20,1	1468,7	548,2	0,0018
1:3	17,5	928,5	272,1	0,0038
1:4	13,3	327,2	131,9	0,0076
1:5	17,0	610,0	191,8	0,0052

Из данных видно, что добавление УТ в полупроводниковую пленку приводит к уменьшению сопротивления пленки и улучшению контакта с электродом сьема. Сопротивление переносу заряда электронов в электродах на основе TiO_2 с УТ 1:4 почти в 4,5

раза меньше, чем у пленки на основе чистого TiO_2 . Это, в свою очередь приводит к более эффективной миграции носителей заряда в полупроводнике и понижению вероятности рекомбинации. Очевидно, что УТ улучшает электрофизические параметры рабочих электродов солнечных ячеек, что приводит к более эффективной миграции носителей заряда и достижению ими электродов съема. Полученные результаты согласуются с данными, полученными для нанокompозитных материалов с углеродсодержащими структурами [18], [19].

Выводы

Проведенные исследования показали, что при добавлении УТ в рабочий электрод солнечной ячейки позволяет добиться почти двукратного прироста КПД солнечных ячеек. При этом наиболее оптимальным является использование О,N-допированных УТ, синтезированных из ЛК и мочевины 1:4. Использование S,N-допированных УТ на основе ЛК и L-цистеина приводит к уменьшению фотовольтаических параметров ячеек DSSC. Увеличение эффективности солнечных ячеек с УТ является результатом роста поглощательной способности полупроводника и улучшения зарядо-транспортных параметров солнечных ячеек.

Полученные результаты могут быть использованы для создания органических люминесцентных материалов, оптических нанотехнологий, а также в фотовольтаике, биофизике и биоимиджинге.

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APPLICATION OF THE AMPERE LAW IN ROCKET TECHNOLOGY AND ARTILLERY

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The development of physics leads to the development of many industries, as well as military equipment. Military actions taking place on planet Earth, uninvited “guests” from space - various celestial bodies such as meteorites, etc., push scientists to create new military technologies for the purpose of security. One of such technological military products is various missiles, including ballistic missiles and artillery devices. Electromagnetic weapons are weapons in which a magnetic field is used to give the projectile an initial velocity, or the energy of electromagnetic radiation is used directly to hit the target. In the first case, the magnetic field is used as an alternative to explosives in firearms. In the second case, the ability to induce high-voltage currents and disable electrical and electronic equipment as a result of the resulting overvoltage or causing pain effects or other effects in humans is used. Weapons of the second type are positioned as safe for people and serve to disable enemy equipment or render enemy manpower incapacitated. belongs to the category of non-lethal weapons [2-3]. The thrust force in almost all such aircraft is created by the energy of rocket fuels - gaseous, liquid, solid substances. Such devices are characterized by the fact that the thrust force acts until the fuel is completely burned or until the assigned task is completed, polluting the surrounding space. This work proposes a method for using electromagnetic phenomena to create thrust. For this purpose, two coils can be used: the first coil or group of coils is fixed to the body of the launch vehicle or on a fixed launcher, and the second coil on the same axis with the first coils, and they are fixed to the body of the rocket itself. It is proposed that all coils were made of superconductor material, because superconductors are capable of conducting electric current without resistance and without energy loss. The rocket is installed on an installation containing electronic installations. Here coil I is fixed with the help of stoppers installed on a wide range of carriers, which include: fixed installations, military ships, submarines, various types of aircraft, and coil II, made of high-temperature superconductor, is fixed in the rocket itself with a special stopper, which can be released at the right moment. With the help of special electronic devices, it is immediately released from the fastening (from the valves, stoppers, stopper) and under the action of a large Ampere force receives a large acceleration. Determining the characteristics of the coils and their geometric shape arrangement is a separate design study. According to Ampere's law, two coils will interact with the Ampere force, then coil II released from the stopper together with the rocket will receive acceleration. To study the mechanical motion of the rocket, in addition to other forces, first of all, it is necessary to know the initial force acting from coil I on coil II. The forces of interaction between the coils can theoretically be calculated by the formula

$$F_x = P_M \frac{\partial B_1}{\partial x} = I_2 S_2 \frac{\partial B_1}{\partial x} = I_2 \frac{\partial (B_1 S_2)}{\partial x} = I_2 I_1 \frac{\partial L_{21}}{\partial x}. \quad (1)$$

We used the well-known relations $B_1 S_2 = \Phi_{21}$ (Φ_{21} - is the magnetic flux penetrating circuit 2, caused by the current in circuit 1, and $\Phi_{21} = L_{21} I_1$, where L_{21} is the coefficient of mutual induction of the circuits, depending on the shape, size, mutual arrangement and magnetic permeability of the medium. It can be shown that $L_{21} = L_{12} = L$.

To enhance the interaction, the circuits are experimentally represented as coils containing a large number of screws, which increases both the magnetic field and the area, therefore, the coefficient of mutual induction L grows as the product of the numbers of turns of both coils.

The force of interaction between two such coils, if the same current of strength I is passed through them in series, is equal to

$$F = I^2 \frac{\partial L}{\partial x}. \quad (2)$$

For the greatest effect, the current pulse in the solenoid must be short-term and powerful. Experimentally, the force of interaction between coils or electromagnets can be determined in different ways, one of which is a beam balance (Fig. 1) [4]. Coil 1 is suspended from one arm of the balance beam, the other coil 2 is located above it as much as possible on a special support, which can be fixed in a certain position. With this design, balancing can only be achieved by repulsing the coils, so the currents must have opposite directions. Figure 1 shows an electric circuit in which coils 1 and 2 are included. In order for the same magnitude and opposite currents to flow through the coils, they must be connected in series, but arranged so that their windings are wound in opposite directions.

The distance between the coils is determined on the scale using special pointers. If, in the absence of current in the circuit, the scales are balanced by a weight (balance) m_0 , and at a certain current and a certain distance between the coils - by a weight (balance) m , then it is obvious that the repulsive force under these conditions will be equal to the difference:

$$F = P - P_0 \text{ or } F = (m - m_0)g, \quad (3)$$

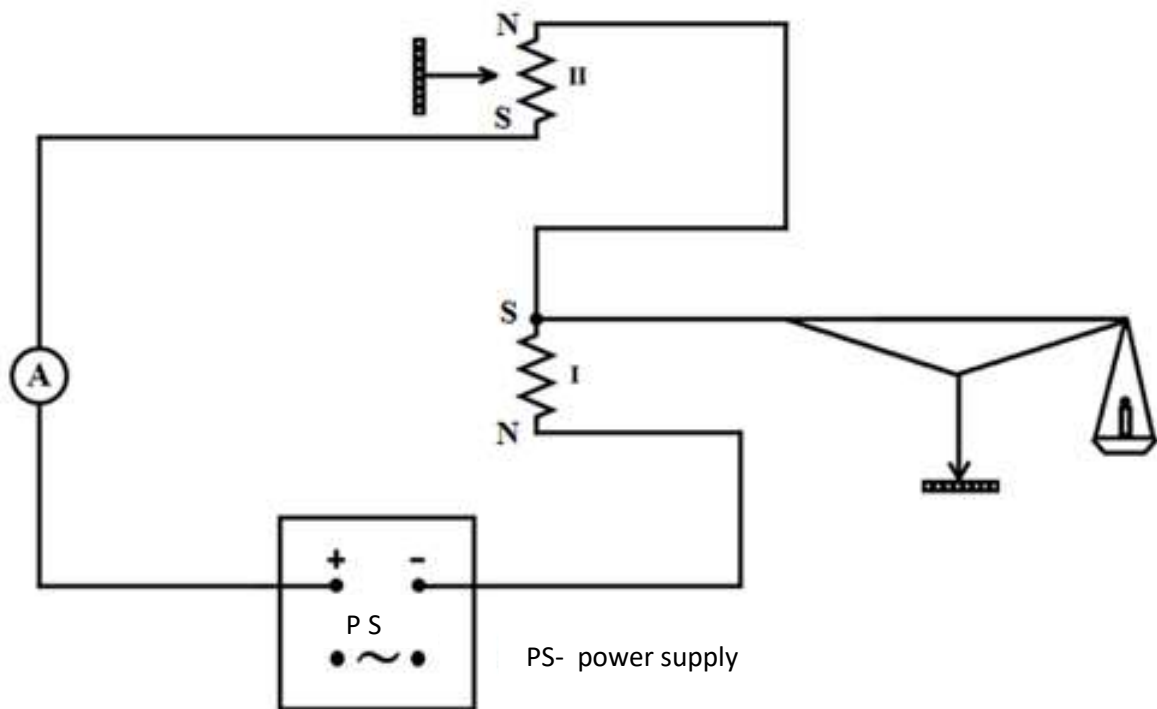


Figure 1. Experimental setup diagram

When determining L_{21} and the EMF of mutual induction, coil 1 is connected to an alternating current source, and coil 2 is connected to a voltmeter. The measurement procedure is as follows: 1. Assemble the electrical circuit shown in Figure 1. 2. Set the distance between the coils r without plugging it into the network. 3. Remove the scale from the stopper (turn the handle located at the base of the scale from left to right) and balance the scale using weights. Calculate the value of m_0 . 4. Turn on the setup. Set the current I , balance the scale using weights. Determine the value of m . 6. Determine the repulsive force using the formula $F = P - P_0$, at different currents. 7. Using the results obtained, find the value of $\partial L / \partial r$ for each position, based on the formula $F = I^2 \partial L / \partial r$. Knowing all the forces and initial conditions, you can study the mechanics of the movement of rockets, shells, etc.

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УДК 535.37

ИССЛЕДОВАНИЕ ЭЛЕКТРОФИЗИЧЕСКИХ СВОЙСТВ СОЛНЕЧНОГО ЭЛЕМЕНТА НА ОСНОВЕ ДИОКСИДА ТИТАНА

МАМАТОВА ДИЛЬНУРА ГАЛЫМОВНА
МЕЙРХАНОВА ТОЛҒАНАЙ ҚАНАТҚЫЗЫ
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Аннотация

В данной статье рассмотрены электрофизические свойства солнечных элементов, основанных на диоксиде титана (TiO_2), а также влияние добавок красителей (N6, 5111) на их характеристики. Проведены экспериментальные исследования вольт-амперных характеристик солнечных ячеек в различных условиях освещения. Показано, что сочетание TiO_2 с определёнными красителями позволяет повысить эффективность преобразования солнечной энергии за счёт увеличения плотности тока и улучшения фоточувствительности. Отмечены преимущества TiO_2 как полупроводника — экологическая чистота, высокая химическая стабильность и доступность, а также указаны его ограничения, преодоление которых возможно посредством модификации состава. Полученные результаты подтверждают перспективность применения модифицированных солнечных элементов на основе TiO_2 в энергетике и смежных отраслях.

Ключевые слова

Диоксид титана, солнечные элементы, фоточувствительность, вольт-амперная характеристика, красители N6 и 5111, TiO_2 , фотоэлектрические свойства.

Солнечные элементы производят электрическую энергию напрямую из солнечного света. Это природный и неисчерпаемый источник энергии. Количество солнечной энергии, поступающей на поверхность Земли, значительно превышает годовое энергопотребление всего человечества. Использование солнечной энергии не загрязняет окружающую среду. Солнечные элементы в процессе работы не выделяют вредных газов (например, CO_2 или NO_x), что является большим преимуществом в борьбе с загрязнением атмосферы и глобальным потеплением.

С помощью солнечных батарей каждый дом, учреждение или страна могут стать энергетически независимыми. Это особенно эффективно в отдалённых сельских районах или в местах, не подключённых к электрической сети. Несмотря на высокую первоначальную стоимость установки, солнечные элементы окупаются в долгосрочной перспективе. Они могут стабильно работать в течение 20–30 лет и требуют минимальных затрат на техническое обслуживание.

Солнечные элементы находят применение от бытовых приборов до промышленности, транспорта (например, автомобили на солнечной энергии), сельского хозяйства и даже космической отрасли. Солнечные элементы — один из важнейших объектов исследований в современной нанотехнологии, фотонике и материаловедении. Новое поколение солнечных элементов (на основе перовскитов, органических соединений, квантовых точек) открывает путь к более эффективному использованию солнечной энергии.

Для создания солнечных элементов важны физическая, оптическая, химическая и экологическая чистота полупроводников.

Среди полупроводников диоксид титана занимает особое место, поскольку он экологически чистый, химически активный, не окисляется и быстро вступает в реакции. Если говорить об оптических свойствах, он обладает длиной волны в ультрафиолетовом диапазоне, а его люминесцентные свойства обусловлены особенностями кристаллической структуры. Что касается физических характеристик, на первом месте стоит высокая подвижность электронно-дырочной проводимости. По сравнению с другими полупроводниками, он экономически более выгоден и доступен по сравнению с другими химическими реактивами.

TiO_2 — это полупроводник с широкой запрещённой зоной (band gap порядка 3,0–3,2 эВ), что делает его пригодным для поглощения света в ультрафиолетовом диапазоне. В солнечных батареях (особенно в солнечных элементах, чувствительных к красителям — DSSC) он возбуждает электроны под воздействием света, обеспечивая их транспорт и генерацию электрического тока. Его фотосенсибилизационные свойства обеспечивают хорошее взаимодействие с молекулами красителей, повышая эффективность фотоэлектрического процесса.

Для улучшения электрофизических и оптических свойств диоксида титана можно использовать благородные металлы, N6, 5111 или рутиновые красители.

В устройствах на основе TiO_2 можно наблюдать вольт-амперные характеристики (ВАХ). Если вы исследуете материалы TiO_2 , его ВАХ как фотокатализатора крайне важны, так как они изменяются под воздействием света. ВАХ в фотокаталитических устройствах могут обладать следующими особенностями: Изменения в точках напряжения; Фотосгенерируемые электроны и дырки под действием света увеличивают проводимость материала, что изменяет зависимость тока от напряжения; Режимы работы «в темноте» и «на свету».

Сравнение ВАХ при различных условиях освещения позволяет оценить фоточувствительность устройства.

В данной части работы были проведены исследования по измерению вольт-амперных характеристик ячеек, которые представлены на рисунке 1..

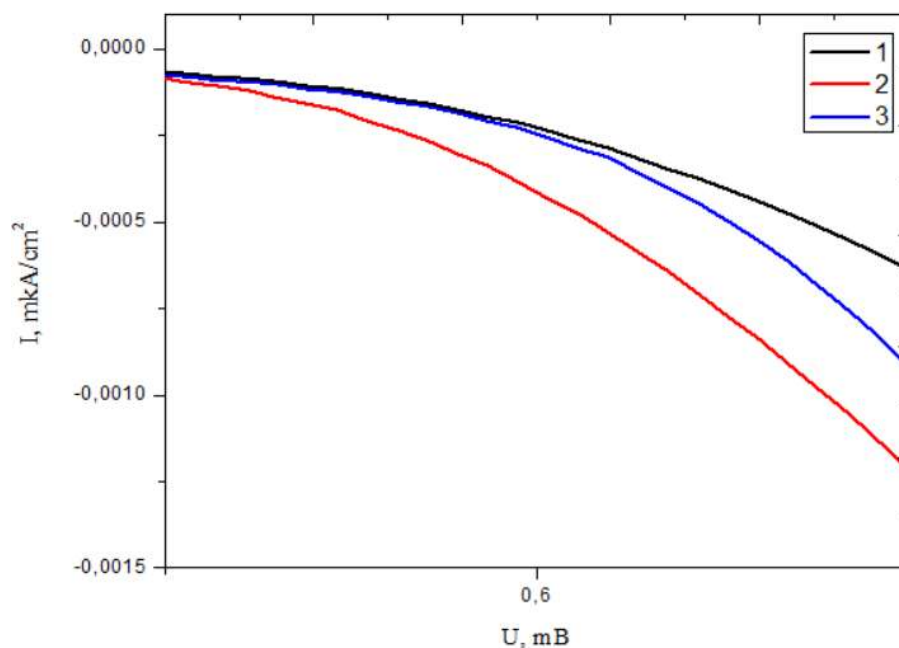


Рисунок 1. Вольт-амперная характеристика солнечных элементов: 1- TiO_2 , 2- $\text{TiO}_2+\text{N6}$, 3- TiO_2+5111

Как видно из рисунка, солнечная ячейка на основе диоксида титана обладает большей удельной поверхностью и более высокой плотностью тока по сравнению с ячейками на основе TiO_2 . Известно, что величина напряжения холостого хода в ячейке определяется природой используемых материалов, а плотность тока — количеством поглощённых молекул красителя.

Основные параметры фотовольтаических (солнечных) элементов используются для оценки их эффективности, производительности и рабочих характеристик. Ниже приведены основные параметры солнечных батарей и их значение:

Этот параметр указывает максимальное напряжение солнечной батареи в состоянии холостого хода (без нагрузки). Он зависит от интенсивности солнечного излучения и материалов элемента. Чем выше значение V_{oc} , тем выше потенциальная мощность, которую может вырабатывать элемент.

В заключение, изготовление солнечных ячеек на основе диоксида титана и красителей N6, 5111 обеспечивает высокоэффективную работу. Диоксид титана обладает рядом преимуществ, но также и недостатками. Например, узкая зона проводимости и способность поглощать свет только в ультрафиолетовой области. Для устранения этих недостатков эффективно сочетать диоксид титана с благородными металлами и красителями с более широкой зоной проводимости.

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СОВРЕМЕННЫЕ МЕТОДЫ ИССЛЕДОВАНИЯ ДИСТАНЦИОННОГО ЗОНДИРОВАНИЯ ЗЕМЛИ

ЕРБОЛ АЛТЫНАЙ

АЛШАТОВА АКМАРАЛ НУРБОЛОВНА

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Аннотация

В статье рассматриваются фотоэлектрические свойства солнечных элементов на основе диоксида титана с использованием органических полиметиновых красителей. Приведены методики приготовления пористых тонкопленочных структур методом doctor-blading, а также результаты термической обработки и их влияние на эффективность преобразования солнечной энергии. Особое внимание уделено влиянию различных красителей на параметры солнечных элементов, таким как напряжение холостого хода, ток короткого замыкания и коэффициент полезного действия. Показано, что добавление красителей способствует повышению эффективности преобразования энергии без увеличения дефектов пленки.

Ключевые слова

Солнечный элемент, диоксид титана, органические красители, полиметин, фотоэлектрические свойства, сенсibilизация, КПД, doctor-blading, пористая структура, наноматериалы

В данной статье рассмотрены электрофизические свойства солнечных элементов, основанных на диоксиде титана (TiO_2), а также влияние добавок красителей (N6, 5111) на их характеристики. Проведены экспериментальные исследования вольт-амперных характеристик солнечных ячеек в различных условиях освещения. Показано, что сочетание TiO_2 с определёнными красителями позволяет повысить эффективность преобразования солнечной энергии за счёт увеличения плотности тока и улучшения fotocувствительности. Отмечены преимущества TiO_2 как полупроводника — экологическая чистота, высокая химическая стабильность и доступность, а также указаны его ограничения, преодоление которых возможно посредством модификации состава. Полученные результаты подтверждают перспективность применения модифицированных солнечных элементов на основе TiO_2 в энергетике и смежных отраслях.

В настоящее время одной из основных стратегических целей мировой экономики является поиск альтернативных и возобновляемых источников энергии. Солнечная энергетика является источником энергии, способным решить проблему мировой

энергетики. Использование тонкопленочных покрытий значительно снижает затраты на солнечные панели, что обусловлено хорошей способностью тонких слоев поглощать солнечный свет. Однако солнечные элементы, требующие малых затрат, имеют свои недостатки. В настоящее время применяются различные методы повышения эффективности солнечных элементов, одним из которых является сенсбилизация различными красителями, позволяющая повысить КПД солнечных элементов типа Гретцеля [1].

Наиболее новой разновидностью солнечных элементов является сенсбилизированный красителем солнечный элемент. Он обладает простой структурой, состоящей из двух электродов, электролита и органических красителей, выполняющих роль фотосенсбилизатора. Один из электродов выполнен из пористого полупроводника (TiO_2 , ZnO , SnO_2 и др.), насыщенного красителем и обладающего прозрачностью для проводимости тока.

Диоксид титана является экологически чистым, дешевым и быстро вступающим в реакцию полупроводником по сравнению с органическими соединениями. Одним из его главных достоинств является способность поглощать ультрафиолетовое излучение. Однако из-за поглощения только на длине волны 360 нм его электрические свойства недостаточны для эффективной работы солнечных элементов. Для повышения электрофизических свойств TiO_2 и сдвига в область видимого спектра используются дорогие металлы и красители. В диссертационной работе выбраны органические полиметиновые красители [2–4].

Полиметиновые красители представляют собой класс органических соединений с чередующимися одинарными и двойными связями. Благодаря высокой способности к поглощению, они эффективно преобразуют солнечную энергию в солнечных батареях.

Сравнивая влияние функциональных групп в структуре красителя на эффективность генерации зарядов в солнечных элементах, можно отметить, что элементы с новыми красителями показывают более высокую эффективность по сравнению с красителем ПБ [5]. Следует отметить, что плазмонный эффект больше влияет на люминесцентные и фотоэлектрические характеристики красителя ПБ. Это может быть связано с наличием бутиральной «цепочки» сульфогруппы в молекулах красителя ПБ, обеспечивающей оптимальное расстояние между плазмонной наноструктурой и хромофором, снижая эффективность переноса энергии FRET. Также наблюдается повышение скорости плазмонно-усиленной флуоресценции. Повышение КПД солнечных элементов с красителями ПБ в 2,5 и 1,2 раза может быть связано с увеличением спектральной чувствительности в диапазоне 600–700 нм и расширением в коротковолновую область до 400–450 нм при наличии плазмонных наноструктур.

Для создания солнечных батарей использовались подложки из стекла с покрытием из фторированного оксида олова (FTO), выпускаемого компанией Sigma-Oldrich, с сопротивлением поверхности 7 Ом/см². Сначала подложки протирались спиртом, затем промывались горячей мыльной водой и тщательно ополаскивались очищенной и ионизированной водой. TiO_2 широко используется в промышленности в качестве фотокатализатора, в сенсбилизированных солнечных батареях, для очистки воды и т.д. Это расширяет область его применения и улучшает характеристики нанокомпозитных материалов. В данной работе были разработаны солнечные элементы на основе TiO_2 и полиметиновых красителей.

Для получения нужных пленок сначала готовилась паста: 0,96 г диоксида титана смешивалось с 2 мл этиленгликоля и перемешивалось в течение 24 часов на магнитной мешалке. Затем в течение следующих 24 часов паста нагревалась до 80°C, с добавлением 10% массы TiO_2 . Для получения пористых пленок применялся метод «doctor-blading». Толщина слоев контролировалась с помощью полимерной ленты определенной толщины.

После нанесения раствор высушивали при температуре 125°C в течение 6 минут. Далее проводили термическое отжиг в диапазоне температур от 120 до 450°C.

Процесс нанесения повторялся для достижения необходимой толщины пленки, проводился отжиг, очистка поверхности от загрязнений и активация поверхности. Для получения пленок толщиной менее 2 мкм в состав пасты добавлялся полимер полиэтиленгликоль-себацонат в количестве 20% от массы TiO_2 . Готовая паста наносилась на стеклянную подложку методом «doctor-blading».

На основе полученных данных в таблице 1 представлены основные параметры фотовольтаических элементов. Расчеты проводились с использованием программного пакета «IV-Measurement». Хотя КПД солнечных элементов ниже по сравнению с литературными данными, они позволяют правильно определить необходимые зависимости.

Таблица 1 — Фотоэлектрические параметры солнечных элементов TiO_2 , TiO_2 +Родамин В, TiO_2 +Эозин

Пористый полупроводник	$U_{oc}, \text{мВ}$	FF	КПД, %	$J_{sc}, \text{мА/см}^2$
TiO_2	407.05	0.32	0.82	2.07
TiO_2 -Эозин	521.2	0.57	1.72	3.59
TiO_2 -Родамин	559	0.41	1.89	3.65

Как показано в предыдущих исследованиях, наибольшее увеличение КПД наблюдается при использовании наночастиц TiO_2 .

Из приведенных данных видно, что добавление красителей приводит к повышению эффективности преобразования солнечной энергии в электрическую. Значения напряжения холостого хода и тока короткого замыкания становятся оптимальными при определенной концентрации красителя. Это свидетельствует о том, что добавление красителей не увеличивает дефекты пленок и скорость рекомбинации зарядов.

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Legal Sciences

Police in the 21st Century: Current Missions and Changing Challenges

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Abstract:

The 21st century brings to the forefront a profound transformation of the role and responsibilities of the police, amid the technological explosion, globalization, and changes within the sphere of criminality. This article examines the current missions of the police in a complex society, where traditional crime coexists with digital and transnational criminality. Through documentary analysis, corroborated with perspectives from recent literature and relevant examples, the main challenges are identified: adapting to technological change, staff shortages, lack of resources, social pressure, and maintaining public trust. The study emphasizes that modern policing can no longer operate in isolation but requires solid partnerships with the private sector, civil society, and the local community to effectively combat crime.

At the same time, the article explores the impact of new technologies—from predictive analytics and digital surveillance to international cooperation in fighting organized crime. It highlights the importance of continuous training, professional specialization, and institutional transparency, as well as the need for legislative reforms to ensure respect for human rights. Special attention is paid to the concept of “*synergy*”, understood as the strategic integration of all relevant actors’ efforts.

The article concludes that, in order to respond to new threats and maintain its legitimacy, the police must become an adaptable actor, open to change, capable of combining operational efficiency with respect for democratic values. Institutional reform, digitalization, partnership with citizens, and the development of digital skills are essential pillars for maintaining safety and social stability in a continuously changing world.

Keywords: Police, digital crime, organized crime, institutional reform, technology, community partnership, fundamental rights, synergy.

I. Introduction

The 21st century finds us at a crossroads of fundamental transformations: accelerated technological development, global mobility, and the diversification of criminal phenomena are forcing a profound rethinking of the role of the police. The institution can no longer be seen merely as a body of coercion, but as a dynamic actor, capable of prevention, intervention, and active collaboration with society as a whole.

In this context, recent research supports the necessity for a rapid and profound adaptation of public order structures. In the *German International Journal of Modern Science* (2025, no. 97), George-Marius Țical warns about the devastating effects of organized crime, which affects not only public order but also the very stability of democratic systems: “*Organized crime is a significant and persistent threat to the global economy... money laundering destabilizes financial systems... corruption allows criminal groups to infiltrate state institutions, undermining governance, eroding public trust...*” (pp. 26-27).

This analysis highlights the fact that modern criminality no longer has physical borders or simple forms, but penetrates deeply into the economic and political structures of states, requiring a strategic and well-coordinated response from the police.

In the same vein, the *Danish Scientific Journal* (2024, no. 91) brings into discussion another essential dimension of effective police functioning: community trust. As highlighted by Tical (2024), “the involvement of the private sector, civil society, and the media enhances transparency and accountability. Only through a holistic approach and a coherent mobilization of global resources can the influence of transnational organized crime be limited and international stability ensured” (p. 7). This simple phrase contains the essence of a modern philosophy of intervention: an effective police force is one that inspires trust, not fear; that builds partnerships, not barriers.

Starting from these perspectives, the present article aims to address three main directions:

- The analysis of the current missions of the police, in light of new types of threats and responsibilities;
- The identification of the challenges facing this institution—from lack of resources, to social pressure and legislative changes;
- The formulation of proposals regarding directions for reform: digital modernization, strengthening the relationship with citizens, and professional specialization.

Through this analysis, we will seek to understand not only where the police stand at this moment of change, but also where they should be heading in order to remain a pillar of stability in an increasingly complex society.

This article aims to analyze the main current missions of the police, as well as the challenges faced by this key institution in maintaining public order and safety in contemporary society.

II. The Current Missions of the Police

1. Preventing and Combating Classical and Modern Criminality

Essentially, the police remain the guardians of public order, but the structural transformations of criminality require a profound recalibration of their missions. Concretely, these missions now intertwine across two dimensions: combating classical offenses and addressing modern threats, especially those in the digital space.

“Classical criminality”—facing complex urban realities. Classical offenses—such as theft, assaults, and drug trafficking—persist, but under new pressures: poverty, exclusion, and vulnerability. Thus, beyond repressive intervention, the police are called to act through intersectoral collaboration—with social services, local administration, and NGOs—to address the root causes of phenomena and prevent recurrence. Integrated strategies are necessary, where each contribution (educational, social, police) helps achieve a lasting effect.

Digital criminality—hidden challenges. Cybercrimes—phishing, banking fraud, identity theft—have revolutionized the criminal landscape, shifting attacks from the physical to digital environments that are difficult to control. Addressing these threats requires:

1. **Specialized cybercrime units**, equipped with advanced technical skills and capable of conducting digital investigations in collaboration with private and international entities.
2. **Predictive analysis—predictive policing solutions**—using artificial intelligence and statistics to anticipate and prevent crimes (researchgate.net). These technologies have proven effective, although they raise issues of fairness and discriminatory patterns.
3. **Public awareness programs** targeting citizens—to educate them on the safe use of the online environment, reducing vulnerability and increasing the willingness to collaborate with authorities.

In short, the prevention and combating of crime in the 21st century requires an integrated approach:

Dimension	Key Element	Impact
Classical	Inter-institutional partnership	Tackling social causes
Digital	Technology and AI	Advanced anticipation and investigation
Interactive	Collaboration with citizens	Strengthening trust

A modernized police force recognizes that efficiency is not only about intervention, but also about education, prevention, and trust. In the next section, we will analyze the role of the police in maintaining public order and the additional challenges posed by protests and public gatherings.

One of the oldest and most fundamental missions of the police is the prevention and combating of criminality. While in the past, the focus was placed almost exclusively on street crime—such as theft, robbery, and domestic violence—today the police are also compelled to address a different kind of criminality: cybercrime and digital fraud.

The development of the internet and social networks has led to an explosion of online offenses, from identity theft to banking fraud and data trafficking. Police officers are thus required to develop digital skills and collaborate with cybersecurity experts to cope with these modern forms of criminality.

Technology and ethics-seeking an effective balance

Over recent years, the use of technologies such as video surveillance, digital tools, and AI has revolutionized policing strategies. Academic analysis highlights the obstacles encountered in such practices—from technological procurement and implementation to field use. Other research points out that transparency from officers (for example, a simple phrase like “I am here to get to know the community”) increases public trust and reduces suspicion.

Moreover, social media surveillance—including the analysis of online conversations—helps with the early detection of criminal plans and rapid intervention.

Interaction with the community-an enabler of prevention

Detection and prevention largely depend on the collaboration between the public and the police. Studies show that online reporting systems can grease the preventive mechanisms of the justice system, but can also generate dissatisfaction if they are useless or anonymous (journals.sagepub.com). To enhance cooperation, the police must invest in technologies that facilitate communication, as well as in training for empathetic and effective contact with victims.

Strategies such as the Chicago Alternative Policing Strategy demonstrate how the direct involvement of citizens in crime analysis and prevention yields results—a significant reduction in crime through locally adapted methods (en.wikipedia.org).

Synergy in the Fight Against Crime

In the complex and dynamic context of the 21st century, combating crime can no longer be approached exclusively through classical tools or isolated efforts of law enforcement institutions. The efficiency and sustainability of results increasingly depend on the creation and consolidation of real synergy between the police, other state institutions, the private sector, civil society, and the community.

Synergy in the fight against crime involves multidimensional collaboration, in which each actor contributes its specific strengths:

- **Public order institutions** collaborate with prosecutors, intelligence services, and local authorities for information exchange, integrated prevention strategies, and rapid intervention.

- **The private sector**, especially companies in the technology and financial fields, supports investigations by providing data, developing digital detection or protection solutions, and by applying ethical standards for the protection of personal data.
- **Civil society and non-governmental organizations** play an essential role in monitoring respect for human rights, educating the population, and mediating the relationship between the police and citizens.
- **The community** remains the central actor, both as a source of useful information and as the beneficiary of collective safety. Civic involvement, increased trust, and participation in prevention initiatives enhance the success of police actions.

Synergy is not limited to institutional collaboration, but also refers to the optimal integration of technology, data, and human resources within an ethical and regulated framework. The example of predictive technologies shows that only through close cooperation between developers, ethics specialists, field officers, and the community can risks of bias, systemic errors, or abuses be prevented.

Thus, the results of this study confirm that a synergistic approach:

- increases the efficiency of investigations,
- reduces recidivism rates,
- strengthens public trust,
- and ensures the balance between security and the respect of fundamental rights.

Synergy between diverse actors and complementary tools represents not only a necessity but the foundation of a modern and legitimate strategy for combating crime in an open society.

2. Maintaining Public Order

Maintaining public order represents a fundamental dimension of police activity, being essential for ensuring the harmonious functioning of a democratic society. In the current context, this mission acquires new meanings, given the intensification of protests, public demonstrations, and the diversification of mass events, from sports or cultural gatherings to emergency situations such as natural disasters.

In a consolidated democracy, the right to free expression, peaceful assembly, and protest are the foundations of an open society. The role of the police is not to restrict these freedoms, but to guarantee them, while ensuring that the safety of other citizens is not endangered. Police interventions must always be proportional, transparent, and in compliance with legal and international standards regarding human rights. Any disproportionate action can lead to the loss of public trust and the escalation of conflicts.

Managing spontaneous protests or public gatherings with conflict potential requires high operational capacity. The police must have personnel specifically trained for dialogue, mediation, and negotiation, as well as logistical resources adapted to different scenarios. International examples show that law enforcement agencies prioritizing communication and the prevention of escalation are more effective in maintaining public order than those that resort to coercive measures from the outset.

In addition to **professional training**, police officers must demonstrate empathy towards protesters and show discernment in operational decisions. Each situation involves specific risks, and a correct assessment can make the difference between peaceful management and escalation. Furthermore, constant communication with event organizers, monitoring the flow of information online, and collaboration with other institutions (emergency services, gendarmerie, medical services) are essential for preventing incidents.

New technologies, such as real-time video monitoring, crowd analysis systems, or online reporting platforms, support the police in identifying risks and efficiently mobilizing resources. At

the same time, transparency regarding the use of these tools is important for maintaining public trust.

Maintaining public order in the 21st century does not mean only rapid intervention; it also requires dialogue, prevention, and adherence to democratic principles. An effective police force is one that knows how to listen, anticipate risks, and find balanced solutions between freedom and security.

3. Interinstitutional and International Cooperation

In the era of globalization and accelerated interconnectedness, the police can no longer act efficiently in isolation. The diversity and complexity of cases encountered—from serious crimes to social emergencies—require an integrated approach based on interinstitutional cooperation and cross-border partnerships.

Managing complex cases, such as human trafficking, organized crime, or interventions in social crisis situations, requires close cooperation between the police, local authorities, medical services, social assistance institutions, and non-governmental organizations. This multidisciplinary partnership enables rapid information exchange, efficient resource coordination, and interventions tailored to community needs. For example, in cases involving vulnerable victims, cooperation with psychologists, social workers, or doctors is essential for their protection and reintegration.

Against the backdrop of increasing cross-border crime—human trafficking, terrorism, money laundering, cyber fraud—the Romanian police have become actively integrated into international crime-fighting networks. **Participation in joint missions and projects** with Europol, Interpol, FRONTEX, or other European Union agencies facilitates the exchange of operational data, access to international databases, and the development of common intervention strategies. Thus, the police contribute not only to the protection of national interests but also to regional and global stability and security.

Joint actions to dismantle human trafficking networks or to combat terrorism demonstrate the effectiveness of international collaboration. Simultaneous operations in several countries, the exchange of liaison officers, or the use of integrated rapid alert systems are relevant examples that underscore the need for a unified approach to global threats.

Interinstitutional and international cooperation is not without challenges: legislative differences, language barriers, varying levels of resources, or different priorities can hinder coordination. For this reason, harmonizing the legal framework, developing common protocols, and continuous investment in professional training for work in multinational teams are necessary.

Extensive cooperation between the police, public institutions, the private sector, and international partners is the foundation of an effective crime prevention and combating strategy in the 21st century. Only through strong partnerships and continuous exchange of best practices can the effective protection of citizens be ensured in an increasingly connected world exposed to global risks.

III. Challenges Facing the Police in Contemporary Society

1. Technological Changes and Digital Crime

Technology is one of the greatest challenges for the police. The emergence of cryptocurrencies, anonymous networks, and cyberattacks on critical infrastructure puts enormous pressure on the police's ability to react quickly and effectively.

Constant retraining of personnel, the acquisition of modern equipment, and collaboration with civilian IT experts are necessary. This reality leads to a redefinition of the modern police officer's profile, who is no longer just an enforcer but an interdisciplinary specialist.

2. Personnel Shortage and Lack of Resources

In many countries, including Romania, the police face a chronic shortage of staff. Migration to the private sector, difficult working conditions, and modest salaries make the recruitment and retention of well-trained personnel a true challenge.

At the same time, outdated infrastructure-police stations not adapted to current needs, lack of modern equipment-affects the ability to intervene and employee morale. Investment in infrastructure and human resources is essential for the efficient functioning of the system.

3. Public Pressure and Lack of Trust

Cases of police abuse or lack of transparency in the management of investigations have led to a decline in public trust in the police, both in Romania and in other countries. In an era of social networks, any action, any mistake, becomes viral and can have serious consequences for the institution's image.

There is a need for an organizational culture based on transparency, responsibility, and open communication with citizens. The police must become a community partner, not just an authority to be feared.

4. Respect for Human Rights

One of the most sensitive issues is the balance between the firmness of police interventions and respect for fundamental rights. Surveillance practices, searches, and the use of force-all must comply with legal standards and the principles of the rule of law.

Training in ethics and human rights, as well as the existence of clear mechanisms for monitoring and sanctioning abuses, are essential for maintaining the institution's legitimacy.

IV. Adapting and the Future of the Police

To respond to these challenges, the police must undergo a profound process of transformation.

1. **Digitalization and modernization.** The implementation of high-performance IT systems (integrated databases, digital forms, predictive crime analysis) can reduce bureaucracy and increase efficiency. Additionally, smart video monitoring and the use of drones can enhance the capacity for real-time intervention.
2. **Continuous training and specialization.** The modern police officer must be in a state of continuous training, both technically and in terms of psychology and ethics. Courses in communication, conflict management, interventions in social cases, or mental health should become part of professional routine.
3. **Community policing and collaboration with citizens.** An increasingly popular model is that of community policing, where police officers are constantly present in the community, not just in times of crisis. This model strengthens trust, reduces institutional distance, and favors prevention over intervention.
4. **Public policy and institutional reforms.** Last but not least, coherent political reforms are needed to ensure a modern legal framework, adequate funding, and effective internal and external control mechanisms.

Conclusion

The 21st century fundamentally redefines the role and mission of the police, forcing this institution to step out of the classic paradigm of punitive authority and adopt a modern, flexible approach based on prevention, collaboration, and transparency. Beyond the challenges generated by organized crime, accelerated digitalization, and social pressure, the police are called to become an active pillar of stability and security in a society undergoing constant change.

The analysis highlights that police efficiency can no longer be measured strictly by the case resolution rate or the number of interventions, but by the institution's ability to build trust and to

construct functional partnerships with citizens, the private sector, and civil society. Synergy among all these actors is the key to successfully combating modern crime, as no single actor can face the complex threats of the present alone.

At the same time, the use of advanced technologies such as predictive analysis, digital surveillance, and artificial intelligence tools opens up new opportunities but also entails risks related to fairness, confidentiality, and the respect for fundamental rights. Thus, continuous professionalization, ethical training, and the creation of a modern legislative framework are essential to ensuring the legitimacy and efficiency of the police.

Finally, public trust and community involvement must be at the core of any institutional strategy. As the literature shows, only through coherent resource mobilization, transparency, responsibility, and open dialogue can the police respond effectively to new threats and contribute to democratic stability.

In conclusion, the future of the police depends on its ability to reinvent itself, to remain open to innovation, and to actively collaborate with society. Only in this way can it sustainably provide the safety, freedom, and trust that every democratic community needs in the 21st century.

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Agricultural Sciences

The Role of Artificial Intelligence in Agricultural Development

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Introduction

Environmental pollution represents one of the most significant global challenges of the 21st century. Agriculture, as a vitally important sector, not only experiences the negative impacts of environmental degradation but can also be one of its causes when traditional, intensive methods are used. Specifically, agriculture is responsible for approximately 18% of global greenhouse gas emissions, 70% of freshwater usage, and about 33% of the world's agricultural land is degraded. Modern technologies, especially artificial intelligence, offer innovative solutions for developing more sustainable and environmentally friendly agriculture.

Modern agriculture increasingly suffers from a shortage of qualified labor, which creates significant obstacles to the sector's effective development. The outflow of the younger generation from rural areas and the physically demanding working conditions exacerbate this problem, making it necessary to implement automation of agricultural processes.

Traditional methods based on manual labor are often inefficient, characterized by low productivity and high risk, which significantly hinders the full realization of agricultural potential. In this context, the integration of artificial intelligence into automated systems offers a revolutionary approach to overcoming existing challenges.

Robots and autonomous systems equipped with artificial intelligence can perform routine and labor-intensive tasks (such as sowing, harvesting, weed control) with high precision and efficiency. Additionally, real-time data analysis and decision-making by artificial intelligence enable the optimization of automated processes and more rational use of resources, which ultimately contributes to increasing agricultural productivity and sustainability.

For example, the automation of modern irrigation systems, which often use artificial intelligence algorithms to analyze soil moisture, weather forecasts, and plant needs, significantly reduces the need for human resources in managing irrigation processes. Automated systems ensure more efficient use of water resources, prevent excessive watering or drying out, which positively affects both yield and the environment.

There are numerous studies confirming the effectiveness of using artificial intelligence to optimize irrigation systems. These studies show that artificial intelligence models can significantly improve water use efficiency and reduce irrigation costs. For instance, a study published in the journal "Agricultural Water Management" shows that using artificial intelligence models can reduce water usage by up to 30% and increase yields. This study used machine learning algorithms to analyze soil moisture, weather, and crop requirement data to optimize irrigation schedules. There are also studies where artificial intelligence is used to monitor irrigation systems, detecting water leakage and other problems, which in turn reduces costs and improper water usage.

In another study conducted by the University of California, researchers developed an artificial intelligence system that uses sensors and satellite images to assess irrigation needs in real-time. Results showed that this system was able to reduce water usage by 25% while maintaining yield.

These studies demonstrate that artificial intelligence models can significantly improve water use efficiency and reduce irrigation costs.

The purpose of this article is to explore the potential of artificial intelligence in developing sustainable fruit farming, with a special emphasis on optimizing organic product production using automated irrigation systems and other intelligent agro-technologies. This article also considers sharing international experience in implementing artificial intelligence in agriculture. The article discusses Germany's approach to AI implementation in agriculture, specifically in fruit farming.

German Experience in AI Implementation in Agriculture

According to German expert Helmut Caspary, artificial intelligence is not yet widely used in German orchards. Currently, many institutes in Germany are developing AI-based models and training them with data, receiving financial support from both the German government and the European Union through the European Innovation Partnership (EIP) program.

The main objectives of AI implementation in German fruit farming are:

1. Prediction and diagnosis of pests and diseases
2. Improving tree pruning techniques
3. Harvest forecasting and harvest management

These focus areas demonstrate the practical approach Germany is taking toward integrating AI into fruit farming operations, concentrating on key challenges that directly impact productivity and sustainability. This experience provides valuable insights for developing appropriate and effective AI solutions for Georgian agriculture, particularly in the fruit farming sector.

AI in Environmental Protection and Reforestation

Beyond its direct applications in traditional agriculture, artificial intelligence is proving instrumental in broader environmental initiatives, such as large-scale reforestation efforts. A notable example comes from Japan, where drones equipped with AI are being deployed for tree planting campaigns.

These specialized drones utilize artificial intelligence to scan damaged land, accurately assessing soil conditions and moisture levels. Following this analysis, they strategically disperse seed capsules into the ground. The efficiency of this method is remarkable: a single drone is capable of planting over 300 capsules and covering an area the size of a football field in less than an hour. The drones operate collaboratively as a team and are efficiently recharged using solar power stations.

Initial results from these initiatives are highly promising, with an impressive 80% seedling survival rate. This demonstrates the significant potential of AI-powered drone technology to accelerate reforestation, enhance biodiversity, and combat environmental degradation on a global scale.

Figure 1: AI-powered drone for reforestation.



(Source: Green Balance)

AI in Agricultural Education and Knowledge Dissemination

Artificial intelligence is also transforming agricultural education by enabling the creation of innovative and engaging learning materials. These tools enhance knowledge dissemination and facilitate a more interactive learning experience for students.

One notable example is an AI-generated voiceover presentation, developed using **Narakeet**, serving as an introduction to fruit growing. This educational resource comprehensively covers the history of fruit cultivation and highlights the key regions where fruit farming is prevalent, including specific areas within Georgia. The presentation aims to provide students with an accessible audio format for learning, making complex information easier to absorb.

Figure 2: Slide from an AI-generated educational presentation on fruit growing in Georgia.



Furthermore, to enhance student engagement and introduce new learning modules, an AI-powered avatar has been utilized. Created with **D-ID** for the avatar and voiced over using **Narakeet**, this virtual instructor introduces students to new topics, such as the "biological foundations of fruit growing." This innovative approach demonstrates the potential of AI to create dynamic and personalized educational content.

Figure 3: AI-powered avatar used for introducing new educational modules.



Beyond structured presentations, interactive video content is also being employed to facilitate practical learning and diagnostic skills. Educational videos showcasing various **fruit diseases** (e.g., apple diseases) and **pests** (e.g., on pomegranates) challenge students to identify specific issues based on visual evidence. These interactive materials encourage critical thinking and practical application of knowledge, preparing students for real-world agricultural challenges.

Conclusion

In conclusion, the integration of artificial intelligence into agricultural practices offers transformative potential for addressing critical global challenges such as environmental pollution, labor shortages, and inefficiencies in traditional farming methods. As demonstrated by the innovative applications in automated irrigation systems and various agro-technologies, AI enables more precise resource management, leading to increased productivity and sustainability. The valuable insights from Germany's experience in AI implementation within fruit farming further underscore the practical benefits and future directions for intelligent agricultural solutions.

The development of AI-powered educational tools, such as the Narakeet-generated presentations and D-ID avatars, highlights another crucial dimension of AI's role – its capacity to enhance knowledge dissemination and facilitate learning in the agricultural sector. These tools serve as a testament to AI's versatility, extending its impact beyond direct farm operations to include vital educational initiatives.

By embracing artificial intelligence, agriculture can move towards a more resilient, efficient, and environmentally friendly future, ensuring food security and sustainable development globally. Further research and collaborative efforts are essential to fully harness AI's capabilities and tailor solutions to diverse agricultural contexts.

ҮЙРЕК ЕТІНЕН ЫСТАЛҒАН ШҰЖЫҚ ӘЗІРЛЕУ ТЕХНОЛОГИЯСЫ

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Аннотация

Бұл мақалада үйрек етін терең өңдеу арқылы тағамдық құндылығы жоғары, ерекше органолептикалық қасиеттерге ие ысталған шұжық өнімін дайындау технологиясы зерттелді. Зерттеу Жәңгір хан атындағы Батыс Қазақстан аграрлық-техникалық университетінің зертханасында жүргізілді. Шикізат ретінде Медео тұқымды үйрек еті мен сиыр еті 50/50 қатынасында қолданылды. Қоспа құрамына натрий нитриті, ас тұзы, кептірілген сарымсақ, чили, қара бұрыш және даршын енгізілді. Технологиялық үдеріс кезеңдері толық сипатталып, органолептикалық көрсеткіштер бойынша дайын өнімнің сапасы жоғары деңгейде екені анықталды. Зерттеу нәтижелері үйрек етін қайта өңдеу арқылы шұжық өндірісін әртараптандыруға мүмкіндік беретінін көрсетті.

Annotation

This article explores the technology of producing smoked sausage from duck meat. The study was conducted at the laboratory of Zhangir Khan West Kazakhstan Agrarian Technical University. The recipe included Medeo duck meat and beef in a 50/50 ratio, as well as sodium nitrite, salt, dried garlic, chili, black pepper, and cinnamon. The technological process was thoroughly described. The final product demonstrated excellent organoleptic properties. The findings confirm the viability of utilizing duck meat in diversifying sausage production.

Кілт сөздер: үйрек еті, ысталған шұжық, технология, органолептикалық көрсеткіштер, тағамдық қауіпсіздік.

Keywords: duck meat, smoked sausage, technology, organoleptic properties, food safety.

Кіріспе. Қазіргі таңда ет өнімдерінің ассортиментін кеңейту, сапасын жақсарту және тұтынушылық қасиеттерін арттыру – тамақ өнеркәсібі саласындағы басты міндеттердің бірі. Соңғы жылдары дәстүрлі емес ет түрлерін, соның ішінде үйрек етін өңдеу және қайта өңдеу мәселесіне ерекше көңіл бөлінуде. Үйрек еті жоғары тағамдық және биологиялық құндылығымен ерекшеленеді: оның құрамында толыққанды ақуыздар, В тобының дәрумендері, темір, мырыш және басқа микроэлементтер бар. Осы қасиеттері оны шұжық өнімдері өндірісінде құнды шикізат ретінде пайдалануға мүмкіндік береді.

Зерттеу мақсаты – үйрек етін қолдана отырып, тағамдық және органолептикалық қасиеттері жоғары ысталған шұжық өнімінің технологиясын жасау және сапасын бағалау.

Зерттеу объектілері мен әдістері

Зерттеу жұмысы Жәңгір хан атындағы Батыс Қазақстан аграрлық-техникалық университетінің «Тағам және қайта өңдеу өндірістерінің технологиясы» зертханасында жүргізілді. Шикізат ретінде университет базасында өсірілген Медео тұқымды үйрек еті

қолданылды. Қосымша ретінде сайғақ еті, тағамдық қоспалар мен дәмдеуіштер пайдаланылды.

Қолданылған негізгі шикізаттар мен қоспалар:

Үйрек еті – ГОСТ 31990-2012;

Ас тұзы – ГОСТ 13830-97;

Натрий нитриті – ГОСТ 32781-2014;

Кептірілген сарымсақ – ГОСТ 16729-71;

Чили – ГОСТ 34269-2017;

Корица – ГОСТ 29049-91;

Ұсақталған қара бұрыш – ГОСТ 29050-91.

Барлық компоненттер санитариялық-гигиеналық талаптарға сәйкес таңдалып, қолданылды.

Ысталған шұжықтың рецептурасы мен технологиясы

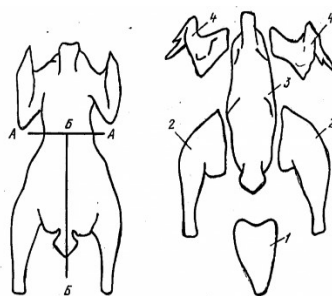
"Жәңгір хан атындағы БҚАТУ" КЕАҚ "Тамақ және қайта өңдеу өндірістерінің технологиясы" зертханасында Жәңгір хан атындағы БҚАТУ-нде өсірілетін Медео тұқым үйрегі етінінен ысталған шұжық даярлау кезінде келесідей тәжірбие жүргізілді. Рецептұра құрастыру барысында 50/50 үйрек еті және сайғақ еті қолданылды. Салыстыру үшін шұжықты жасанды және табиғи қаптамалар қолданылды.

Кесте 1 – Үйрек етінен ысталған шұжық әзірлеу рецептурасы

Шикізат	Үлгі
Үйрек еті, г	500
Сайғақ еті, г	500
Ас тұзы, г	10
Натрий нитриті, г	10
Кептірілген сарымсақ, г	2
Чили, г	2
Корица, г	1
Ұсақталған қара бұрыш, г	1

Технологиялық процесс ет өнеркәсібі кәсіпорындары үшін санитариялық қағидаларды, сойылған жануарларды ветеринариялық тексеру және ет пен ет өнімдеріне ветеринариялық-санитариялық сараптама қағидаларын, белгіленген тәртіппен және осы технологиялық нұсқаулық бойынша бекітілген ет және құс өңдеу өнеркәсібі кәсіпорындарында жуу және профилактикалық дезинфекциялау жөніндегі нұсқаулықтарды сақтай отырып жүзеге асырылуға тиіс. Ысталған шұжық өндірісі келесі схема бойынша жүзеге асырылады:

Мұздатылған шикізат технологиялық нұсқаулыққа сәйкес ерітіледі. Ерігеннен кейін сүйектегі жамбас бұлшықетінің қалыңдығындағы ет температурасы 1°C тан төмен болмауы керек. Ұшадан төмендегі суретке сәйкес құйрығы, артқы аяқтары, қанаттары бөлініп тасталады.



Сурет 1. Ұйрек ұшасын бөлшектеу.

Ұшалар мен олардың бөлшектері мынадай талаптарға сәйкес болуы тиіс:

- жақсы қансызданған, таза;
- бөгде қосылуларсыз (мысалы, шыны, резеңке, металл);
- бөтен иіссіз;
- нәжістік ластанусыз;
- көзге көрінетін ұйыған қан жоқ;
- ішек пен клоак, кеңірдек, өңеш, жетілген репродуктивті органдар қалдықтарынсыз;
- қауырсын, мамық, кеңдір, балауыз қалдықтарынсыз;
- тоңазытқыш күйіктерсіз, өт төгілген дақтарсыз.

Ұшаны сүйектен ажырату және жіліктеу белгіленген тәртіппен технологиялық нұсқаулыққа сәйкес жүргізіледі. Ұшаны сүйектен ажыратқаннан кейін ет үлкен кесектерге кесіледі. Рецепттураға сәйкес 500гр ұйрек еті және 500 гр сайғақ еті өлшеніп дайындалады.



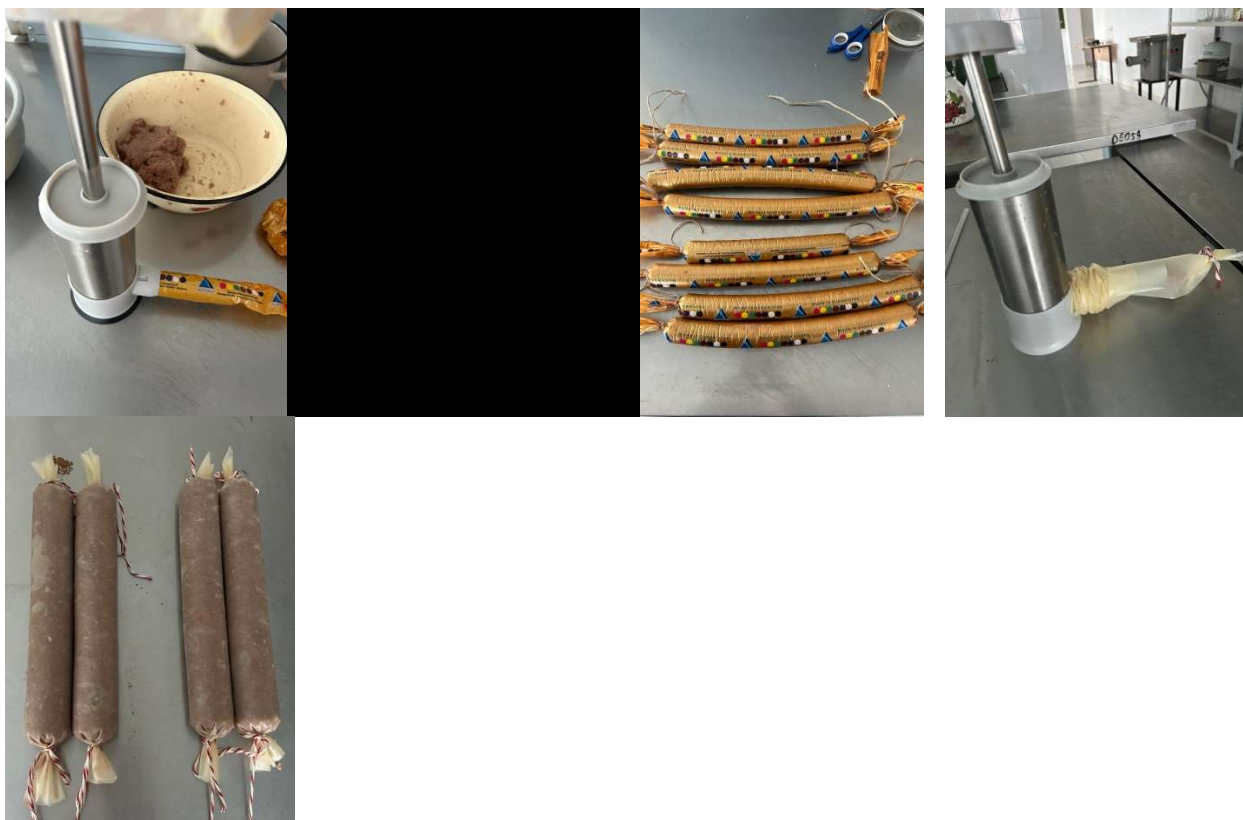
Сурет 2. Шикізатты дайындау

Содан кейін шикізатқа дәмдеуіштер қосылып тұздалынады. Тұздау-ет рецептке байланысты тұз, дәмдеуіштер мен дәмдеуіштермен толтырылады. Біртекті масса болу үшін тұздалған етті күттерге ұсақтауға жібереміз .



Сурет 3. Күттерде ұсақтау

Дайын болған фаршты шприцтің көмегін табиғи немесе жасанды қаптамаға толтырамыз.



Сурет 4. Шприцтеу

Толтырылған және байланған шұжықтарды құрғақ, салқын бөлмеде сақталады, оларды арнайы жақтауларға іліп қойып 12-24 сағатқа тынықтырады.

Тынықтырылған шұжықтарды арнайы ыстау құрылғысына 90°C - 100°C- та 40-50 минутқа ыстауға жібереді.



Сурет 5. Ыстау

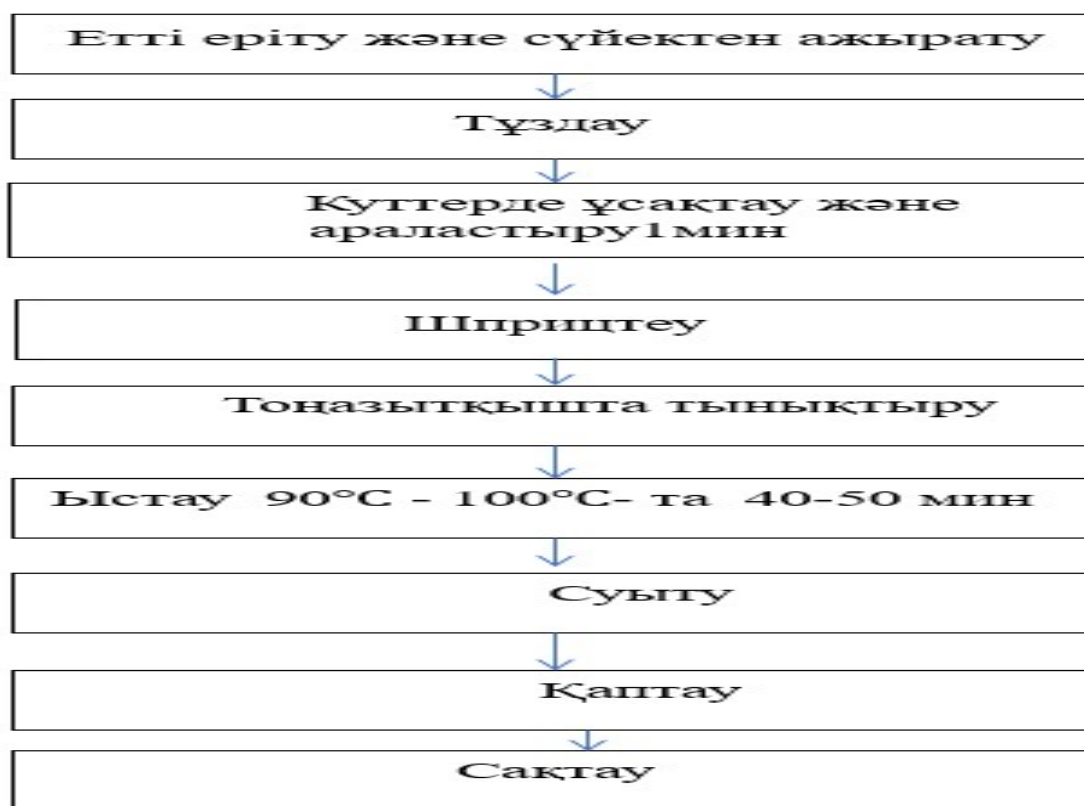
Шұжықтың басқа түрлерінен айырмашылығы, ысталған шұжықтардың құрамында белоктар мен майлар көп, олар ерекше дайындау технологиясы есебінен сақталады. Ылғалдың 22-38% және тұздың 5-6% концентрациясының төмен болуына байланысты мұндай бұйымдардың ұзақ жарамдылық мерзімі бар.

Ыстаудан кейін шұжықтар суытып, дайын өнімге дегустация жасалды.



Сурет 6. Дайын өнім

Тәжірбие соңында табиғи қаптамаға толтырылған шұжықтардың ыстауға қолайлылығы анықталды. Сыртқы сипаты жағынан табиғи қаптамаға қапталған шұжық басымдылық көрсетті.



Сызба 1. Ысталған шұжық өндірісінің технологиялық сызбасы

3. Өнімнің сапасын бағалау

Зертханалық жағдайда дайындалған үйрек етінен ысталған шұжықтың сапалық көрсеткіштері органолептикалық бағалау арқылы анықталды. Сараптамалық комиссия құрамында 5 тәжірибелі дегустациялаушы болды. Бағалау «өте жақсы», «жақсы», «қанағаттанарлық», «нашар» шкаласы бойынша жүргізілді.

Сынама нәтижелері көрсеткендей, үйрек етінен дайындалған шұжық консистенциясы мен ішкі құрылымы (кескен кездегі түрі) бойынша жоғары балл алды. Ет массасының біркелкілігі, тартылған еттің тығыз орналасуы және ашық-қызыл реңк дайын өнімнің сапалық көрсеткіштерге сәйкес келетінін көрсетті. Сонымен қатар, сыртқы түрі бойынша көрсеткіштер

аздап төмен баға алды. Бұл дайын өнімнің беткі қабатын қалыптастыру процесін жетілдіру қажеттілігін айқындайды (мысалы, қабықша түрін, тығындау тығыздығын оңтайландыру).

Кесте 2 – Үйрек етінен ысталған шұжыққа қойылатын органолептикалық талаптар (шикі ысталған шұжық үлгісі бойынша)

Көрсеткіш атауы	Сипаттамасы
Сыртқы түрі	Таза, құрғақ беті бар, дақтары жоқ, слиптері жоқ, қабығы зақымданбаған, тартылған еттің ағып шығуы байқалмайды
Консистенциясы	Тығыз, серпімді
Кескен кездегі түрі	Біркелкі араласқан тартылған ет, қою қызыл түсті, сұр дақтарсыз, құрылымы тығыз, бос кеңістіктер жоқ
Иісі және дәмі	Шұжық өнімдеріне тән, дәмдеуіштердің жеңіл реңкімен, бөтен иіс пен дәмсіз
Пішіні және өлшемі	Сопақ немесе цилиндр тәрізді, қабыққа сәйкес біртекті формада

Жалпы алғанда, алынған нәтижелер үйрек етінен дайындалған ысталған шұжықтың **органолептикалық сапасы нормативтік талаптарға толық сәйкес келетінін** көрсетті. Сонымен қатар, өнімнің сыртқы түрін жақсарту мақсатында **қаптама түрін таңдау, тығындау параметрлері және беткі қабатты қалыптастыру әдістері** бойынша қосымша зерттеулер жүргізу ұсынылады.

Қорытынды. Үйрек етін шұжық өндірісінде пайдалану оның құндылығын арттырумен қатар, ет өнімдерінің ассортиментін кеңейтуге мүмкіндік береді. Зерттеу нәтижесінде дайындалған ысталған шұжықтың сапасы жоғары екені дәлелденді және технологиялық процесс өндірістік ауқымда қолдануға лайықты деп танылды. Болашақта өнімнің сақтау мерзімін ұзарту мен сыртқы түрін жақсартуға бағытталған қосымша жұмыстар жүргізу ұсынылады.

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Резюме

В статье рассматривается технология производства сырокопчёной колбасы из утиного мяса. Исследование проводилось в лаборатории Западно-Казахстанского аграрно-технического университета имени Жангир хана. В рецептуру включено мясо утки породы Медео и говядина в пропорции 50/50. Дополнительные компоненты: нитрит натрия, поваренная соль, сушёный чеснок, перец чили, чёрный перец, корица. Технологические этапы полностью описаны. Готовый продукт продемонстрировал высокие органолептические характеристики. Полученные данные подтверждают целесообразность использования утиного мяса для расширения ассортимента мясных изделий.

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Analysis of Digital Marketing Activities of SMEs in the European Union

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Abstract: To develop effectively and efficiently, SMEs in the European Union must adopt modern communication tools for interactions between businesses and workers, as well as between businesses and customers. In this context, digital marketing plays a crucial role in enhancing the competitiveness and visibility of small and medium-sized enterprises (SMEs). This article analyzes the role of digital marketing in SME operations within the EU, focusing on how it facilitates communication, engagement, and the promotion of products and services. The paper highlights that digital marketing tools, such as social media, email campaigns, and SEO, are essential for building brand awareness, increasing customer loyalty, and expanding market reach. Furthermore, the article discusses how SMEs can leverage digital marketing strategies to target specific audiences and improve their marketing effectiveness. Finally, the importance of digital marketing in strengthening the competitive position of SMEs in the EU market is emphasized, demonstrating how it enables businesses to adapt to market changes and meet customer expectations.

Keywords: SMEs, digital marketing, communication, branding, customer engagement, EU market

Small and medium-sized enterprises (SMEs) play a key role in the economic development of the European Union (EU). Their contribution to overall economic activity, innovation and job creation is significant. SMEs are generally defined as enterprises with fewer than 250 employees and an annual turnover below a certain threshold. [3] However, they face a number of challenges, including lack of funding, difficulties in adopting digital technologies and limited resources. These challenges hinder the growth and development of SMEs and limit their competitiveness. [7] Digital transformation, in particular digital marketing tools, help SMEs address these challenges and strengthen their market positions. SMEs in the European Union are using social media and other digital tools to strengthen customer relationships and enter new markets. [10] The use of digital tools also helps to increase customer loyalty, build brand identity and expand their customer base. [5] Thus, social media marketing (SMM) is one of the main tools that increase the competitiveness of SMEs and make their activities more agile. [1]

The change in customer behavior and business models through social media and the Internet allows SMEs to collect customer data using digital tools and provide services with a more personalized approach. At the same time, these platforms allow them to directly connect with customers and obtain their opinions. [12] These digital technologies allow SMEs to adapt to market changes, build closer relationships with customers and meet the demands of the modern era. This article will analyze the digital marketing activities of SMEs in the European Union and the role of social media marketing.

The contribution of SMEs to the economy in the European Union and the digitalisation of SMEs after the pandemic.

Small and medium-sized businesses are the backbone of the economy in the European Union. SMEs, in general, play an important role in the EU employment market and play a significant role in the formation of GDP. According to EU statistics for 2020, small and medium-sized businesses account for around 99% of the economy and provide more than 70% of total employment.[3] Given the great importance of SMEs for economic development and social well-being, increasing their competitiveness and sustainable development is a priority area in the economic policies of the European Union. [8]

In recent years, digital transformation has become a key element of the European Union's economic development policy. Within the framework of the Digital Strategy for Europe (Digital Compass), the EU aims to achieve major advances in the digital field by 2030. The main objective of this strategy is to accelerate the EU's digital transformation, develop digital infrastructure and increase the efficiency of the digital economy within the EU. [3]

The increased use of digital tools for SMEs helps to strengthen their market position and reduce operational costs. The EU also provides financial and technological support to small and medium-sized businesses to undertake their digital transformation. [7]

The COVID-19 pandemic has changed business activities worldwide and has increased the importance of digital transformation. SMEs in the European Union have started to switch to digital tools and online sales channels due to the impact of the pandemic. At the beginning of the pandemic, many SMEs faced difficulties in switching from traditional business models to digital ones, but the pace of this process has increased during the pandemic. The EU has offered various programmes and financial instruments to support the digitalisation of SMEs, especially in the post-pandemic period. [3] This digital transition has enabled SMEs to be more agile in the market and to respond quickly to customer demands. [13] As a result, the pandemic accelerated the digital transformation of SMEs and further strengthened their role in the economy.

Digital Marketing Activities Implemented by SMEs in the EU.

Small and medium-sized businesses in the European Union are increasing their competitiveness and expanding their customer base by implementing digital marketing strategies. The main marketing tools that SMEs use to develop their digital activities include SEO, social media marketing, e-commerce, email marketing and mobile marketing. These tools help SMEs to effectively connect with customers and expand their online presence in today's market conditions.

SEO and Content Marketing: Search engine optimization (SEO) is a key tool for SMEs to increase their online visibility and reach customers more easily. SMEs in the European Union countries are implementing SEO strategies to improve the ranking of their websites and make them easier for customers to find. SEO is not only about achieving high results in search engines, but also requires that the site be user-friendly and create relevant content. This content is structured according to the interests of customers and provides information that meets their needs. The combination of SEO and content marketing allows SMEs to position themselves more effectively in the digital market. [5]

Social Media Marketing: In Europe, social media marketing is one of the most widely used tools by SMEs to increase their customer base. Social media platforms such as Facebook, Instagram and LinkedIn allow SMEs to connect directly with customers, provide information about products and services and collect customer reviews. Advertising on these platforms helps SMEs reach a wider audience and increase brand awareness. The main advantage of social media marketing is customer proximity and personalization of the customer experience. SMEs can better understand their needs by interacting with customers through social media and provide tailored offers. [11]

E-commerce Platforms: E-commerce is a key tool that allows SMEs in the European Union to expand their activities in international markets. Operating on Amazon Europe, Zalando and other large digital platforms allows SMEs to present their products and services not only in local but also in global markets. Participation in e-commerce platforms allows SMEs to reach more customers and offer their products in a wider geographical area. It also accelerates the digital transformation process of SMEs and makes their business activities more agile, especially in the era of increasing popularity of online shopping. [1]

Email Marketing: Email marketing is one of the most effective tools that businesses use in the digital environment to manage customer relationships and provide personalized experiences. In the European Union, SMEs widely benefit from targeted email campaigns to better understand their customer base and increase customer loyalty by providing personalized experiences. This method allows for personal connections with potential customers and existing customers, with messages tailored to customer behavior and interests. The main advantage of email marketing is to attract customers' attention by providing them with relevant offers and encourage their loyalty. [9] Proper management of email campaigns makes businesses' marketing activities more sophisticated and effective, especially in European markets, acting as a means of strengthening customer relationships.

This approach also helps personalize the customer experience, as customers are exposed to content that is relevant to their interests rather than just receiving generic advertising messages. As a result, SMEs not only get to know their customer base better, but also develop customer relationships in a more long-term and effective way.

Mobile Marketing: Mobile marketing is a very important strategy for small and medium-sized businesses, especially in the European Union, as mobile technologies create a wide range of opportunities to connect with and serve customers. The implementation of mobile marketing allows SMEs to reach a wider customer base and engage them even while on the move. With the rapid growth of mobile device usage in European countries, SMEs are offering customers a more convenient and profitable shopping experience through mobile-friendly websites and applications. The main goal of mobile marketing is to present companies' services and products to customers via mobile devices, as well as to increase their interest in the product or service by attracting their attention.

SMEs implementing this strategy, especially through mobile apps and websites, can simplify the customer shopping experience and ensure better customer satisfaction. The effectiveness of mobile marketing is also increased by sending advertising messages to customers in real time, which strengthens customer loyalty and brand trust. With consumers in Europe using mobile devices, this method is becoming an effective means of reaching more potential customers and attracting customers. [2]

Advantages and challenges of using digital marketing by SMEs in the EU.

Advantages.

Cost-Effectiveness: Digital marketing requires less financial expenditure than traditional marketing methods. This allows SMEs to achieve more effective results with a limited budget. In particular, advertising campaigns carried out through social media and search engines allow companies to reach a wide audience without the need for large investments. [2]

Expanding Market Reach: Digital marketing tools allow SMEs to expand their customer base not only on the local market, but also on a regional and global level. The European Union's digital development policies have made it easier for SMEs to enter international markets. They have the opportunity to serve global customer segments through digital channels such as e-commerce platforms and social media. [3]

Data-Driven Decision Making: Digital marketing enables more effective decision-making through the collection and analysis of data. Using analytical tools, it is possible to measure the effectiveness of marketing strategies and optimize results. This allows SMEs to properly track their return on investment (ROI) and make more optimal use of marketing resources. [6]

Challenges

Regulatory Barriers: The legal framework governing digital marketing activities in the EU poses significant challenges, particularly with regard to the General Data Protection Regulation (GDPR). For SMEs, this requires additional resources and training, not only in terms of data protection, but also in terms of compliance with regulations on digital advertising and the use of personal data. [4] These regulations can make digital marketing activities for SMEs more complex and costly.

Limited Resources: One of the biggest challenges SMEs face in implementing digital marketing is financial and technological constraints. Effective use of digital tools requires initial investment and technological infrastructure. Also, while digital transformation is generally more affordable for large and financially capable enterprises, it poses barriers for small and medium-sized enterprises. [11]

Skills Gap: It is well known that SMEs face a shortage of specialists in the field of digital marketing. Modern marketing activities require technical knowledge and detailed knowledge of digital tools. In addition, SMEs have difficulty finding employees with sufficient training in this field, which limits the effectiveness of digital marketing. [10]

The role of the European Union in the digitalisation of SMEs

Policy Support: The European Union (EU) has implemented a number of initiatives and programmes to support the digitalisation of SMEs. For example, the EU4 Digital programme provides financial and technical support to SMEs to adapt to technological innovations and use digital tools more effectively in order to accelerate digital development in EU countries. This programme is an important tool for improving digital skills and expanding online services, especially in developing regions. In addition, the Horizon Europe fund provides financial resources to SMEs across the EU to support digital innovation and research activities, which will enable them to improve their digital skills and adopt new technologies. [3]

Digital Skills Development: In order for SMEs to be successful in their digitalisation, it is essential that employees and managers have digital skills. The EU aims to improve the digital skills of SME managers and employees through various training and mentoring programmes. These trainings help employees gain experience in areas such as digital marketing, e-commerce, and social media use. The EU is also working with local educational institutions and business centres to help SMEs overcome the challenges they face in their digital transformation. [3]

Improving Infrastructure: The EU is supporting the digital transformation of SMEs, particularly in rural and sparsely populated areas, by promoting broadband internet. These initiatives enable SMEs to reach a wider customer base, offer online services and optimise their digital marketing activities. Improving internet access in rural areas is crucial for SMEs to compete in the global market, as companies in these areas often face difficulties in adapting to the digital economy. EU-implemented projects such as the Connecting Europe Facility aim to accelerate the development of digital infrastructure in these areas. [3]

Conclusions and Recommendations.

For SMEs: Developing effective strategies is essential for the successful implementation of the digital transformation of SMEs. First of all, it is recommended to invest in training and professional development programmes to strengthen SMEs' digital marketing activities. These trainings will increase the knowledge and skills of employees in the use of digital tools, strengthening their competitiveness. In addition, SMEs should optimally benefit from various

digital marketing tools, such as SEO, social media platforms and e-commerce tools. Cooperation with digital agencies will help to increase the effectiveness of marketing strategies by ensuring professional support.

For policymakers: Policymakers should implement various initiatives to support the digital transformation of SMEs and promote their development. To achieve this, the development of digital infrastructure, especially in rural and sparsely populated areas, is essential. In addition, policymakers should provide subsidies and financial support for SMEs, which should enable them to expand their digital marketing activities. At the same time, legal difficulties faced by SMEs operating in the EU should be eliminated and regulatory frameworks should be simplified.

Summary of Findings: Our research shows that digital marketing activities of SMEs in the European Union are an important tool for developing their economic activities and increasing their market share. The use of digital tools and platforms has enabled SMEs to reach a wider customer base and develop customer relationships. At the same time, digital marketing applications have enabled SMEs to develop more flexible and effective business strategies, increasing their competitiveness.

Future Directions: The role of new technologies and digital trends in the digitalization process of SMEs is expected to increase in the future. New digital tools, in particular artificial intelligence (AI), data analytics and automated systems, will further develop the marketing strategies of SMEs and accelerate this transformation. In addition, the application of AI and other digital technologies will allow SMEs to target more accurately and build effective customer relationships. In the future, it is also expected that policies and relevant incentives will be further strengthened for the sustainable development of digital marketing.

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The Explainable AI

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1. Introduction

Artificial Intelligence (AI) systems are increasingly integral to decision-making in critical domains such as healthcare, finance, transportation, and criminal justice. While these systems often achieve remarkable predictive accuracy—especially when powered by complex models like deep neural networks—they frequently lack interpretability. This opacity presents a fundamental challenge: when AI-driven decisions significantly impact human lives, stakeholders must understand not just what decisions were made, but why and how they were reached.

This challenge has given rise to the field of **Explainable Artificial Intelligence (XAI)**. XAI aims to bridge the gap between the powerful but opaque "black-box" models and the need for transparency, trust, and accountability. It seeks to render AI systems more interpretable without significantly compromising performance, thereby enabling users to evaluate, trust, and act upon AI-generated outputs with greater confidence.

In this article, we present a structured overview of the current landscape of XAI, covering foundational principles, categorization of explanation techniques, key tools and methods, and real-world applications. Special emphasis is placed on the trade-offs between accuracy and interpretability, the varying needs of different stakeholders, and the ethical implications of opaque AI systems. We conclude by identifying ongoing challenges in the field and outlining directions for future research and development.

By offering a clear, practical, and comprehensive synthesis of the state of the art in XAI, this article serves as a reference for both technical practitioners and interdisciplinary stakeholders navigating the growing demand for transparent and responsible AI.

2. Foundations of Explainability in AI

The demand for transparency in artificial intelligence arises from the growing integration of machine learning systems into critical decision-making processes. While AI systems have demonstrated impressive performance across various domains, their inner workings often remain opaque—particularly in the case of complex models like deep neural networks and ensemble learning methods. This opacity has led to what is widely referred to as the **black box problem**.

2.1 The Black Box Problem

The black box problem refers to the lack of transparency in many high-performing machine learning models. In traditional statistical models such as linear regression or decision trees, it is relatively straightforward to understand how input variables influence the output. However, in modern AI models—especially those based on deep learning—this interpretability is lost.

These models often involve millions of parameters and multiple layers of abstraction. For instance, convolutional neural networks (CNNs) used in image recognition or transformer architectures in natural language processing operate on such a high-dimensional and non-linear space that tracing the contribution of each input feature becomes infeasible. The outputs may be accurate, but the logic behind them is difficult to decipher, even for experts.

This complexity presents practical risks. When users, auditors, or regulators cannot comprehend how a model reaches its conclusions, it becomes difficult to detect biases, validate correctness, or establish accountability. The inability to interrogate model behavior undermines trust and raises ethical, legal, and operational concerns.

Real-world examples of the black box problem are numerous. In healthcare, models may recommend treatment plans without offering clinicians insight into the reasoning process. In finance, customers may be denied loans without understanding the decision logic. In criminal

justice, opaque risk assessment tools have been shown to reinforce societal biases. In each case, the lack of explainability limits the system's reliability and erodes user trust.

As AI continues to advance, solving the black box problem has become a central challenge. Explainable AI (XAI) seeks to address this issue by developing techniques that make complex models more understandable, whether by using inherently interpretable models or by applying post-hoc explanations to black-box systems. In the following sections, we explore these approaches in detail and assess how they contribute to building trustworthy and transparent AI systems.

2.2 Interpretability vs. Explainability

In the context of artificial intelligence, the terms *interpretability* and *explainability* are often used interchangeably, but they denote distinct concepts that are critical to understanding and designing transparent AI systems.

Interpretability refers to the degree to which a human can understand the internal mechanics of a machine learning model. In other words, it concerns whether the model's decision-making process is inherently transparent. Interpretable models, such as decision trees, linear regression, or rule-based systems, allow stakeholders to trace the reasoning behind a prediction by examining the model's structure and parameters. For example, a decision tree can be followed node by node to understand exactly how a particular input leads to a specific output.

Explainability, on the other hand, focuses on the ability to describe or justify the decisions made by a model—especially when the model itself is complex or opaque. Explainability becomes essential when dealing with "black-box" models like neural networks or ensemble methods, which may achieve high accuracy but do not readily reveal how decisions are made. In such cases, **post-hoc explanation techniques** are employed to approximate and communicate the rationale behind a prediction. These include methods such as SHAP (SHapley Additive exPlanations), LIME (Local Interpretable Model-agnostic Explanations), and counterfactual reasoning.

The distinction is crucial. While interpretability is a property of the model itself, explainability is often added after the fact through external tools or analyses. Interpretability allows us to directly understand a model's behavior, whereas explainability helps us make sense of models that we cannot fully open or inspect.

Each approach has its strengths and limitations. Interpretable models are typically simpler and offer greater transparency, but they may lack the expressive power needed for complex, high-dimensional problems. Conversely, black-box models often deliver superior predictive performance but require explainability methods to make them accessible and trustworthy to users.

Importantly, the choice between interpretability and explainability should be informed by the context of application. In high-stakes domains—such as healthcare, finance, or criminal justice—where accountability and fairness are paramount, the need for human-understandable logic may outweigh marginal gains in accuracy. In other scenarios, explainability methods may suffice, provided they offer reliable and comprehensible insights into the model's behavior.

In practice, many AI systems now incorporate both paradigms: leveraging high-performing black-box models while using explainability techniques to enhance their transparency for stakeholders. This dual strategy reflects a growing recognition that trust in AI depends not only on performance but also on the ability to understand and challenge its decisions.

2.3 Stakeholders and the Value of Explanation

One of the defining challenges of Explainable AI (XAI) lies in its audience: explanations are not created in a vacuum but are meant to be consumed and acted upon by various stakeholders, each with different backgrounds, objectives, and levels of technical expertise. For XAI to be effective, it must recognize and respond to this diversity—offering explanations that are not only accurate but also appropriate in form, language, and detail.

Developers are primarily concerned with debugging, validating, and improving model performance. For them, explanations must provide insights into the internal logic of the system—

such as feature attributions, error patterns, or training behavior—that can guide model refinement and optimization. Explanations at this level are typically technical and quantitative.

End-users, on the other hand, are often laypersons interacting with AI systems through interfaces—such as recommendation engines, loan applications, or automated diagnosis tools. These users may not understand the technical underpinnings of AI and instead require clear, concise explanations that are understandable and actionable. For instance, a customer denied a credit card may not benefit from an explanation referencing feature weights but would value a plain-language summary of the decision and potential steps to improve their outcome.

Domain experts—such as doctors, lawyers, or financial analysts—occupy an intermediate position. They require more detailed and context-specific explanations than end-users but may not be machine learning specialists. For them, XAI should bridge the gap between technical logic and domain relevance. A radiologist, for example, might require an explanation highlighting which image regions influenced a diagnosis, paired with statistical confidence levels and references to known medical indicators.

Regulators and policymakers demand explanations to ensure that AI systems comply with ethical standards, legal requirements, and social values. Their concerns include fairness, accountability, and discrimination. Explanations for this group must demonstrate model transparency, document decision logic, and provide evidence of compliance with laws like the General Data Protection Regulation (GDPR) or industry-specific mandates.

Given these varied needs, a “one-size-fits-all” explanation approach is neither feasible nor effective. Instead, XAI should support **role-sensitive** and **context-aware** explanations, which adapt based on the stakeholder’s identity, goals, and decision context. For instance, an AI-driven loan approval system might generate one explanation for a customer, another for a loan officer, and a third for a compliance auditor—all derived from the same underlying model but tailored for relevance and clarity.

Additionally, effective explanations must balance **simplicity**, **relevance**, and **completeness**:

- **Simplicity** ensures that the explanation can be understood without overwhelming the user.
- **Relevance** ensures that the explanation focuses on what matters most to the decision or context.
- **Completeness** ensures that the explanation is sufficiently detailed to support meaningful interpretation or action.

Designing explanations that satisfy all three dimensions—while remaining faithful to the model—is a core challenge in XAI and an active area of research. Ultimately, the value of an explanation lies not only in what it reveals but in how well it serves its intended audience.

3. Taxonomy of XAI Techniques

Explainable AI techniques can be categorized along several dimensions, reflecting how, when, and for whom explanations are generated. One of the most fundamental distinctions is between **intrinsic** and **post-hoc** methods. This classification highlights whether explainability is built into the model from the outset or introduced after model training.

3.1 Intrinsic vs. Post-hoc Methods

Intrinsic methods refer to machine learning models that are inherently interpretable by their design. These models are constructed in such a way that their internal decision-making process is directly accessible and understandable to humans. Examples include:

- **Decision trees**, where predictions are made by following a transparent path of logical rules.
- **Linear regression**, where outputs are a weighted sum of input features.
- **Generalized Additive Models (GAMs)**, which model the effect of each feature separately and additively, allowing for visual interpretation of feature influence.

The primary advantage of intrinsic models lies in their **faithfulness**—the explanation reflects the actual computation performed by the model, not an approximation. Their **transparency** makes them particularly valuable in regulated domains, such as healthcare or finance, where decisions must be explainable and auditable.

However, these models often **lack the expressive power** of more complex architectures. In situations involving high-dimensional, non-linear, or unstructured data (such as images or text), intrinsic models may struggle to achieve acceptable predictive performance.

Post-hoc methods, in contrast, are applied after the model has already been trained—typically on a black-box model whose internal mechanics are not easily interpretable. These techniques aim to approximate or summarize the model’s decision-making behavior without altering the model itself. Common post-hoc methods include:

- **LIME (Local Interpretable Model-agnostic Explanations)**, which fits an interpretable model locally around a prediction.
- **SHAP (SHapley Additive exPlanations)**, which distributes the output prediction among input features based on principles from cooperative game theory.
- **Saliency maps and attention visualizations**, often used in deep learning to identify which parts of the input data most influenced the model’s output.

Post-hoc methods are highly **flexible**, as they can be applied to any model regardless of its architecture. This flexibility makes them indispensable when working with high-performing black-box models. However, a key drawback is their potential **lack of fidelity**: because explanations are approximations, they may not accurately reflect the model’s true reasoning.

The choice between intrinsic and post-hoc methods often involves a **trade-off** between interpretability and predictive performance. Intrinsic methods offer direct, faithful transparency but may underperform on complex tasks. Post-hoc methods enable the use of powerful models but introduce an additional layer of abstraction between the model’s logic and the explanation provided.

In practice, hybrid strategies are increasingly common: for example, using a black-box model for prediction and a simpler surrogate model for interpretability, or combining model-agnostic explanations with visualization tools to support human understanding.

Understanding the distinction between intrinsic and post-hoc approaches is essential for selecting appropriate XAI methods based on context, stakeholder needs, and regulatory constraints.

3.2 Global vs. Local Interpretability

Another key dimension in the taxonomy of explainable AI techniques is the distinction between **global** and **local** interpretability. This classification refers to the scope of the explanation—whether the goal is to understand the model’s overall behavior or to clarify a specific decision.

Global interpretability seeks to provide insights into how a model behaves across the entire input space. This type of explanation answers questions such as: *Which features are most important overall? How does the model’s decision boundary look in general? What patterns does the model rely on consistently?* Global interpretability is especially valuable for model developers, auditors, and policymakers who need to evaluate fairness, robustness, and compliance at the system level.

Techniques used for global interpretability include:

- **Feature importance analysis**, which ranks input features based on their overall contribution to the model’s predictions.
- **Partial Dependence Plots (PDPs)**, which visualize the marginal effect of a feature on the predicted outcome.
- **Surrogate models**, which approximate the behavior of a complex model with a simpler, interpretable one trained on the same dataset.

These methods provide a holistic view, but may abstract away specific behaviors that occur in localized regions of the input space. As such, they may not capture nuances or anomalies in individual predictions.

Local interpretability, by contrast, focuses on understanding the model's behavior in the neighborhood of a particular data point. It answers questions like: *Why did the model make this prediction for this instance? Which input features had the most influence on this specific output?* This kind of explanation is crucial for end-users, domain experts, and decision-makers who need to trust and verify individual model outputs in real time.

Popular local interpretability techniques include:

- **LIME**, which approximates the model locally using a simple, interpretable model.
- **SHAP**, which attributes contributions of input features for a single prediction based on game-theoretic principles.
- **Counterfactual explanations**, which show how a small change to an input would result in a different output.
- **Saliency maps**, commonly used in image classification tasks, which highlight regions of an image that most influenced the prediction.

Each approach has its strengths and limitations. Global interpretability offers system-wide transparency but may overlook case-specific logic. Local interpretability provides detailed, instance-level understanding, but often lacks generalizability. Moreover, local methods are typically approximate and depend on the choice of neighborhood and perturbation strategy, which can affect explanation quality and stability.

In many real-world systems, both forms of interpretability are needed. Global explanations support policy compliance, risk analysis, and model auditing, while local explanations support user interaction, trust calibration, and individualized accountability. Designing systems that support both levels of insight—seamlessly and coherently—is a critical goal in modern XAI research and deployment.

3.3 Model-Specific vs. Model-Agnostic Approaches

A further distinction within explainable AI methods lies between **model-specific** and **model-agnostic** approaches. This classification addresses the generality and flexibility of explanation techniques—specifically, whether they are designed for a particular class of models or can be universally applied across different architectures.

Model-specific methods are tailored to work with a particular type of machine learning model. These techniques take advantage of the internal structure and mathematical properties of the model to produce more accurate or meaningful explanations. Because they have access to the model's parameters, activations, and gradients, model-specific methods often offer high **fidelity**—that is, their explanations closely reflect the model's actual decision-making process.

Examples of model-specific techniques include:

- **Saliency maps** and **activation visualizations** in convolutional neural networks (CNNs), which highlight the areas of an image most influential in a classification decision.
- **Attention heatmaps** in transformer-based models used for natural language processing, which indicate which input tokens the model attended to while generating an output.
- **Feature importance scores** for decision trees and random forests, derived from measures like Gini impurity or information gain.
- **Weight visualization** in linear and logistic regression models, where coefficients directly reflect the influence of each input feature.

While model-specific methods can yield precise and insightful explanations, their applicability is limited. They are not transferable to other model types and may require specialized implementation for each algorithm, which can reduce flexibility in multi-model environments.

Model-agnostic methods, on the other hand, are designed to be independent of the underlying model architecture. These methods treat the model as a black box: they require only the ability to query the model with inputs and observe the outputs. Model-agnostic approaches are highly versatile and can be applied to any classifier or regressor, making them especially useful in complex pipelines involving multiple model types or proprietary algorithms.

Well-known model-agnostic techniques include:

- **LIME (Local Interpretable Model-agnostic Explanations)**, which approximates the black-box model locally using interpretable surrogate models such as linear classifiers or decision trees.
- **SHAP (SHapley Additive exPlanations)**, which attributes feature contributions based on a unified framework derived from cooperative game theory.
- **Permutation feature importance**, which assesses the effect of randomly shuffling a feature on the model's performance to evaluate its importance.

The strength of model-agnostic methods lies in their **flexibility** and **broad applicability**. However, because they do not have direct access to the model's internals, they often rely on approximations and may be more computationally intensive. Moreover, their fidelity can vary depending on how well the approximation captures the model's true behavior.

In practice, the choice between model-specific and model-agnostic methods depends on the **goals of explanation**, the **type of model in use**, and the **target audience**. In many real-world applications, both approaches are employed: model-specific methods provide deep technical insights for developers, while model-agnostic tools offer generalized, consistent explanations suitable for end-users, domain experts, or regulatory review.

4. Major XAI Techniques

Numerous techniques have been developed to provide explanations for machine learning models, ranging from simple visualizations to mathematically grounded attribution methods. Among these, two methods—**SHAP** and **LIME**—have emerged as foundational tools in the field of explainable AI. They are widely used due to their flexibility, model-agnostic design, and applicability to both research and practical deployment.

4.1 SHAP and LIME

SHAP (SHapley Additive exPlanations) is a model-agnostic explanation method rooted in cooperative game theory. It attributes a model's prediction to its input features by calculating the average marginal contribution of each feature across all possible combinations of inputs. In essence, SHAP answers the question: *How much did each feature contribute to the final prediction compared to a baseline or average prediction?*

The strength of SHAP lies in its theoretical guarantees. It satisfies key properties such as:

- **Local accuracy:** The sum of SHAP values across features equals the model's output.
- **Consistency:** If a feature has a greater impact in a new model, its SHAP value does not decrease.
- **Missingness:** Features that are not present have zero attribution.

These properties make SHAP a highly principled approach for feature attribution. Moreover, SHAP can be applied both globally (e.g., through summary plots showing overall feature importance across a dataset) and locally (e.g., explaining a single instance's prediction). Optimized variants such as TreeSHAP make it computationally feasible for tree-based models like XGBoost and LightGBM.

LIME (Local Interpretable Model-agnostic Explanations) takes a different approach. It generates explanations for individual predictions by approximating the complex model locally with a simpler, interpretable model—typically a sparse linear regression or decision tree. The process involves:

1. Generating synthetic data by perturbing the original input.
2. Getting predictions from the black-box model for the perturbed data.
3. Fitting a local surrogate model weighted by proximity to the original instance.
4. Extracting the surrogate model's coefficients to form an explanation.

LIME is especially useful for providing intuitive, instance-specific explanations. For example, it can show which words in a sentence most influenced a sentiment classifier's output or which features drove a particular loan rejection. Its visual and accessible outputs have made it popular in interactive applications.

Despite their strengths, both SHAP and LIME have limitations:

- SHAP, while theoretically grounded, can be computationally expensive, particularly with large datasets or complex models.
- LIME introduces randomness in sampling, which can result in instability across runs. Its local linear approximations may oversimplify the model's behavior in highly non-linear regions.

Nonetheless, SHAP and LIME have become standard components of modern XAI toolkits due to their general applicability, intuitive outputs, and community support. They are often used in combination with other tools and visualization techniques to provide layered, multidimensional explanations of model behavior.

4.2 Visual Explanation Methods

In domains such as computer vision and natural language processing (NLP), where models often operate on high-dimensional and unstructured data, visual explanation methods play a crucial role in interpreting predictions. These techniques aim to highlight which parts of an input—whether pixels in an image or tokens in a text—contributed most significantly to the model's decision. By providing intuitive, human-interpretable representations, visual methods help bridge the gap between complex model behavior and human understanding.

Saliency maps are one of the earliest and most widely used visual explanation tools, particularly for convolutional neural networks (CNNs). A saliency map highlights regions of an input image by computing the gradient of the output with respect to the input pixels. In other words, it measures how sensitive the model's prediction is to small changes in each pixel. The resulting heatmap visually indicates which areas the model "focused on" during classification. While simple to compute, saliency maps can be noisy and may not always provide reliable attributions, especially in deeper networks.

Activation maximization is another visual method that generates synthetic inputs that highly activate a particular neuron or output class. By iteratively adjusting input values to maximize activation, this technique reveals what a neuron has "learned" to detect. In CNNs, this can help visualize filters that detect edges, textures, or specific objects. Activation maximization offers insight into internal representations, although the results can sometimes be abstract or difficult to interpret without regularization.

Attention mechanisms, widely used in transformer-based architectures (such as BERT and Vision Transformers), inherently provide a form of interpretability. Attention weights indicate how much influence each input token or image patch has on the model's output. For instance, in a sentiment analysis task, attention visualizations can show which words the model concentrated on when assigning a label. In vision applications, attention maps can highlight object regions relevant to classification or localization tasks.

Additional visual explanation techniques include:

- **Grad-CAM (Gradient-weighted Class Activation Mapping)**, which extends saliency maps by incorporating feature maps from intermediate layers, producing smoother and more focused visualizations in CNNs.
- **Integrated Gradients**, which attribute predictions by averaging gradients along a path from a baseline input to the actual input, often visualized similarly to saliency maps.
- **Layer-wise Relevance Propagation (LRP)**, which propagates prediction scores backward through the network to assign relevance to each input feature.

These visual tools are particularly valuable in tasks where model decisions must be interpretable to non-technical stakeholders, such as radiologists evaluating AI-assisted diagnoses or content moderators reviewing flagged images. However, it is important to note that visualizations, while compelling, are still approximations. Their interpretation should be done cautiously, especially when used for decision-making in critical applications.

In sum, visual explanation methods enhance interpretability in AI systems that process perceptual data. They do so not by translating model logic into formal statements, but by aligning outputs with human perception—making them indispensable in explainable AI for vision and language tasks.

4.3 Counterfactual Explanations

Counterfactual explanations provide insights into model decisions by identifying the smallest or most plausible changes to input features that would have led to a different outcome. Instead of simply attributing responsibility for a decision, counterfactuals answer questions such as: *What would need to change for this decision to be different?* For example, in the context of a loan application, a counterfactual explanation might indicate: *“If your income had been \$5,000 higher and your credit utilization slightly lower, the loan would have been approved.”*

This form of explanation is inherently actionable. It not only clarifies why a decision was made but also offers guidance on how to achieve a desired outcome, making it particularly relevant in high-stakes, user-facing applications such as credit scoring, hiring, and academic admissions.

From a technical standpoint, generating counterfactuals involves searching the input space for instances that are close to the original data point but yield a different prediction from the model. The challenge lies in ensuring that the proposed changes are feasible and meaningful—for instance, suggesting changes to age or gender would be inappropriate or non-actionable, whereas recommending adjustments to spending habits or income levels may be acceptable.

Several criteria guide the quality of counterfactuals:

- **Proximity:** The change from the original input should be minimal.
- **Plausibility:** The altered inputs should remain realistic and consistent with domain knowledge.
- **Sparsity:** As few features as possible should change to maintain clarity.
- **Actionability:** Users should be able to act on the explanation.

Counterfactual explanations are not only valuable for individuals receiving model decisions but also for developers, who can use them to identify model vulnerabilities, biases, or inconsistencies. Moreover, they align well with ethical and regulatory goals, as they promote fairness and transparency by providing a direct link between input data and outcomes.

4.4 Tools and Frameworks

The growing demand for explainable AI has led to the development of several open-source tools and frameworks designed to support the implementation and evaluation of XAI techniques. These platforms help researchers, practitioners, and organizations integrate interpretability into their machine learning workflows efficiently and systematically.

Key tools include:

- **IBM AI Explainability 360 (AIX360):** A comprehensive Python toolkit that offers a wide range of algorithms for both pre-model and post-model interpretability. It includes implementations of LIME, SHAP, counterfactual explanations, and rule-based models, with a focus on fairness and compliance. AIX360 is accompanied by tutorials and documentation for integration into data science pipelines.
- **Microsoft InterpretML:** This library provides a unified interface for interpretable models (e.g., Explainable Boosting Machines) and explanation methods (e.g., SHAP, LIME). InterpretML emphasizes human-interpretable outputs and supports both global and local interpretability. It includes visual dashboards to help developers and stakeholders explore feature contributions and prediction behavior interactively.
- **Google What-If Tool (WIT):** Designed as a visual interface integrated with TensorBoard, WIT allows users to inspect model performance, test hypothetical scenarios, compare counterfactuals, and visualize fairness metrics—all without writing code. Its emphasis on interactivity and usability makes it suitable for users without deep technical expertise.

Other notable tools include:

- **Alibi Explain:** A Python library focused on explaining black-box models through techniques such as anchor explanations, counterfactuals, and integrated gradients.
- **SHAP and LIME libraries:** Standalone packages that are widely adopted and often integrated into model training and evaluation pipelines.

These tools not only democratize access to XAI methods but also promote transparency, accountability, and responsible AI development. They are essential components in building interpretable systems, enabling teams to move beyond theoretical models and into deployable, human-centered applications.

6. Conclusion and Future Directions

As artificial intelligence becomes increasingly embedded in systems that influence everyday life—from personalized healthcare to credit scoring, legal judgments, and autonomous decision-making—the demand for transparency and interpretability has never been more urgent. Explainable Artificial Intelligence (XAI) has emerged as a critical response to this demand, aiming to close the gap between complex model performance and human understanding.

This article has surveyed the foundational principles, taxonomies, techniques, and application areas of XAI. We distinguished between intrinsic and post-hoc methods, global and local interpretability, and model-specific versus model-agnostic approaches. We explored key techniques such as SHAP, LIME, saliency maps, and counterfactual explanations, alongside the growing ecosystem of open-source tools like IBM AI Explainability 360, Microsoft InterpretML, and Google's What-If Tool. The importance of human-centered design and stakeholder-sensitive explanations was emphasized, particularly in high-stakes domains where trust, accountability, and compliance are non-negotiable.

Despite this progress, several critical challenges remain. The absence of standardized evaluation criteria for explanation quality, the persistent trade-off between accuracy and interpretability, and the tension between technical capabilities and legal/ethical imperatives continue to shape the research agenda. Moreover, the effectiveness of explanations is not only a technical issue—it is a socio-technical one, deeply tied to who uses them, how they are presented, and for what purposes.

Future directions for XAI research and practice should include:

- **Development of reliable evaluation frameworks** that balance fidelity, simplicity, and user trust across different stakeholder groups.

- **Advancement in inherently interpretable model architectures** that do not sacrifice performance for transparency.
- **Greater integration of XAI with human-computer interaction (HCI)** principles to design intuitive, adaptive, and personalized explanations.
- **Increased interdisciplinary collaboration**, particularly involving ethicists, domain experts, regulators, and end-users in the co-design of explainable systems.
- **Adaptation to new frontiers**, such as explainability in federated learning, privacy-preserving AI, generative models, and multimodal systems.
- **Scalability and automation of explanation pipelines**, to support continuous learning systems and MLOps workflows.

Ultimately, the future of trustworthy and ethical AI depends not only on what models can do, but on how transparently and justifiably they do it. Explainability is essential for validating outcomes, uncovering biases, building user confidence, and ensuring that AI serves society in a responsible and equitable manner. The journey from opaque systems to comprehensible intelligence is not just a technical challenge—it is a societal mandate.

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Clustering Algorithms in Swarm-Based Robotic Systems

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Abstract

This article explores the application of clustering algorithms in swarm robotics, a field inspired by biological collectives and characterized by decentralized, self-organizing robotic behavior. Clustering, as a method of unsupervised learning, provides a foundation for grouping robots by behavior, location, or task allocation without central control. The article presents an overview of major clustering methods—such as K-Means, DBSCAN, OPTICS, and fuzzy clustering—and examines their adaptability for distributed, communication-constrained robotic systems. Practical applications in foraging, exploration, and task allocation are analyzed, along with associated challenges such as sensor noise, communication limitations, and dynamic environments. Performance metrics used to evaluate clustering effectiveness are also discussed. The study concludes that clustering algorithms significantly enhance coordination and task efficiency in swarm robotic systems and highlights the need for continued research to address real-world deployment issues and enable scalable, fault-tolerant solutions.

Keywords: swarm robotics, clustering algorithms, decentralized control, task allocation, foraging, unsupervised learning, performance evaluation

Introduction

Swarm robotics involves designing and controlling groups of autonomous robots that function without centralized control, drawing inspiration from collective behaviors in nature such as insect colonies and bird flocks.^[1] Key principles include **decentralization**, where no robot is in command; **self-organization**, where coordination emerges from local interactions; and **collective behavior**, where the group achieves capabilities beyond any individual. Other characteristics include robustness to robot failures, scalability with swarm size, and flexibility across tasks and environments. Swarms typically consist of many simple, often homogeneous, robots with increasing trends toward miniaturization.^[2]

These principles demand computational approaches that support distributed decision-making based on local information. Clustering algorithms naturally align with this need by enabling subgroup formation for spatial organization or task execution.^[3] For example, clustering supports task allocation by grouping robots based on proximity or capability.^[4] It also enhances foraging and exploration by segmenting environments among robot groups.^[5] Thus, clustering introduces structure into decentralized systems, enabling sophisticated collective behaviors otherwise difficult to achieve through individual actions.

This article explores the role of clustering algorithms in swarm robotics, covering core concepts, algorithm categories, adaptations, practical applications, current limitations, performance metrics, and real-world challenges.

Purpose

The primary purpose of this study is to explore and evaluate the application of clustering algorithms in swarm robotics systems. As swarm robotics draws inspiration from collective behaviors in nature, efficient organization and coordination of robotic agents are essential for scalability and adaptability in dynamic environments. This paper investigates how various clustering algorithms—both classical and bio-inspired—can enhance task allocation, communication efficiency, and spatial organization in robotic swarms. By analyzing their performance across simulated scenarios and real-world constraints, the study aims to identify suitable clustering strategies that improve overall system robustness, efficiency, and autonomy.

Relevance of the Problem and Related Studies

The rising complexity of multi-robot systems and their expanding applications across domains—ranging from environmental monitoring to military surveillance and industrial automation—have heightened the importance of efficient, scalable coordination mechanisms. Swarm robotics, inspired by collective behaviors observed in nature, offers a decentralized framework to manage large groups of simple agents collaboratively. However, as the number of agents increases and their tasks diversify, the challenge of maintaining system coherence and task efficiency becomes more pronounced.

Clustering algorithms emerge as a compelling solution to this challenge, enabling structured interactions, load balancing, and localized decision-making. In swarm robotics, clustering can facilitate functionalities such as spatial partitioning, role assignment, and fault tolerance, making it foundational for system robustness and scalability. Moreover, the dynamic and distributed nature of swarm environments requires clustering methods that are adaptive, communication-efficient, and capable of functioning under uncertainty and partial observability.

Previous research has highlighted the critical role of clustering in addressing these challenges. For instance, [6] explored the integration of K-Means clustering with self-organizing robotic agents to enhance area coverage and task allocation. Similarly, density-based methods like DBSCAN have been adapted for robot grouping in unstructured environments, where their noise-resilient properties improve swarm reliability. Bio-inspired approaches, such as those modeled on ant and bee colonies, also demonstrate clustering behaviors conducive to decentralized control and emergent intelligence [4], [15].

Despite these advances, gaps remain in applying clustering to swarm robotics effectively. Many conventional algorithms rely on assumptions—such as global knowledge or fixed data distributions—that do not hold in real-world swarm deployments. Moreover, the heterogeneity of robotic agents, communication delays, and environmental unpredictability pose additional constraints. As such, current studies are shifting toward lightweight, distributed clustering techniques that incorporate local interaction rules, adaptive thresholds, and evolutionary optimization to address these limitations^[13].

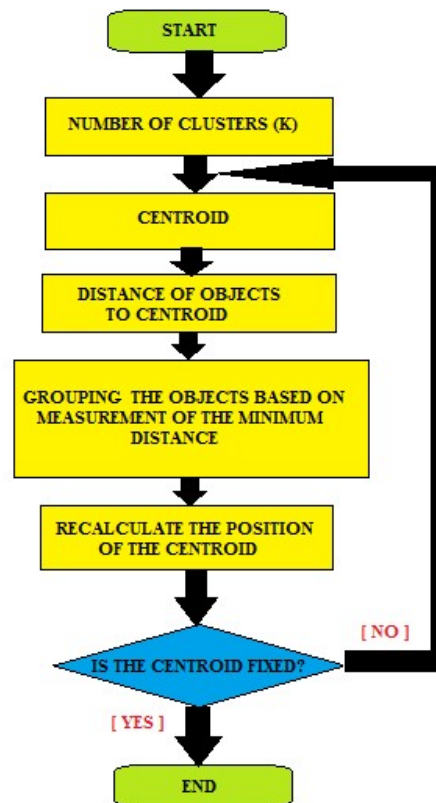
This paper contributes to this evolving field by reviewing, categorizing, and critically evaluating clustering algorithms in the context of swarm-based robotic systems. Through this analysis, we aim to clarify the suitability of various methods under practical constraints and to identify avenues for future research in decentralized robotic clustering.

Fundamentals of Clustering Algorithms

Clustering is an unsupervised machine learning technique used to group data points by similarity. The aim is to maximize intra-cluster similarity and minimize inter-cluster similarity. This method is widely applied in fields like machine learning, pattern recognition, and robotics. Its

relevance to swarm robotics lies in its ability to help autonomous robots self-organize into meaningful groups using local information, without predefined labels or centralized control.

Centroid-based clustering, including K-Means and K-Medoids, assigns data points to cluster centers—means in K-Means, and medoids (actual data points) in K-Medoids. K-Means requires specifying the number of clusters 'k' and iteratively updates cluster assignments and centroids until convergence. K-Medoids is more robust to outliers but computationally costlier. These algorithms assume centralized access to data and predefined k-values, limiting their direct application in decentralized swarms with dynamic group sizes.



Picture 1. Flow Chart of K-Means Clustering.

Hierarchical clustering builds a nested cluster structure either bottom-up (agglomerative) or top-down (divisive). While it reveals natural groupings and supports task hierarchies, it is computationally intensive for large swarms and lacks a definitive stopping point, which complicates decentralized deployment.

Density-based clustering, such as DBSCAN and OPTICS, groups densely packed points and identifies sparse outliers. These algorithms do not require specifying k and can discover arbitrarily shaped clusters. DBSCAN uses density reachability/connectivity, while OPTICS orders points to reveal cluster structure. Their reliance on local interactions and adaptability to dynamic densities align well with swarm systems, which benefit from identifying sparse areas (e.g., for exploration or fault detection).

Distribution-based clustering, like Gaussian Mixture Models (GMMs), models data as a combination of probabilistic distributions. These can handle varying cluster shapes and densities but are less suitable for swarm robotics due to difficulties in assuming distributions or estimating parameters in dynamic, decentralized settings.

Spectral and fuzzy clustering offer alternative paradigms. Spectral clustering uses similarity matrices and eigenvalue decomposition for dimensionality reduction, while fuzzy clustering (e.g., FCM) allows partial membership in multiple clusters. Spectral methods can model complex inter-

robot relationships, fuzzy clustering captures role overlap. However, both require careful consideration for decentralized implementation.

Adapting Clustering Algorithms for Swarm Robotic Systems

Traditional clustering algorithms often assume centralized data access, which conflicts with the decentralized, distributed nature of swarm robotics.^[6] Robots typically have limited computational resources, operate in dynamic environments, and face communication constraints like range, bandwidth, and noise.^[7] Moreover, the number of clusters may not be known in advance and can change over time.^[4] Security concerns, such as malicious robots disrupting clustering, also pose challenges. These conditions demand lightweight, adaptive, and local-information-based algorithms.

Researchers have addressed these issues through decentralized adaptations of existing methods. Distributed versions of K-Means and DBSCAN have been developed for local communication and distance sensing.^[6] Ant-inspired approaches, such as decentralized K-Means, help with resource aggregation, mimicking ant behavior.^[6] Gossip-based protocols enable estimation of cluster sizes, while consensus and load balancing techniques support spatial clustering through local communication.^[8] Some methods even eliminate communication altogether, relying on environmental cues (stigmergy) for clustering — as in “swarm synergy.”

The effectiveness of these adaptations depends heavily on communication and sensing capabilities. Swarms often use short-range technologies like Bluetooth or infrared. Indirect methods, like stigmergy using artificial pheromones, are also common. Sensor noise and limited perception can affect clustering accuracy. Thus, successful clustering in swarms must be robust to imperfect data and communication bottlenecks.

Categories of Clustering Algorithms in Swarm Robotics

Clustering in swarm robotics can be categorized based on grouping criteria: behavior, spatial position, or task assignment.

Behavior-Based Clustering: Robots are grouped by their roles or actions, such as exploration or foraging.^[9] This is often implemented using probabilistic finite state machines (PFSMs), which model behavior transitions. Evolutionary robotics can also be used to develop controllers that lead to emergent clustering. Threshold-based models, inspired by insect decision-making, help robots form behavior-driven clusters in response to stimuli.^[10] This approach supports task specialization and functional coordination.

Spatial Clustering: This groups robots based on physical proximity. Decentralized versions of K-Means and DBSCAN are commonly applied.^[6] Natural analogies, such as liquid settling, inspire communication-free clustering using virtual loads. Local consensus and load balancing can also yield spatial separation. Spatial clustering is key for forming localized robot groups in tasks requiring regional coordination.

Task-Based Clustering: Robots are clustered based on tasks they are or will be assigned. Useful in multi-robot task allocation (MRTA), this helps assign nearby robots to grouped tasks. Algorithms like enhanced dynamic distributed PSO (ED2PSO) can form task clusters dynamically.^[4] Variants like K-Means++ limit maximum clusters to match robot capacities, often followed by optimization-based task assignment. This facilitates parallel task execution and workload balancing in complex missions.

Applications of Clustering Algorithms in Swarm Robotics

Clustering enhances swarm performance in various domains, including foraging, exploration, and task allocation.

Foraging

In foraging tasks, clustering helps organize the swarm's search and collection strategy. [5] Fish-inspired algorithms using self-organizing maps (SOM) enable subgroup formation that mimics fish schools. Ant colony optimization (ACO) is also widely applied for path optimization. Clustering aids in reducing congestion around collection zones by enabling dynamic robot chain formations to transport resources efficiently. [11]

Exploration

For exploration, clustering helps divide unknown environments into manageable zones. Integrating clustering with random walk strategies improves area coverage. [12] Distributed clustering supports localization and mapping. Modified bee swarm optimization (BSO) enables efficient detection of clustered targets, with robots taking on scout or forager roles to balance exploration and exploitation. [13]

Task Allocation

Clustering supports solving multi-robot task allocation problems by grouping tasks spatially or functionally. Algorithms like PSO or genetic algorithms can dynamically identify task clusters and assign robots accordingly. K-Means++ helps match tasks to robots based on their processing capacity, improving efficiency and scalability. [1] By organizing robots and tasks into clusters, complex missions can be tackled in parallel with optimal resource use.

Challenges, Limitations, and Performance Evaluation of Clustering in Swarm Robotics

Clustering in real-world swarm robotics faces practical constraints that impact performance and reliability. Sensor noise can distort environmental or positional data, affecting proximity-based clustering. Variations in robot behavior due to hardware inconsistencies also pose challenges. [14] Algorithms must be robust to such imperfections through noise filtering or fault-tolerant strategies. [15]

Communication limitations—such as short range, low bandwidth, and signal loss—restrict the complexity of clustering algorithms and increase the risk of incoherent group formation. Decentralized algorithms relying on minimal data exchange are essential to maintain coherence.

Swarm environments are dynamic, with changing obstacles, tasks, or robot availability. Clustering strategies must adapt in real time to evolving conditions, especially for task allocation. Systems should also remain fault-tolerant—redistributing responsibilities when robots fail—to preserve swarm integrity.

Evaluating clustering effectiveness requires both cluster quality and task-specific performance metrics. Cluster cohesion and separation can be quantified using metrics like **Total Distance (TD)**, **Cluster Metrics (CM)**, and **Expected Cluster Size (ECS)**. Task performance is measured by completion time, resources gathered, and area coverage, especially in foraging or exploration. Per-robot efficiency is crucial for assessing scalability as swarm size grows.

Benchmarking across different clustering approaches and scenarios helps identify optimal methods. Such evaluations should consider swarm size, environmental complexity, and communication constraints to ensure real-world applicability.

Conclusion

Clustering algorithms represent a powerful toolset for organizing and coordinating the behavior of swarm robotic systems. Inspired by the principles of swarm intelligence and drawing from a rich history of research in computer science and data analysis, these algorithms have been adapted and applied across a diverse range of swarm robotics tasks, including foraging, exploration, and task allocation. While significant progress has been made, the unique challenges posed by real-world deployments, such as noisy sensor data, communication constraints, dynamic environments, and security concerns, necessitate ongoing research and innovation. Future directions in this field promise to yield more robust, adaptive, and intelligent clustering solutions through the integration of machine learning and

artificial intelligence, the development of specialized algorithms for heterogeneous swarms, and the exploration of novel applications in emerging domains. The establishment of standardization and benchmarking practices will be crucial for fostering continued progress and ensuring the reliable translation of these technologies from the laboratory to practical real-world impact.

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Comparative characteristics of methods of extraction of wild-growing raw materials of Northern Kazakhstan

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ABSTRACT

Plant polyphenols are an important group of bioactive compounds with pronounced antioxidant properties. They are able to neutralize free radicals, reduce oxidative stress, and prevent the development of chronic diseases, including cardiovascular, neurodegenerative, and inflammatory pathologies. The purpose of this study was to compare the effectiveness of various methods for extracting the total amount of phenolic compounds from three types of medicinal plants: sweet clover (*Melilotus officinalis*), St. John's wort (*Hypericum perforatum*) and purslane (*Portulaca oleracea*). Three methods were considered in the work: maceration, percolation (using the Soxlet apparatus) and extraction using curd whey as an environmentally friendly solvent. The parameters of temperature, hydraulic module and processing time were studied and optimized. Experimental data have shown that the highest content of phenolic compounds is achieved using the percolation method with 70% ethyl alcohol. Despite the use of curd whey provides a lower yield of polyphenols, this method has the advantages of environmental safety and the possibility of integration into non-alcoholic technologies. The results obtained can be used in the development of functional food products and natural antioxidant supplements with a high level of biological activity.

Key words: extraction, phenolic compounds, sweet clover, St. John's wort, purslane, curd whey

Introduction

The Republic of Kazakhstan has experience in the traditional use of wild plants in the manufacture of food and the treatment of various diseases. However, recently, the national strategy and concept for the development of the food industry have developed a focus on the use of local raw materials. Products made from local plant raw materials have the greatest therapeutic effect for people living in the relevant area. Such products increase the body's resistance to extreme situations, normalize mental and physical performance.

In recent years, with a significant reduction in the energy consumption of modern humans, there has been a tendency to consume refined foods, simple carbohydrates, salt, and animal fats. This leads to widespread deficiency of vitamins, minerals, and other vital ingredients. A deficiency of biologically active substances in human nutrition leads to a decrease in immunity, the occurrence of various diseases, and a decrease in mental and physical performance. Simultaneously with this shortage, the population of many regions of the Republic of Kazakhstan is experiencing constant environmental stress, high stress effects in everyday life and at work. Therefore, the task of restoring the capacity and operability of the human body's systems responsible for adapting to adverse environmental factors has recently become particularly urgent.

Currently, much attention is being paid to the development and production of combined food products for therapeutic and preventive purposes, having a balanced composition that helps strengthen the protective functions of the body.

Most modern research in the field of nutrition necessitates the creation of functional products that provide for the leveling of negative environmental conditions and meet the requirements of preventive nutrition for various age groups of the population.

In the production of functional food products, the use of wild-growing raw materials has broad prospects. Wild plants are of great value, primarily due to specific combinations of biologically and pharmacologically active components (micronutrients). Such substances are difficult to create artificially, they are well tolerated by the human body, have therapeutic and/or preventive effects. At the same time, from an ecological point of view, wild plants are more favorable sources of plant raw materials than traditionally used plants cultivated with fertilizers and pesticides.

There are few studies on the use of secondary metabolites in food production and their effect on finished products. In this regard, there is an insufficient amount of research implemented into the development of food technology with useful ingredients that have a positive effect on human health.

Biologically active natural products are secondary plant metabolites formed by various biological pathways during secondary metabolism. Plants are a rich source of chemical compounds such as flavonoids, alkaloids, phenols, steroids, tannins, glycosides, and essential oils. These compounds are found in various parts of plants, such as flowers, leaves, bark, roots, fruits, seeds, and fruitworts [1].

Extraction of soluble substances from various solids is the most common process in the production of concentrates, extracts, tinctures, powders, soft drinks and other products. The raw materials being extracted have a wide variety of shapes, sizes, mechanical, thermal, physical, and physico-chemical properties [2].

Currently, pharmaceutical technology uses traditional extraction methods such as maceration and percolation. However, many modern extraction methods without mechanical action are known, such as ultrasound extraction, fermentation extraction, countercurrent extraction, and supercritical fluid extraction [3].

In addition, more and more attention is being paid to "green" and sustainable extraction technologies using non-toxic solvents (for example, deep eutectic solvents - DES), aqueous solutions of naturally occurring acids, as well as biocatalysts. Such approaches correspond to the concept of sustainable development and can be adapted to the conditions of the food industry [4].

In modern practice, not only traditional methods such as maceration and percolation are used, but also innovative approaches including supercritical extraction, ultrasound exposure, microwave irradiation and the use of deep eutectic solvents [5,6,7,8].

These methods make it possible to increase the efficiency of extraction of target components and reduce the loss of biologically active substances.

There are reviews showing that ultrasonic and microwave extractions can reduce the processing time by several times while maintaining the antioxidant activity of polyphenols [9, 10].

Given the high metabolic activity of polyphenols, it is necessary to take into account their modifications when passing through the gastrointestinal tract [11].

Thus, an integrated approach to the extraction, analysis and application of polyphenols requires interdisciplinary efforts and the introduction of modern technological solutions [12].

Thus, the development and implementation of effective, environmentally friendly and resource-saving methods for extracting polyphenols from plant raw materials is an important task of modern food science and biotechnology.

Materials and methods of research. The research was conducted in the laboratory of the Kazakh Agrotechnical Research University named after S. Seifullin. The objects of the study were dried powders of medicinal plants: sweet clover (*Melilotus officinalis*), St. John's wort (*Hypericum perforatum*) and purslane (*Portulaca oleracea*).

Preparation of vegetable raw materials. The plants were dried convectively in a Sedona drying cabinet (Tribest, South Korea) at a temperature of 35-40 °C for 4 hours, after which they were ground into a powder in a Pulverisette 11 laboratory knife mill (Fritsch, Germany).

Extraction methods. The following methods were used to extract biologically active substances:

1. Maceration. Herbal powders (sweet clover, St. John's wort, purslane) were extracted with distilled water, 40% and 70% ethanol in a 1:10 ratio of raw materials to solvent, and infused for 24 hours at temperatures of 30-70 °C in a TS-1/20 SPU thermostat chamber (Russia). The obtained extracts were filtered through a Blue Ribbon filter and evaporated on a Stegler rotary evaporator (Russia). The content of dry substances and the total amount of phenolic compounds were measured.

2. Percolation (Soxlet apparatus). Circulating extraction using 70% ethanol at the boiling point of the solvent was studied. The variable parameters were the hydraulic module (1:5, 1:10, 1:20) and the exposure (60, 120, 240, 360 min). The effectiveness was assessed by the total content of phenolic compounds (mg/g) using photometry.

3 Extraction using curd whey retentate. Retentate obtained by ultrafiltration from curd whey was used. Curd whey retentate was obtained on the Viva Flow 50R ultrafiltration unit from Sartorius (Italy) at a temperature of 35 °C at a pressure of 2.5 Bar for 40-50 minutes. Extraction was carried out at a temperature of 40-100 °C for 30 minutes. It was found that the optimal temperature is 90 °C, while the content of phenolic compounds has reached: sweet clover – 17.7 mg/g, St. John's wort – 17.8 mg/g, purslane – 18.8 mg/g.

The results and their discussion. The purpose of these studies is to study various methods of extracting polyphenols from wild-growing raw materials in Northern Kazakhstan.

To extract BAS in the studied samples of St. John's wort, sweet clover and purslane, the following methods were used: maceration, percolation and extraction using curd whey obtained by ultrafiltration. At the beginning of the analysis, the herbs were dried convectively in a Sedona

drying cabinet (Tribest, South Korea) at a temperature of 35-40 °C for 4 hours, crushed in a Pulverisette 11 laboratory knife mill (Fritsch, Germany).

These powders of St. John's wort, purslane, and sweet clover herbs were further used to produce extracts. The extraction of herbs was carried out by 3 methods: maceration, percolation and extraction using whey obtained by ultrafiltration.

Extractants were examined and selected for maceration extraction. Distilled water, 40% ethyl alcohol, and 70% ethyl alcohol were used in the analysis. The samples in the form of herbal powder were mixed with extractants in a ratio of 1:10 and left for a day at different temperature conditions in the thermostat chamber TS-1/20 SPU (Russia). After infusion, these samples were filtered through a «Blue Ribbon» filter. Next, the obtained extracts were evaporated in a rotary evaporation unit Stegler (Russia). The obtained extracts were tested for the content of dry substances and the total amount of phenolic compounds.

The efficiency of extraction of secondary metabolites from plant raw materials was observed at temperatures from 30 °C to 70 °C, in increments of 10 degrees, the maceration duration for all temperature conditions was 24 hours. As a result of the conducted research, it was found that the optimal parameters of maceration extraction are the following parameters; extraction temperature 50 °C. The effectiveness of the chosen regime was determined by the total content of phenolic compounds and dry substances in plant raw materials. The research data is shown in the Table 1.

Table 1 - Changes in the content of phenolic compounds depending on temperature

Plant raw material	30 °C	50 °C	70 °C
Sweet clover (mg/g)	7,2	21,8	16,7
St. John's Wort (mg/g)	8,1	20,1	17,1
Portulaca (mg/g)	4,1	18,6	14,2

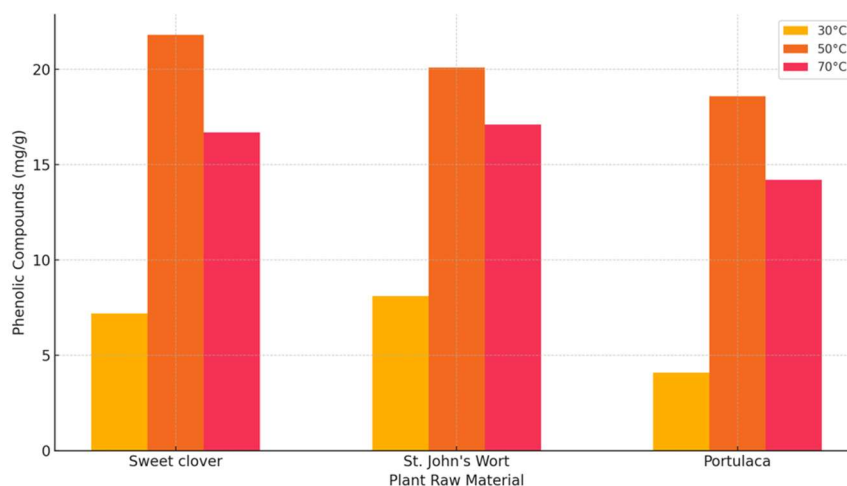


Figure 1 - Changes in the content of phenolic compounds depending on temperature

Next, these herbs were extracted using the percolation method in a Soxlet apparatus. This method is characterized by an increased diffusion rate compared to static extraction methods. A series of experiments were conducted using 70% ethyl alcohol as an extractant in a Soxlet apparatus, extraction was carried out at the boiling point of the solvent. The variable parameters were the hydraulic module (1:5, 1:10, 1:20) and exposure (60, 120, 240 and 360 min). Extraction of phenolic compounds from plant raw materials using 70% ethyl alcohol in a Soxlet apparatus showed that the maximum phenolic content is reached after 240-360 minutes of extraction. At

the same time, the content of phenolic substances varies from 27 to 30 mg/g, which indicates a high concentration of flavonoids and coumarins in plants (figure 2,3).

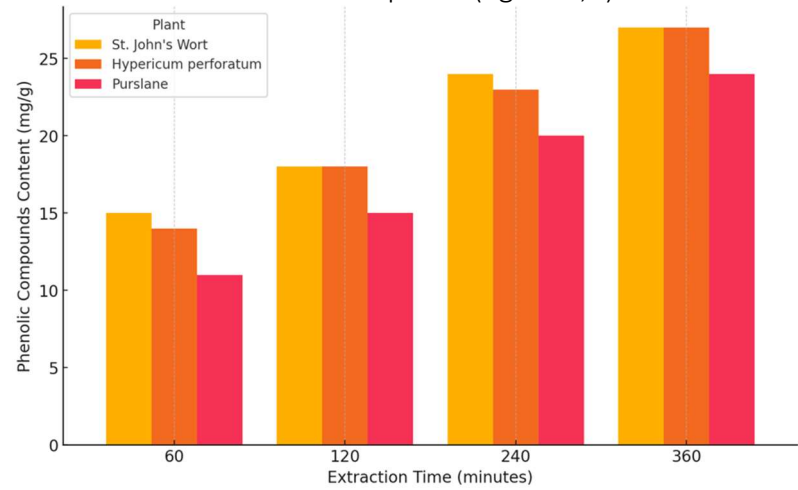


Figure 2 – Dependence of Phenolic compounds content of extraction time of plant raw materials

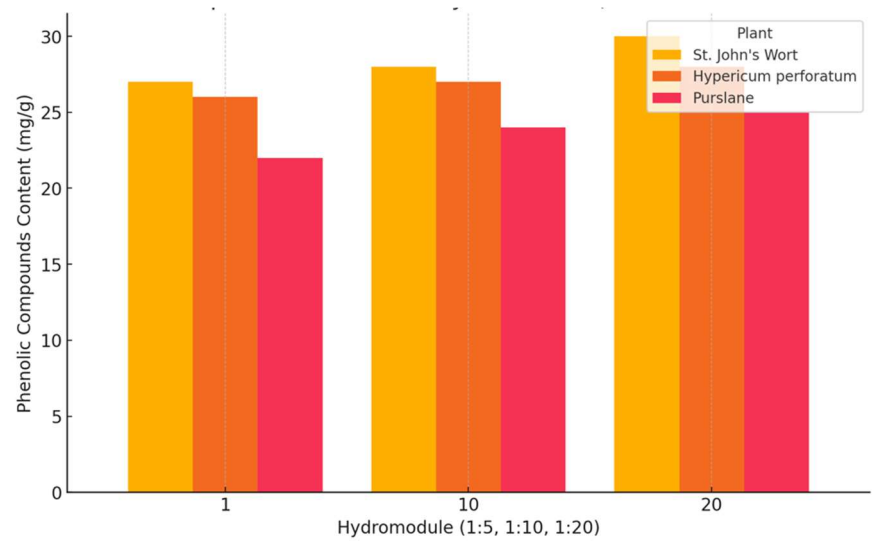


Figure 3 – Dependence of phenolic Compounds Content vs Hydromodule (240 minutes extraction) of plant raw materials

The third method was extraction using a retentate of curd whey obtained by ultrafiltration. For this purpose, the Vivaflow 50 R ultrafiltration unit from Sartorius was used. Ultrafiltration was performed using polyethersulfone (PES) membrane filters with a cut-off threshold (MWCO) of 100 kDa at an inlet pressure of 3 Bar and an outlet pressure of 2.5 Bar at a rate of 200-400 ml/min. Extraction was carried out at a temperature of 40 °C for 30 minutes. In the study, curd whey retentate was used as an extractant.

The data on the chemical composition of the curd whey before and after ultrafiltration are shown in Table 2.

Table 2 – Comparative indicators of the chemical composition of curd whey treated with Ultrafiltration

Parameters	Control (raw) whey	Whey after UF	Whey protein after UF
Acidity, °T	56±1	38±2	46±2
Active titration, pH	4,2±0,2	4,8±0,1	4,4±0,1
Dry matters, %	7,4±1,5	1,7±0,04	5,7±0,45
Mass fraction of lactose, %	4,7±0,1	4,3±0,2	0,3±0,1

Table 2 provides a comparative analysis of the chemical composition of curd whey subjected to ultrafiltration (UF) under three conditions: raw (control) whey, whey after UF, and whey protein concentrate after UF. The acidity in raw whey is $56 \pm 1^\circ\text{T}$, which is higher than in whey after UF ($38 \pm 2^\circ\text{T}$) and whey protein concentrate after UF ($46 \pm 2^\circ\text{T}$). This reduction in acidity can be attributed to the removal of organic acids and other soluble components during ultrafiltration. The pH of the raw whey is 4.2 ± 0.2 , typical of fermented dairy products, while after UF, the pH increases to 4.8 ± 0.1 , indicating a shift in the acid-base environment due to the removal of certain compounds, such as milk acids. Whey protein concentrate after UF has a pH of 4.4 ± 0.1 , which reflects only a slight change in acidity after concentrating the proteins. The dry matter content decreases significantly after UF, from $7.4 \pm 1.5\%$ in raw whey to $1.7 \pm 0.04\%$, indicating the removal of water, salts, and sugars during the filtration process. Whey protein concentrate after UF contains $5.7 \pm 0.45\%$ dry matter, confirming that proteins remain in the product after filtration. The mass fraction of lactose in raw whey is $4.7 \pm 0.1\%$, which is typical for dairy products. After UF, the lactose content slightly decreases to $4.3 \pm 0.2\%$, suggesting partial removal during filtration. However, whey protein concentrate after UF shows a significant reduction in lactose content to $0.3 \pm 0.1\%$, indicating that most of the lactose is removed while the proteins are concentrated in the final product. Overall, ultrafiltration proves to be an effective method for removing water, lactose, and other soluble components from curd whey, concentrating the proteins and other bioactive compounds in the final whey protein concentrate.

The results of the studies showed that the optimal extraction temperature is 90°C , the duration of extraction is 30 minutes, the total content of phenolic compounds in the amount (mg/g) of sweet clover is 17.7, St. John's wort is 17.8 and purslane is 18.8. This method shows lower rates of phenolic compounds, however, it is more environmentally friendly, given that the extract will be used in technologies of dairy products.

Conclusion. According to the results of the conducted studies, the parameters of extraction of phenolic compounds by various methods have been established. The use of the maceration method of plant raw materials has shown a significant effect on the extraction of phenolic compounds. However, the extraction method using curd whey obtained by ultrafiltration requires a more in-depth study, since lactic acid has a high diffusion rate, which ensures the extraction of dry substances. Moreover, whey extraction is more environmentally friendly, especially considering

that the extracts obtained will be used in dairy technology.

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Biological Sciences

Студенттерде емтихан тапсыру кезеңінде қан айналымы жүйесінің кейбір гемодинамикалық көрсеткіштерінің өзгеру жағдайы

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Аңдатпа

Бұл жұмыс емтихан кезеңінде студенттердің қан айналымы жүйесінің кейбір гемодинамикалық параметрлерінің өзгерістерін зерттейді. Емтихандағы стресс - организмнің әртүрлі физиологиялық реакцияларын тудыруы мүмкін маңызды психоэмоционалды фактор. Зерттеу емтиханға дейінгі және емтихан кезеңінде студенттердің қан қысымы, жүрек соғу жиілігі және жүрек соғу жиілігінің өзгермелілігі сияқты параметрлерге талдау жасады. Алынған деректер систолалық және диастолалық қысымның жоғарылауын, жүрек соғу жиілігінің жоғарылауын және жүрек соғу жиілігінің өзгермелілігінің төмендеуін көрсетеді, бұл симпатoadренальды жүйенің белсендірілуін және стресс деңгейінің жоғарылауын көрсетеді.

Аннотация

В данной работе исследуются изменения некоторых гемодинамических показателей системы кровообращения студентов в период экзамена. Стресс во время экзамена является важным психоэмоциональным фактором, который может вызывать различные физиологические реакции организма. В ходе исследования были проанализированы такие параметры, как артериальное давление, частота сердечных сокращений и вариабельность сердечного ритма студентов до и во время экзамена. Полученные данные показывают повышение систолического и диастолического давления, увеличение частоты сердечных сокращений и снижение вариабельности сердечного ритма, что свидетельствует об активации симпатoadренальной системы и повышении уровня стресса.

Abstract

This paper examines changes in some hemodynamic parameters of the students' circulatory system during the exam period. Stress during the exam is an important psychoemotional factor that can cause various physiological reactions of the body. During the study, such parameters as arterial pressure, heart rate, and heart rate variability of students before and during the exam were analyzed. The data obtained show an increase in systolic and diastolic pressure, an increase in heart rate, and a decrease in heart rate variability, which indicates activation of the sympathoadrenal system and an increase in stress levels.

Қазіргі заманғы білім беру жүйесі студенттердің когнитивті және психоэмоционалдық жүктемесінің үнемі артуымен сипатталады. Әсіресе, емтихан кезеңі студенттердің жүйке жүйесіне және ағзаның барлық функционалдық жүйелеріне, соның ішінде жүрек-қан тамырлары жүйесіне үлкен стресс түсіретін кезең болып табылады. Осыған байланысты, емтихан алдындағы және кейінгі физиологиялық өзгерістерді зерттеу, олардың ағзаға әсерін бағалау бүгінгі күннің өзекті мәселелерінің бірі болып табылады.

Гемодинамикалық көрсеткіштер адам ағзасының жүрек-қан тамырлары жүйесінің жұмысын сипаттайтын маңызды физиологиялық параметрлер болып табылады. Оларға қан қысымы, жүрек соғу жиілігі (ЖСЖ), қан айналымының минуттық көлемі, тамырлық тонус және жүрек қызметінің басқа да көрсеткіштері жатады. Бұл параметрлер адамның физикалық және эмоционалдық жағдайының сенімді индикаторы болып табылады. Сондықтан студенттердің сессия кезіндегі физиологиялық күйін бағалауда гемодинамикалық өзгерістерді зерттеу ерекше мәнге ие.

Зерттеудің тағы бір өзектілігі – алынған нәтижелерді студенттердің емтиханға психофизиологиялық бейімделу стратегияларын әзірлеуге қолдану мүмкіндігі. Бұл білім беру процесін оңтайландырып, оқу үдерісінің тиімділігін арттыруға мүмкіндік береді.

Емтихан кезінде студенттер көптеген психоэмоционалды және когнитивті жүктемелерге тап болады. Үлкен көлемдегі ақпаратты меңгеру, емтихандарға дайындық, уақыт тапшылығы және нәтижеге деген алаңдаушылық – мұның барлығы стресс деңгейін жоғарылатып, симпатикалық жүйке жүйесінің белсенділігін арттырады. Бұл өз кезегінде жүрек соғу жиілігінің артуына, артериялық қысымның көтерілуіне, жүрек бұлшықетінің оттегіге деген сұранысының ұлғаюына және басқа да физиологиялық өзгерістерге әкеледі.

Емтихан кезеңінде ұйқының бұзылуы, физикалық белсенділіктің төмендеуі, дұрыс тамақтанбау сияқты факторлар қан айналымы жүйесіне қосымша жүктеме түсіреді. Мұндай жағдайлар жүрек-қан тамырлар жүйесінің бейімделу қабілетін төмендетіп, ұзақ мерзімді физиологиялық және психологиялық әсерлерге әкелуі мүмкін. Сондықтан, емтихан кезеңіндегі физиологиялық өзгерістерді кешенді зерттеу студенттердің денсаулығын сақтау және оқу процесін оңтайландыру үшін маңызды.

Зерттеудің өзектілігі – алынған нәтижелерді студенттердің емтиханға психофизиологиялық бейімделу стратегияларын әзірлеуге қолдану мүмкіндігі. Бұл білім беру процесін оңтайландырып, оқу үдерісінің тиімділігін арттыруға мүмкіндік береді. Сонымен қатар, зерттеу нәтижелері білім беру мекемелеріндегі денсаулық сақтау бағдарламаларын әзірлеу барысында қолданылуы мүмкін. Сонымен қатар, зерттеу нәтижелері білім беру мекемелеріндегі денсаулық сақтау бағдарламаларын әзірлеу барысында қолданылуы мүмкін.

Осы зерттеудің нәтижелері студенттердің денсаулығына, оқу үлгеріміне және жалпы әл-ауқатына әсер ететін маңызды факторларды анықтауға көмектеседі. Гемодинамикалық өзгерістерді бақылау арқылы студенттердің стресске төзімділігін арттыру жолдарын ұсынуға болады. Сондықтан, емтихан алдындағы және кейінгі қан айналымы жүйесінің физиологиялық параметрлерін зерттеу ғылыми әрі практикалық тұрғыдан аса өзекті болып табылады.

Емтихан тапсыру кезеңінде гемодинамикалық көрсеткіштерді зерттеу студенттердің қан айналым жүйесіндегі өзгерістерді анықтауға мүмкіндік береді. Бұл процесте бірқатар физиологиялық параметрлер өлшеніп, олардың уақыт бойынша қалай өзгеретіні салыстырылады. Зерттеуді тиімді ұйымдастыру үшін бірнеше әдістер мен нақты тәртіп сақталады. Университет студенттерінің қан қысымы систолалық (жоғарғы) және диастолалық (төменгі) мәндер бойынша өлшенеді. Бұл үшін стандартты автоматты тонометрлер пайдаланылады. Өлшеу тыныш жағдайда, студенттердің күнделікті іс-

әрекетінен тыс уақытта жүргізіледі. Өлшеу жүргізубарысында студенттердің денсаулық жағдайы, тамақтануы, көңіл-күйі, қобалжуын ескере отыра жүргіземіз. Студенттерді олардан алынатын зерттеу әдістерінің сипаттамасы және көрсеткіштерімен толық таныстырамыз (1-кесте).

1-кесте. Зерттеу әдістері

Әдіс	Сипаттамасы
Қан қысымын өлшеу	Университет студенттерінің қан қысымы систолалық (жоғарғы) және диастолалық (төменгі) мәндер бойынша өлшенеді. Бұл үшін стандартты автоматты тонометрлер пайдаланылады. Өлшеу тыныш жағдайда, студенттердің күнделікті іс-әрекетінен тыс уақытта жүргізіледі.
Жүрек соғу жиілігін (ЖСЖ) анықтау	Студенттердің ЖСЖ (пульс) арнайы пульсометрлер немесе қолжетімді әдістер (саусақты артерияға тигізу) арқылы өлшенеді. Бұл көрсеткіш жүрек-қан тамырлары жүйесінің ағымдағы күйін және емтихан алдындағы эмоционалдық жүктеменің әсерін көрсетуге көмектеседі.
Орташа артериялық қысымды есептеу	Орташа артериялық қысым систолалық және диастолалық қысым негізінде есептеледі. Бұл көрсеткіш қан айналымының тұрақтылығын бағалауға мүмкіндік береді. Студенттердің оқу жүктемесіне байланысты артериялық қысымның өзгеруін анықтау үшін осы әдіс қолданылады.
Веноздық қысымды өлшеу	Кейбір жағдайларда студенттердің орталық веноздық қысымы анықтпайды, қанның қысымын бағалауға және психоэмоционалдық жүктеменің тамыр жүйесіне әсерін зерттеуге мүмкіндік береді. Құрылғылар қолжетімдігіне қарай көрсеткіш әдістермен анықталады.

Жүргізу тәртібі: Зерттеу М.Мәметова атындағы педагогикалық жоғары колледжі, биология білім беру бағдарламасының 1 курс студенттерінің қатысуымен жүргізілді. Қатысушылар саны 46 студент. Зерттеу алдын студенттердің бірнеше критерийлерін қадағалаймыз: созылмалы аурулар, психикалық бұзылыстар, артимия мен тахикардия, жүрек-қан тамыр, көру және жүйке жүйелерінің ауруларын, дәрі-дәрмек қабылдау және тамақтану. Зерттеу барысында студенттердің емтиханға дейінгі 1 сағат алдындағы жай-күйін бақылауға аламыз. Қатысушылардың қан қысымы, жүрек соғу жиілігі, және басқа гемодинамикалық параметрлері емтихан алдындағы және емтиханнан кейінгі кезеңдерде өлшенді.

1. Емтихан алдындағы өлшеулер:

Барлық 46 студенттен сессия басталғанға дейін бір сағат бұрын өлшеу жүргізілді. Студенттер тыныштық күйінде, тыныс алу және физикалық белсенділіктің қалыпты деңгейінде болуы қамтамасыз етілді. Қан қысымы автоматты тонометрлер арқылы екі рет өлшеніп, орташа мәндері тіркелді. Жүрек соғу жиілігі арнайы пульсометрлермен есептелді.

Өлшеу деректері арнайы жазбаларда тіркелді және кейінгі салыстыру үшін жүйелендірілді.

2. Емтихан кезіндегі бақылау:

- Зерттеу кезінде студенттер емтиханның әр кезеңдерінде бақылауда болды.
- Кейбір қатысушылардың қан қысымы мен жүрек соғу жиілігі бірнеше рет өлшеніп, динамикалық өзгерістер тіркелді.
- Емтихан кезіндегі психоэмоционалдық жүктеменің қанайналым жүйесіне әсері осылай бағаланды.

3. Емтиханнан кейінгі өлшеулер:

- Емтихан аяқталғаннан кейін және бір тәулік өткен соң қайтадан өлшеу жүргізілді.
- Қан қысымымен жүрек соғу жиілігін өлшеу үшін дәл сол әдістер қолданылды.
- Емтихан алдындағы және кейінгі мәліметтер салыстырылып, деректерге талдау жасалды.

Қанқысымы, жүрек соғу жиілігі және орташа артериялық қысым көрсеткіштерін өлшеу. Емтиханға дейін және одан кейінгі гемодинамикалық өзгерістерді анықтау үшін студенттерден бірнеше физиологиялық параметрлер өлшенеді.

Бұл параметрлер қан айналымының жағдайын сипаттап, оқу процесінің әсерін анықтауға мүмкіндік береді.

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Culturology

Visual, Optical Art and Illusions in Costume

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Costume art, as a system, represents a combination of silhouette, construction, color, and texture, all of which are subject to various interpretations of visual perception. An optical illusion is a visual illusion — a misperception of visual stimuli caused by different factors, such as inaccuracies or inadequacies in the unconscious correction processes of visual representation (e.g., incorrect assessment of segment lengths, angles, colors, illusions of movement in depicted objects, etc.). The physical causes of optical illusions have been studied both in the context of the physiology of vision and the psychology of visual perception. In artistic imagery, the deliberate distortion of perspective creates special effects, most famously demonstrated in the works of M.C. Escher (see, for example, his lithographs: *Up and Down* (1947), *Convex and Concave* (1955), *Belvedere* (1958), and others). The creation of optical illusions was also a frequent theme in Salvador Dalí's works (see, for instance, his paintings *Slave Market with the Disappearing Bust of Voltaire* (1938), *Swans Reflecting Elephants* (1937), and others). (see fig. 2)

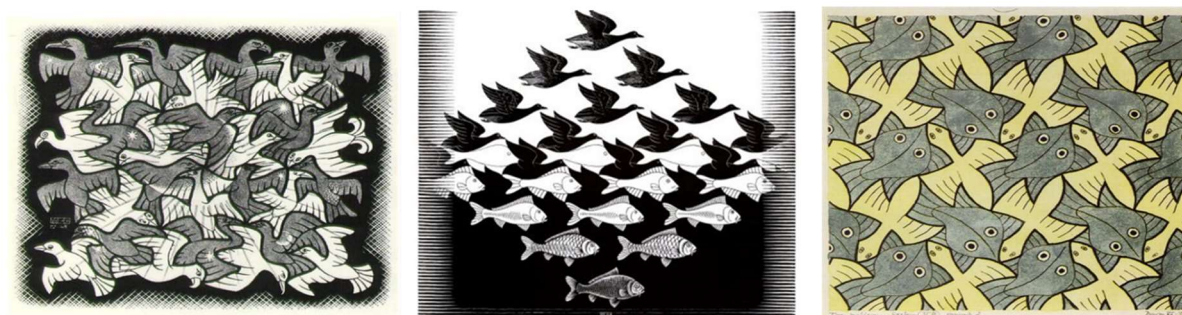
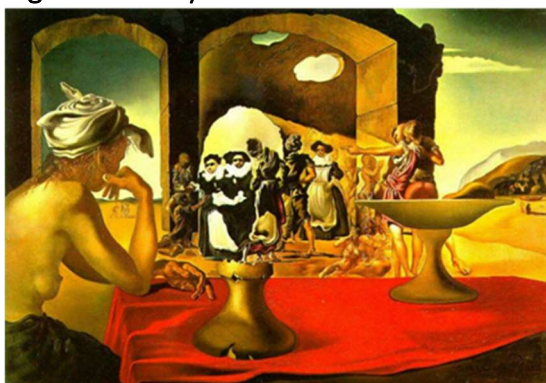


Fig. 1 Works by Maurice Escher



See Fig. 2 — Salvador Dalí: "Slave Market" and "Swans Reflecting Elephants"

Visual illusions created by color can significantly alter the perceived proportions of the human body. Color is a physiological attribute perceived directly by the retina of the eye. As fashion designers, we know well that a black dress makes the figure appear slimmer. This is due to the irradiation effect: dark and especially black colors visually reduce volume and absorb light, whereas lighter and particularly warm tones increase the effect of volume. When a costume is made using a single color or a monochromatic (low-contrast) palette, the wearer appears taller and slimmer. Color-based optical illusions occur in some cases when the human eye misinterprets colors due to lighting, contrast, viewing angle, or other factors. The phenomenon of color constancy has been

known for nearly a century: when an image composed of light and dark areas appears on the retina, light from the illuminated areas seems to "spill over" into the darker zones. This phenomenon is referred to as optical irradiation. One such illusion was described in 1995 by MIT professor Edward Adelson, known as "Adelson's Shadow Illusion." Color perception illusions have the same impact on human visual and psychological perception. Despite the psychological impact and visual activity of color, it is ultimately light and shadow — bright and dark tones — that play the central role in conveying form, both in painting and costume design, enabling the effective expression of illusion or reality. There is a visual perception effect where the observer consciously or unconsciously gives an interpretation that does not match reality, based on the image observed. This is well known to anyone who has watched clouds drifting across the sky and noticed that they sometimes resemble familiar objects. A similar effect can occur when observing the distribution of shadows on three-dimensional objects from certain angles relative to light sources.

Depth perception illusions occur when there is an inaccurate representation of an object or its properties. Currently, the most studied are the illusory effects that appear during the visual perception of two-dimensional contour images. The brain subconsciously interprets these shapes as convex. Perception depends on the direction of external (real or implied) lighting. [2] The 3D effect (where a 2D image appears three-dimensional) is created using light and shadow, and conveying volume and space is a crucial component in the creation of an artistic work.

Op art (optical art) is a modern method for creating visual illusions. These artworks are abstract, and most of the best-known pieces are in black and white. When viewed, they give the observer sensations of movement, hidden images, and visual vibration. Op art, or optical art, refers to works of art and other artistic expressions that use optical illusions. It is also known as geometric abstraction or sharp-angled abstraction, though the more appropriate term is cognitive abstraction. Op art emerged as a product of Bauhaus constructivist practice — the German school founded by Walter Gropius, which emphasized the interaction of form and function within analytical and rational frameworks. Students were encouraged to focus on general design or complete compositions to envision a unified whole.

Some optical illusions have also been studied within the framework of Gestalt psychology (e.g., Akiyoshi Kitaoka). He also noted that color perception is highly influenced by the background, and the same colors can appear different depending on their surrounding context, even when they are simultaneously visible and in close proximity. [2] This is particularly true in design compositions consisting of many forms that visually convey a sense of volume and depth at the same time.

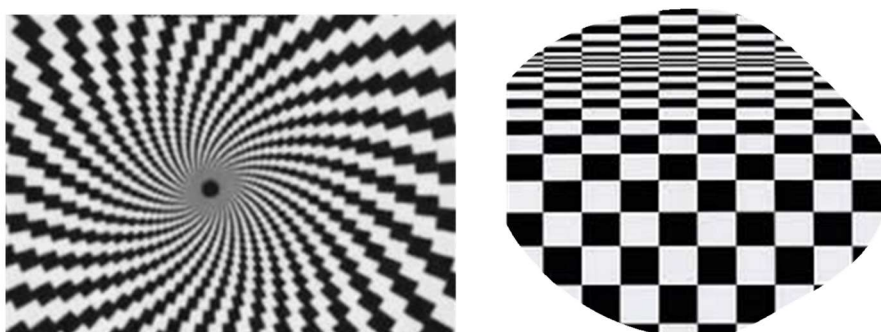


Fig. 3 — Examples of Optical Art

In costume design, illusions are primarily created through various combinations of shape, color, and texture — through garment lines, fabric surface patterns, colors, and decorative embellishments. In many cases, errors in optical perception (visual illusions) significantly influence the aesthetic perception of a costume and serve as a powerful tool to enhance or diminish the visual impact of specific elements. It is possible to alter proportions in costume design through the thoughtful combination of light and dark colors, decorative contrasts, different silhouettes, and

construction lines. In addition to the types of illusions mentioned above, the placement of accents and visual dominants — which guide the viewer's focus — plays an essential role. This is achieved through the direction of lines, rhythm and contour of details, the overall shape of the costume, and the use of the optical properties of color. If we examine the history of costume, we can see that throughout the centuries, the waistline was narrowed using wide skirts and tightly fitted corsets. Raising the waistline created the illusion of longer legs; oversized collars were used to make the head appear smaller — and so on.



Fig. 4 — Fragments from the History of Costume

To achieve visual effects that correct or enhance the figure, designers today continue to use various methods — primarily through construction, decoration, and color. First, let's consider decoration, which is often responsible for creating illusions in costumes. These include the aforementioned Op Art, various stripe combinations (vertical, horizontal, ornamental, and dotted patterns). Visual illusions allow us to give the figure an ideal appearance, primarily through decoration and color, while construction lines play a secondary role. When vertical and horizontal lines are part of the surface pattern of the fabric, the structural lines and silhouette lose their primary function in creating the illusion. In such cases, the designer intentionally shifts attention toward the surface pattern of the fabric, often overloaded with large-scale prints. It is more effective when the silhouette, construction lines, and the surface appearance or color of the fabric work in harmony and do not interfere with the perception of the costume's shape or the human figure — helping to achieve the desired visual illusion.

The Role of Optical Illusions in Fashion Design “Optical art is a drawing technique aimed at interaction between illusion and the flat surface of the image — between perception and vision.” The use of optical illusions in fashion design makes it possible to create visually intriguing and impactful clothing. As previously mentioned, these illusions can be achieved using various techniques, particularly through fabric selection and color blocking. Optical illusions work extremely well in the fashion industry. They truly have the power to grab attention and visually captivate audiences. Optical illusions are most effectively achieved on garments through various types of lines. Remarkably, a protruding part of the body can be visually minimized using silhouettes, and weight can be redirected to specific areas with the addition of design elements such as pleats, folds, seams, and necklines. For example, the direction of lines may be vertical, horizontal, diagonal, or curved: Vertical lines create the illusion of height and visually slim the figure. Horizontal lines generally broaden the appearance of a form. Diagonal lines — due to their slant — are perceived as extremely slim, and regardless of where they are placed on the body, they create a narrowing effect. Curved lines are elegant. When gently curved, they appear soft, while tighter curves look bold. Designers can create illusions of depth, movement, and texture. For instance, a vertically striped dress can make the wearer appear taller, while a diagonally striped dress can suggest motion. This phenomenon is known as the Helmholtz illusion, where a square composed of vertical lines appears wider and shorter than the same square made of horizontal

lines. Similarly, a dress with horizontal stripes appears broader and shorter than one with vertical stripes. [2] Optical illusions play an important role in fashion design because they help designers create garments that appear to have a different shape, size, or dimension than they actually do. By applying the principles of optical illusions, fashion designers can craft visually captivating and unique designs that draw the eye and give a sense of depth or movement.



Fig. 5 – Various Forms of Op Art on Dresses

Optical art is a mathematically inspired form of abstract art that uses the repetition of simple shapes and colors to create vibrating effects, moiré patterns, and psychedelic designs. These designs can incorporate optical illusions such as visual waves, moiré patterns, distortions, and other effects that generate visual interest and appeal. They serve to confuse the perception of foreground and background, exaggerate the sensation of depth, and introduce a range of other compelling visual effects. The Op Art movement gained international attention in the mid-1960s, during a time of global social and technological transformation. It emphasized the viewer's perception and inspired fashion designers to study optical effects within garment design. What makes this so fascinating is that designers pursued their research as rigorously as they did aesthetic appeal — aligning silhouettes with textures, lines, and curves to create cohesive visual statements. [3]

As mentioned, optical illusions can create dazzling visual effects in fashion through Op Art. Eye-catching optical prints and the pop art trend represent geometric precision, striking design, and the bold expression of illusions, as shown in the image below. These dresses reflect a combination of mathematics and fashion design. Designers use color placement, lines, and pattern distribution to create unique looks that can visually alter the body's proportions. Such garments help to conceal imperfections and enhance the appearance of the figure. For instance, dresses with spiral illusion patterns can make the body appear fuller. By adjusting and arranging color blocks, designers can manipulate the perceived proportions of a woman's body to achieve the desired effect. [2]



Fig. 6 – Optical Art with Lines and Impressive Illusions on Dress Design

Another fascinating method of visual illusion is irradiation, where bright shapes placed against a dark background create the impression of greater volume due to contrast.



Fig. 7 Irradiation

The Bezold effect — named after German professor Wilhelm von Bezold — refers to the phenomenon where colors appear different depending on their surrounding hues. For example, red appears lighter on a white background and darker on a black one. In Fig. 1.m, from Henri Matisse's (1869–1954) painting *Nu Blue II*, the variation in background color and brightness enhances the clarity of the figure.

Manipulating shapes and silhouettes through optical illusions is also a powerful tool in fashion design. [2]



Fig. 8 Bezold effect



Fig. 9 – Annakiki, Ready-to-Wear, Spring/Summer 2023 Collection

By playing with proportions, designers can create diverse forms and silhouettes suited to various body types. A notable example is Stella McCartney's "miracle dress," which is famous for its figure-enhancing properties. This design employs simple geometry — such as curved side panels — to alter the perception of the body's shape. Often referred to as a "shading illusion," it helps to create a slimmer, more sculpted look. [4] Texture is another element that can be manipulated using optical illusions. By combining different fabrics and textures, designers can generate depth and visual intrigue. For instance, a lace-overlay dress may create a soft and feminine appearance, while leather trim can add a sharper, more contemporary edge.



Fig. 10 – Stella McCartney's Miracle Dress with Side Panels

Optical illusions are a delightful trick of perception that require no advanced technology — they're purely visual phenomena. Black is often used due to its high contrast, which enhances moiré effects. A minimalist style, carefully selected materials, and precise pattern placement are key to achieving a refined silhouette. This kind of textile design is also known for producing the illusion of movement.



Fig. 11 – Mary Katrantzou, Spring/Summer 2017 Collection

Thus, optical illusion has had a significant impact on the fashion industry and, more specifically, on the work of individual designers such as Anrealage, Giorgio Armani, Dries Van Noten, Carolina Herrera, Issey Miyake, Mary Katrantzou, Jean-Paul Gaultier, Guy Laroche, Balmain,

and others. The ability to alter human visual perception offers designers a novel method for creating stunning garments — a way to think beyond conventional knowledge and a new technique for conveying meaningful themes and narratives. The diverse applications of optical illusion that we've explored — despite their inherent ambiguity — serve the aesthetic experience remarkably well. They support designers in crafting visually striking and memorable costumes that instantly capture attention and leave a lasting impression. Optical illusion in fashion is not only a visual phenomenon but a promising direction with potential for future industry development. Only time will reveal the extent of its long-term influence.

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2. Role of Optical Illusions in Fashion Designing By Jahanara Rony
3. <https://contest.damuseum.ru/project/b75575cfb64242d1b20dc85bb9f5736e4>.
4. Stella McCartney relaunches modernised 'Miracle Dress', Sandra Halliday Published December 10, 2024

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CERVICAL CANCER: MODERN CLINICAL AND DIAGNOSTIC STRATEGY

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Annotation: This scientific work purposefully analyzes modern world and regional data on incidence, mortality and five-year survival rate of the most common oncological pathology of gynecological localization – cervical cancer. In addition to the issues of etiology and pathogenesis, the features of distribution, clinical manifestations, modern principles of early diagnostics and prognosis of this formidable disease for the coming decades are shown. The article reflects in detail the achieved successes and modern directions of development of prevention of this pathology in the form of vaccination against HPV and applied screening programs. A multifactorial epidemiological characteristic of this pathology in our republic is given in the context of the regions of the country.

Key words: oncology, gynecology, cervical cancer, epidemiology, incidence, human papilloma virus, screening, diagnostics, Pap test, smear for oncocytology, mortality, five-year survival rate, prognosis.

Cervical cancer (CC) is a disease that is related to visually accessible localizations, in connection with which aspects of early diagnostics have been worrying the entire oncological community for several decades. To do this, it is enough to correctly use accessible and informative methods of morphological and endoscopic diagnostics. In addition, timely detection and treatment of background and precancerous processes of the cervix can prevent the development of CC. It is known that CC is preceded for many years and even decades by precancerous lesions - cervical intraepithelial neoplasia (CIN). Timely diagnosis and treatment of CIN become the prevention of invasive CC. CIN initiates in the cervical transformation zone and is maintained by persistent infection caused by human papillomaviruses (HPV) of high carcinogenic risk. In 1980-1990, the connection between HPV and dysplasia and squamous cell cancer was clearly shown. Using hybridization methods, it was found that 80-100% of CC contain HPV DNA. A rough correlation was found between the frequency of CC and the detection of HPV in the population. Moreover, in squamous cell cancer, HPV type 16 was most often encountered (in more than 50% of cases), while HPV type 18 was more often associated with adenocarcinoma and poorly differentiated cancer. In 95% of cases, HPV is localized in the zone of transitional epithelium, where about 90% of dysplasias, which are classified as cervical precancer, occur. It is precancerous diseases, in which HPV types 16 and 18 are detected, that have the greatest risk of developing into invasive CC. Intraepithelial lesions are, in fact, stages of cervical carcinogenesis. Conventionally, three degrees are distinguished: CIN 1 (mild dysplasia); CIN 2 (moderate dysplasia); CIN 3 (severe dysplasia and pre-invasive cancer - carcinoma in situ, CIS). At the same time, there are two concepts of the occurrence of CC against the background of persistence of HPV of high carcinogenic risk. The first, classic, reflects the sequential change of CIN 1, 2, 3 to invasive cancer. The second, more recent one, suggests that CIN 2-3, which are severe intraepithelial lesions, can occur bypassing CIN 1 [1].

The diagnostic criteria for CC are as follows [2]: 1) complaints of acyclic bloody, watery, purulent discharge from the genital tract; pain in the lower abdomen and lumbar region of a pulling nature; bleeding due to menopause; 2) anamnesis: there are no pathognomonic complaints; as a rule, the disease has a pronounced pre-invasive stage, which can last from 1 year to 5 years or more; microinvasive cervical carcinoma is most often discovered during accidental presentation; the reason for women diagnosed with CC in stages Ib1-IIa2 to visit a gynecologist is bloody discharge from the genital tract; in later stages (IIb-IVa) there are complaints of pain in the lumbar region, lower abdomen; 3) physical examinations: gynecological examination (condition of the external genitalia; examination of the vagina and cervix on speculum (presence of vaginal infiltration, metastatic foci on the vaginal walls, size, condition of the cervix); presence of pathological discharge (purulent, bloody); bimanual examination (size and shape of the uterus; condition of the appendages; infiltration of the anterior and posterior vaginal fornix); 4) laboratory tests: cytological examination with Papanicolaou staining - PAP test (increase in cell size up to giant, change in the shape and number of intracellular elements, an increase in the size of the nucleus, its contours, different degrees of maturity of the nucleus and other elements of the cell, changes in the number and shape of nucleoli (pronounced cellular polymorphism, increase in cell size, pronounced hypochromia, large nuclei contain one or more nucleoli, there are glandular structures); from cancer cells in the form of rosettes, many cells in a state of mitosis); 5) instrumental studies: ultrasound of the pelvic organs (if CC is suspected, the size of the cervix will be normal or increased, its structure is heterogeneous, the condition of the uterus and ovaries is also assessed); magnetic resonance imaging of the pelvic organs (with CC, the size of the cervix will be normal or increased, its structure is heterogeneous, the condition of the uterus and ovaries is also assessed); computed tomography of the chest, abdominal cavity and pelvis (assessment of pelvic lymph nodes and retroperitoneal space, organic changes in the chest and abdominal organs); cystoscopy according to indications (for the purpose of diagnosing the germination of the

tumor process into the bladder); sigmoidoscopy or colonoscopy according to indications (for the purpose of diagnosing the spread of the tumor process to the colon or rectum); skeletal scintigraphy (prescribed for suspected bone metastases); positron emission tomography of the whole body (performed to diagnose the extent of the tumor process or to assess the dynamics of the effectiveness of special treatment).

GLOBOCAN estimates that in 2020, there were 604,000 new cases and 342,000 deaths from CC worldwide, of which 80% occurred in low- and middle-income countries, mainly in sub-Saharan Africa, South-East Asia, and Latin America and the Caribbean [3].

As noted by Torres-Roman J.S. et al. [4], CC remains a major public health problem in low- and middle-income countries. Due to the high burden of this disease, in 2020 the World Health Organization (WHO) adopted a global strategy to decrease the number of new CC cases, with the aim of maintaining an incidence rate below 4 per 100,000 women. Currently, 29 of the 47 countries (and territories) in the Latin American and Caribbean region have implemented vaccination programs for girls and almost all countries have screening services in place, and while certain screening programs in the region achieve considerable coverage, the ambitious goals set by the CC elimination strategy have yet to be achieved. Researchers evaluated the mortality trends of CC among young women from 16 Latin American and Caribbean countries (and territories) and predicted mortality rates until 2030. Downward trends were observed in Chile, Colombia, Cuba, El Salvador, Mexico, Nicaragua, Panama, and Peru for the entire period; whereas Brazil, Argentina, Chile, and Costa Rica showed initial downward trends from –0.9% to –6.2% followed by significant upward trends from 2.5 to 4.8% (for the period~ 2006-2017). In the last 4 years of study (2014-2017), Paraguay and Venezuela had the highest mortality rates, whereas Puerto Rico had the lowest mortality. By 2030, authors projected that mortality for CC will increase in some countries that were examined. Colleagues considered CC mortality in young women only because of the lack of research in the Latin American and Caribbean region, which has focused on CC mortality in general. They point out that because HPV infection is the most important risk factor for CC, younger women are likely to have experienced higher rates of HPV infection compared to older women. The authors also note that CC mortality rates among young women in Latin America and the Caribbean are higher than in Eastern Europe. While Western and Southern Europe recorded rates below 2 deaths per 100 000 population in 2017, rates were below 6 deaths per 100 000 population in Northern and Eastern Europe. In conclusion, the researchers emphasize that most countries in Latin America and the Caribbean experienced a decline in mortality rates between 1997 and 2017. The variations of the mortality rates between countries during the last period of observation can be largely explained by the timing of implementation of nation-wide screening campaigns in different time periods and the variation of public health programs within each country, among others. Despite favorable downward trend, the mortality rate in some Latin America and the Caribbean countries remains high. HPV vaccination, screening, and early diagnosis and treatment are necessary to accelerate a rapid decline in CC mortality by 2030.

As noted by Abu-Rustum N.R. et al. [5], an estimated 13,960 new cases of carcinoma of the uterine cervix (ie, CC) will be diagnosed in the United States in 2023, and an estimated 4,310 people will die of the disease. Overall, CC rates are decreasing in the United States, although incidence remains high among Hispanic/Latino, Black, and Asian populations. In 2020, the global new cases of and deaths from CC were estimated to be 604,127 and 341,831, respectively. It is the fourth most common cancer in individuals assigned female at birth worldwide, with 85% of cases occurring in developing countries, where CC is a leading cause of cancer death in individuals assigned female at birth. Squamous cell carcinoma (SCC), adenocarcinoma (AC) or adenosquamous carcinoma (ASC) are the 3 common histologies of CC. SCC accounts for approximately 80% of all CCs and AC accounts for approximately 20%. In developed countries, the substantial decline in incidence and mortality of SCC of the cervix is presumed to be the result of

effective screening and higher HPV vaccination coverage, although racial, ethnic, and geographic disparities exist. However, AC and ASC of the cervix have increased over the past 3 decades, probably because cervical cytologic screening methods are less effective for AC/ASC because the lesions are located deeper than the ectocervix. The ASC subtype is rare and accounts for approximately 5% to 6% of all cervical carcinomas. Presently, there is no difference in treatment between SCC and AC/ASC CC subtypes, although the clinical features and prognosis of disease vary considerably between these subtypes. Persistent HPV infection is a major factor in the development of CC. The incidence of CC appears to be related to the prevalence of HPV in the population. In countries with a high incidence of CC, the prevalence of chronic HPV is approximately 10% to 20%, whereas in low-incidence countries it is 5% to 10%. Screening methods using HPV testing may increase detection of adenocarcinoma. Vaccination with HPV vaccines may also decrease the incidence of both SCC and AC. In 2020, the WHO updated the Female Genital Tumors classification of CC by subdividing the CC lesions into HPV-associated and HPV-independent tumors based on new pathologic findings. Among these subtypes, HPV-associated SCC is the most prevalent, with very rare occurrences of HPV-independent SCC. The HPV-independent AC subtype has a less favorable prognosis compared with HPV-associated AC. The NCCN CC Panel acknowledges that although the prior versions of the WHO classification discussed these tumors based on morphologic features, the integration of the immunohistochemical and molecular profiles has led to a better classification system, which is now adapted in the 2020 WHO Classification of Female Genital Tumors for CC.

Screening plays an important role in improving early diagnosis and treatment outcomes for CC. According to the Guidelines for Early Diagnosis of Cancer by Ilbawi A. et al. [6], screening aims to detect unrecognized cancer or its prior lesions in a typically healthy, asymptomatic population through tests (e.g., HPV test), screenings (e.g., visual inspection of VIA with acetic acid), or other procedures that can be applied quickly and are widely available to the target population. In screening, the target population is assessed for unrecognized cancer or precancer, and most people tested will not be diagnosed with the disease. Screening should be seen as a process and not as the performance of a specific test, examination, or procedure. The screening process includes a system of informing and inviting the target population to participate; administering the screening test; following-up with test results and referral for further testing among those with abnormal test results; ensuring timely pathologic diagnosis, staging and access to effective treatment with routine evaluation to improve the process. A screening programme encompasses the process from invitation to treatment and requires planning, coordination and monitoring and evaluation.

As pointed out by Pimple S.A., Mishra G.A. et al. [7], CC is highly preventable and can be easily treated if detected at early stages. However, there is disproportionate high burden of CC incidence and mortality in low-middle income country settings that lack organized screening and prevention programs. Robust evidence for prevention and screening of CC is currently available. However, there are barriers for country specific adoption and implementation. These pose unique challenges such as organizing prevention and screening services delivery through the current health infrastructure, access to screening facilities, follow-up management and adequate linkages for confirmatory diagnosis and subsequent treatment. Overall rates of CC screening and cancer screening among women remain suboptimal in many low- and middle-income countries.

Brisson M. et al. [8] demonstrate in their work that in May, 2018, WHO issued a global call to eliminate CC as a public health problem. To inform its global strategy to accelerate CC elimination, WHO created the CC Elimination Modelling Consortium (CCEMC) to examine the following key questions: what elimination threshold should be used; what prevention strategies can lead to elimination; when could elimination be reached for different countries; and how many cancers could be averted. The current working definition of elimination is an age-standardised CC

incidence of four or fewer cases per 100 000 women-years. Alternative definitions, such as an incidence of ten or fewer cases per 100 000 women-years and an 80-90% reduction in incidence, have also been suggested. The only previous multicountry modelling study of CC elimination suggests that global elimination is possible through girls-only human papillomavirus (HPV) vaccination at 80-100% coverage with a perfectly effective 9-valent vaccine and twice-lifetime HPV-based screening. Herewith less than 30% of low- and middle-income countries have introduced HPV vaccination compared with more than 85% of high-income countries. Additionally, only about 20% of women in low- and middle-income countries have ever been screened for CC compared with more than 60% in high-income countries. Given that models necessarily include simplifying assumptions, the goal of the consortium is to use multiple models, taking into account their respective strengths and limitations, to illustrate the robustness of predictions. A systematic comparative modelling approach was used. To form the CCEMC, WHO selected three models that met the predefined eligibility criteria: HPV-ADVISE, Harvard, and Policy1-Cervix. The models projected reductions in CC incidence over time based on standardised HPV vaccination and cervical screening scenarios determined after consultations at various WHO technical expert, advisory group, and global stakeholder meetings. Three elimination thresholds were examined (CC incidence of four or fewer cases per 100 000 women-years, ten or fewer cases per 100 000 women-years, and $\geq 85\%$ reduction in incidence). The three CCEMC models (HPV-ADVISE, Harvard, and Policy1-Cervix) have been used extensively to inform recommendations on cervical screening and HPV vaccination in Australia, Canada, the UK, the USA, and at a global level [8]. Although developed independently, the models have common features. First, they are transmission-dynamic models of HPV infection and the natural history of CC. Second, they include the following components: sexual behaviour and HPV transmission, natural history of CC, vaccination, and screening, diagnosis, management, and treatment of cervical lesions and cancer. HPV transmission and cervical carcinogenesis are modelled for the HPV types in the 9-valent vaccine (HPV types 16, 18, 31, 33, 45, 52, 58) and other high-risk types. The models simulate type-specific HPV transmission through sexual activity, based on different risk groups and sexual mixing. The models reproduce the type-specific natural history of CC, from persistent HPV infection to CC via precancerous cervical lesions (cervical intraepithelial neoplasia grade 1 to 3). All models assume that HPV vaccines are prophylactic and capture post-vaccination herd effects. They can also simulate complex cervical screening and treatment algorithms at the individual level, by tracking and simulating each woman's screening history. Finally, all models were calibrated to highly stratified sexual behaviour and epidemiological data, validated to clinical trials or post-vaccination data, or both, and reproduce the age-specific CC incidence estimates from the Global Cancer Observatory (GLOBOCAN) 2018 for all 78 low- and middle-income countries.

A comparative modelling analysis by Brisson M. et al. [8], which includes projections from three independent transmission-dynamic models, provides consistent results predicting that CC can be eliminated as a public health problem by the end of the century, based on WHO's proposed elimination threshold (i.e., CC incidence of four or fewer cases per 100 000 women-years). This modelling study shows that girls-only HPV vaccination would lead to CC elimination in most low- and middle-income countries, if high coverage is reached ($>90\%$ coverage) and the vaccine provides long-term protection. However, countries with the highest CC incidence at present (>25 cases per 100 000 women-years), more than 90% of which are in sub-Saharan Africa, would not reach elimination by vaccination alone. To achieve CC elimination in all 78 low- and middle-income countries, these models predict that scale-up of both girls-only HPV vaccination and twice-lifetime screening is necessary, with 90% HPV vaccination coverage, 90% screening uptake, and long-term protection against HPV types 16, 18, 31, 33, 45, 52, and 58. If this global elimination strategy, which includes a combination of intensive scaling up of HPV vaccination and cervical screening, is implemented, the results suggest that CC elimination can be achieved in all countries by 2100. In

doing so, CC incidence would be reduced by 97% and more than 74 million cases would be averted over the next century.

An interesting and important study was conducted by Simms K.T. et al. [9], who in their work modeled the global situation with CC for future decades depending on the coverage of the population with HPV vaccination and screening. In this study, the authors aimed to quantify the potential cumulative effect of scaled up global vaccination and screening coverage on the number of CC cases averted over the 50 years from 2020 to 2069, and to predict outcomes beyond 2070 to identify the earliest years by which CC rates could drop below two absolute levels that could be considered as possible elimination thresholds-the rare cancer threshold (six new cases per 100 000 women per year, which has been observed in only a few countries), and a lower threshold of four new cases per 100 000 women per year. In this statistical trend study and modeling, our colleagues conducted did a statistical analysis of existing trends in CC worldwide using high-quality cancer registry data included in the Cancer Incidence in Five Continents series published by the International Agency for Research on Cancer. Next, the authors used the comprehensive and extensively validated simulation platform, Policy1-Cervix, to do a dynamic multicohort modelled analysis of the impact of potential scale-up scenarios for CC prevention, in order to predict the future incidence rates and burden of CC. Data are presented globally, by Human Development Index (HDI) category, and at the individual country level. As a result of the study, the following conclusions were drawn. In the absence of further intervention, there would be 44.4 million CC cases diagnosed globally over the period 2020-2069, with almost two-thirds of cases occurring in low-HDI or medium-HDI countries. Rapid vaccination scale-up to 80-100% coverage globally by 2020 with a broad-spectrum HPV vaccine could avert 6.7-7.7 million cases in this period, but more than half of these cases will be averted after 2060. Implementation of HPV-based screening twice per lifetime at age 35 years and 45 years in all low- or middle-income countries with 70% coverage globally will bring forward the effects of prevention and avert a total of 12.5-13.4 million cases in the next 50 years. Rapid scale-up of combined high-coverage screening and vaccination from 2020 onwards would result in average annual CC incidence declining to less than six new cases per 100 000 individuals by 2045-2049 for very-high-HDI countries, 2055-2059 for high-HDI countries, 2065-2069 for medium-HDI countries, and 2085-2089 for low-HDI countries, and to less than four cases per 100.000 by 2055-2059 for very-high-HDI countries, 2065-2069 for high-HDI countries, 2070-2079 for medium-HDI countries, and 2090-2100 or beyond for low-HDI countries. However, rates of less than four new cases per 100 000 would not be achieved in all individual low-HDI countries by the end of the century. If delivery of vaccination and screening is more gradually scaled up over the period 2020-2050 (eg, 20-45% vaccination coverage and 25-70% once-per-lifetime screening coverage by 2030, increasing to 40-90% vaccination coverage and 90% once-per-lifetime screening coverage by 2050, when considered as average coverage rates across HDI categories), end of the century incidence rates will be reduced by a lesser amount. In this scenario, average CC incidence rates will decline to 0.8 cases per 100 000 for very-high-HDI countries, 1.3 per 100 000 for high-HDI countries, 4.4 per 100 000 for medium-HDI countries, and 14 per 100 000 for low-HDI countries, by the end of the century. At the same time, the researchers emphasize that more than 44 million women will be diagnosed with CC in the next 50 years if primary and secondary prevention programmes are not implemented in low- or middle-income countries. If high coverage vaccination can be implemented quickly, a substantial effect on the burden of disease will be seen after three to four decades, but nearer-term impact will require delivery of cervical screening to older cohorts who will not benefit from HPV vaccination. Widespread coverage of both HPV vaccination and cervical screening from 2020 onwards has the potential to avert up to 12.5-13.4 million CC cases by 2069, and could achieve average CC incidence of around four per 100 000 women per year or less, for all country HDI categories, by the end of the century.

In our country, according to Decree of the Government of the Republic of Kazakhstan dated

February 20, 2024 No. 102 [10], the list of diseases against which mandatory preventive vaccinations are carried out as part of the guaranteed volume of medical care at the expense of the republican budget includes routine preventive vaccinations against diseases caused by HPV (Annex 1). According to Annex 2 of this Resolution, girls aged 11 and 11.5 years will be vaccinated.

Now, as for this pathology in our republic. CC in the structure of all malignant tumors of both sexes of the population in 2022 took 6th place with a share of 5.51% (2021 - 4th place, 5.54%), in women - stable 2nd place - 9.7% (9.7%) [11].

The incidence rate per 100 thousand population increased from 9.4 to 9.92. In 10 regions of the republic, the incidence rate is higher than the national average: Pavlodar - 17.2 per 100 thousand people (2021 – 16.7) – the highest level, East Kazakhstan – 14.3 (10.8), North Kazakhstan – 14.3 (10.2), Atyrau – 13.2 (13.8), Zhetysu - 11.7, Karaganda - 11.7 (12.0), Abay - 11.1, Akmola - 11.1 (11.9), Mangistau - 11.1 (9.7), Kostanay - 10.8 (10.6) regions.

Low incidence rates in Zhambyl region - 5.8 per 100 thousand population (5.7), Turkestan region - 6.1 (5.2), Aktobe region - 8.3 (11.6), Kyzylorda region - 8.5 (8.2) areas.

CC in the structure of causes of death from malignant tumors of the population of both sexes in 2022 rose from 9th to 8th position, with a share of 4.6% (2021 - 4.3%), mortality from CC is stable at 3.1 per 100 thousand population (3.1).

The mortality rate from CC in 10 regions is higher than the national average: Akmola - 4.2 per 100 thousand population (2021 - 3.1) - maximum level, West Kazakhstan - 4.1 (4.8), Pavlodar - 3.8 (5.6), Almaty – 3.7 (2.5), Zhetysu – 3.7, Atyrau – 3.4 (4.0), East Kazakhstan – 3.3 (3.8), Karaganda - 3.2 (4.7), Kostanay - 3.2 (2.4) regions and Almaty city - 3.4 (2.9).

Below the national average mortality rate was registered in the Kyzylorda region - 1.7 (3.5) - the best result; North Kazakhstan - 2.0 (2.6), Aktobe - 2.2 (3.0), Turkestan - 2.3 (2.2), Mangystau - 2.8 (3.0), cities of Astana, Shymkent – and Abay region - 2.9 per 100 thousand population [11].

In 12 regions, a 100% level of morphological verification of the diagnosis is ensured. The lowest or worst indicator for the third year in a row was recorded in the Kyzylorda region - 94.3%. Below the national average, this figure was noted in Akmola - 98.8%, Atyrau - 98.9%, Kostanay - 98.9%, Mangistau - 97.6%, Pavlodar - 96.6% regions and Almaty city - 98.5 %.

In a number of regions, the frequency of diagnosis of stage I-II CC was lower than the national average (88.1%) - in Akmola - 76.2% - the worst result in the country, in Karaganda - 77.2%, Pavlodar - 81.3%, Zhetysu - 82.9%, Abay - 83.8%, Kostanay - 84.3%, Aktobe - 85.5%, West Kazakhstan - 85.7% regions. In the Atyrau region there is a 100% result.

The proportion of stage IV CC is higher than the republican average (2.7%) in the following regions: the worst result is in the Zhetysu region - 6.1%; next come: Karaganda - 5.1% (2021 - 5.6%), Akmola - 4.8% (2.3%), Kostanay - 4.5% (4.4%), North Kazakhstan - 3.9% (7.4%), Shymkent city - 3.8% (5.9%), Almaty - 3.7% (5.1%), Almaty city - 3.6% (1.8%), Zhambyl - 2.9% (0.0) regions. No advanced forms were registered in 3 regions. The lowest neglect is in the East Kazakhstan region - 1.0% (0.7%).

Indicators of late diagnosis of this pathology, as visually accessible localization (III-IV stages) are higher than the national average - 11.9% (15.4% in 2021) were noted in the Akmola region - 23.8% (2021 - 26.4 %) - worst result; Karaganda - 22.8% (35.2%), Pavlodar - 18.8% (20.8%), Zhetysu - 17.1% (24.2%), Abay - 16.2% (12.8%), Kostanay - 14.6% (15.6%), Aktobe - 14.5% (9.6%), West Kazakhstan - 14.3% (32.4%) regions. The least neglect is in the Mangistau region - 6.0% (20.8%).

Across the country, the five-year survival rate of patients with CC registered in 2018 was 59.9% in 2022, with a decrease from the level of 2021 (67.5% for those registered in 2017), and with a significant range in by region, from the maximum – 72.9% (2021 – 70.7%) in the North Kazakhstan region, to the minimum – 34.9% (64.4%) in the Atyrau region [11].

Next, regarding CC screening. CC screening is a periodic, comprehensive examination of women of a certain age group as part of a special medical program to prevent and reduce

incidence and mortality from CC.

Type of screening - population. The purpose of screening is to identify pre-invasive diseases of the cervix with subsequent recovery. The screening method is a cytological examination of a smear for oncocytology from the cervix (traditional and liquid cytology) - Pap test. Interval - 1 time in 4 years. Target group: women aged 30-70 years who are not registered in the dispensary for CC. The expected results are a decrease in incidence and mortality from CC.

Screening steps:

1) Preparatory - formation of target groups, information support and invitation to screening. The preparatory stage is carried out by the nurses of the primary health care organization responsible for preventive measures and includes: annual compilation of a list of women subject to screening in the coming year by November 15 of the current year, followed by monthly correction; informing target groups of the female population about the need for screening; screening invitation; ensure timely screening.

2) Screening - filling out a statistical card of a preventive medical examination (screening) of an outpatient (form 025-08/y), a register of patients subject to cytological screening and taking material for cytological examination from the cervix. The screening examination of the target groups of the female population is carried out by a specially trained midwife of the primary health care organization.

3) The final one is obtaining the results of cytology, informing the woman and developing further management tactics, fill out accounting and reporting statistical documentation. Responsible for the final stage of screening is the obstetrician-gynecologist of primary health care [12].

Cytological screening of CC is a complex of organizational and medical measures aimed at early detection of precancerous and neoplastic diseases of this localization and at reducing the mortality of this cohort of patients. For traditional cytology, a smear containing 8-12 thousand cells of stratified squamous epithelium (including cells of metaplastic epithelium) is considered adequate; for liquid cytology - 5 thousand cells. For both methods, the number of cells of endocervical epithelium and/or metaplastic epithelium (from the transformation zone) must be at least 10 (single or in clusters). If more than 75% of the cells of the stratified squamous epithelium are covered with erythrocytes, leukocytes, etc., then the quality of the smear is considered unsatisfactory.

Interpretation of the results of a cytological study is carried out according to the Bethesda-terminology cytological system:

Intraepithelial changes and malignant processes are absent (NILM). This group includes cytological conclusions about the normal state of the epithelium, as well as the presence of various non-neoplastic diseases. Normally, squamous epithelial cells, groups of cells of columnar epithelium and metaplastic epithelium, a small number of leukocytes, and rod/mixed microflora are found in preparations. In the presence of non-neoplastic processes, their nature and, if possible, the cause are specified: atrophic changes, reactive changes associated with inflammation, including typical regeneration. In addition, the presence of microorganisms is indicated: *Trichomonas vaginalis*, fungi, morphologically corresponding to *Candida* spp., bacterial vaginosis, cellular changes corresponding to the defeat of Herpes simplex virus, squamous epithelial cells with atypia of unknown significance (ASC-US), squamous epithelial cells with atypia of unclear significance, not excluding the presence of a high degree of intraepithelial changes (ASC-H). Low-grade squamous intraepithelial changes (LSIL) include lesions associated with HPV and CIN I, high-grade squamous intraepithelial changes (HSIL) include CIN II, CIN III, carcinoma in situ and cases suspected of invasion, squamous cell carcinoma, cervical (glandular) epithelium with atypia of unknown significance, cells of the cervical (glandular) epithelium, possibly neoplasia, endocervical adenocarcinoma in situ, endocervical adenocarcinoma, endometrial

adenocarcinoma, secondary adenocarcinoma, unclassified carcinoma, other malignant tumors.

There are certain features when taking material for oncocytology: firstly, the examined woman should be informed about the exclusion of sexual intercourse, vaginal manipulations, including douching, baths, tampons, etc. 2 days prior to sampling. Taking material for cytological examination is carried out by the midwife of the examination room of the department of medical examinations of the primary health care organization: the traditional method (2 glasses - with obligatory fixation in 96% alcohol, it is preferable to use glass slides with a polished edge, which are easily marked) or the liquid cytology method (one container with stabilizing liquid); the code or surname of the patient, identical to the code and surname in the form for sending material for cytological examination, should be clearly marked on the glasses or container [12].

At the same time, when using the traditional method, the biomaterial is delivered to the cytological laboratory as soon as possible after its collection in specialized containers for glass slides with 96% alcohol. If there are visible visual changes in the cervix, then the material is taken from the woman and, without waiting for the results, she is referred for an examination by an obstetrician-gynecologist.

A cytological study is carried out in centralized cytological laboratories at oncological institutions, where an archive of cytological preparations of patients involved in the screening examination is formed, regardless of the result, for a period of at least 10 years with the formation of a computer database.

What material and technical equipment is required to take material for a Pap test? It is as follows: soap and water for washing hands, a light source for cervical examination, a gynecological chair, a disinfected speculum and gloves, an Eyre spatula, a glass slide and a marking pen, a container with a stabilizing solution for liquid cytology, a fixative solution (96% alcohol), a container with warm water for lubricating and warming the vaginal mirrors, a 0.5% chlorine solution for disinfecting gloves and instruments, or another approved for this purpose. And, of course, the registration form itself.

For carrying out liquid cytology, you additionally need: a disposable cervix brush, a container with a stabilizing solution for liquid cytology, and a fixing solution.

At the same time, a smear for oncocytology cannot be taken: during menstruation, earlier than 48 hours after sexual contact or after using lubricants, vinegar or Lugol solution, tampons or spermicides, after vaginal examination or douching, and also during the treatment of genital infection.

The results of CC screening are as follows. In 2022, 771,282 women of the target group aged 30 to 70 years were examined during cytological screening (in 2021 - 757,454).

During cytological screening in 2022, 392 cases of CC were identified (319 in 2021). The detection rate increased from 0.42 to 0.51 per 1000 women examined [11].

High detection of CC during screening is ensured in Aktobe, Almaty, Atyrau (1.59 is the best result), East Kazakhstan, Kyzylorda, Pavlodar, North Kazakhstan, Turkestan regions and Shymkent city.

The detection rate in these regions ranges from 0.55 to 1.59 per 1000 women examined. Compared to 2021, there is an increase in detection in 10 regions, with the exception of Akmola, Aktobe, Zhambyl, Kostanay, Mangistau, North Kazakhstan regions and Shymkent city. The worst result in Astana city is 0.15 per 1000 women examined.

Cytologically, cervical precancer was detected in 1.16% of those examined (2021 – 0.99%). The detection rate of precancer below 0.6% (the planned indicator for 2022, according to the Comprehensive Plan) was noted in Aktobe, Karaganda and Kostanay regions.

A high proportion of stage I CC (70% or more) was detected in 6 regions of the country (in 8 in 2021): Kostanay, Mangistau (94.7% - best result), North Kazakhstan, Turkestan regions, cities of Almaty and Astana. Low levels of early detection of CC (below 50%) were not observed in any

region.

Localized processes (stages I-II) were identified in 99.2% of all cases of detected cancer (96.5% in 2021). In the Akmola and Karaganda regions, cases of SS were identified not only in the localized, but also in the widespread stages of the process. A total of 3 cases of SS were identified in stage III and not a single case in stage IV (in 2021 - 11 and 0, respectively) [11].

In conclusion, it can be stated that CC occupies one of the leading places among all existing nosological forms of malignant tumors. At the same time, despite the small percentage of patients detected at stages III and IV of the disease, as a visually accessible localization, taking into account a number of factors, early diagnostic indicators do not allow oncologists and gynecologists to “sleep peacefully.” Variability, nonspecificity and veiledness of symptoms, its similarity with various non-tumor processes, leads to neglect of the tumor process. All this requires both oncologists and, first of all, primary health care workers and, of course, gynecologists to increase the level of oncological alertness, inform the population about early symptoms that may indicate this pathology or the onset of proliferative changes and carrying out high-tech diagnostic measures and, as a result, timely treatment. Patients at risk with precancerous diseases should undergo routine examination within the prescribed time frame. The development of screening technologies and methods of primary prevention in the form of vaccination of adolescent girls against HPV allows us to hope for a reduction in the incidence of this disease in the female population.

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ОСОБЕННОСТИ ТЕЧЕНИЯ САХАРНОГО ДИАБЕТА У ДЕТЕЙ ДОШКОЛЬНОГО ВОЗРАСТА: РЕТРОСПЕКТИВНЫЙ АНАЛИЗ

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Введение и цель исследования

Сахарный диабет 1 типа у детей дошкольного возраста является серьезной эндокринной патологией, требующей своевременной диагностики и тщательного контроля. В данном возрастном периоде заболевание характеризуется высокой лабильностью углеводного обмена, что затрудняет управление терапией и повышает риск развития осложнений.

Проблема осложняется тем, что дети младшего возраста не способны самостоятельно описывать своё состояние, в связи с чем диагностика может быть запоздалой, особенно при атипичных симптомах. Частые колебания гликемии, включая как гипогликемии, так и гипергликемии, создают угрозу для развития острых состояний и формирования ранних хронических осложнений. Кроме того, устойчивый гликемический контроль в значительной степени зависит от соблюдения инсулинового режима и питания, что в случае с маленькими детьми полностью ложится на родителей, чья недостаточная осведомлённость и высокая нагрузка могут приводить к систематическим ошибкам в управлении заболеванием.

Дополнительнымотягающим фактором выступает тот факт, что именно в дошкольном возрасте закладываются основы пищевого поведения, распорядка дня и эмоционального восприятия болезни. Невозможность ребёнка полноценно участвовать в собственной

терапии требует от медицинской системы комплексного подхода: помимо контроля за физическим состоянием, необходимы образовательные и психологические вмешательства, ориентированные на семью.

В условиях роста заболеваемости диабетом 1 типа среди детей и тенденции к его дебюту в более раннем возрасте становится особенно важным выявление факторов, влияющих на течение болезни, а также разработка персонализированных стратегий наблюдения и лечения. Исследование, направленное на анализ клинических и поведенческих аспектов течения диабета у детей 3–6 лет, позволяет не только точнее понять особенности патогенеза в этой группе, но и выстроить практические рекомендации для снижения риска осложнений.

Цель исследования — анализ особенностей течения сахарного диабета у детей дошкольного возраста, выявление факторов риска и оптимизация подходов к лечению.

Материалы и методы В исследование были включены данные 135 детей дошкольного возраста (от 3 до 6 лет), находившихся под наблюдением в эндокринологических отделениях специализированных медицинских учреждений в период с 2020 по 2023 год. Исследование имело ретроспективный характер и основывалось на анализе медицинской документации, включая амбулаторные карты, выписки из стационаров и результаты лабораторных исследований.

Изучались следующие параметры:

- возраст выявления заболевания;
- клинические проявления на момент постановки диагноза;
- показатели гликемии и уровень гликированного гемоглобина (HbA1c);
- частота острых метаболических состояний (гипогликемии, гипергликемии, кетоацидоз);
- наличие диабетических осложнений (ретинопатия, нейропатия);
- семейный анамнез по аутоиммунным заболеваниям;
- наличие перенесённых инфекций до дебюта диабета;
- приверженность к терапии, включая регулярность инсулинотерапии, соблюдение режима питания и мониторинга.

Для статистической обработки использовались методы описательной статистики (средние значения, стандартные отклонения, проценты) и корреляционный анализ (оценка связи между отдельными параметрами и развитием осложнений).

Критерии включения в исследование:

- возраст ребёнка от 3 до 6 лет на момент постановки диагноза;
- наличие подтверждённого диагноза сахарного диабета 1 типа, установленного на основании клинической картины и лабораторных данных (гипергликемия, уровень С-пептида, наличие аутоантител);
- наблюдение в профильном эндокринологическом учреждении не менее 12 месяцев;
- наличие полной медицинской документации, включая данные о терапии и динамике показателей.

Критерии исключения:

- возраст младше 3 лет или старше 6 лет на момент постановки диагноза;
- диабет второго типа, моногенные формы диабета или другие эндокринные нарушения;
- отсутствие достаточной клинической информации для анализа;
- случаи с тяжёлой сопутствующей патологией (в т.ч. онкологической или неврологической), способной повлиять на течение основного заболевания;

- отказ родителей от участия в исследовании (в случаях, когда требовалось дополнительное информированное согласие при сборе данных).

Ретроспективный характер работы позволил охватить значительный объём информации о динамике состояния пациентов, определить ключевые паттерны течения заболевания и факторы, влияющие на терапевтический прогноз. Этические аспекты исследования были соблюдены, персональные данные пациентов обезличены.

Результаты

1. Возраст постановки диагноза и особенности дебюта.

Сахарный диабет 1 типа чаще всего проявлялся у детей в возрасте 4–5 лет. Средний возраст постановки диагноза составил $4,3 \pm 0,8$ года. Почти в двух третях случаев (63%) обращение за медицинской помощью происходило уже на фоне выраженной декомпенсации — кетоацидотического состояния, что указывает на низкую скорость выявления заболевания на ранней стадии.

2. Клиническая картина и лабораторные показатели

Наиболее частыми жалобами, фиксируемыми в анамнезе, были полиурия (89%), полидипсия (85%) и быстрая потеря веса (73%). У 22% детей болезнь начиналась с неспецифических симптомов: вялость, нарушения сна, изменения поведения, что затрудняло своевременную диагностику.

Показатели гликемии на момент поступления демонстрировали выраженные колебания, при этом уровень HbA1c в среднем составлял 8,6%, что превышает рекомендованные целевые значения ($<7,5\%$). У 41% пациентов отмечались частые эпизоды гипогликемий (от 2 и более в неделю), что указывает на нестабильность компенсации.

Таблица 1. Клинико-лабораторные характеристики выборки (n = 135)

Показатель	Значение
Средний возраст постановки диагноза	$4,3 \pm 0,8$ года
Дебют с кетоацидозом	63%
HbA1c, среднее значение	8,6%
Частые гипогликемии (>2 в неделю)	41%
Распространённость полиурии	89%
Распространённость полидипсии	85%
Потеря массы тела на момент постановки	73%
Неспецифические симптомы	22%

3. Развитие осложнений

Хронические осложнения диабета диагностировались у 18% детей уже в течение первых двух лет наблюдения. Наиболее часто встречалась начальная стадия ретинопатии (11%), несколько реже — признаки периферической нейропатии (7%). Осложнения чаще фиксировались у пациентов с изначально высоким уровнем HbA1c ($>9\%$) и у тех, кто систематически пропускал контрольные визиты.

4. Факторы риска и семейные особенности

В 35% случаев у детей была зафиксирована отягощённая наследственность по аутоиммунным заболеваниям (включая диабет, тиреоидит, целиакию). У 27% детей диабету предшествовали острые вирусные или бактериальные инфекции в течение 1–3 месяцев до дебюта. Подобные эпизоды, как показал анализ, чаще встречались у детей с ранним началом заболевания.

Таблица 2. Сопутствующие факторы риска и трудности терапии

Параметр	Распространённость (%)
Наследственность по аутоиммунным заболеваниям	35%
Инфекции в анамнезе до манифестации диабета	27%
Нарушение режима инсулинотерапии	41%
Проблемы с соблюдением диеты	38%
Отсутствие регулярного мониторинга гликемии	29%
Сниженный уровень информированности родителей	33%

5. Проблемы приверженности к лечению

Каждая третья семья сталкивалась с трудностями в соблюдении терапии. Причины включали нехватку времени, нерегулярность в ведении дневников самоконтроля, страх перед гипогликемией, а также отсутствие базовых знаний о заболевании. Эти факторы прямо коррелировали с более высокими значениями HbA1c и частотой острых состояний.

Обсуждение.

Результаты проведённого анализа подтверждают: течение сахарного диабета 1 типа у детей дошкольного возраста носит не просто нестабильный, а зачастую непредсказуемый характер. В этом возрасте уровень метаболической компенсации трудно поддерживать на целевых значениях, несмотря на назначенную инсулинотерапию. Средний уровень HbA1c у наблюдаемых пациентов значительно превышал рекомендуемый порог, а каждый четвёртый ребёнок регулярно испытывал острые гликемические колебания. Это чётко указывает на высокую чувствительность организма дошкольника к погрешностям в режиме и дозировках, а также на сложность подбора схемы терапии в условиях постоянно меняющейся суточной активности и питания.

Частота дебюта диабета в форме кетоацидоза (63%) вызывает особую тревогу. Это означает, что заболевание нередко распознаётся уже на этапе, когда развиваются острые метаболические нарушения. Отчасти это можно объяснить возрастными особенностями восприятия симптомов самим ребёнком: он не может осознанно жаловаться на жажду или утомляемость, и любые признаки остаются вне поля внимания до тех пор, пока не становятся критическими. В этих условиях роль родителей становится определяющей, однако треть из них демонстрирует недостаточный уровень осведомлённости о заболевании и его рисках. Это — тревожный сигнал для системы профилактической педиатрии, где пока явно не хватает направленных образовательных стратегий.

Интерес также вызывает значительная доля семей с нарушениями режима инсулинотерапии и питания (41% и 38% соответственно). Эти показатели говорят не столько о неосознанности, сколько о перегруженности родителей и отсутствии выстроенной системы поддержки. Введение современных технологий (инсулиновые помпы, системы

непрерывного мониторинга глюкозы) могло бы стать решающим шагом в снижении риска гипогликемий и повышения качества жизни, однако уровень доступности этих решений до сих пор остаётся ограниченным, особенно за пределами крупных городов.

Отдельно стоит подчеркнуть роль инфекций как возможного триггера. У четверти детей в анамнезе зафиксированы эпизоды ОРВИ или бактериальных заболеваний, предшествующих дебюту диабета. Это коррелирует с уже существующими представлениями о возможной роли вирусной нагрузки в активации аутоиммунного ответа у предрасположенных детей. Также нельзя игнорировать высокий процент случаев с отягощённой наследственностью — 35%, что подтверждает важность сбора подробного семейного анамнеза при любом подозрении на эндокринную патологию у ребёнка.

Обнаруженные ранние признаки осложнений у 18% детей (включая ретинопатию и нейропатию) указывают на то, что неблагоприятный метаболический профиль быстро переходит в органические последствия, даже на столь раннем этапе. Это подчёркивает необходимость регулярного скрининга осложнений уже в первые годы после постановки диагноза — практика, которая до сих пор не в полной мере реализуется в детских эндокринологических службах.

Таким образом, исследование демонстрирует многопрофильность проблемы: нестабильность течения диабета в раннем возрасте тесно переплетается с социальными, поведенческими и организационными трудностями. Эффективное лечение в этой группе невозможно без комплексного сопровождения семьи, доступных образовательных программ и внедрения современных технологий, способных компенсировать возрастные ограничения пациента. Вывод очевиден: медицинские усилия должны быть переориентированы с чисто клинической диагностики на систему поддержки и профилактики, направленную на всю семью.

Заключение

Сахарный диабет у детей дошкольного возраста характеризуется выраженной лабильностью гликемии, высоким риском острых и хронических осложнений, а также зависимостью от участия родителей в управлении заболеванием. Для улучшения качества лечения требуется мультидисциплинарный подход, включающий обучение семей, использование современных технологий контроля гликемии (инсулиновые помпы, системы мониторинга) и улучшение доступности специализированной помощи. Внедрение программ по обучению родителей и повышению их компетенций в управлении диабетом у детей может способствовать снижению частоты осложнений и улучшению исходов лечения.

Ключевые слова: сахарный диабет, дети дошкольного возраста, особенности течения, осложнения, инсулинотерапия.



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