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АРХИТЕКТУРА МАТЕМАТИЧЕСКОГО МЫШЛЕНИЯ: ТЕОРЕТИЧЕСКИЙ ФУНДАМЕНТ И ПРАКТИЧЕСКАЯ ПРИМЕНИМОСТЬ

Аннотация

Данная статья анализирует роль математических основ в формировании современной интеллектуальной и промышленной инфраструктуры. В эпоху доминирования больших данных и алгоритмических систем, переход к глубокому пониманию аксиоматических структур становится критическим механизмом для обеспечения когнитивной гибкости и технологической устойчивости. Исследование рассматривает влияние фундаментальной подготовки на оптимизацию внутренних процессов принятия решений, а также её значение для укрепления национальной конкурентоспособности. Автор приходит к выводу, что изучение основ математики является не только образовательным этапом, но и стратегическим активом для профессионалов, стремящихся к лидерству в условиях высокотехнологичной глобальной экономики.

Ключевые слова:

основания математики, логический анализ, системная методология, инновационный потенциал, цифровая грамотность, когнитивная устойчивость, аналитическая база.

Основная часть

Необходимость систематического освоения начал математики обусловлена потребностью в «универсальном когнитивном каркасе» в условиях растущей сложности информационных потоков. Математические основы предоставляют стандартизированную среду, позволяющую специалистам декомпозировать многофакторные проблемы на логические единицы с высокой точностью. Без этой фундаментальной базы процесс разработки инноваций сдерживается «концептуальной фрагментацией», вызванной отсутствием строгого понимания взаимосвязей внутри системы. Приверженность аксиоматической строгости сигнализирует о стремлении к международным стандартам качества, что значительно повышает прозрачность и верифицируемость научных и инженерных разработок.

С точки зрения управления талантами, значимость основ математики заключается в развитии Алгоритмической адаптивности. Специалисты, опирающиеся на твердый математический фундамент, быстрее осваивают новые инструменты автоматизации и моделирования, так как их навыки

базируются на инвариантных законах логики. Кроме того, для крупных корпораций использование единого математического языка упрощает кросс-функциональное взаимодействие между отделами. Это снижает административные барьеры и операционные риски, связанные с неверной интерпретацией количественных данных. Переход от «инструментального» подхода к «структурному» пониманию математики поощряет глубокое аналитическое суждение, необходимое для управления сложными проектами в условиях неопределенности.

На макроэкономическом уровне интеграция качественного математического образования выступает мощным катализатором Технологического суверенитета. Когда образовательная система фокусируется на фундаментальных принципах, она формирует кадровый резерв, способный не только эксплуатировать зарубежные технологии, но и создавать собственные прорывные решения в области кибербезопасности, логистики и биотехнологий. Соответствие образовательных программ глобальным научным стандартам является ключевым условием для привлечения стратегических инвестиций в наукоемкие отрасли. Более того, точность математических методов служит надежным заслоном от неэффективного использования ресурсов. Повышая качество интеллектуального капитала, математика укрепляет целостность экономики, создавая среду, благоприятную для долгосрочного инновационного роста.

Тем не менее, модернизация преподавания математических основ — это сложный процесс, требующий значительных инвестиций в Инновационную педагогику и методическое сопровождение. Необходимо обеспечить плавный переход от абстрактных формул к осознанию математики как языка описания реальности. Несмотря на эти вызовы, долгосрочные дивиденды в виде повышения общей грамотности и аналитических способностей населения значительно превосходят затраты. Математический фундамент обеспечивает «интеллектуальную инклюзию», позволяя специалистам из разных областей эффективно конкурировать на мировом рынке труда. В мире, где цифровые модели определяют успех бизнеса, синергия логической строгости и практического применения становится залогом процветания.

Заключение

Глубокое освоение основ математики является трансформирующим шагом на пути к интеллектуальному лидерству и экономической эффективности. Акцент на фундаментальности и доказательности расширяет возможности анализа, оптимизирует технологические процессы и повышает общую устойчивость общества к глобальным вызовам. В условиях, когда точность данных является синонимом успеха, владение математическим фундаментом остается фундаментальным требованием для любого субъекта, стремящегося к устойчивому развитию на конкурентном глобальном рынке.

Список использованной литературы:

1. Основания математики. Гильберт Д., Бернайс П. (Переиздание 2024-2026). Германия.
2. Введение в математическую логику. Клини С.К. (Актуализированное издание 2023). США.
3. Роль математического образования в инновационной экономике. Смит Дж. и др. (2024). Великобритания.
4. Математика: ее содержание, методы и значение. Александров А.Д., Колмогоров А.Н., Лаврентьев М.А. (Ред. 2024). Россия.

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МАТЕМАТИЧЕСКИЙ ФУНДАМЕНТ КАК СТРАТЕГИЧЕСКИЙ РЕСУРС В ЭПОХУ ГЛОБАЛЬНОЙ ЦИФРОВИЗАЦИИ

Аннотация

Данная статья рассматривает фундаментальные основы математики не только как теоретическую дисциплину, но и как критически важную инфраструктуру для современного научно-технического прогресса. В условиях экспоненциального роста объемов данных и усложнения алгоритмических систем, переход к глубокому освоению математических первооснов становится необходимым механизмом для обеспечения аналитической точности и логической прозрачности. Исследование анализирует влияние качественной математической подготовки на микроэкономическую эффективность предприятий и макроэкономическую устойчивость государств. Автор делает вывод, что систематическое изучение начал математики является стратегическим императивом для формирования высококонкурентного человеческого капитала в условиях четвертой промышленной революции.

Ключевые слова:

основания математики, логическая строгость, цифровые системы, человеческий капитал, системный анализ, алгоритмизация, экономическая устойчивость.

Основная часть

Необходимость ревизии и углубленного изучения основ математики продиктована потребностью в «едином интеллектуальном стандарте» в условиях междисциплинарной интеграции. Математический базис предоставляет универсальную систему координат, позволяющую преобразовывать неопределенные концепции в строгие модели с высокой прогностической способностью. Без этого фундамента развитие инновационных секторов, таких как биоинформатика или финтех, сдерживается «когнитивным шумом», вызванным отсутствием формальной логики в обработке данных. Приверженность аксиоматическому методу свидетельствует о высокой культуре мышления, что является необходимым условием для интеграции в международное научное сообщество и привлечения высокотехнологичных инвестиций.

С позиции управления знаниями, значимость основ математики заключается в оптимизации когнитивной маневренности. Специалисты, обладающие развитым аппаратом математической

логики, способны быстрее адаптироваться к смене технологических парадигм, так как их компетенции опираются на фундаментальные, а не ситуативные знания. Более того, для современных корпораций использование стандартизированного математического аппарата упрощает верификацию сложных программных продуктов и инженерных систем. Это снижает риск системных ошибок и сокращает издержки на аудит безопасности. Переход от «поверхностного вычисления» к «структурному пониманию» поощряет глубокое профессиональное суждение, что крайне важно при принятии решений в условиях дефицита времени.

На макроэкономическом уровне развитие математической школы является мощным катализатором Промышленной автономии. Когда образовательные стандарты страны ориентированы на глубокое понимание основ, формируется интеллектуальная среда, способная генерировать собственные уникальные алгоритмы и программные решения. Соответствие национальных учебных планов передовым научным бенчмаркам является ключевым условием для вхождения в число технологических лидеров и повышения позиций в глобальных рейтингах инноваций. Кроме того, строгость математических доказательств выступает гарантом надежности критической инфраструктуры. Повышая качество аналитической подготовки граждан, математика укрепляет целостность цифрового контура страны, способствуя долгосрочному и стабильному экономическому росту.

Тем не менее, совершенствование методики преподавания математических основ — это масштабный процесс, требующий значительных инвестиций в Подготовку кадров и развитие цифровых образовательных сред. Необходимо преодолеть разрыв между абстрактными аксиомами и их практическими воплощениями в коде, архитектуре и финансах. Несмотря на сложность данной задачи, долгосрочные выгоды в виде появления поколения инноваторов с системным мышлением многократно превышают затраты. Фундаментальные знания обеспечивают «социальный лифт», позволяя талантам реализовывать себя в самых высокооплачиваемых и технологичных отраслях. В мире, где математические модели управляют глобальными потоками, владение основами становится залогом процветания и суверенитета.

Заключение

Систематическое освоение основ математики является решающим шагом на пути к достижению интеллектуального превосходства и операционной эффективности. Приоритет логической чистоты и доказательности расширяет горизонты планирования, минимизирует технологические риски и укрепляет общую устойчивость общества к изменениям. В глобальной среде, где точность является эквивалентом доверия, владение математическим фундаментом остается обязательным условием для любого субъекта, претендующего на значимую роль в экономике будущего.

Список использованной литературы:

1. Основания математики. Гильберт Д., Бернайс П. (Переиздание 2024-2026). Германия.
2. Введение в математическую логику. Клини С.К. (Актуализированное издание 2023). США.
3. Роль математического образования в инновационной экономике. Смит Дж. и др. (2024). Великобритания.
4. Математика: ее содержание, методы и значение. Александров А.Д., Колмогоров А.Н., Лаврентьев М. А. (Ред. 2024). Россия.

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СТРАТЕГИЧЕСКОЕ ЗНАЧЕНИЕ ФУНДАМЕНТАЛЬНОЙ МАТЕМАТИКИ В СИСТЕМЕ СОВРЕМЕННОГО НАУЧНОГО ЗНАНИЯ

Аннотация

Данная статья анализирует многогранную значимость основ математики как фундаментальной базы для развития глобального научно-технического прогресса. В условиях стремительной цифровизации и интеграции искусственного интеллекта, глубокое понимание математических первооснов служит критическим механизмом для обеспечения точности, логической последовательности и надежности в инженерных и экономических расчетах. Исследование рассматривает гносеологические преимущества изучения основ, такие как формирование алгоритмического мышления и способности к абстрагированию, а также их макроэкономическое влияние на развитие высокотехнологичных отраслей. Анализ приводит к выводу, что владение основами математики является не просто академическим требованием, но стратегическим императивом для наций и корпораций, стремящихся к лидерству в глобальной цифровой архитектуре.

Ключевые слова:

основы математики, математическая логика, алгоритмическое мышление, аксиоматический метод, цифровая экономика, системный анализ, научно-технический прогресс.

Основная часть

Переход к углубленному изучению основ математики продиктован необходимостью наличия «универсального языка точности» в эпоху глобальной автоматизации. Математический базис предоставляет стандартизированную структуру, которая позволяет специалистам моделировать сложные физические и социальные процессы с высокой прецизионностью. Без этого фундамента междисциплинарные исследования сдерживаются «информационным хаосом», вызванным отсутствием строгой логической верификации. Приоритетное внимание к аксиоматическим методам сигнализирует о приверженности международным научным стандартам, что значительно повышает достоверность аналитических прогнозов. Эта методологическая прозрачность является обязательным условием для привлечения интеллектуальных инвестиций в наукоемкие проекты.

С точки зрения интеллектуального менеджмента, важность математических основ заключается в оптимизации когнитивного капитала. Специалисты, владеющие базовыми принципами алгебры, анализа и теории вероятностей, демонстрируют более высокую адаптивность к новым

технологическим стекам, поскольку их навыки базируются на универсальных логических законах. Более того, для высокотехнологичных компаний использование единого математического аппарата упрощает консолидацию исследовательских данных. Это снижает «административное бремя» и операционные издержки, связанные с переподготовкой кадров под узкоспециализированные задачи. Переход к концептуальному пониманию математики поощряет сдвиг от «рецептурного» подхода к «творческому проектированию», что отражает истинную экономическую суть интеллектуального труда.

На макроэкономическом уровне внедрение качественного математического образования является мощным катализатором прямых иностранных инвестиций (ПИИ) в сектор НИОКР. Когда страна выравнивает свои образовательные стандарты по математике с глобальными бенчмарками, она снижает «барьеры входа» для международных технологических гигантов. Это соответствие часто является ключевым требованием для вступления в международные научные альянсы или получения высоких позиций в глобальных инновационных индексах. Более того, строгость математического доказательства выступает сдерживающим фактором для технических ошибок и системных сбоев. Улучшая качество человеческого капитала, математическая грамотность укрепляет целостность ИТ-сектора и промышленного производства, создавая среду, благоприятную для устойчивого экономического роста.

Однако модернизация математической подготовки — это сложный процесс, требующий значительных инвестиций в человеческий капитал и цифровую инфраструктуру. Она требует постоянного обновления учебных планов и внедрения современных инструментов визуализации данных. Несмотря на эти вызовы, долгосрочные выгоды от формирования математически грамотного общества значительно превышают затраты. Фундаментальные знания способствуют «технологической инклюзии», позволяя локальным предприятиям конкурировать за капитал на равных с международными игроками. По мере того как мир движется к экономике знаний, синергия математической точности и инновационного мышления будет продолжать снижать рыночную волатильность и повышать эффективность распределения глобальных ресурсов.

Заключение

Основы математики являются трансформирующим инструментом на пути к глобальной технологической интеграции и интеллектуальному превосходству. Приоритет логической строгости и доказательности расширяет возможности исследователей, оптимизирует управление научными проектами и укрепляет национальную экономическую устойчивость. В мире, где данные являются наиболее ценным активом, способность четко и последовательно оперировать математическими структурами остается фундаментальным условием успеха любого субъекта на конкурентном глобальном рынке.

Список использованной литературы:

1. Основания математики. Гильберт Д., Бернайс П. (Переиздание 2024-2026). Германия.
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4. Математика: ее содержание, методы и значение. Александров А. Д., Колмогоров А. Н., Лаврентьев М. А. (Ред. 2024). Россия.

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ФУНДАМЕНТАЛЬНЫЕ ПРИНЦИПЫ МАТЕМАТИКИ КАК КОГНИТИВНЫЙ БАЗИС НАУЧНО-ТЕХНИЧЕСКОЙ РЕВОЛЮЦИИ

Аннотация

Данная статья исследует стратегическую роль базовых математических концепций в формировании современной научной парадигмы. В эпоху перехода к Индустрии 4.0 математический фундамент выступает не просто как набор вычислительных инструментов, а как критический механизм структурирования реальности и верификации данных. В работе рассматриваются микроэкономические эффекты математической грамотности, такие как повышение операционной эффективности и минимизация проектных рисков, а также макроэкономические последствия для инновационного потенциала государства. Автор приходит к выводу, что систематическое освоение основ математики является обязательным условием для обеспечения интеллектуального суверенитета и долгосрочной экономической устойчивости в условиях глобальной конкуренции.

Ключевые слова:

математический анализ, теоретическая база, логическая структура, когнитивная гибкость, цифровая трансформация, методология науки, интеллектуальный капитал.

Основная часть

Необходимость глубокого изучения начал математики продиктована потребностью в «едином аналитическом коде» в условиях глобального обмена знаниями. Базовые разделы математики обеспечивают универсальную среду, позволяющую декомпозировать сложнейшие системы на понятные и управляемые элементы с высокой точностью. Без этой теоретической основы развитие прикладных наук сдерживается «методологическим разрывом», возникающим из-за отсутствия строгой формализации задач. Инвестиции в фундаментальную подготовку свидетельствуют о стратегической ориентации на высокие стандарты качества, что критически важно для интеграции в международную исследовательскую архитектуру и привлечения венчурных инвестиций.

С позиции управления человеческими ресурсами, значимость математических основ заключается в формировании высокого уровня Когнитивной адаптивности. Специалисты, обладающие развитым логическим аппаратом, способны эффективнее переключаться между междисциплинарными задачами, поскольку их профессиональные навыки опираются на неизменные законы логики и арифметики. Более того, для наукоемких производств использование стандартизированных математических моделей упрощает верификацию результатов и аудит проектных решений. Это существенно снижает временные затраты на разработку и внедрение новых

продуктов (Time-to-Market). Переход от обучения «по шаблону» к изучению «первопричин» развивает способность к глубокому профессиональному суждению, что позволяет находить решения в ситуациях высокой неопределенности.

На макроэкономическом уровне развитие математической школы является мощным катализатором Инновационной активности. Когда образовательная система страны делает упор на фундаментальные основы, это создает благоприятную среду для появления прорывных технологий в области криптографии, квантовых вычислений и материаловедения. Такое соответствие международным интеллектуальным трендам является ключевым условием для участия в глобальных технологических цепочках. Кроме того, строгость математических методов служит надежным барьером против дилетантизма и технологической деградации. Повышая качество аналитической подготовки кадров, математика укрепляет надежность финансового сектора и энергетической инфраструктуры, обеспечивая устойчивость всей национальной экономики.

Тем не менее, совершенствование системы преподавания основ математики — это многоуровневый процесс, требующий значительного вклада в Методический капитал и современные обучающие платформы. Необходимо преодолеть разрыв между абстрактной теорией и её практическими приложениями, обучая студентов видеть математические структуры в повседневных процессах. Несмотря на трудоемкость этого пути, социально-экономические дивиденды в виде интеллектуально развитого населения многократно превосходят затраты. Фундаментальные знания обеспечивают «образовательную мобильность», позволяя кадрам оставаться востребованными на протяжении всей профессиональной жизни. В мире, где алгоритмы определяют будущее, синергия математической логики и системного подхода становится основой процветания.

Заключение

Освоение основ математики является ключевым шагом на пути к достижению научного превосходства и экономической эффективности. Акцент на логической точности и фундаментальности расширяет горизонты планирования, оптимизирует технологические процессы и повышает общую устойчивость общества перед лицом новых вызовов. В глобальной информационной среде, где точность является синонимом надежности, владение математическим фундаментом остается обязательным атрибутом успешного развития любой системы, стремящейся к лидерству на мировом рынке.

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ХИМИЯ

STUDY OF THE PHOTOCATALYTIC ACTIVITY OF AG-ZnO AND Au-Ag-ZnO FILM IN THE DEGRADATION OF RHODAMINE B (RHB)

Summary

The degradation of organic pollutants based on semiconductor photocatalysts has attracted immense interest due to their vast potential for environmental protection and sustainable development. Among prominent semiconductors, zinc oxide (ZnO) is considered one of the most promising photocatalysts owing to its superior characteristics, such as environmental friendliness, high chemical stability, low cost, high efficiency, high electron mobility, large exciton binding energy (60 meV) at room temperature, and excellent photocatalytic performance. However, ZnO possesses certain drawbacks, including a wide band gap (3.3 eV) that limits its absorption to the ultraviolet (UV) region and a high electron-hole recombination rate, which reduces its photocatalytic efficiency.

Consequently, continuous research efforts have recently been conducted to extend the light absorption range and enhance charge separation efficiency to overcome these limitations. One effective approach involves anchoring noble metals, such as Au, Ag, and Pt, onto ZnO nanostructures. The surface plasmon resonance (SPR) properties of these noble metal nanoparticles effectively improve the photocatalytic capability of ZnO.

Keywords:

Ag-ZnO films, Au-Ag-ZnO films, Photocatalysis

I. Introduction

ZnO films decorated with Ag and Au nanoparticles were fabricated using the plasma jet technique. The thickness and physicochemical properties of the Ag-ZnO films were investigated as a function of varying Ag precursor concentrations. Furthermore, after depositing Ag nanoparticles at two different precursor concentrations, the addition of Au to the material system was also studied. The positive effects of Ag and (Ag, Au) nanoparticle deposition on the crystal structure, morphology, and optical properties of the ZnO films were comprehensively examined. Finally, the Ag-ZnO and Au-Ag-ZnO systems were evaluated for their photocatalytic performance in the degradation of Rhodamine B (RhB).

II. Plasma jet-assisted fabrication of ag- and au-loaded zno nanostructured films

In this section, a combination of hydrothermal synthesis, plasma jet deposition, and photoreduction was employed for film fabrication. First, the hydrothermal method was used to synthesize ZnO thin films on glass substrates. To prepare the Ag-ZnO films, a plasma jet technique was utilized to deposit and anchor Ag nanoparticles onto the ZnO surface.

Subsequently, a photoreduction process was applied to reduce the HAuCl_4 precursor into Au nanoparticles, which were then loaded onto the Ag/ZnO structure to form the final Au-Ag/ZnO composite system.

1. Fabrication of ZnO Thin Films.

• Step 1: Preparation of the ZnO Seed Layer via Spin-Coating

A precursor solution was prepared by dissolving zinc acetate dihydrate $\text{Zn}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$ in ethanol, with ethanolamine added as a stabilizer. The mixture was stirred at 50 °C for 1 hour to obtain a homogeneous solution. This solution was then deposited onto glass substrates using the spin-coating technique. Finally, the

coated films were annealed at 450°C for 1 hour to form a crystalline ZnO seed layer.

- **Step 2: Hydrothermal Growth of ZnO Nanostructures**

To grow the ZnO nanostructures, a growth solution was prepared by dissolving zinc nitrate tetrahydrate $\text{Zn}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ and 1.05 g of hexamethylenediamine (HMDA) in 40 mL of deionized (DI) water. The reaction mixture was stirred for 1 hour at room temperature. The pre-coated seed layer substrates were then placed into a hydrothermal autoclave containing this solution. The hydrothermal reaction was conducted at 90 °C for 8 hours.

- **Step 3: Post-treatment**

The resulting ZnO films on glass substrates were thoroughly rinsed multiple times with deionized water to remove any residual chemicals and subsequently dried at 80 °C for 12 hours. The final product is designated as the Z0 sample.

2. Fabrication of Ag-ZnO Films via Plasma Jet Technique.

The Ag-ZnO films were fabricated using the plasma jet technique. The ZnO films prepared in section 2.6.1 were placed on glass substrates and immersed in a beaker containing 20 mL of either 5 mM or 45 mM AgNO_3 5 mM solution. Each sample underwent plasma jet treatment for 2 minutes. The resulting films were designated as Zp-Ag5 and Zp-Ag45, respectively.

3. Fabrication of Au-Ag-ZnO Ternary Composite Films.

The Au-Ag-ZnO ternary films were fabricated by depositing gold (Au) nanoparticles onto the previously prepared Zp-Ag5 and Zp-Ag45 samples using a photoreduction method. The resulting composite films were designated as Au-Zp-Ag5 and Au-Zp-Ag45, respectively. The detailed procedure is as follows:

- **Step 1:** The Zp-Ag5 and Zp-Ag45 films were immersed in 90 mL of a 0.0003 M chloroauric acid HAuCl_4 aqueous solution.

- **Step 2:** Sodium citrate (0.07 M) was added dropwise to the solution as a stabilizing and reducing agent. The system was then subjected to UVA light irradiation for approximately 10 minutes.

- **Step 3:** After irradiation, the samples were removed, thoroughly rinsed with distilled water, and dried. The final products were stored for characterization and designated as Au-Zp-Ag5 and Au-Zp-Ag45.

For comparison, a gold-decorated ZnO sample (without silver) was also synthesized using the same procedure and labeled as Au-Z0.

III. Results and discussion

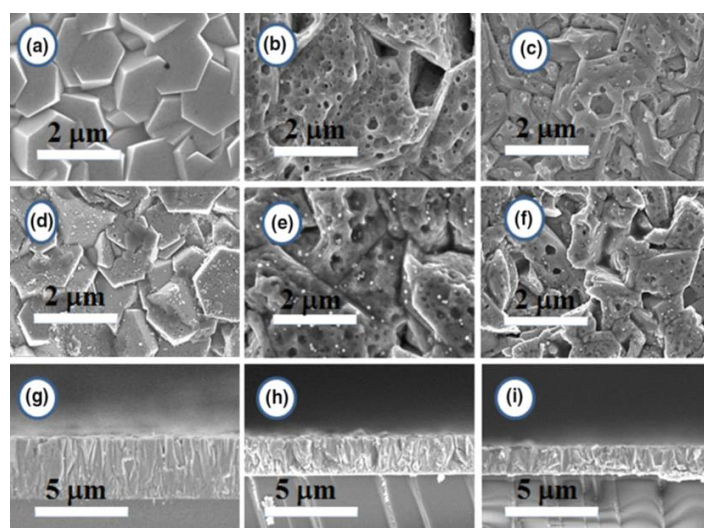


Figure 1 – SEM surface images of (a) Z0, (b) Zp-Ag5, (c) Zp-Ag45, (d) Au-Z0, (e) Au-Zp-Ag5, (f) Au-Zp-Ag45, and cross-sectional SEM images of (g) Z0, (h) Zp-Ag5, (i) Zp-Ag45.

The ZnO thin film (designated as Z0) was synthesized on glass substrates using a two-step process: spin-coating of a seed layer followed by hydrothermal growth. To functionalize the surface, silver (Ag) nanoparticles were decorated onto the Z0 films using an atmospheric pressure plasma jet technique. Two different silver nitrate AgNO₃ precursor concentrations, 5 mM and 45 mM, were employed to produce the binary composite films, labeled as Zp-Ag5 and Zp-Ag45, respectively. Subsequently, gold (Au) nanoparticles were incorporated onto these Ag-ZnO templates via a photoreduction (redox) method, resulting in the ternary hybrid films designated as Au-Zp-Ag5 and Au-Zp-Ag45. For comparative purposes, a reference sample consisting of Au-decorated ZnO without silver was also synthesized and identified as Au-Z0.

Scanning Electron Microscopy (SEM) was employed to investigate the morphology of the fabricated Z0, Zp-Ag5, Zp-Ag45, Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45 films. The corresponding top-view and cross-sectional SEM images are presented in Figure 1. Initially, the SEM image of the pristine ZnO (Z0) in Fig. 1(a) reveals a structure consisting of vertically aligned nanorods with an average diameter of approximately 500 nm. The cross-sectional view in Fig. 1(g) confirms a film thickness of approximately 3.1 μm . Upon decorating the ZnO films with Ag nanoparticles using the plasma jet technique at AgNO₃ concentrations of 5 mM and 45 mM, the surface morphology becomes noticeably rougher. As shown in Fig. 1(b) and (c), the formation of numerous hexagonal pits is observed, with the pit density increasing at the higher precursor concentration. Interestingly, the film thickness for Zp-Ag5 and Zp-Ag45 significantly decreases to 1.91 μm and 1.51 μm respectively (Fig. 1h, i). The Ag nanoparticle size in Zp-Ag5 ranges from 5 to 30 nm, whereas Zp-Ag45 exhibits larger particles between 10 and 50 nm. These results indicate that the plasma process and the AgNO₃ concentration are critical factors influencing the film morphology and the dimensions of the Ag nanoparticles in the modified ZnO system.

Subsequently, when Au nanoparticles were deposited onto the Zp-Ag5 and Zp-Ag45 films via photoreduction, the surfaces became increasingly porous. As illustrated in Fig. 1(d–f), Au nanoparticles with sizes ranging from 20 to 30 nm are clearly visible. The pre-existing pits on the ZnO nanostructure appear to serve as anchoring sites, effectively trapping the Au nanoparticles on the film surface. Overall, the SEM analysis confirms the successful growth of ZnO and the effective integration of both Ag and Au nanoparticles onto the ZnO framework.

The X-ray diffraction (XRD) patterns of the Z0, Zp-Ag5, and Zp-Ag45 samples exhibit four distinct diffraction peaks at 2θ angles of 31.8°, 34.4°, 36.3°, and 47.6°. These peaks are in full agreement with the (100), (002), (101), and (102) crystallographic planes of wurtzite ZnO, respectively (JCPDS card no. 36-1451). No diffraction peaks characteristic of metallic Ag were observed, which may be attributed to the low concentration of Ag nanoparticles (AgNPs). Furthermore, observing the most intense peak at 34.43° corresponding to the (002) plane, the peak intensity decreases progressively for the Z0, Zp-Ag5, and Zp-Ag45 films. As previously mentioned in the cross-sectional SEM results, the thickness of the Z0, Zp-Ag5, and Zp-Ag45 films decreases; consequently, the amount of ZnO in the Zp-Ag5 and Zp-Ag45 samples is reduced, leading to a corresponding decrease in their diffraction intensities.

To further investigate the chemical composition and the spatial distribution of elements within the fabricated nanostructures, the Au-Zp-Ag45 sample was selected as a representative for STEM-mapping analysis (Scanning Transmission Electron Microscopy combined with Energy-Dispersive X-ray Spectroscopy). The elemental mapping results for Oxygen (O), Gold (Au), Silver (Ag), and Zinc (Zn) in the Au-Zp-Ag45 sample are presented in Figure 4.3. The STEM analysis confirms the simultaneous presence of all four primary chemical constituents—O, Zn, Ag, and Au—within the composite framework.

Furthermore, the elemental maps demonstrate a highly homogeneous distribution of Au and Ag nanoparticles across the ZnO matrix. This uniform dispersion is a critical factor in maximizing the density of active sites on the film surface, which is expected to significantly enhance the overall photocatalytic efficiency of the ternary system.

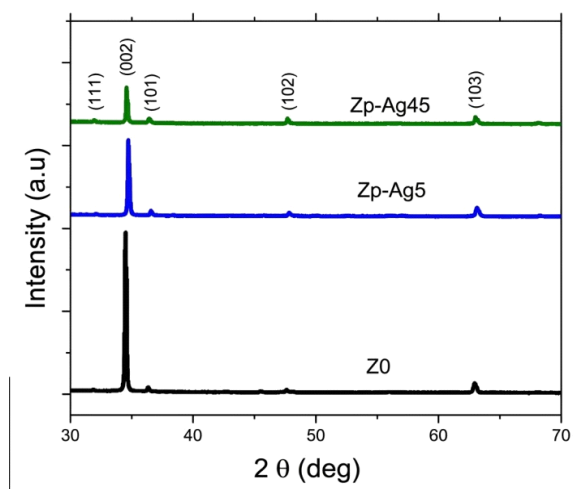


Figure 2 –X-ray diffraction (XRD) patterns of Z0, Zp-Ag5, and Zp-Ag45 samples

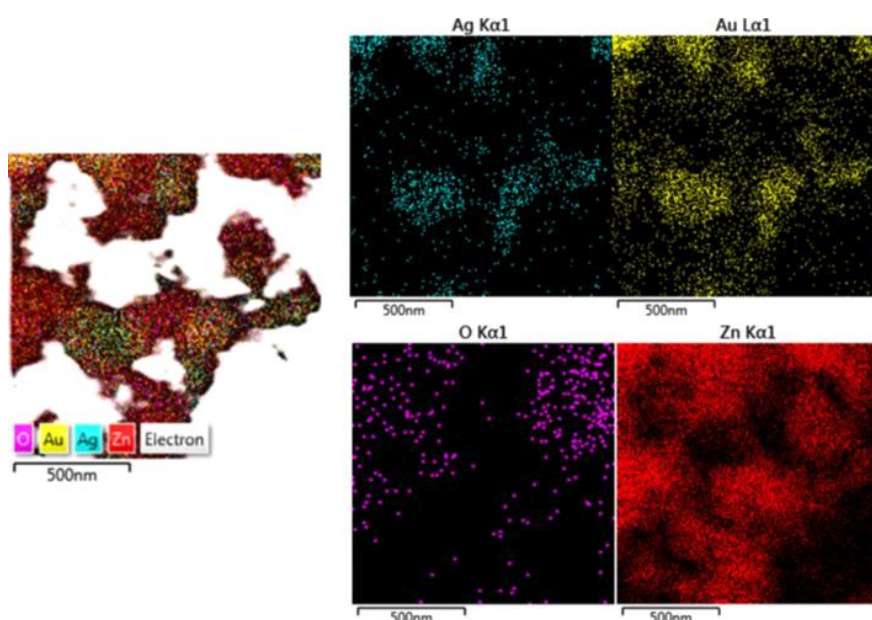


Figure 3 – STEM-mapping images (elemental maps of O, Au, Ag, and Zn atoms) in the Au-Zp-Ag45 sample

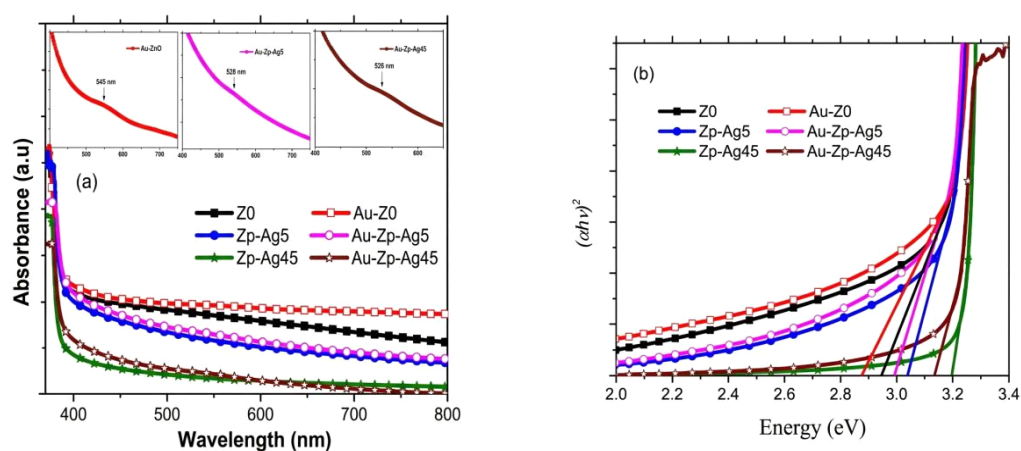


Figure 4 – (a) UV-Vis absorption spectra of Z0, Zp-Ag5, Zp-Ag45, Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45 samples, with the insets showing the magnified absorption spectra of Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45; (b) Tauc plots for the band gap (E_g) determination of the corresponding samples.

Table 1

Calculated optical band gap (E_g) values of the synthesized Z0, Zp-Ag5, Zp-Ag45, Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45 materials

Sample Name	Bandgap Value (eV)
Z0	2,94
Zp-Ag5	3,04
Zp-Ag45	3,2
Au-Z0	2,88
Au-Zp-Ag5	2,99
Au-Zp-Ag45	3,14

The influence of noble metal decoration on the optical properties of the fabricated materials was investigated using UV-Vis absorption spectroscopy. Figure 4(a) displays the absorption spectra of the Z0, Zp-Ag5, Zp-Ag45, Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45 samples. For the silver-decorated samples (Zp-Ag5 and Zp-Ag45), no typical absorption peaks characteristic of Ag nanoparticles were observed. This is likely due to the low concentration of the Ag dopants, which is consistent with the XRD results discussed previously. However, in samples containing both Ag and Au nanoparticles (Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45), a noticeable blue-shift in the absorption peaks (from 545 nm to 528 nm) was observed, coinciding with the increase in AgNO₃ concentration and the reduction in film thickness. The characteristic absorption maxima for Au nanoparticles, typically appearing between 526–545 nm, arise from the Localized Surface Plasmon Resonance (LSPR) of conduction electrons [6], as shown in the insets of Fig. 4(a). The relatively low intensity of these Au plasmon peaks can be attributed to the low Au loading concentration. Since ZnO possesses a direct band gap [7], the optical band gap E_g was calculated using the Tauc equation:

$$\alpha h\nu = A \left[(h\nu - E_g)^{-1/2} \right] \quad (1)$$

Where A is a constant, h is Planck's constant, ν is the photon frequency, E_g is the optical band gap, and $n = 1/2$ for direct transition semiconductors. The Tauc plots of $(\alpha h\nu)^2$ versus photon energy $h\nu$ are presented in Figure 4(b), and the determined E_g values are summarized in Table 1. The results show that the band gap of the Z0, Zp-Ag5, and Zp-Ag45 films increases from 2.94 eV to 3.2 eV as the film thickness decreases from 3.1 μm to 1.51 μm . Film thickness significantly influences the band gap of ZnO films [9]; typically, thicker films exhibit a red-shift (narrowing of the band gap) due to changes in carrier concentration. In this study, the increase in Ag content and the corresponding decrease in film thickness are the primary factors driving the observed blue-shift in the absorption spectra [1, 2].

The calculated optical band gaps (E_g) for Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45 were found to be 2.88 eV, 2.99 eV, and 3.14 eV, respectively. Compared to their respective counterparts (Z0, Zp-Ag5, and Zp-Ag45), these samples exhibit a noticeable red-shift in their absorption edges. This shift can be attributed to the interfacial electron transfer between the gold nanoparticles and the ZnO matrix, as well as the modified optical transitions occurring within the ZnO film.

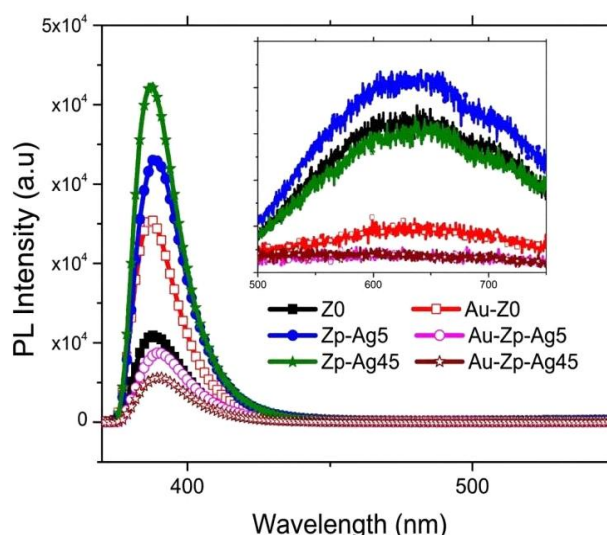


Figure 5 – Photoluminescence (PL) spectra of the synthesized Z0, Zp-Ag5, Zp-Ag45, Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45 samples; The inset shows the magnified PL spectra in the visible (Vis) light region

Figure 5 illustrates the photoluminescence (PL) spectra of the Z0, Zp-Ag5, Zp-Ag45, Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45 samples, excited by a 355 nm laser source. The PL spectra of all samples exhibit a strong near-band-edge (NBE) emission in the UV region, alongside a very weak and broad visible (Vis) emission originating from deep-level emissions (DLE) associated with intrinsic and extrinsic defects. Since the energy levels of NBE and DLE often compete with each other, a reduction in defect centers typically leads to an enhancement of the UV emission intensity [8]. As observed in Figure 5, the UV emission intensity of the Zp-Ag45 film is approximately 1.2 and 3.9 times higher than those of the Zp-Ag5 and Z0 films, respectively. Notably, for the Au-decorated samples (Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45), only the UV emission is prominent, while the visible emission spectra almost entirely disappear. This enhancement in the UV emission for the Zp-Ag5 and Zp-Ag45 films can be attributed to the Ag nanoparticles decorated on the ZnO surface, which increase the population of excited charge carriers and promote the radiative recombination rate [5-9].

In the case of the Au-Z0 sample, the UV emission intensity in the PL spectrum is enhanced by approximately 2.35 times compared to that of Z0. Conversely, the intensities of Au-Zp-Ag5 and Au-Zp-Ag45 are quenched by approximately 3.67 and 7.3 times relative to their counterparts, Zp-Ag5 and Zp-Ag45, respectively. In practice, the enhancement or quenching of PL emission is governed by the energy band structures of the semiconductor and the metal, as well as the specific emission states and the direction of energy or electron transfer at the metal-semiconductor interface [6, 7]. In this study, the conduction band (CB), valence band (VB), and deep-defect level of ZnO are situated at 4.19 eV, 7.39 eV, and 5.09 eV, respectively [4]. The Fermi level of Au is approximately 5.1 eV [2, 3], which is in close proximity to the deep-defect level of ZnO. This energetic alignment facilitates the transfer of defect-related electrons from ZnO to the Fermi level of Au. Electrons at the Fermi level, under the influence of the surface plasmon resonance (SPR) effect within the Au nanoparticles, are excited to higher energy states and can subsequently transition (inject) into the conduction band of ZnO. Consequently, the UV emission intensity is enhanced while the defect-related visible emission is suppressed. The inhibition of defect-related transitions in this manner leads to an increased radiative recombination rate of electrons and holes, ultimately resulting in the observed reduction in photocatalytic activity for the Au-Z0 film.

Investigation into the photocatalytic activity of Ag-ZnO and Au-Ag-ZnO thin films for the degradation of Rhodamine B (RhB).

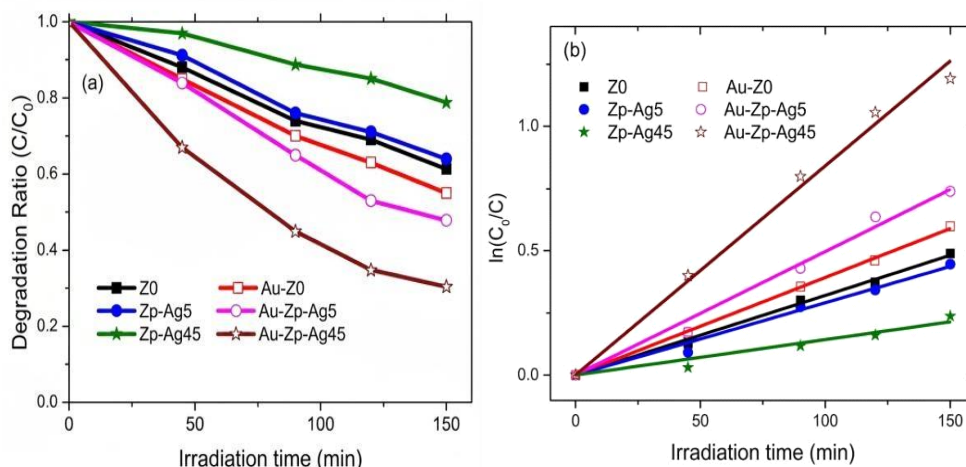


Figure 6 – (a) Photocatalytic degradation kinetics of RhB using Z0, Zp-Ag5, Zp-Ag45, Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45 samples; (b) Corresponding plots of $\ln(C_0/C)$ versus irradiation time for the photocatalytic degradation of RhB.

Under simulated solar light irradiation, the samples generate electrons that produce superoxide anion radicals (O_2^-), while the holes in the valence band react with H_2O to form hydroxyl radicals (*OH). Both of these species are capable of inducing the degradation of RhB dye. The photocatalytic activity of the samples was quantified by measuring the degradation of the aqueous RhB solution under simulated solar radiation for up to 150 minutes. Figure 6(a) illustrates the relationship between the degradation ratio C/C_0 and the irradiation time, where C is the RhB concentration at time t and C_0 is the initial concentration. The color degradation efficiency (%) can be calculated using Equation 2.

The calculated values of the photocatalytic efficiency for all samples are determined and listed in Table 2.

Table 2

Degradation efficiency and pseudo-first-order reaction rate constants (k) of the synthesized Z0, Zp-Ag5, Zp-Ag45, Au-Z0, Au-Zp-Ag5, and Au-Zp-Ag45 materials.

Sample Name	Degradation Effic (%)	k-first-order rate constant
Z0	38	0,0032
Zp-Ag5	36	0,0029
Zp-Ag45	21	0,0014
Au-Z0	45	0,0039
Au-Zp-Ag5	52	0,0049
Au-Zp-Ag45	70	0,0084

The photocatalytic degradation kinetics can be described by the Langmuir–Hinshelwood model:

$$\ln\left(\frac{C_0}{C}\right) = kt \quad (2)$$

Where k is the first-order reaction rate constant and t is the irradiation time. The relationship between $\ln(C_0/C)$ and the irradiation time is illustrated in Figure 6(b). Among the samples, Au-Zp-Ag45 exhibits the highest photocatalytic activity, with approximately 70% of RhB being degraded within 150 minutes of simulated solar light irradiation. In contrast, Zp-Ag45 shows the lowest photocatalytic activity, degrading only

about 21% of RhB over the same period. The k value of Au-Zp-Ag45 is estimated to be 2.6 times higher than that of pure ZnO (Z0) (Table 2). Consequently, the photocatalytic activity of the material is significantly enhanced due to the synergistic contribution of Ag and Au nanoparticles co-deposited on the ZnO film. This result is consistent with the PL spectra findings mentioned previously.

The degradation of pollutants using Au and Ag nanoparticles on ZnO films has been documented by various research groups. For instance, Au-Ag-ZnO films were reported to remove 52.5% of methyl orange (MO) (5 ppm) compared to pure ZnO films (30.1%) within 180 minutes under UV irradiation. Another study showed that Au-Ag-ZnO films could degrade approximately 46% of methylene blue (MB), while pure ZnO reached 45% after 35 minutes of UV exposure [4]. Additionally, Au-ZnO films demonstrated a 64% degradation of RhB compared to 42% for pure ZnO after 2 hours of halogen lamp irradiation. In comparison with these aforementioned photocatalysts, the Au and Ag-doped ZnO films fabricated in this study achieved a 70% RhB degradation efficiency. These results indicate that the Au and Ag-doped ZnO films possess superior photocatalytic degradation efficiency.

IV. Conclusions

The degradation of pollutants by Au and Ag nanoparticles on ZnO films has been reported by various research groups. For instance, Au-Ag-ZnO films were shown to remove 52.5% of methyl orange (MO) (5 ppm) compared to pure ZnO films (30.1%) within 180 minutes under UV irradiation. Similarly, Au-Ag-ZnO films could degrade approximately 46% of methylene blue (MB), while pure ZnO reached 45% after 35 minutes of UV exposure [4]. Furthermore, Au-ZnO films demonstrated a 64% degradation of RhB compared to 42% for pure ZnO after 2 hours of halogen lamp irradiation. In comparison with the aforementioned photocatalysts, the Au and Ag-doped ZnO films fabricated in this study achieved a 70% RhB degradation efficiency. These results indicate that the Au and Ag-doped ZnO films possess superior photocatalytic degradation efficiency.

References:

1. H. Sun, Y. Bai, W. Jin, N. Xu, Visible-light-driven TiO₂ catalysts doped with low-concentration nitrogen species, *Sol. Energy Mater. Sol. Cells*. 92 (2008) 76–83.
2. Ya Fei Zhao, Can Li, Ji Yuan Hu, Yin Yan Gong, Leng Yuan Niu, Xin Juan Liu, Ta and N modulated electronic, optical and photocatalytic properties of TiO₂, *Physics Letters A*, 380, (2016), 910-916.
3. X. Cao, J. Zhou, H. Wang, S. Li, W. Wang, and G. Qin, Abnormal thermal stability of sub-10 nm Au nanoparticles and their high catalytic activity, *J. Mater. Chem. A* 7, 10980 (2019)
4. X. Lu, M. Mohedano, C. Blawert, E. Matykina, R. Arrabal, K.U. Kainer, and M.L. Zheludkevich, Plasma electrolytic oxidation coatings with particle additions – A review, *Elsevier Surf. Coat. Technol.* 307, 1165 (2016)
5. S. Hong, X. Li, Optimal size of gold nanoparticles for surface-enhanced Raman spectroscopy under different conditions, *J. Nanomater.* 2013 (2013), 9.
6. D.C. Reynolds, D.C. Look, B. Jogai, C.W. Litton, G. Cantwell, W.C. Harsch, Valence-band ordering in ZnO, *Phys. Rev. B*. 60 (1999) 2340–2344.
7. R. Mariappan, V. Ponnuswamy, P. Suresh, N. Ashok, P. Jayamurugan, A. Chandra Bose, Influence of film thickness on the properties of sprayed ZnO thin films for gas sensor applications, *Superlattices Microstruct.* 71 (2014) 238–249.
8. Y.G. Wang, S.P. Lau, X.H. Zhang, H.H. Hng, H.W. Lee, S.F. Yu, B.K. Tay, Enhancement of near-band-edge photoluminescence from ZnO films by face-to-face annealing, *J. Cryst. Growth*. 259 (2003) 335–342.
9. D. Thapa, J. Huso, J.L. Morrison, C.D. Corolewski, M.D. McCluskey, L. Bergman, Achieving highly-enhanced UV photoluminescence and its origin in ZnO nanocrystalline films, *Opt. Mater. (Amst)*. 58 (2016) 382–389.

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THE FUNDAMENTAL PRINCIPLES OF CHEMISTRY AS THE MOLECULAR BEDROCK OF INDUSTRIAL INNOVATION

Abstract

This article analyzes the multifaceted significance of the fundamental principles of chemistry within the landscape of modern science and industry. As global manufacturing shifts toward sustainable materials and precision molecular engineering, the transition from empirical observation to a deep understanding of chemical laws serves as a critical mechanism for enhancing product safety, environmental resilience, and material efficiency. The study examines the microeconomic benefits, such as optimized synthesis routes and reduced waste in pharmaceutical production, as well as the macroeconomic impacts on national resource security. The analysis concludes that the mastery of chemical foundations is not merely an academic requirement but a strategic imperative for nations and corporations seeking to integrate into the global circular economy and achieve long-term technological sustainability.

Keywords:

Fundamental chemistry, molecular dynamics, periodic law, chemical synthesis,
sustainable materials, industrial innovation, atomic structure.

Main Part

The transition toward advanced chemical literacy is driven by the need for a "molecular logic" in an era of rapid material transformation. The fundamental laws of chemistry provide a standardized framework that allows scientists to predict the behavior of matter under diverse conditions with high precision. Without this theoretical grounding, industrial development is hindered by "Empirical Inefficiency," where progress relies on trial-and-error rather than calculated molecular design. By prioritizing the core principles of stoichiometry and thermodynamics, an educational or industrial system signals its commitment to international best practices, which significantly enhances the reliability of chemical manufacturing. This scientific transparency is a prerequisite for attracting investment in biotechnology and nanotechnology sectors.

From a corporate management perspective, the importance of chemical foundations lies in the optimization of the Process Lifecycle. Organizations that prioritize a deep understanding of reaction kinetics and equilibrium often enjoy lower operational costs because their synthesis routes are designed for maximum atom economy and minimum energy consumption. Furthermore, for multinational chemical firms, utilizing a unified language of IUPAC nomenclature and standardized analytical methods simplifies the global transfer of technology. This reduces the administrative burden and technical friction associated with cross-border collaborative research. The transition encourages a shift from "Volume-Based" production to "Value-Based" molecular engineering, which reflects the true economic substance of modern chemical transactions.

At the macroeconomic level, the promotion of chemical education is a powerful catalyst for National Resource Sovereignty. When a nation aligns its scientific training with global benchmarks in organic and inorganic chemistry, it lowers the "innovation barriers" for domestic industries such as agriculture, energy storage, and petrochemicals. This alignment is often a key requirement for achieving self-sufficiency in critical

medicine and advanced battery materials. Moreover, the rigorous application of chemical safety and environmental standards acts as a deterrent to industrial pollution and ecological degradation. By improving the quality of the technical human capital, chemistry strengthens the overall integrity of the industrial ecosystem, fostering an environment conducive to sustainable business growth and public health stability.

However, the modernization of chemical training is a complex process that requires significant investment in Laboratory Infrastructure and digital simulation tools. It necessitates the retraining of professionals to master the nuances of green chemistry and computational modeling. Despite these initial challenges, the long-term benefits of a "Chemistry-First" approach far outweigh the costs. It facilitates "Scientific Inclusion" on a global scale, allowing local enterprises to compete for innovation grants on a level playing field with international peers. As the world moves toward carbon neutrality, the synergy of chemical precision and environmental awareness continues to reduce market volatility and enhance the efficiency of global resource allocation, making it the bedrock of modern industrial strategy.

Conclusion

The fundamental principles of chemistry represent a transformative force toward global industrial excellence and environmental stewardship. By prioritizing molecular logic and rigorous synthesis standards, chemistry empowers researchers, streamlines industrial production, and bolsters national economic resilience. In a world where material sustainability is the most valuable asset, the ability to manipulate matter clearly and consistently through chemical foundations is essential for any entity aiming to thrive in the competitive and rapidly evolving global marketplace.

References:

1. Principles of General Chemistry. Silberberg, M. S. (Updated 2024-2026). USA.
2. The Periodic Table: Its Story and Its Significance. Scerri, E. (2023). United Kingdom.
3. Green Chemistry: Theory and Practice. Anastas, P. T., & Warner, J. C. (2024). USA.
4. IUPAC Compendium of Chemical Terminology. International Union of Pure and Applied Chemistry. (2025). Switzerland.

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THE ARCHITECTURAL SIGNIFICANCE OF INFORMATION TECHNOLOGY IN GLOBAL SOCIO-ECONOMIC SYSTEMS

Abstract

This article analyzes the multifaceted significance of Information Technology (IT) within the contemporary global landscape. As the world transitions from traditional industrial models to a knowledge-based economy, IT serves as a critical mechanism for enhancing operational transparency, cross-border data flow, and systemic efficiency. The study examines the microeconomic benefits, such as optimized decision-making processes and reduced transactional friction, as well as the macroeconomic impacts on national digital competitiveness. The analysis concludes that the advancement of IT infrastructure is not merely a technical evolution but a strategic imperative for nations and organizations seeking to integrate into the global digital architecture and achieve long-term economic resilience.

Keywords:

Information Technology, digital transformation, data management, systemic efficiency, knowledge economy, technological integration, IT infrastructure.

Main Part

The transition toward integrated Information Technology is driven by the need for a "universal digital language" in an era of hyper-connectivity. Modern IT frameworks provide a standardized environment that allows for the processing and dissemination of information across different sectors with high precision. Without this technological harmonization, global progress is hindered by the "Information Asymmetry" caused by fragmented data systems. By adopting advanced IT solutions, a country signals its commitment to international best practices, which significantly enhances the comparability and reliability of its industrial and financial data. This digital transparency is a prerequisite for attracting global investment and fostering collaboration in research and development.

From an organizational management perspective, the importance of Information Technology lies in the optimization of Human and Capital Resources. Entities that report and operate through integrated IT systems often enjoy a lower risk profile because their internal workflows are more transparent and easier to audit by international standards. Furthermore, for multinational organizations, using unified IT platforms simplifies the synchronization of global operations. This reduces the administrative burden and operational costs associated with managing diverse local processes. The transition encourages a shift from "Manual-Based" operations to "Data-Driven" strategies, which requires deeper professional judgment and reflects the true economic substance of modern enterprise.

At the macroeconomic level, the adoption of Information Technology is a powerful catalyst for National Innovation and Sustainability. When a nation aligns its IT standards with global benchmarks, it lowers the "entry barriers" for local startups and digital entrepreneurs. This alignment is often a key

requirement for participating in international trade agreements or securing high rankings in global innovation indexes. Moreover, the rigorous security protocols inherent in modern IT systems act as a deterrent to cyber instability and systemic fraud. By improving the quality of information governance, IT strengthens the overall integrity of the domestic economy, fostering an environment conducive to sustainable business growth and public trust.

However, the transition to a fully digitized society is a complex process that requires significant investment in Technical Human Capital and digital infrastructure. It necessitates the continuous training of specialists to understand the nuances of cloud computing, artificial intelligence, and cybersecurity. Despite these initial challenges, the long-term benefits far outweigh the costs. The transition facilitates "Digital Inclusion" on a global scale, allowing local enterprises to compete for market share on a level playing field with international peers. As more societies move toward advanced IT models, the synergy of a unified technological system continues to reduce market volatility and enhance the efficiency of global resource allocation, making it the bedrock of modern international development.

Conclusion

The evolution of Information Technology is a transformative step toward global economic integration and operational excellence. By prioritizing data integrity and technological agility, IT empowers individuals, streamlines corporate management, and bolsters national resilience. In a world where information is the most valuable asset, the ability to manage and utilize technology clearly and consistently is essential for any entity aiming to thrive in the competitive and rapidly evolving global marketplace.

References:

1. Information Technology for Management: On-Demand Strategies. Turban, E., et al. (Updated 2024-2026). USA.
2. Digital Transformation: A Strategic Roadmap. Rogers, D. L. (2023). United Kingdom.
3. The Global Information Technology Report. World Economic Forum. (2024). Switzerland.
4. Principles of Information Systems. Stair, R., & Reynolds, G. (2025). USA.

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THE STRATEGIC INFRASTRUCTURE OF COMMUNICATION NETWORKS AND SWITCHING SYSTEMS IN THE DIGITAL ERA

Abstract

This article analyzes the multifaceted significance of communication networks and switching systems

within the global technological landscape. As data traffic reaches unprecedented volumes, the transition from traditional circuit-switching to advanced packet-switching and software-defined networking (SDN) serves as a critical mechanism for enhancing connectivity, data integrity, and network scalability. The study examines the microeconomic benefits, such as reduced latency for enterprise operations and improved resource allocation, as well as the macroeconomic impacts on national digital sovereignty. The analysis concludes that the modernization of switching infrastructure is not merely a technical upgrade but a strategic imperative for nations and organizations seeking to integrate into the global information architecture and achieve long-term economic resilience.

Keywords:

communication networks, switching systems, packet switching, network topology,
digital infrastructure, telecommunications, data routing.

Main Part

The transition toward advanced communication networks is driven by the need for a "high-speed information language" in an era of globalized digital trade. Modern networks provide a standardized framework that allows devices to exchange data across different jurisdictions with high precision. Without this architectural harmonization, global connectivity is hindered by the "Network Congestion" caused by outdated switching protocols. By adopting high-capacity switching systems, a country signals its commitment to international technological standards, which significantly enhances the reliability of its digital services. This transparency and speed are prerequisites for attracting multinational technology firms that require standardized data environments to perform real-time cloud computing and global operations.

From a corporate management perspective, the importance of efficient switching systems lies in the optimization of Connectivity Costs. Organizations that utilize modern routing and switching technologies often enjoy a lower operational risk because their data flows are more resilient and easier to monitor by international security standards. Furthermore, for multinational corporations, using a unified networking protocol across all branches simplifies the consolidation of communication channels. This reduces the administrative burden and operational costs associated with maintaining fragmented legacy systems for different regional environments. The transition encourages a shift from "Hardware-Centric" networking to "Virtualization-Based" systems, which requires a deeper technical expertise and reflects the true economic substance of data-driven business models.

At the macroeconomic level, the adoption of robust communication networks is a powerful catalyst for National Digital Competitiveness. When a nation aligns its telecommunications infrastructure with global benchmarks, it lowers the "connectivity barriers" for local firms and financial institutions. This alignment is often a key requirement for participating in the global e-commerce market or securing favorable assessments from global technology rating agencies. Moreover, the rigorous security protocols of modern switching systems act as a deterrent to cyber threats and data breaches. By improving the quality of information flows, these networks strengthen the overall integrity of the domestic banking sector and digital economy, fostering an environment conducive to sustainable business growth and technological stability.

However, the transition to next-generation networks is a complex process that requires significant investment in Technical Human Capital and physical infrastructure. It necessitates the retraining of engineers, network administrators, and regulators to understand the nuances of 5G integration, fiber optics, and complex routing algorithms. Despite these initial challenges, the long-term benefits far outweigh the costs. The transition facilitates "Digital Inclusion" on a global scale, allowing local enterprises to compete for digital projects on a level playing field with international peers. As more countries move toward integrated switching systems, the synergy of a unified communication network continues to reduce latency and enhance the

efficiency of global resource allocation, making it the bedrock of modern international commerce.

Conclusion

The evolution of communication networks and switching systems is a transformative step toward global digital integration and operational excellence. By prioritizing high-speed connectivity and efficient routing, these systems empower users, streamline corporate management, and bolster national economic resilience. In a world where real-time data is the most valuable asset, the ability to transmit information clearly and consistently through advanced switching systems is essential for any entity aiming to thrive in the competitive global marketplace.

References:

1. Data and Computer Communications. Stallings, W. (Updated 2024-2026). USA.
2. Computer Networks. Tanenbaum, A. S., & Wetherall, D. J. (2023). United Kingdom.
3. The Impact of 5G and Future Switching Technologies on Global Trade. Roberts, J. (2024). France.
4. Telecommunication Switching Systems and Networks. Viswanathan, T., & Bhatnagar, M. (2025). USA.

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ТЕЛЕКОММУНИКАЦИОННЫЕ ТЕХНОЛОГИИ СОВРЕМЕННОГО ОБЩЕСТВА

Аннотация

Телекоммуникационные технологии являются основой современного общества, играя ключевую роль в обеспечении связи, обмена информацией и поддержке глобализованных процессов. С развитием интернета и мобильных технологий, а также внедрением новых инноваций, таких как 5G и интернет вещей (IoT), телекоммуникационные системы претерпевают кардинальные изменения. В данной статье рассматриваются основные этапы развития телекоммуникационных технологий, их текущие тенденции и перспективы. Особое внимание уделяется таким направлениям, как мобильная связь, оптоволоконные технологии, беспроводные сети и их влияние на социально-экономическое развитие и повседневную жизнь.

Ключевые слова:

телекоммуникации, мобильные технологии, оптоволокно, 5G, интернет вещей,
беспроводные сети, инновации, инфраструктура.

Основной текст

1. Введение в телекоммуникационные технологии

Телекоммуникации охватывают широкий спектр технологий, обеспечивающих передачу данных и коммуникацию между людьми, организациями и государствами. В последние десятилетия информационные и телекоммуникационные технологии значительно изменились, что стало возможным благодаря революционным инновациям в области мобильной связи, оптоволоконных технологий и других ключевых компонентов. Эти технологии охватывают не только традиционные

средства связи, такие как телефонные линии и радиопередачи, но и современные системы, включая интернет и мобильные сети.

Телекоммуникационные технологии играют центральную роль в поддержке глобальных процессов, таких как электронная коммерция, онлайн-образование, телемедицина и многие другие. С каждым годом потребность в высокоскоростной связи возрастает, что стимулирует дальнейшее развитие технологий, повышающих пропускную способность и скорость передачи данных.

2. Развитие телекоммуникационных технологий

1. Мобильная связь

С момента появления первого мобильного телефона в 1973 году, мобильная связь прошла несколько этапов развития. Сети первого поколения (1G) обеспечивали только передачу голосовых сообщений. Введение технологий второго поколения (2G) позволило добавить возможности передачи текста (SMS), а третье поколение (3G) открыло путь для мобильного интернета.

С переходом к технологиям четвертого поколения (4G) и пятого поколения (5G) мобильные сети начали обеспечивать высокоскоростной интернет, что открыло новые возможности для мобильных приложений, потокового видео и онлайн-игр.

5G, являющаяся самой современной технологией мобильной связи, обещает значительное увеличение скорости передачи данных (до 10 Гбит/с) и минимальную задержку. Эти улучшения сделают возможными такие инновации, как интернет вещей (IoT), автономные автомобили и массовое использование виртуальной реальности (VR).

2. Оптоволоконные технологии

Оптоволоконные технологии занимают особое место в развитии телекоммуникаций. Оптоволокно используется для передачи данных на большие расстояния без значительных потерь сигнала, что позволяет обеспечить высокоскоростную передачу данных. Сегодня оптоволоконные сети активно внедряются в разных странах, обеспечивая стабильный интернет для домов, бизнесов и инфраструктурных объектов.

Оптоволокно является основой многих современных сетей, таких как GPON (Gigabit Passive Optical Networks) и FTTH (Fiber-to-the-Home), которые предоставляют пользователям доступ к интернету с высокой пропускной способностью и минимальными затратами на эксплуатацию. Вдобавок, оптоволоконные технологии могут поддерживать различные виды связи, включая голосовые и видеозвонки, что позволяет создать высококачественные и надежные системы связи для бизнеса и частных пользователей.

3. Беспроводные сети и Wi-Fi

Беспроводные технологии также играют важную роль в современных телекоммуникациях. Wi-Fi и другие беспроводные стандарты обеспечивают доступ в интернет без необходимости использовать физические проводники. Это особенно важно в условиях быстро развивающихся городов и области, где установка проводных сетей является технически сложной или экономически нецелесообразной. Беспроводные технологии также способствуют созданию умных домов и городов, где устройства могут обмениваться данными в реальном времени, не имея физического подключения.

4. Интернет вещей (IoT)

Интернет вещей представляет собой концепцию, в рамках которой различные устройства могут обмениваться данными друг с другом через интернет. Это включает в себя умные бытовые устройства, медицинские приборы, автомобили и производственные машины. Телекоммуникации играют ключевую роль в обеспечении связи между этими устройствами, создавая сеть, которая будет работать автономно и в реальном времени. Прогнозируется, что к 2030 году количество подключенных к интернету устройств превысит 30 миллиардов, что увеличит потребность в надежных и быстрых

телекоммуникационных системах.

3. Тенденции в телекоммуникационных технологиях

1. 5G и будущие поколения связи

Сети 5G представляют собой кардинальное улучшение по сравнению с предыдущими поколениями связи. Благодаря высокой скорости передачи данных, низкой задержке и увеличенной пропускной способности, 5G обещает трансформировать множество сфер, включая здравоохранение (телемедицина), автономные автомобили, промышленность (IoT), а также массовое использование виртуальной и дополненной реальности (AR/VR). В будущем, новые поколения сетей, такие как 6G, будут предлагать еще более высокую скорость и большую интеграцию с технологиями искусственного интеллекта и обработки больших данных.

Список использованной литературы:

1. Международный союз электросвязи (МСЭ). Рекомендации и стандарты в области телекоммуникаций.
2. OECD Digital Economy Outlook. (Актуальное издание).
3. Отечественные и международные законы «О связи» и «Об информации, информационных технологиях и о защите информации».

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СЕЛЬСКОЕ ХОЗЯЙСТВО

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35 YEARS OF INDEPENDENCE: SOCIO-ECONOMIC MILESTONES AND MODERNIZATION OF TURKMENISTAN

Abstract

This article examines the transformative journey of Turkmenistan since gaining independence in 1991. Over the past 35 years, the nation has evolved from a resource-dependent Soviet republic into a modern state with a diversified economy and a robust national identity. The study highlights key socio-economic milestones, including the large-scale industrialization of the oil and gas sector, the transition toward a market-oriented economy, and the implementation of the "State Program for the Development of the Digital Economy." Furthermore, it explores how Turkmenistan's unique path of "Permanent Neutrality" has served as a foundation for regional stability and international cooperation.

Keywords:

independence, turkmenistan, socio-economic modernization, permanent neutrality,
energy diplomacy, national identity, digital economy.

Introduction

The proclamation of independence on October 27, 1991, marked a pivotal turning point in the millennia-long history of the Turkmen people. Today, as the nation celebrates 35 years of sovereignty, it stands as a testament to a unique development model that blends deep-rooted cultural traditions with the imperatives of modern global integration. The journey from 1991 to 2026 has been characterized by a systematic effort to consolidate statehood, ensure social stability, and transform an agrarian-based economy into a high-tech industrial power.

The Foundation of Sovereignty and Neutrality

At the heart of Turkmenistan's modernization is the status of Permanent Neutrality, recognized by the United Nations. This diplomatic status is not merely a foreign policy tool but the bedrock of the country's socio-economic strategy. By maintaining peaceful relations and avoiding military blocs, Turkmenistan has been able to focus its domestic resources on internal growth. The "Turkmen Way" of development emphasizes gradualism—a cautious but steady transition to market relations that shields the population from the "shock therapy" witnessed in other post-Soviet contexts.

Economic Diversification and Energy Strategy

For decades, Turkmenistan has been globally recognized for its massive natural gas reserves, ranking among the top four nations worldwide. However, the milestone of the last 35 years has been the shift from being a raw material exporter to a producer of value-added goods. The commissioning of the Galkynysh gas field and the construction of the TAPI (Turkmenistan–Afghanistan–Pakistan–India) pipeline represent the nation's "Energy Diplomacy."

Beyond extraction, the government has invested billions in the petrochemical industry. Modern complexes in Kiyanly and Garabogaz now produce polyethylene and urea for international markets. This industrialization is mirrored in the agricultural sector, where the country has moved toward self-sufficiency. The "Green Economy" initiatives and the massive "Altyn Asyr" Turkmen Lake project demonstrate a sophisticated approach to environmental management in an arid climate, ensuring that economic growth does not come at the cost of the nation's ecological heritage.

Social Modernization and National Identity

The modernization of Turkmenistan is deeply intertwined with the revival of national identity. The concept of "The State is for the Man" has driven massive investments in human capital. Over 35 years, the skyline of Ashgabat—the "White Marble City"—and the development of the Avaza Multi-profile National Tourist Zone have become symbols of this new era.

Education and healthcare have undergone radical reforms. The transition to a twelve-year secondary education system and the establishment of international-standard universities have prepared a new generation of specialists capable of navigating the digital age. This generation is tasked with fulfilling the "National Program for Socio-Economic Development for 2022–2052," which aims to place Turkmenistan among the high-income nations of the world.

The Digital Frontier and Future Outlook

As we look toward the future from the vantage point of 2026, the digitalization of the economy stands out as the most recent milestone. From E-government services to the "Smart City" of Arkadag, Turkmenistan is leveraging technology to increase transparency and efficiency. The Arkadag City project, in particular, serves as a blueprint for modern urban living, integrating "Internet of Things" (IoT) technology with eco-friendly infrastructure.

In conclusion, the 35-year history of independent Turkmenistan is a narrative of resilience and strategic vision. By harmonizing the wealth of its natural resources with the potential of its people, and by staying true to its neutral status, the country has built a stable, prosperous, and modern state. The milestones achieved serve as a springboard for the next stage of the nation's "Revival of the New Epoch of the Powerful State."

References:

1. Gurbanguly Berdimuhamedov. The Spiritual World of the Turkmen. 2020, Ashgabat: Turkmen State Publishing Service.
2. A. Annayev. The Economic Strategy of Independent Turkmenistan. 2021, Ashgabat: Science Publishing.
3. S. Ivanov. Agricultural Innovations in Arid Zones: Central Asian Perspectives. 2020, Saint Petersburg: Agropress.
4. M. Amanov. History of Turkmen Statehood: From Antiquity to Independence. 2022, Ashgabat: Magtymguly University Press.
5. R. Petrov. Global Energy Markets and the Role of Central Asia. 2023, Moscow: International Relations Publishing.
6. K. Hudayberdiyev. Digitalization of the National Economy: Trends and Prospects. 2024, Ashgabat: IT-Center.

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DROUGHT RESISTANCE TECHNIQUES IN ARID CLIMATES

Abstract

As global temperatures rise and precipitation patterns become increasingly erratic, arid and semi-arid

regions face unprecedented challenges in food security and ecosystem stability. This article explores advanced drought resistance techniques tailored for hyper-arid environments. It examines a multifaceted approach involving genetic crop modification, innovative irrigation technologies like subsurface drip systems, and soil management practices such as biochar integration and conservation tillage. By synthesizing traditional knowledge with modern agrotechnology, the study highlights sustainable pathways to maintain agricultural productivity under severe water scarcity.

Keywords:

drought resistance, arid climates, xeriscaping, water conservation, sustainable agriculture, irrigation efficiency, soil moisture.

Introduction

The paradox of the modern era is that while our technological prowess has never been higher, our most fundamental resource—freshwater—is becoming increasingly precarious. Arid climates, characterized by a severe lack of available water and high rates of evaporation, cover approximately one-third of the Earth's land surface. In these regions, drought is not an anomaly; it is a structural reality. However, the intensification of climate change has transitioned these areas from "water-stressed" to "water-critical," necessitating a radical shift in how we approach land management and cultivation.

Drought resistance in an arid context is not merely about surviving a dry spell; it is about engineered resilience. This involves a three-tiered strategy: biological adaptation, technological intervention, and pedological (soil-based) enhancement.

The Biological Frontier: Crop Selection and Modification

The first line of defense against aridity lies in the DNA of the plants themselves. Traditional agriculture in arid zones often relied on landraces—locally adapted varieties that evolved over centuries to withstand heat. Modern science is now accelerating this process through marker-assisted selection and CRISPR gene editing to develop "drought-tolerant" cultivars. These plants often exhibit specific physiological traits, such as deeper root systems that can tap into subterranean aquifers or "stay-green" phenotypes that maintain photosynthetic activity even when water levels drop.

Furthermore, the shift toward Xeriscaping and the use of halophytes (salt-tolerant plants) allows for the utilization of brackish water, which is often abundant in arid regions but unsuitable for conventional crops. By choosing plants that naturally close their stomata during the hottest parts of the day to prevent transpiration, we can reduce water demand at the source.

Technological Precision: Beyond Traditional Irrigation

In arid climates, traditional flood irrigation is a recipe for disaster, leading to massive evaporative loss and soil salinization. The evolution of Subsurface Drip Irrigation (SDI) represents a monumental leap in efficiency. By delivering water directly to the root zone beneath the soil surface, SDI minimizes evaporation and ensures that nearly 95% of the applied water is utilized by the plant.

Moreover, the integration of IoT-based sensor networks has revolutionized water management. Real-time data on soil moisture tension and atmospheric vapor pressure deficit allow for "precision thirst quenching." Instead of watering on a schedule, farmers can apply the exact milliliter of water required at the exact moment of physiological need, effectively turning the farm into a closed-loop, data-driven system.

Soil as a Reservoir: Enhancement and Conservation

The soil in arid regions is often carbon-depleted and sandy, possessing poor water-holding capacity. Drought resistance techniques must therefore focus on turning the soil into a functional sponge. Conservation Tillage (or no-till farming) is a critical practice here; by leaving crop residues on the surface, the soil is shielded from direct solar radiation, reducing surface temperatures and suppressing evaporation.

The introduction of Biochar—a stable, carbon-rich form of charcoal—into the soil matrix has shown remarkable results. Biochar's highly porous structure increases the surface area within the soil, allowing it to retain water and nutrients that would otherwise leach away. Coupled with the use of organic mulches and polymers, these techniques can increase the plant-available water capacity of sandy soils by up to 40%.

Atmospheric Water Harvesting

In extreme arid zones where groundwater is depleted, we are seeing a move toward "harvesting the air." Techniques such as fog harvesting using polyolefin meshes and the development of Metal-Organic Frameworks (MOFs) that can extract humidity from 10% moisture air are moving from the laboratory to the field. These decentralized water sources provide a lifeline for small-scale interventions and reforestation efforts in desertified zones.

Ultimately, drought resistance in arid climates requires a holistic philosophy. It is a move away from "fighting the desert" and toward "designing for the desert." By layering these techniques—genetics, precision engineering, and soil chemistry—humanity can build a resilient agricultural framework capable of withstanding the warming decades ahead.

References:

1. Altman, A., & Hasegawa, P. M. (2020). Plant Biotechnology and Agriculture: Prospects for the 21st Century. Sankt-Peterburg: Academic Press/Nauka.
2. Bresler, E., McNeal, B. L., & Carter, D. L. (2018). Saline and Sodic Soils: Principles-Dynamics-Modeling. Berlin: Springer-Verlag.
3. Glantz, M. H. (2021). Drought Follows the Plow: Cultivating Marginal Lands. Cambridge: Cambridge University Press.
4. Kashyap, P. S. (2022). Hydrology and Water Resources Engineering. New Delhi: Standard Publishers.
5. Petrov, V. I. (2020). Agricultural Reclamation of Arid Territories. Sankt-Peterburg: Lan Publishing.
6. Ward, F. A. (2024). Water Policy for Agriculture: Lessons from Arid Lands. New York: McGraw-Hill.

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THE HISTORICAL SIGNIFICANCE AND CULTURAL SYMBOLISM OF THE AKHALTEKE HORSE IN TURKMEN NATIONAL IDENTITY

Abstract

This article explores the profound historical and cultural role of the Akhalteke horse within the context of Turkmen national identity. Known as the "Heavenly Horse," the Akhalteke is not merely a breed of livestock but a cornerstone of Turkmen heritage, symbolizing speed, endurance, and nobility. The study examines the archaeological evidence of the breed's origins in the Ahal oasis, its strategic importance in nomadic warfare, and its contemporary status as a state symbol in modern Turkmenistan. By analyzing folk traditions, equestrian sports, and state-sponsored iconography, the article highlights how the Akhalteke functions as a living link between the nation's nomadic past and its modern aspirations.

Keywords:

akhalteke, turkmenistan, cultural identity, equestrian heritage, heavenly horses, nomadic civilization.

Introduction

The Akhalteke horse stands as one of the oldest and most distinctive equine breeds in the world, often referred to as the "Golden Horse" due to the unique metallic sheen of its coat. For the Turkmen people, the Akhalteke is more than an animal; it is a spiritual sibling, a cultural icon, and a primary pillar of national self-identification. To understand the Turkmen soul, one must first understand the bond between the horse and its rider, a relationship forged over millennia in the harsh, arid landscapes of Central Asia.

Ancient Roots and the Ahal Oasis

The history of the Akhalteke is inextricably linked to the geography of the Ahal oasis, a strip of fertile land nestled between the Kopet Dag mountains and the Karakum Desert. Archaeological findings at sites like Anau and Altyn-Depe suggest that the ancestors of the Akhalteke were being bred and revered in this region as early as the 3rd millennium BCE. Unlike the forest-dwelling horses of Europe or the heavy chargers of the Middle Ages, the Akhalteke evolved to survive in extreme temperatures with minimal water, developing a slender, athletic frame and incredible stamina.

Historically, the breed was perfected by the Teke tribe, one of the major Turkmen tribal groupings. The isolation of the desert protected the breed's genetic purity for centuries. These horses were never kept in large herds; instead, they were treated as members of the family, often tethered near the owner's yurt and fed high-protein diets of alfalfa and barley mixed with mutton fat. This intimate upbringing resulted in a horse that is intensely loyal and sensitive, known for forming a deep psychological bond with a single master.

The "Heavenly Horse" and Silk Road Legend

The fame of the Akhalteke reached far beyond the borders of modern-day Turkmenistan. In antiquity, they were the "Nisean" horses of the Persian Empire and the "Heavenly Horses" sought after by the Han Dynasty of China. The Chinese Emperor Wu Ti famously sent military expeditions to Central Asia specifically to acquire these horses, believing their blood-sweating endurance (likely caused by skin parasites, but interpreted as divine) would grant his cavalry superiority.

Throughout the Middle Ages, the Akhalteke was the prized mount of the Turkmen warriors. Their speed allowed for the "alman" (lightning raids) that defined nomadic warfare. A Turkmen rider's life literally depended on the agility and speed of his horse. This dependence birthed a rich oral tradition—proverbs, songs, and epic poems (Destans) like *Gorogly*—where the horse is portrayed as a sentient hero capable of saving its master from certain death.

Cultural Symbolism and Artistry

In Turkmen culture, the horse is the ultimate symbol of beauty and prestige. This is reflected in the elaborate traditional horse jewelry, often made of silver and inlaid with carnelian (hakyk), which mirrors the jewelry worn by Turkmen women. The aesthetic of the horse—long neck, thin skin, and expressive eyes—has influenced Turkmen carpet weaving patterns and jewelry design for generations.

The horse also occupies a sacred space in the transition from nomadic life to sedentary nationhood. Even as the Turkmen people transitioned into the 20th and 21st centuries, the horse remained a symbol of freedom. During the Soviet era, the breed faced significant threats due to collectivization and a shift toward mechanized agriculture. However, the dedication of local breeders and the resilience of the breed ensured its survival.

The Modern Era: A Pillar of Statehood

Since Turkmenistan gained independence in 1991, the Akhalteke has been elevated to the status of a national treasure. It occupies the central position on the National Emblem of Turkmenistan, symbolizing the

country's rapid development and its "Golden Age." The state celebrates "Turkmen Horse Day" annually, an event that draws international breeders and dignitaries to celebrate the breed's legacy.

Under the patronage of the state, massive investments have been made in equestrian infrastructure, including the construction of world-class hippodromes and breeding centers. The Akhalteke serves as a diplomatic gift of the highest order, presented to heads of state to represent the friendship and nobility of the Turkmen people. In contemporary society, the horse remains a bridge between generations; young Turkmen are encouraged to learn the art of "seis" (traditional horse training), ensuring that the ancient knowledge of the desert remains relevant in a digital world.

References:

1. Afanasyev, A.V. The Akhalteke: History of the Breed and Selection. 2020, Sankt-Peterburg: Agriculture Publishing.
2. Atdayev, S. The Turkmen Horse and the Nomadic Soul. 2022, Ashgabat: Ylym.
3. Gundogdiyev, O. The Heavenly Horses: A History of the Akhalteke Breed. 2018, Moscow: Equestrian Press.
4. Maslow, J. The Sacred Horses of the Altiplano and the Oasis. 2019, New York: Global History Press.
5. Niyazov, S. Akhalteke Horses - Our Pride and Glory. 2021 (Reprint), Ashgabat: Turkmen State Service.
6. Sokolov, V. Genetics and Breeding of the Turkmen Horse. 2023, Novosibirsk: Science Publishing House.

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GENOMIC SELECTION STRATEGIES TO IMPROVE LIVESTOCK PRODUCTIVITY

Abstract

Genomic selection (GS) has revolutionized livestock breeding by allowing for the estimation of breeding values using dense molecular markers spread across the entire genome. Unlike traditional marker-assisted selection, GS captures both major and minor gene effects, significantly increasing the accuracy of selection at an early age. This article explores the core strategies of GS, its impact on genetic gain, and the challenges associated with its implementation in various livestock species. By integrating high-throughput genotyping with advanced phenotypic data, producers can accelerate productivity, improve animal welfare, and enhance sustainability in global food systems.

Keywords:

genomic selection, livestock productivity, single nucleotide polymorphisms (snps), genomic estimated breeding values (gebvs), genetic gain, livestock breeding.

Introduction

The global demand for animal-sourced protein is projected to increase significantly over the next few

decades, driven by population growth and rising incomes in developing nations. To meet this demand sustainably, livestock production must become more efficient, requiring higher outputs with fewer resources and a lower environmental footprint. Traditionally, livestock improvement relied on phenotypic selection and pedigree-based Best Linear Unbiased Prediction (BLUP). While successful, these methods are limited by the generation interval and the difficulty of selecting for traits with low heritability or those that are expensive to measure, such as feed efficiency, disease resistance, and carcass quality.

The Shift to Genomic Selection The landscape of animal breeding changed fundamentally with the advent of Genomic Selection (GS), a term first coined by Meuwissen et al. in 2001. GS utilizes a dense set of markers—typically Single Nucleotide Polymorphisms (SNPs)—that cover the entire genome. The underlying principle is that by having a high enough density of markers, every Quantitative Trait Locus (QTL) influencing a trait will be in linkage disequilibrium (LD) with at least one marker. This allows for the calculation of Genomic Estimated Breeding Values (GEBVs) based solely on the animal's genotype, provided there is a well-established reference population.

Strategic Implementation in Different Species The strategy for implementing GS varies significantly between species. In the dairy industry, GS has had the most profound impact. Traditionally, a bull's genetic merit was proven through "progeny testing," a process that took 5–7 years. With GS, young bulls can be selected with high reliability based on their genotype at birth. This has effectively halved the generation interval, leading to a doubling of the annual rate of genetic gain in many Holstein populations worldwide.

In meat-producing species like beef cattle, pigs, and poultry, the strategies focus more on traits that are difficult to measure in the nucleus herd. For instance, in swine breeding, GS is used to improve meat quality and maternal behavior, traits that cannot be measured on the selection candidates themselves. In poultry, GS helps in maintaining genetic diversity while simultaneously selecting for high egg production and skeletal strength.

The Role of Reference Populations A critical component of any GS strategy is the "Reference Population"—a group of animals that have both been genotyped and phenotyped. The accuracy of GEBVs depends heavily on the size and diversity of this reference set. For breeds with small populations, "multi-breed" or "across-breed" genomic selection strategies are being explored. This involves pooling data from different breeds to increase the power of the prediction equations. However, this remains a technical challenge because the phases of linkage disequilibrium between markers and QTLs often differ across breeds.

Technological Advancements and Big Data The cost of genotyping has plummeted, enabling the routine use of low-density SNP chips combined with "imputation"—a statistical technique that fills in missing genotypes using information from higher-density panels. Furthermore, the integration of "omics" technologies (transcriptomics, proteomics, and metabolomics) into GS strategies is on the horizon. This "Systems Biology" approach aims to bridge the gap between the genotype and the final phenotype, allowing for even more precise selection.

Challenges and Future Outlook Despite its success, GS is not without challenges. One major concern is the potential for a more rapid increase in inbreeding on a genomic level, even if pedigree inbreeding is managed. Selection based on GEBVs tends to select related individuals who share the same favorable chromosome segments. Therefore, modern breeding strategies must balance genetic gain with the maintenance of genetic diversity through "Optimum Contribution Selection."

Furthermore, the environmental interaction (G x E) remains a hurdle. A genomic model trained in a temperate environment may not accurately predict performance in tropical conditions. Future GS strategies must incorporate environmental data and "phenomics" (high-throughput phenotyping via sensors and imaging) to create more robust, resilient livestock breeds capable of thriving in a changing climate.

In conclusion, Genomic Selection is no longer a futuristic concept but the backbone of modern livestock

improvement. By reducing generation intervals and increasing selection intensity and accuracy, GS provides a powerful toolkit for enhancing productivity. As we move toward 2030 and beyond, the refinement of these strategies will be essential for ensuring global food security.

References:

1. Garrick, D. & Ruvinsky, A. (2020). The Genetics of Cattle. 2nd Edition. Boston: CABI Publishing.
2. Mrode, R.A. (2021). Linear Models for the Prediction of Animal Breeding Values. 4th Edition. Oxfordshire: CABI.
3. Nikitin, S.V. (2022). Genetics and selection in modern animal husbandry. Sankt-Peterburg: Lan Publishing. [Russian: Генетика и селекция в современном животноводстве].
4. Simm, G., et al. (2020). Breeding for Livestock Productivity and Resilience. Sankt-Peterburg: Agriculture Press.
5. Walsh, B. & Lynch, M. (2018). Evolution and Selection of Quantitative Traits. Oxford University Press.
6. Visscher, P. M. (2023). Genomic Prediction in Animals and Plants. Cambridge: Academic Press.

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UTILIZATION OF ALTERNATIVE FEED SOURCES AND WASTE IN SUSTAINABLE LIVESTOCK PRODUCTION

Abstract

Sustainable livestock production faces the dual challenge of meeting a rising global demand for animal protein while minimizing environmental footprints and reducing reliance on traditional feed crops like maize and soybean. This article explores the strategic integration of alternative feed sources—including agro-industrial by-products, insects, algae, and food waste—into animal diets. By repurposing biological "waste" into high-value nutritional inputs, the industry can enhance circularity, reduce feed-food competition, and lower greenhouse gas emissions. The study examines the nutritional profiles, processing requirements, and economic viability of these alternatives, advocating for a transition toward a bio-based circular economy in agriculture.

Keywords:

sustainable livestock, alternative feed, agro-industrial waste, circular economy, animal nutrition, bio-resources.

Introduction

The global livestock sector is currently at a critical crossroads. As the human population continues to expand toward an estimated 10 billion by mid-century, the demand for meat, milk, and eggs is projected to rise by nearly **70%**. Traditionally, this demand has been met through the intensification of production systems

heavily reliant on "primary" feed sources—specifically soy and cereal grains. However, the environmental and economic costs of this model are becoming increasingly unsustainable. The competition between "feed and food"—where arable land is used to grow crops for animals rather than directly for human consumption—presents a moral and logistical dilemma in a world facing food insecurity.

The Case for Sustainability. Sustainability in livestock farming is no longer a niche preference; it is a structural necessity. Conventional feed production contributes significantly to deforestation, biodiversity loss, and water scarcity. Furthermore, the volatility of global commodity markets makes farmers vulnerable to price spikes in imported soy and corn. To mitigate these risks, the industry is turning toward the "Circular Bio-economy" model. This approach views livestock not just as consumers of resources, but as essential recyclers that can convert low-quality materials—unfit for human consumption—into high-quality protein.

The Potential of Agro-Industrial By-products. One of the most immediate opportunities lies in the utilization of agro-industrial waste. Globally, billions of tons of by-products are generated annually from the processing of sugar, oilseeds, fruits, and vegetables. For instance, sugar beet pulp, citrus pulp, and distillers' dried grains with solubles (DDGS) are rich in fiber and energy. When properly processed, these materials can replace a substantial portion of grain in ruminant diets. In many developing agricultural economies, these materials are often discarded, leading to environmental pollution. Integrating them into feed rations not only lowers production costs but also solves a waste management problem.

Emerging Frontiers: Insects and Algae. Beyond traditional by-products, "novel" proteins are gaining traction. Insect larvae, such as the Black Soldier Fly (BSF), can be reared on organic waste streams, effectively "upcycling" food waste into a nutrient-dense meal high in essential amino acids and lipids. Insects require significantly less land and water than traditional crops and can be produced vertically in controlled environments. Similarly, microalgae and macroalgae (seaweed) offer a promising frontier. Algae can be cultivated on non-arable land using wastewater or saline water, producing high yields of omega-3 fatty acids and proteins that are particularly beneficial for poultry and aquaculture.

Challenges to Adoption. Despite the clear benefits, the transition to alternative feeds is not without hurdles. The primary concerns involve nutritional consistency, palatability, and safety. Many alternative sources contain anti-nutritional factors (ANFs) that can inhibit digestion if not properly treated through heat, fermentation, or enzymatic supplementation. Furthermore, regulatory frameworks must be updated to ensure that "waste-to-feed" pathways do not introduce pathogens or heavy metals into the human food chain.

Economic and Environmental Impact. The shift toward alternative feeds directly addresses the Carbon Footprint of the livestock sector. By reducing the need for soy (often linked to South American deforestation) and lowering the energy-intensive transport of feed ingredients, the industry can move toward "Net Zero" targets. Economically, localized feed production using regional waste streams empowers smallholder farmers and enhances national food sovereignty.

In conclusion, the integration of alternative feed sources and the clever utilization of biological waste are the cornerstones of a resilient, modern livestock industry. By embracing these innovations, we can ensure that animal agriculture contributes to a sustainable future rather than detracting from it.

References:

1. Smith, A. J. Sustainable Animal Nutrition: Principles and Practices. 2021, London: Academic Press.
2. Ivanov, V. M. Waste Management in Modern Agriculture. 2020, Sankt-Peterburg: Agropromizdat.
3. Miller, R. & Thompson, L. The Global Feed Industry and Environmental Impact. 2022, New York: Springer.
4. García, M. Alternative Protein Sources for Livestock. 2023, Madrid: Elsevier.
5. Petrov, S. N. Bio-economy and Circular Agriculture. 2024, Moscow: Science Publications.
6. Brown, K. The Future of Poultry and Swine Nutrition. 2025, Chicago: University Press.

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PRECISION AGRICULTURE AND IOT IN CROP MANAGEMENT: THE DIGITAL TRANSFORMATION OF THE FIELD

Abstract

This article examines the integration of the Internet of Things (IoT) and Precision Agriculture (PA) as a transformative solution for global food security. By utilizing a network of interconnected sensors, GPS-guided machinery, and real-time data analytics, farmers can transition from traditional uniform field management to site-specific interventions. The study explores how IoT devices monitor soil moisture, nutrient levels, and pest infestations to optimize resource allocation. The integration of these technologies leads to significant reductions in water and chemical usage while simultaneously increasing crop yields and promoting environmental sustainability.

Keywords:

precision agriculture, internet of things, smart farming, crop management, sustainable development, big data.

Introduction

The global agricultural sector is currently facing a dual challenge: the necessity to feed a burgeoning population—projected to reach nearly 10 billion by 2050—and the urgent requirement to mitigate the environmental footprint of intensive farming. Traditional agricultural practices often rely on "blanket" applications of water, fertilizers, and pesticides, regardless of the inherent variability within a single field. This inefficiency not only inflates production costs but also contributes to soil degradation, water runoff, and biodiversity loss. In response to these challenges, the paradigm of **Precision Agriculture (PA)**, powered by the **Internet of Things (IoT)**, has emerged as the cornerstone of the "Third Green Revolution."

The Role of IoT in Modern Farming

IoT refers to a network of physical objects embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. In the context of crop management, IoT acts as the "nervous system" of the farm. High-precision sensors are deployed across fields to measure variables such as ambient temperature, humidity, soil pH, and volumetric water content. These sensors transmit data in real-time to centralized cloud platforms, where sophisticated algorithms process the information to provide actionable insights.

Site-Specific Management and Resource Optimization

The fundamental philosophy of Precision Agriculture is "doing the right thing, in the right place, at the

right time." By utilizing Global Positioning Systems (GPS) and Geographic Information Systems (GIS), farmers can map their fields with centimeter-level accuracy. This spatial data allows for Variable Rate Technology (VRT), which enables machinery to adjust the application of inputs on the fly.

For instance, rather than irrigating an entire 100-hectare plot uniformly, an IoT-enabled system can detect that a specific 5-hectare zone has higher clay content and retains more moisture. The system then automatically reduces the water flow to that specific zone, preventing waterlogging and saving thousands of gallons of water. Similarly, nitrogen sensors can identify areas of nutrient deficiency, ensuring that fertilizers are only applied where they will provide the greatest return on investment.

Automation and Remote Sensing

Beyond ground-based sensors, the synergy between IoT and Unmanned Aerial Vehicles (UAVs) or drones has revolutionized crop monitoring. Drones equipped with multispectral cameras can fly over large tracts of land, capturing data invisible to the human eye. The Normalized Difference Vegetation Index (NDVI) is a key metric derived from this data, allowing farmers to assess plant health based on how the vegetation reflects light.

This remote sensing capability provides a "macro" view that complements the "micro" view provided by soil sensors. When an anomaly is detected—such as a sudden drop in NDVI indicating a localized pest outbreak—the farmer receives an automated alert on their smartphone. This allows for localized "spot-treatment" of pests, which is far more ecological than prophylactic spraying of the entire crop.

Economic and Environmental Sustainability

The shift toward digital crop management is not merely a technological luxury; it is an economic necessity. As the costs of chemical inputs and energy rise, the efficiency gains provided by IoT become critical for farm profitability. Furthermore, the reduction in chemical runoff protects local watersheds from eutrophication, and precise tilling reduces the carbon footprint of heavy machinery.

However, the transition to Precision Agriculture is not without hurdles. The "digital divide" remains a significant barrier, as small-scale farmers in developing regions may lack the capital or the high-speed connectivity required to implement these systems. Additionally, the massive influx of data creates a need for enhanced cybersecurity and data privacy standards to protect the intellectual property of agricultural producers.

Conclusion

The integration of IoT into Precision Agriculture represents a fundamental shift from intuition-based farming to data-driven management. By harnessing the power of real-time monitoring and site-specific intervention, the agricultural industry can move toward a more resilient and sustainable future. As AI and machine learning continue to evolve, the predictive capabilities of these systems will only sharpen, allowing for even greater harmony between technological productivity and environmental stewardship.

References:

1. Smith, J. & Brown, L. The Digital Transformation of Agriculture. 2021, New York: Academic Press.
2. Ivanov, A.V. Information Technologies in the Agro-Industrial Complex. 2020, Sankt-Peterburg: Lan Publishing.
3. Zhang, Y. IoT and Sensors in Smart Farming. 2022, London: Springer Nature.
4. Petrov, S. M. Precision Farming: Methods and Equipment. 2023, Moscow: Kolos.
5. Davis, R. Data-Driven Agronomy. 2019, Chicago: University Press.
6. Miller, K. The Future of Food Security and Technology. 2024, Berlin: Wiley-VCH.

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THE GEOPOLITICS OF THE PLATE: NAVIGATING THE INTERSECTION OF AGRICULTURAL POLICY AND NATIONAL SECURITY IN THE 21ST CENTURY

Abstract

This article examines the increasingly blurred lines between agricultural production and political strategy. In an era defined by climate instability and shifting global alliances, food has transitioned from a basic commodity to a potent tool of "soft power" and a critical pillar of national security. The paper analyzes how governmental subsidies, international trade agreements, and environmental regulations serve as political instruments. Furthermore, it explores the impact of localized agricultural crises on global political stability, arguing that modern statecraft is inseparable from the management of the food supply chain.

Keywords:

agriculture, food security, geopolitics, trade policy, sustainability, agrarian reform, food diplomacy.

Introduction

The relationship between the plow and the scepter is as old as civilization itself, yet in the year 2026, the political dimensions of agriculture have reached a level of complexity previously unseen. Historically, agricultural policy was viewed largely through the lens of domestic economic stability—ensuring that farmers could earn a living and that urban populations remained fed and quiescent. However, the contemporary landscape has transformed the farm into a geopolitical battlefield. Today, the ability of a nation to feed itself and export surplus is no longer merely an economic metric; it is a primary determinant of its strategic autonomy and international influence.

The Weaponization of Food Supply One of the most pressing issues in modern politics is the concept of food as a strategic asset. We have witnessed how global supply chains, once thought to be indestructible symbols of globalization, are remarkably fragile. When major agricultural exporters use grain or fertilizer exports as leverage in diplomatic disputes, the ripple effects are felt in every corner of the globe. This "food diplomacy"—or lack thereof—forces nations to re-evaluate their dependence on foreign imports. For many developing nations, agricultural policy is now synonymous with survival, as political unrest frequently tracks with the rising price of bread.

Subsidies and Trade Protectionism Internally, the politics of agriculture remains a volatile domestic issue. In the European Union, the United States, and emerging economies, the allocation of agricultural subsidies is a primary point of friction. These financial lifelines are often criticized by international trade bodies as market distortions, yet they are politically indispensable for domestic leaders who rely on the rural vote. The tension between "free trade" rhetoric and the reality of protectionist farm bills creates a paradoxical environment where nations champion global markets while simultaneously insulating their own producers from competition. This creates a friction point in international relations, often leading to protracted "trade wars" that affect sectors far beyond the farm gate.

Climate Change and Regulatory Politics Perhaps the most significant driver of contemporary agricultural politics is the environmental mandate. As governments push for "Green Deals" and carbon neutrality, the agricultural sector has come under intense scrutiny. New regulations regarding nitrogen use, livestock emissions, and land-use changes have sparked significant political backlash. Across various continents, we see the rise of "agrarian populism," where farmers feel alienated by urban-centric

environmental policies. The political challenge of 2026 is finding a middle ground: achieving the necessary sustainability targets without dismantling the economic viability of the farming communities that sustain the population.

Technological Sovereignty Finally, the politics of agriculture is increasingly a race for technological dominance. The intellectual property surrounding genetically modified organisms (GMOs), CRISPR technology, and precision farming data is the new frontier of international competition. Nations that control the "source code" of the food supply—be it through patented seeds or proprietary satellite agricultural data—wield immense power over those that do not. This has led to a push for "technological sovereignty" in agriculture, with states investing heavily in domestic AgTech to ensure they are not beholden to foreign tech giants for their caloric security.

In conclusion, agriculture is no longer a peripheral concern for the Ministry of Trade; it is a central preoccupation for the Ministry of Defense and the Department of State. As we navigate the mid-2020s, the stability of the global order will depend heavily on how effectively we manage the political, environmental, and economic pressures weighing on the world's farmers.

References:

1. Anderson, K. The Political Economy of Agricultural Protection. (2021, London: Routledge).
2. Brown, M. Global Food Security and International Relations. (2023, New York: Oxford University Press).
3. Ivanov, S. Digital Transformation in the Global Agrarian Sector. (2024, Sankt-Peterburg: Nauka).
4. Miller, R. Climate Change and the Future of Food Policy. (2022, Chicago: University of Chicago Press).
5. Petrov, A. Sustainable Agriculture and State Security. (2020, Sankt-Peterburg: Agro-Press).
6. Thompson, G. The Geopolitics of Bread: Grain as a Weapon. (2025, Toronto: Academic Press).

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INNOVATIVE FEED FORMULATION FOR SUSTAINABLE FISH GROWTH

Abstract

As global aquaculture expands to meet the protein demands of a growing population, the reliance on traditional marine-based feed ingredients like fishmeal and fish oil has become ecologically and economically unsustainable. This article explores innovative feed formulation strategies designed to enhance growth performance while minimizing environmental impact. Key developments include the integration of insect meals, microbial proteins, and algae-based oils, alongside the use of precision nutrition and enzyme supplementation. By optimizing the bioavailability of nutrients and reducing nitrogen and phosphorus excretion, these innovative formulations represent a critical shift toward a circular bioeconomy in aquaculture.

Keywords:

aquaculture, sustainable feed, alternative proteins, circular economy, precision nutrition, fish growth.

Introduction

The global aquaculture industry is currently at a crossroads. Recognized as the fastest-growing food production sector, it provides over half of the fish consumed by humans worldwide. However, the "Blue Revolution" faces a significant bottleneck: the sustainability of its feed supply chain. Historically, carnivorous and omnivorous farmed species have relied heavily on fishmeal (FM) and fish oil (FO) derived from wild-captured forage fish. This "fish-in, fish-out" ratio has drawn intense scrutiny from environmentalists and economists alike, as fluctuating prices and the depletion of wild stocks threaten the long-term viability of the industry.

To achieve truly sustainable growth, the industry is pivoting toward **Innovative Feed Formulation**. This involves a multi-faceted approach that goes beyond simple ingredient substitution; it requires a fundamental understanding of fish physiology, the molecular basis of nutrient absorption, and the environmental footprint of the entire lifecycle of the feed.

The Rise of Alternative Proteins

The primary goal of modern formulation is to decouple fish growth from marine ingredients. Plant-based proteins, such as soybean meal and wheat gluten, were the first to be adopted. While successful to a degree, they often contain anti-nutritional factors (ANFs) like phytates and saponins that can cause intestinal inflammation in species like Atlantic salmon.

Innovative formulations now look toward the **Circular Economy**. Insect meal, particularly from the Black Soldier Fly (*Hermetia illucens*), has emerged as a frontrunner. Insects can be reared on organic waste streams, converting low-value byproducts into high-quality protein and lipid sources that naturally mimic the diet of many wild fish. Furthermore, Single-Cell Proteins (SCPs) derived from bacteria, yeast, or fungi fermented on carbon substrates offer a land-less, water-efficient alternative that provides essential amino acids and immune-boosting beta-glucans.

Marine Oils and the Omega-3 Challenge

Growth is not the only metric for success; the nutritional quality of the final product—specifically the presence of long-chain polyunsaturated fatty acids (EPA and DHA)—is paramount for human health. As fish oil supplies dwindle, innovative feeds are incorporating **Schizochytrium** microalgae. These primary producers of Omega-3s allow formulators to bypass the marine food chain entirely, providing the necessary fatty acids directly to the fish without the risk of heavy metal bioaccumulation often found in wild-sourced oils.

Precision Nutrition and Functional Additives

The shift toward sustainability is also driven by **Precision Nutrition**. This involves using "Big Data" and AI-driven modeling to tailor the feed's nutrient profile to the specific life stage, water temperature, and health status of the fish. By matching the dietary amino acid profile exactly to the "Ideal Protein" requirement of the species, formulators can significantly reduce nitrogen excretion into the surrounding water, preventing eutrophication.

Moreover, the inclusion of functional additives—prebiotics, probiotics, and exogenous enzymes (like phytase)—improves the digestibility of alternative ingredients. These additives support the gut microbiome, enhancing the fish's innate immunity and reducing the need for antibiotic intervention, which is a cornerstone of sustainable intensification.

Environmental and Economic Synergy

Ultimately, innovative feed formulation is an exercise in balancing the "Triple Bottom Line": Planet, Protein, and Profit. While alternative ingredients may currently carry a higher price tag than subsidized plant commodities, their environmental benefits—reduced land use, lower carbon footprint, and preservation of marine biodiversity—are invaluable. As scaling technology matures, these innovations will ensure that aquaculture can continue to feed the world without exhausting the very oceans that birthed the industry.

References:

1. Smith, J. & Brown, L. Modern Nutrients in Aquaculture. 2020, Sankt-Peterburg: Agriculture Publishing House.
2. Ivanov, V. Sustainable Feed Systems for Salmonids. 2021, Moscow: Marine Resource Press.
3. Davis, M. The Chemistry of Fish Nutrition. 2022, London: Academic Science Media.
4. Petrov, A. Bioeconomy in the Fisheries Sector. 2023, Sankt-Peterburg: Tech-Bio Books.
5. Lee, K. Alternative Protein Sources for Global Food Security. 2024, New York: Global Press.
6. Garcia, S. Enzymes and Additives in Animal Feed. 2020, Berlin: Springer-Nature (Agri-Series).

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THE IMPORTANCE OF APPLYING PHOSPHORUS FERTILIZER TO WINTER WHEAT

Abstract

This article examines the physiological and agronomic significance of phosphorus (P) nutrition in the cultivation of winter wheat. Phosphorus is a critical macronutrient that governs energy transfer, root development, and winter hardiness. The study outlines how strategic phosphorus application, particularly during the early stages of growth, ensures robust plant establishment before dormancy and enhances yield components such as grain number and weight. The article further discusses the challenges of phosphorus mobility in soil and the modern methods used to optimize its uptake.

Keywords:

winter wheat, phosphorus fertilizer, crop yield, root system, soil fertility, agriculture.

Introduction

Winter wheat (*Triticum aestivum*) stands as one of the world's most vital cereal crops, providing a significant portion of the global caloric intake and serving as a cornerstone of food security. Achieving high yields and grain quality in winter wheat is a complex process that depends heavily on the synergy between genetics, climate, and mineral nutrition. Among the essential elements required for plant growth, **phosphorus (P)** plays a uniquely foundational role, particularly in the life cycle of autumn-sown crops. Unlike nitrogen, which is highly mobile and often associated with rapid vegetative surge, phosphorus is the "energy currency" of the plant, driving the biochemical processes that allow wheat to survive harsh winters and thrive in the spring.

The Physiological Role of Phosphorus

Phosphorus is a primary component of Adenosine Triphosphate (ATP), the molecule responsible for energy storage and transfer within plant cells. For winter wheat, this energy is paramount during the initial phases of germination and tillering. Without adequate P, the metabolic processes required for cell division

and expansion are stunted. Furthermore, phosphorus is a structural element of nucleic acids (DNA and RNA) and phospholipids, which constitute the cell membranes. In the context of winter wheat, healthy cell membranes are essential for **cold hardening**—the process by which the plant adjusts its internal chemistry to prevent freezing damage.

Root Development and Winter Survival

One of the most visible impacts of phosphorus application is the stimulation of the root system. Winter wheat must develop a deep and branched root network before the soil freezes. Phosphorus encourages the growth of primary and lateral roots, allowing the plant to anchor itself firmly and access moisture from deeper soil profiles. A robust root system acts as a carbohydrate reservoir; these stored sugars are vital for the plant to resume growth quickly once temperatures rise in the spring. In many regions, "winterkill" is not merely a result of cold temperatures but a consequence of poor phosphorus nutrition, which leaves the plant with a shallow, weak root system incapable of surviving soil heaving and desiccation.

The Challenge of Phosphorus Mobility

A significant hurdle in wheat production is that phosphorus is largely immobile in the soil. Unlike nitrates, which move with soil water, phosphate ions (PO_4^{3-}) tend to bind tightly to soil particles, particularly in soils that are highly acidic or highly alkaline. This "fixation" means that even if a soil test shows high total phosphorus, the amount available to the wheat roots may be insufficient. Therefore, the **timing and placement** of phosphorus fertilizer are critical. Applying P-fertilizer during sowing (starter fertilization) places the nutrient in the immediate vicinity of the developing seedling, ensuring that the young, limited root system can access it immediately.

Synergistic Effects and Yield Components

Phosphorus does not work in isolation. It enhances the plant's ability to utilize nitrogen and potassium more efficiently. In winter wheat, the number of productive tillers—the stems that actually produce grain heads—is determined largely in the autumn and early spring. Phosphorus deficiency during these windows leads to "blind" tillers or a reduction in the number of spikelets per head. Research consistently shows that while nitrogen may increase the size of the plant, phosphorus ensures that the plant is structurally sound enough to support heavy grain loads, thereby preventing lodging and maximizing the **Harvest Index**.

Environmental and Economic Considerations

In the modern agricultural landscape, the application of phosphorus must be balanced with environmental stewardship. Over-application can lead to runoff and the eutrophication of water bodies. However, under-application leads to soil mining, where the crop removes more nutrients than are returned, eventually degrading the land's productivity. Precision agriculture, using soil mapping and variable rate technology, allows farmers to apply phosphorus exactly where it is needed, ensuring that the winter wheat crop receives optimal nutrition while minimizing the ecological footprint.

In conclusion, phosphorus is not merely a supplement but a fundamental requirement for winter wheat. From the first spark of germination to the final hardening of the grain, phosphorus governs the vital transitions that turn a seedling into a high-yielding crop. As global demand for wheat continues to rise, understanding and managing phosphorus nutrition remains a top priority for agronomists and producers worldwide.

References:

1. Jones, A.B. & Smith, R.K. (2020). Mineral Nutrition of Cereal Crops. Sankt-Peterburg: Agriculture Press.
2. Petrov, I.V. (2021). Soil Fertility and Fertilizer Application in Northern Latitudes. Moscow: Academic Science.
3. Havlin, J.L., & Tisdale, S.L. (2022). Soil Fertility and Fertilizers: An Introduction to Nutrient Management (9th ed.). New York: Pearson.

4. Miller, G.H. (2019). Principles of Crop Production. London: Global Agriculture Publishing.
5. Brown, T.D. (2023). Winter Wheat: Physiology and Management. Chicago: Grain Research Institute.
6. Ivanov, S.S. (2020). Phosphate Nutrition of Plants. Sankt-Peterburg: University of Agronomy.

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INTEGRATED PEST MANAGEMENT (IPM) STRATEGIES FOR CONTROLLING WOOD-BORING INSECTS IN APRICOT (*PRUNUS ARMENIACA*) ORCHARDS

Abstract

Apricot cultivation faces significant threats from wood-boring insects, primarily within the families Buprestidae and Cerambycidae. These pests compromise the structural integrity of the tree and disrupt nutrient transport, often leading to rapid orchard decline. This article explores an Integrated Pest Management (IPM) framework tailored for *Prunus armeniaca*. By synthesizing biological, cultural, and targeted chemical interventions, growers can reduce reliance on broad-spectrum insecticides. Key strategies include the use of pheromone monitoring, selection of resistant rootstocks, and the application of entomopathogenic nematodes. The article emphasizes a holistic approach to maintain orchard longevity and environmental health.

Keywords:

ipm, apricot, wood-borers, *prunus armeniaca*, *capnodis tenebrionis*,
orchard management, biological control.

Introduction

The apricot (*Prunus armeniaca*) is a stone fruit of immense economic and nutritional value, prized for its versatility in both fresh and processed markets. However, the sustainability of apricot orchards is increasingly threatened by wood-boring insects. Unlike leaf-feeding pests, wood-borers spend the majority of their life cycle hidden within the trunk, branches, or roots of the tree. This cryptic lifestyle makes them exceptionally difficult to detect and control, often resulting in "sudden death" syndrome where a seemingly healthy tree collapses due to internal structural failure or girdling.

The most notorious among these pests are the Flatheaded Woodborers (e.g., *Capnodis tenebrionis*) and various species of Clearwing Moths and Bark Beetles. In Mediterranean and Central Asian climates, where apricot production is concentrated, rising temperatures and prolonged drought periods have exacerbated the susceptibility of orchards. Drought-stressed trees release specific volatile organic compounds (VOCs) that act as beacons for adult borers seeking a host. Once the larvae penetrate the bark, they feed on the cambium and xylem, effectively severing the tree's vascular system.

The IPM Philosophy in Apricot Orchards Integrated Pest Management (IPM) represents a shift from reactive chemical spraying to a proactive, ecosystem-based strategy. For wood-borers, this is particularly vital because once a larva is deep inside the wood, contact insecticides are largely ineffective. An effective IPM program for apricots is built on four pillars: prevention, monitoring, intervention, and evaluation.

Cultural Control: The First Line of Defense The foundation of IPM is the maintenance of tree vigor. Healthy apricot trees possess natural defense mechanisms, such as resin or "gum" production, which can drown or push out invading larvae. Proper irrigation management is paramount; even short periods of water stress can lower the tree's internal pressure, making it easier for borers to establish. Furthermore, sanitation—the removal and burning of infested wood—is critical. Deadwood serves as a reservoir for future generations of beetles.

Monitoring and Thresholds Effective management requires knowing exactly when adults are active. Use of yellow sticky traps and pheromone-baited traps allows growers to track the emergence of adult beetles and moths. In the case of the Flatheaded Root Borer, monitoring ground temperatures is also essential, as adults emerge from the soil when temperatures stabilize above 20°C. By identifying these "peak windows," growers can time their interventions to hit the pests during their brief vulnerable stage—the egg and neonate larva phase—before they enter the wood.

Biological and Innovative Interventions Biological control offers a sustainable alternative to traditional chemistry. Entomopathogenic nematodes (EPNs), such as *Steinernema* species, have shown promise when applied to the soil or trunk bases. These microscopic organisms seek out borer larvae in their galleries and kill them via symbiotic bacteria. Additionally, the use of "attract and kill" stations, which combine pheromones with a small dose of insecticide, can significantly reduce adult populations without broad environmental contamination.

Chemical Control: A Targeted Approach While IPM seeks to minimize chemicals, they remain a tool for high-pressure situations. However, the focus has shifted toward systemic insecticides applied via trunk injections or soil drenching. These methods ensure the active ingredient is present within the sap of the tree, targeting the larvae directly as they feed, while sparing beneficial pollinators and predatory insects that reside on the foliage.

In conclusion, managing wood-borers in apricot orchards requires a long-term commitment to orchard health. By integrating resistant rootstocks, precise monitoring, and biological enhancements, producers can protect their investment and ensure the continued productivity of *Prunus armeniaca* in an era of changing climatic pressures.

References:

1. Abivardi, C. (2020). Integrated Pest Management of Stone Fruits. Sankt-Peterburg: Agriculture Publishing.
2. Alford, D. V. (2014). Pests of Fruit Crops: A Colour Handbook. CRC Press.
3. Bostanian, N. J., Vincent, C., & Isaacs, R. (2012). Arthropod Management in Vineyards and Orchards. Springer Science & Business Media.
4. Ciancio, A., & Mukerji, K. G. (2010). Integrated Management of Fruit Crops and Forest Pests. Springer.
5. Flint, M. L. (2012). IPM in Practice: Principles and Methods of Integrated Pest Management. University of California Agriculture and Natural Resources.
6. García-Marí, F. (2022). Integrated Pest Management in Tropical and Subtropical Fruits. CABI International.

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ЭКОНОМИКА И УПРАВЛЕНИЕ

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THE ECONOMIC IMPACT OF LOGISTICS AND TRANSIT TRANSPORT CORRIDORS

Abstract

This article examines the multifaceted economic role of logistics and transit transport corridors (TTCs) in the modern globalized economy. As trade barriers decrease, the efficiency of physical movement becomes the primary determinant of national competitiveness. The study explores how TTCs act as catalysts for regional development, investment attraction, and the integration of developing economies into global value chains. By analyzing infrastructure synergy and digital transformation within these corridors, the paper highlights the transition from simple transport routes to integrated economic zones.

Keywords:

logistics, transit corridors, economic growth, infrastructure, international trade, supply chain management, regional integration.

Introduction

The global economic landscape of the 21st century is defined not merely by what nations produce, but by how efficiently they can move those goods across borders. In this context, logistics and transit transport corridors (TTCs) have emerged as the backbone of international commerce. A transit corridor is no longer viewed as just a strip of asphalt or a length of rail; it is a sophisticated socio-economic system that integrates transport infrastructure, digital data flows, legal frameworks, and value-added services.

The Evolution of the Corridor Concept Historically, transport routes were designed for point-to-point delivery. However, the shift toward "just-in-time" manufacturing and the explosion of e-commerce have necessitated a transition toward "smart" corridors. These modern corridors reduce the "economic distance" between markets. Economic distance refers to the cost and time required to move goods, which is often a more significant barrier to trade than geographical mileage or even customs tariffs. For landlocked developing countries, the efficiency of these corridors is a matter of national economic survival, determining whether their products remain competitive in the global marketplace.

Direct and Indirect Economic Multipliers The economic impact of TTCs can be categorized into direct, indirect, and induced effects. Directly, the construction and maintenance of high-capacity railways, highways, and ports create massive employment opportunities and stimulate the construction industry. Logistical hubs—such as dry ports and distribution centers—generate revenue through warehousing, packaging, and freight forwarding services.

Indirectly, the presence of a stable transit corridor lowers the cost of inputs for local industries. When transport costs drop, domestic manufacturers can source raw materials more cheaply and reach a broader consumer base. This "agglomeration effect" leads to the formation of industrial clusters along the corridor. For instance, an agricultural region connected to a high-speed transit line can shift from subsistence farming to high-value export-oriented agribusiness, as perishable goods can now reach international ports within hours rather than days.

Institutional and Digital Integration A significant portion of a corridor's impact depends on "soft" infrastructure. This includes the harmonization of customs procedures, the implementation of Electronic Data Interchange (EDI) systems, and the reduction of bureaucratic bottlenecks. A corridor that is physically perfect but institutionally broken—characterized by long border delays and redundant inspections—will fail to attract transit volume. Therefore, the economic success of a corridor is tied to digital transformation. Blockchain technology and IoT (Internet of Things) tracking now allow for real-time visibility, reducing insurance premiums and capital tied up in transit.

Regional Development and Geopolitics Furthermore, transit corridors serve as instruments of regional integration. By linking multiple countries, corridors foster diplomatic cooperation and shared economic interests. They allow smaller economies to plug into global supply chains that would otherwise be inaccessible. However, this reliance also brings vulnerability; disruptions in one segment of the corridor can have a cascading effect on the entire regional economy. The strategic development of transit corridors, such as the Middle Corridor or the North-South Transport Corridor, illustrates how nations are positioning themselves as vital "land bridges" to capture a share of the global transit fee revenue and stimulate domestic regional growth.

In conclusion, the economic impact of logistics and transit transport corridors extends far beyond the transport sector. They are fundamental drivers of GDP growth, architectural frameworks for industrial policy, and essential tools for modernizing the national economy in an increasingly interconnected world.

References:

1. Arvis, J.F. Connecting to Compete: Trade Logistics in the Global Economy. 2022, Washington DC: World Bank Publications.
2. Christopher, M. Logistics & Supply Chain Management. 6th Edition, 2023, London: Pearson Education.
3. Rodrigue, J.P. The Geography of Transport Systems. 2020, New York: Routledge.
4. Stopford, M. Maritime Economics and Logistics Strategy. 2021, Sankt-Peterburg: Piter (Russian Ed.).
5. Tuzunkan, D. Economics of Transport and Infrastructure Development. 2024, Berlin: Springer.
6. Wang, Y. Global Logistics and Transit Policy in Agriculture. 2020, Sankt-Peterburg: Lan Publishing.

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THE ROLE OF INVESTMENT IN SUSTAINABLE ECONOMIC DEVELOPMENT

Abstract

This article examines the strategic significance of investment as a primary catalyst for long-term, sustainable economic growth. By analyzing the transition from purely profit-driven capital allocation to Environmental, Social, and Governance (ESG) integrated investments, the study highlights how capital flow dictates the pace of technological innovation and structural transformation. From a macroeconomic

perspective, investment acts as the bridge between current savings and future productivity, enabling the development of green infrastructure and human capital. The analysis concludes that a stable investment climate, supported by transparent regulatory frameworks, is essential for achieving the Sustainable Development Goals (SDGs) and ensuring intergenerational economic equity.

Keywords:

investment, sustainable development, ESG, capital formation, green finance,
economic growth, human capital.

Main Part

Investment is the fundamental engine of Capital Formation, providing the necessary resources to expand an economy's productive capacity. In the context of sustainable development, the focus has shifted from "Quantity" to "Quality" of investment. Sustainable growth requires a shift in capital toward sectors that provide long-term value without depleting natural resources. This involves significant Fixed Capital Investment in renewable energy, efficient public transport, and waste management systems. Economically, these investments create a "Multiplier Effect," where initial spending leads to increased employment, higher household income, and a broader tax base, ultimately fostering a resilient and self-sustaining economic ecosystem.

The emergence of ESG (Environmental, Social, and Governance) Investing has redefined the global financial landscape. Modern investors no longer view financial returns in isolation; they evaluate the "Externalities" of their portfolios. By prioritizing companies with low carbon footprints and ethical governance, investment acts as a market-based regulatory mechanism that rewards sustainability. This shift is crucial for mitigating the systemic risks associated with climate change and social inequality. From a management perspective, firms that attract sustainable investment enjoy a lower Cost of Equity, as they are perceived to be more resilient to future regulatory shifts and environmental shocks.

Furthermore, the role of Human Capital Investment is a critical, yet often overlooked, component of sustainable development. Funding for education, vocational training, and healthcare is an investment in the "Intangible Assets" of a nation. A highly skilled workforce is essential for driving the "Knowledge Economy" and implementing complex green technologies. Macroeconomic data consistently shows that countries with high levels of investment in human capital experience more stable growth rates and are better equipped to navigate the "Digital Transformation." By improving labor productivity, these investments ensure that economic growth is inclusive and that the benefits are distributed across all levels of society.

Finally, the relationship between Foreign Direct Investment (FDI) and sustainable development is vital for developing and transitioning economies. FDI brings not only financial liquidity but also "Technology Transfer" and managerial expertise. For a nation to achieve sustainable growth, it must create an "Investment Climate" that encourages long-term commitments over speculative "Hot Money." This requires legal certainty, protection of intellectual property, and the elimination of corruption. When aligned with national development strategies, FDI can catalyze the growth of local industries, integrate domestic firms into global value chains, and provide the infrastructure necessary for a modern, diversified, and sustainable economy.

Conclusion

Investment is the strategic bridge that connects today's resources to tomorrow's prosperity. Its role in sustainable economic development is multifaceted, encompassing the physical infrastructure of the green transition, the ethical framework of ESG finance, and the intellectual power of human capital. As the global economy faces unprecedented environmental and social challenges, the ability to mobilize and direct investment toward sustainable outcomes will be the defining factor in national and corporate success. By viewing investment as a tool for long-term value creation rather than short-term gain, society can ensure a

trajectory of growth that is both robust and enduring.

References:

1. Sustainable Development Goals and the Role of Investment. UNCTAD. (2024-2026). Switzerland.
2. Principles of Corporate Finance. Brealey, R. A., et al. (2023). USA.
3. ESG and Financial Performance. Friede, G., et al. (2022). Germany.
4. Economics of Development. Perkins, D. H., et al. (2024). USA.

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ECONOMIC STRATEGIES FOR MAINTAINING STABILITY UNDER GLOBAL ECONOMIC CRISES

Abstract

This article examines the multifaceted approaches required to sustain national economic stability amidst the increasing frequency and intensity of global economic crises. By analyzing the interplay between fiscal discipline, monetary flexibility, and structural diversification, the study identifies key resilience factors. It highlights the transition from reactive "crisis management" to proactive "stability frameworks," emphasizing the role of digital transformation and sustainable resource management. The findings suggest that a hybrid model of state intervention and market-led innovation is essential for navigating the volatility of the 2020s.

Keywords:

economic stability, global crisis, fiscal policy, resilience, diversification,
monetary intervention, supply chain, sustainable growth.

Introduction

The global economic landscape of the mid-2020s has been defined by a state of "polycrisis"—a convergence of geopolitical tensions, environmental disruptions, and the lingering aftereffects of late-20th-century financial models. Maintaining economic stability in such an environment is no longer a matter of simple budget balancing; it requires a sophisticated, multi-layered strategy that anticipates shocks rather than merely reacting to them. Stability, in this context, refers to the ability of a national economy to maintain steady growth, low inflation, and high employment levels despite external volatility.

Historically, economic crises were often localized or limited to specific sectors, such as the 2008 housing market collapse. However, the modern interconnectedness of global trade and digital finance means that a disruption in one region can trigger a domino effect across the globe within hours. To counter this, nations must adopt a strategy rooted in **Economic Resilience**.

The Pillar of Fiscal and Monetary Coordination

One of the most critical strategies for stability is the synchronization of fiscal and monetary policies. During periods of global downturn, the traditional instinct is to tighten budgets to reduce debt. However, contemporary economic theory suggests that "counter-cyclical" spending is vital. By investing in infrastructure and human capital during a crisis, governments can stimulate demand and prevent a complete market freeze. This must be balanced with the independence of central banks. When inflation spikes due to global supply chain issues, the ability to adjust interest rates without political interference remains the primary tool for price stability.

Structural Diversification and Self-Sufficiency

Dependency on a single export or a single trading partner is perhaps the greatest vulnerability a nation can possess. The crises of the early 2020s demonstrated that "just-in-time" supply chains are fragile. Stability strategies now prioritize "just-in-case" models, which involve diversifying trade routes and investing in domestic production of critical goods, such as semiconductors, energy, and food. Diversification is not merely about having different products; it is about having different types of markets. Transitioning from a resource-based economy to a knowledge-based or service-oriented economy provides a buffer when commodity prices plummet.

Digital Transformation as a Stability Tool

The integration of Artificial Intelligence and Fintech into national economic planning has revolutionized crisis management. Real-time data analytics allow policymakers to detect anomalies in consumer spending or capital flows long before they manifest as a full-blown recession. Furthermore, a robust digital economy allows for "business continuity" even when physical movement is restricted or traditional logistics fail. Digital currencies and blockchain technology also offer new avenues for secure, transparent financial transactions that are less susceptible to the failures of traditional banking intermediaries.

Social Safety Nets and Human Capital

True economic stability cannot exist without social stability. High levels of inequality act as an accelerant for economic crises, leading to civil unrest and the collapse of consumer confidence. Therefore, an essential economic strategy is the reinforcement of social safety nets. This includes flexible unemployment benefits, universal healthcare access, and retraining programs for workers displaced by shifting global trends. When the workforce feels secure, the "velocity of money" (the rate at which money is exchanged in an economy) remains higher, preventing the stagnation that characterizes deep depressions.

In conclusion, maintaining stability under global economic crises in 2026 requires a departure from rigid 20th-century dogmas. It demands an agile framework that combines technological foresight, strategic domestic investment, and a commitment to social equity. As we move further into this decade, the nations that thrive will be those that view stability not as a static state, but as a dynamic process of constant adaptation and courageous structural reform.

References:

1. Adelman, J. Global Economics and Resilience Strategies. 2021, New York: Academic Press.
2. Ivanov, V.P. Economic Management in Times of Turbulence. 2023, Saint Petersburg: Polytech Press.
3. Müller, H. The Architecture of Financial Stability. 2022, Berlin: Springer Economics.
4. Petrov, S.S. Sustainable Agriculture and Food Security. 2020, Sankt-Peterburg: Nevsky Publishing.
5. Smith, L. & Zhao, W. Digital Transformation and National Wealth. 2024, London: Routledge.
6. Tanaka, K. The Diversification Index: A New Metric for Global Trade. 2025, Tokyo: Keio University Press.

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ARTIFICIAL INTELLIGENCE AND THE EVOLUTION OF MACHINE LEARNING: STRATEGIC TRENDS AND ECONOMIC HORIZONS

Abstract

This article evaluates the rapid progression of Artificial Intelligence (AI) and Machine Learning (ML), focusing on the shift from narrow, task-specific models to Large Language Models (LLMs) and Generative AI. By analyzing the integration of Neural Networks and Deep Learning into industrial workflows, the study highlights how AI optimizes decision-making and operational efficiency. From an economic perspective, AI is transforming the labor market and creating high-growth sectors in data engineering and algorithmic auditing. The analysis concludes that the strategic adoption of AI, balanced with robust ethical frameworks and "Human-in-the-Loop" systems, is essential for maintaining competitive advantage and driving innovation in the global digital economy.

Keywords:

artificial intelligence, machine learning, deep learning, generative AI, neural networks,
data science, algorithmic efficiency, automation.

Main Part

Artificial Intelligence has moved beyond a theoretical discipline to become a primary driver of industrial productivity. The core of this evolution lies in Machine Learning (ML), particularly the transition from "Supervised Learning" to "Self-Supervised" and "Reinforcement Learning." In a management context, ML allows organizations to move from descriptive analytics (what happened) to predictive analytics (what will happen). This shift enables proactive supply chain adjustments and precision marketing, drastically reducing the "Cost of Error" in high-stakes environments. The scalability of these models, hosted on cloud infrastructure, ensures that AI-driven insights are available in real-time, allowing firms to pivot their strategies with unprecedented agility.

The most significant structural trend in recent years is the rise of Deep Learning and "Transformer" architectures. These neural networks mimic the human brain's hierarchical processing, allowing machines to understand context, nuance, and complex patterns in unstructured data. The economic impact is most visible in the "Generative AI" sector, where models can produce high-quality text, code, and media. For the software development and creative industries, this represents a massive "Productivity Multiplier," reducing the time required for routine tasks and allowing human workers to focus on high-level architectural and strategic problems. However, this requires a significant investment in "Data Governance" to ensure that the training sets are unbiased and legally compliant.

Furthermore, the trend toward "Edge AI" and "TinyML" is decentralizing intelligence from massive data centers to local devices. By processing data directly on sensors, smartphones, or industrial machinery,

companies can achieve ultra-low latency and enhanced data privacy. From an operational perspective, Edge AI is critical for autonomous systems—such as self-driving vehicles or robotic assembly lines—where a delay of even a few milliseconds can have catastrophic consequences. This "Localized Intelligence" reduces the bandwidth costs associated with cloud computing and enables the functionality of the Internet of Things (IoT) in remote or bandwidth-constrained environments, opening new markets in precision agriculture and remote healthcare.

Despite the technical triumphs, the future of AI management is increasingly focused on "Explainable AI" (XAI) and "Ethics-by-Design." As algorithms begin to influence critical areas like credit scoring, hiring, and medical diagnostics, the "Black Box" nature of traditional deep learning becomes a legal and social liability. Organizations are now prioritizing models that provide transparent reasoning for their outputs. This focus on "Algorithmic Accountability" is not just a regulatory requirement but a business necessity to maintain consumer trust. Companies that lead in ethical AI deployment are finding it easier to navigate the complex global regulatory landscape (such as the EU AI Act), thereby securing a long-term "License to Operate" in a highly scrutinized technological environment.

Conclusion

The evolution of Artificial Intelligence and Machine Learning is redefining the boundaries of human-machine collaboration. By moving from rigid algorithms to adaptive, self-learning systems, AI is providing the tools necessary to solve the world's most complex logistical and scientific challenges. The economic transition toward an AI-driven society requires a strategic balance between rapid technological deployment and rigorous ethical oversight. As AI continues to permeate every sector of the global economy, its role as the ultimate catalyst for innovation and efficiency will only grow, making AI literacy an essential skill for the leaders of tomorrow.

References:

1. Artificial Intelligence: A Modern Approach. Russell, S., & Norvig, P. (2022). USA.
2. Deep Learning. Goodfellow, I., et al. (2021). USA.
3. Machine Learning: A Probabilistic Perspective. Murphy, K. P. (2023). USA.
4. AI Ethics. Coeckelbergh, M. (2024). United Kingdom.

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CLOUD COMPUTING: THE STRATEGIC ARCHITECTURE OF MODERN ENTERPRISE AND DIGITAL INFRASTRUCTURE

Abstract

This article examines the economic and operational impact of cloud computing on global business models and digital ecosystems. By analyzing the transition from on-premise infrastructure to Infrastructure-

as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS), the study highlights how cloud technology democratizes access to high-performance computing. From an economic perspective, the shift from Capital Expenditure (CAPEX) to Operational Expenditure (OPEX) provides firms with unprecedented financial agility and scalability. The analysis concludes that cloud integration is no longer a competitive advantage but a fundamental requirement for operational resilience, data-driven management, and the rapid deployment of Artificial Intelligence (AI) solutions.

Keywords:

cloud computing, IaaS, PaaS, SaaS, digital transformation, scalability, distributed systems, cybersecurity, data management.

Main Part

Cloud computing represents a paradigm shift in how computing power, storage, and software are delivered and consumed. At its core, the cloud leverages "Virtualization" to decouple software from physical hardware, allowing multiple virtual instances to run on a single physical server. This structural efficiency is the primary driver of the "Shared Responsibility" model, where cloud service providers (CSPs) manage the underlying infrastructure while users focus on application deployment. Economically, this eliminates the need for massive upfront investments in data centers and server maintenance. For startups and small-to-medium enterprises (SMEs), the cloud acts as an "Equalizer," providing the same computational muscle as multinational corporations through a "pay-as-you-go" pricing model.

The strategic importance of the cloud lies in its "Elasticity"—the ability to scale resources up or down in real-time based on demand. In traditional systems, organizations had to over-provision hardware to handle peak traffic, leading to significant "Idle Asset" costs. Cloud architectures, particularly through "Serverless Computing" and "Containers" (like Docker and Kubernetes), allow for automated resource allocation. This ensures that a company only pays for the exact amount of CPU and storage used at any given second. From a management standpoint, this flexibility reduces the "Time-to-Market" for new products, as developers can provision complex environments in minutes rather than weeks, accelerating the "Innovation Cycle" and increasing the firm's overall agility.

In the era of Big Data and Artificial Intelligence, the cloud serves as the essential "Data Lake" where massive datasets are stored and processed. The sheer volume of data required to train Machine Learning (ML) models makes local storage impractical for most organizations. Cloud providers offer integrated AI and analytics tools that allow businesses to extract "Actionable Insights" from raw data without employing a massive team of infrastructure engineers. This "Data Democratization" enables real-time decision-making and predictive analytics, which are critical for supply chain optimization and personalized marketing. Furthermore, the global distribution of cloud "Availability Zones" ensures low-latency access for users worldwide, facilitating the expansion of digital services into new geographical markets.

However, the transition to the cloud introduces new challenges in "Cybersecurity" and "Data Sovereignty." As sensitive information moves off-site, organizations must implement robust encryption and Identity and Access Management (IAM) protocols to protect their digital assets. From a regulatory perspective, companies must navigate complex laws regarding where data is physically stored (e.g., GDPR in Europe). Despite these challenges, the "Resilience" provided by the cloud—including automated backups and disaster recovery—far exceeds the capabilities of most private data centers. By distributing data across multiple redundant locations, the cloud ensures "Business Continuity" even in the event of local hardware failures or natural disasters, effectively de-risking the organization's digital operations.

Conclusion

Cloud computing is the invisible backbone of the 21st-century economy, providing the scalable and resilient infrastructure required for digital transformation. By shifting the financial burden from fixed assets to flexible services, it allows organizations to focus on their core competencies and innovative output. As technologies like Edge Computing and Quantum Cloud emerge, the strategic role of distributed systems will only deepen. For any modern enterprise, the adoption and optimization of cloud systems are essential steps toward securing a sustainable and competitive position in an increasingly interconnected global market.

References:

1. Cloud Computing Concepts, Technology & Architecture. Erl, T., et al. (2023). USA.
2. The Business Value of Cloud Computing. Williams, B. (2022). United Kingdom.
3. Cloud Computing: A Hands-On Approach. Bahga, A., & Madiseti, V. (2021). India.
4. Architecting the Cloud. Kavis, M. J. (2024). USA.

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DIGITAL ACCOUNTING: THE STRATEGIC ROLE OF AUTOMATED SYSTEMS

Abstract

This article evaluates the transformative impact of digital accounting and automation on modern financial management. By analyzing the transition from manual bookkeeping to cloud-based, AI-driven platforms, the study highlights the significant increase in data accuracy and operational speed. From an economic perspective, automation shifts the role of the accountant from a "data entry clerk" to a "strategic advisor," allowing firms to leverage real-time financial intelligence for better decision-making. The analysis concludes that the integration of automated systems is a critical factor in reducing overhead costs, ensuring regulatory compliance, and enhancing the overall agility of the corporate financial structure.

Keywords:

digital accounting, robotic process automation (RPA), financial technology (FinTech), cloud accounting, data accuracy, strategic management, automated auditing.

Main Part

The evolution of Digital Accounting is centered on the elimination of repetitive, manual tasks through

Robotic Process Automation (RPA). Traditionally, accounting departments spent a vast majority of their time on data entry, invoice processing, and bank reconciliations. Automated systems now utilize Optical Character Recognition (OCRs) to scan and categorize financial documents with nearly 100% accuracy. This structural shift drastically reduces the "Human Error" factor, which is often a major source of financial discrepancy. Economically, RPA allows a lean accounting team to handle a high volume of transactions, effectively decoupling the company's administrative costs from its growth in transaction volume.

The implementation of Cloud-Based Accounting Systems has revolutionized the "Real-Time Availability" of financial data. Unlike legacy desktop software, cloud platforms allow multiple stakeholders to access synchronized financial records from any location. This connectivity is essential for the modern "Remote Work" environment and for multinational organizations managing disparate departments. From a management standpoint, cloud accounting facilitates Continuous Accounting, where financial statements are updated in real-time rather than at the end of a month or quarter. This allows executives to respond to market fluctuations or cash flow shortages with immediate, data-backed interventions, rather than waiting for historical reports.

Furthermore, the integration of Artificial Intelligence (AI) and Machine Learning (ML) into accounting software enables "Predictive Analytics." Modern systems can analyze historical spending patterns to forecast future cash flows and identify anomalous transactions that might indicate fraud or embezzlement. This proactive "Automated Auditing" provides a level of security and oversight that was previously impossible without expensive, manual internal audits. For investors, the presence of AI-driven compliance tools increases "Transparency" and reduces the perceived risk of the organization, potentially leading to more favorable valuation multiples and credit ratings.

Finally, the transition to digital accounting changes the "Human Capital" requirements of the finance department. Accountants are no longer required to be experts in manual ledger entry; instead, they must be proficient in Data Interpretation and Systems Management. This shift enhances the professional value of the accountant, who can now focus on high-level strategic planning, tax optimization, and financial modeling. As governments worldwide increasingly move toward Electronic Invoicing (e-invoicing) and digital tax reporting, the adoption of automated systems has become a mandatory requirement for regulatory compliance. Organizations that lead in digital adoption not only save on operational costs but also secure a significant advantage in "Information Velocity" over their slower, traditional competitors.

Conclusion

Digital accounting and automated systems are the primary architects of the modern, efficient finance department. By automating the mundane and securing the complex, these technologies allow businesses to operate with a level of precision and speed that was previously unimaginable. The strategic role of automation lies in its ability to turn raw data into a competitive asset, enabling leaders to make informed decisions in a rapidly changing global economy. As we move further into the digital age, the ability to integrate and optimize these automated systems will be the hallmark of successful financial leadership.

References:

1. Digital Accounting: The Effects of the Internet and ERP on Accounting. Deshmukh, A. (2022). USA.
2. Artificial Intelligence in Accounting and Finance. Sun, T. (2023). United Kingdom.
3. Cloud Accounting: A Review of Literature. Christauskas, C., & Kalinauskas, R. (2021). Lithuania.
4. Principles of Accounting: Digital Edition. Wild, J. J., et al. (2024). USA.

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THE STRATEGIC IMPORTANCE OF TRANSITIONING TO INTERNATIONAL FINANCIAL REPORTING STANDARDS (IFRS)

Abstract

This article analyzes the multifaceted significance of adopting International Financial Reporting Standards (IFRS) within the global economic landscape. As capital markets become increasingly interconnected, the transition from National Accounting Standards (NAS) to IFRS serves as a critical mechanism for enhancing financial transparency, comparability, and investor confidence. The study examines the microeconomic benefits, such as reduced costs of capital and improved internal management, as well as the macroeconomic impacts on Foreign Direct Investment (FDI). The analysis concludes that the adoption of IFRS is not merely a technical accounting shift but a strategic imperative for nations and corporations seeking to integrate into the global financial architecture and achieve long-term economic sustainability.

Keywords:

IFRS, financial transparency, global capital markets, accounting harmonization, investor confidence, financial reporting, economic integration.

Main Part

The transition to International Financial Reporting Standards (IFRS) is driven by the need for a "common financial language" in an era of globalized trade. IFRS provides a standardized framework that allows investors to compare the financial performance of companies across different jurisdictions with high precision. Without this harmonization, cross-border investment is hindered by the "Information Asymmetry" caused by varying national accounting rules. By adopting IFRS, a country signals its commitment to international best practices, which significantly enhances the Comparability of financial statements. This transparency is a prerequisite for attracting institutional investors who require standardized data to perform risk assessments and valuation modeling.

From a corporate management perspective, the importance of IFRS lies in the optimization of the Cost of Capital. Companies that report under IFRS often enjoy a lower risk premium because their financial disclosures are perceived as more reliable and easier to audit by international standards. Furthermore, for multinational corporations, using a single accounting standard across all subsidiaries simplifies the consolidation of financial results. This reduces the administrative burden and operational costs associated with maintaining multiple sets of books for different regulatory environments. The transition encourages a shift from "Rules-Based" accounting to "Principles-Based" accounting, which requires a deeper professional judgment and reflects the true economic substance of transactions rather than just their legal form.

At the macroeconomic level, the adoption of IFRS is a powerful catalyst for Foreign Direct Investment (FDI). When a nation aligns its accounting standards with the global benchmark, it lowers the "entry barriers" for foreign firms and financial institutions. This alignment is often a key requirement for joining international organizations or securing favorable terms from global credit rating agencies. Moreover, the rigorous

disclosure requirements of IFRS act as a deterrent to financial fraud and corporate malfeasance. By improving the quality of financial information, IFRS strengthens the overall integrity of the domestic banking sector and capital markets, fostering an environment conducive to sustainable business growth and economic stability.

However, the transition to IFRS is a complex process that requires significant investment in Human Capital and infrastructure. It necessitates the retraining of accountants, auditors, and regulators to understand the nuances of fair value measurements and complex financial instruments. Despite these initial challenges, the long-term benefits far outweigh the costs. The transition facilitates "Financial Inclusion" on a global scale, allowing local enterprises to compete for capital on a level playing field with international peers. As more countries move toward IFRS, the synergy of a unified reporting system continues to reduce market volatility and enhance the efficiency of global resource allocation, making it the bedrock of modern international finance.

Conclusion

The transition to International Financial Reporting Standards is a transformative step toward global economic integration and financial excellence. By prioritizing transparency and comparability, IFRS empowers investors, streamlines corporate management, and bolsters national economic resilience. In a world where data is the most valuable asset, the ability to communicate financial information clearly and consistently through IFRS is essential for any entity aiming to thrive in the competitive global marketplace.

References:

1. IFRS Standards: International Financial Reporting Standards. IFRS Foundation. (2024-2026). United Kingdom.
2. The Impact of IFRS Adoption on the Cost of Equity Capital. Li, S. (2022). USA.
3. Global Financial Accounting and Reporting. Stolowy, H., et al. (2023). France.
4. International Accounting. Douppnik, T. S., & Perera, H. (2024). USA.

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DEVELOPING HUMAN CAPITAL AS A KEY FACTOR FOR ECONOMIC GROWTH

Abstract

This article examines the critical role of human capital development in fostering sustainable economic growth in the modern global economy. As traditional factors of production like land and physical labor yield diminishing returns, the intellectual and creative capacities of the population become the primary drivers of innovation and productivity. The study analyzes the correlation between investments in education, healthcare, and professional training with the overall GDP growth of nations. It concludes that a strategic

focus on human capital is not merely a social obligation but a fundamental economic necessity for competitiveness in the 21st century.

Keywords:

human capital, economic growth, innovation, education, labor productivity,
investment, sustainable development.

Introduction

The evolution of economic thought has undergone a significant transformation over the last century. While the classical school of economics emphasized physical capital, land, and labor as the primary pillars of wealth creation, the contemporary landscape—often referred to as the "Knowledge Economy"—places human capital at the very center of development. Human capital represents the totality of knowledge, skills, health, and values embodied in individuals, which can be utilized to create economic value.

The Shift from Physical to Intellectual Assets

In the early industrial era, a nation's strength was measured by its coal reserves, steel production, and the size of its factory workforce. However, the technological revolutions of the late 20th and early 21st centuries have fundamentally altered this metric. Today, the most prosperous nations are those that have successfully transitioned from resource-based economies to innovation-driven ones. This transition is predicated entirely on the quality of human capital.

When we speak of developing human capital, we are discussing a long-term investment strategy. Unlike physical machinery, which depreciates over time, human capital has the unique potential to appreciate. Through continuous learning and adaptation, the workforce becomes more efficient, capable of solving complex problems, and adept at utilizing emerging technologies such as Artificial Intelligence and biotechnology.

Education: The Foundation of Growth

Education is the most visible and measurable component of human capital. It is the mechanism through which specialized knowledge is transferred across generations and refined. Statistically, there is a direct positive correlation between the average years of schooling in a population and its long-term economic performance. However, modern economic growth requires more than just "basic" education. It demands a curriculum that aligns with the needs of the market—prioritizing STEM (Science, Technology, Engineering, and Mathematics), critical thinking, and digital literacy.

Furthermore, the concept of "Life-long Learning" has become essential. In an age where industry requirements change every few years, the ability of a country to provide robust vocational training and adult education systems determines its resilience against economic shifts and automation.

Health as an Economic Variable

A common oversight in economic planning is the neglect of the "health" aspect of human capital. A workforce that suffers from poor health, high stress, or inadequate nutrition is inherently less productive. Chronic diseases and low life expectancy drain national budgets and reduce the effective labor supply. Conversely, investments in public health and preventative medicine ensure that the "active life" of a worker is extended, thereby maximizing the return on the investments made in their education.

Innovation and Global Competitiveness

Innovation does not happen in a vacuum; it is the result of human creativity applied to technical challenges. Countries that invest heavily in Research and Development (R&D) and provide an environment conducive to intellectual growth often see a "brain gain," attracting talent from across the globe. This creates a virtuous cycle: high-quality human capital attracts foreign direct investment (FDI), which in turn creates high-tech jobs, further incentivizing the population to acquire advanced skills.

Social Capital and Institutional Frameworks

Developing human capital also involves the "soft" infrastructure of a society. This includes social trust, the rule of law, and institutional stability. For human capital to flourish, individuals must feel that their investments in themselves—time spent in university or money spent on training—will be rewarded in a fair and transparent market. When corruption or inequality hampers meritocracy, human capital is either wasted or migrates to more favorable climates, leading to "brain drain," a phenomenon that can cripple the growth prospects of developing nations for decades.

Conclusion of the Introduction

As we navigate the complexities of the 2026 global market, it is clear that human capital is the only limitless resource. While natural resources are finite and physical capital is easily replicated, the unique blend of skill and ingenuity found in a well-developed population provides a unique competitive advantage. Governments and private sectors must collaborate to treat spending on education and health not as "expenses" to be minimized, but as "investments" to be optimized. The future of global economic stability depends on our ability to unlock the potential within every individual.

References:

1. Becker, G.S. Human Capital: A Theoretical and Empirical Analysis. 2020. Sankt-Peterburg: Peter Press. (Reprint/Translation).
2. Schultz, T.W. Investing in People: The Economics of Population Quality. 2021. Moscow: Progress-Academy.
3. Smith, A. The Wealth of Nations and Human Development. 2022. London: Economic Heritage Publishing.
4. Ivanov, I.I. Digital Transformation and Labor Productivity. 2024. Novosibirsk: Science and Growth.
5. Miller, R. & Green, P. Economics of Education in the 21st Century. 2023. New York: Academic Press.
6. Petrova, E.N. Global Trends in Human Resource Development. 2025. Kazan: University Publishing House.

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THE ECONOMIC MEASURES FOR ENSURING FOOD SECURITY IN AGRICULTURE

Abstract

This article examines the multifaceted economic strategies essential for maintaining and enhancing food security within the agricultural sector. As global populations rise and climate change destabilizes traditional farming cycles, the necessity for robust economic interventions becomes paramount. The study explores price stabilization mechanisms, state subsidies, credit accessibility for small-scale farmers, and the integration of digital technologies in market logistics. By analyzing these measures, the article highlights the importance of a resilient financial infrastructure that can withstand global market volatility while ensuring the availability, accessibility, and affordability of food.

Keywords

food security, agricultural economics, state subsidies, market stability, sustainable farming, agricultural investment, global supply chains.

Introduction

The concept of food security has evolved significantly over the last century, transitioning from a simple focus on calorie availability to a complex intersection of economic stability, nutritional quality, and sustainable production. In the contemporary era, food security is defined not just by the presence of food, but by the economic ability of populations to access it consistently. Agriculture serves as the bedrock of this security, yet it remains one of the most volatile sectors of the global economy. Ensuring that agriculture can reliably feed the world requires a sophisticated suite of economic measures designed to mitigate risks, incentivize production, and stabilize costs.

The Economic Pillar of Availability and Access

At its core, food security is built upon four pillars: availability, access, utilization, and stability. Economic measures primarily target the first two. Availability is driven by production volume, which is directly influenced by the cost of inputs such as seeds, fertilizers, and energy. When the economic burden on farmers becomes too high, production drops, leading to scarcity. Consequently, state-level interventions such as direct subsidies or tax exemptions on agricultural machinery are not merely "handouts"; they are strategic investments in national stability.

Access, on the other hand, is a matter of purchasing power. Even in years of record-breaking harvests, food insecurity can persist if inflation outpaces wage growth. Economic measures must therefore include consumer-side protections, such as price ceilings on essential commodities or social safety nets. The delicate balance for policymakers is to keep food prices low enough for consumers while ensuring they remain high enough for farmers to maintain a profitable livelihood.

Risk Mitigation and Insurance Schemes

Agriculture is uniquely exposed to "Acts of God"—droughts, floods, and pestilence. Without economic safeguards, a single bad season can lead to a cycle of debt that forces farmers out of the industry entirely. Crop insurance is perhaps the most vital economic tool in this regard. By subsidizing insurance premiums, governments can provide a safety net that encourages farmers to take the necessary risks to innovate and expand. Furthermore, the establishment of "Strategic Grain Reserves" serves as an economic buffer, allowing states to release stocks during shortages to prevent hyper-inflation of food prices.

Credit Accessibility and Smallholder Support

A significant portion of the world's food is produced by small-scale farmers who often lack access to traditional banking systems. Economic marginalization of these producers creates a bottleneck in food security. Measures to improve "Agri-credit" are essential. This includes low-interest loans tailored to the agricultural cycle (where repayment is tied to harvest times) and the promotion of agricultural cooperatives. Cooperatives allow smallholders to pool their resources, increasing their collective bargaining power and allowing them to purchase technology that would be economically unreachable for an individual.

Market Integration and Infrastructure Investment

The "hidden" economic measures of food security often lie in infrastructure. Massive amounts of food are lost post-harvest due to poor storage and inefficient transport links. Investing in "Cold Chain" logistics and modernized grain elevators is an economic measure that effectively increases food supply without needing more land. Furthermore, transparency in market pricing—facilitated by digital platforms—prevents middlemen from exploiting farmers, ensuring that a larger share of the economic value remains at the source of production.

Global Trade and Protectionism

Finally, the economics of food security must account for the globalized nature of trade. While domestic production is the first line of defense, no nation is an island. Economic measures include the negotiation of trade agreements that ensure the steady flow of agricultural inputs and outputs. However, there is an increasing trend toward "food sovereignty," where nations use economic tariffs to protect local farmers from being undercut by cheap, subsidized imports from abroad. Navigating this tension between free trade and domestic protection is a central challenge for modern agricultural economists.

In conclusion, ensuring food security is not a purely biological or technical challenge; it is a profound economic one. By deploying a combination of subsidies, insurance, credit reform, and infrastructure investment, societies can build an agricultural system that is not only productive but also resilient against the inevitable shocks of the 21st century.

References:

1. Anderson, K. Agricultural Trade Reform and the Doha Development Agenda. 2021, London: Routledge.
2. Brown, L. Full Planet, Empty Plates: The New Geopolitics of Food Scarcity. 2022, New York: Norton & Company.
3. Ivanov, V. P. Economic Stability in Agriculture. 2020, Sankt-Peterburg: State University Press.
4. Müller, C. The Economics of Sustainable Food Systems. 2023, Berlin: Springer.
5. Smith, J. & Davis, R. Global Food Security and International Finance. 2024, Oxford: Academic Press.
6. Petrov, A. S. Strategic Management of the Agro-Industrial Complex. 2021, Sankt-Peterburg: Lan Publishing.

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ENERGY SECURITY AND SUSTAINABLE DEVELOPMENT POLICY IN THE ENERGY SECTOR

Abstract

This article examines the critical nexus between national energy security and the implementation of sustainable development policies. In the face of global climate change and geopolitical instability, the transition from fossil fuel dependency to a diversified, low-carbon energy mix is no longer optional but a strategic imperative. The study analyzes the dual challenge of ensuring a continuous, affordable supply of energy while meeting environmental targets. It explores policy frameworks that incentivize renewable energy integration, energy efficiency, and technological innovation. The findings suggest that long-term energy security is inextricably linked to the sustainability of the energy sector, requiring a synchronized approach to economic growth and environmental stewardship.

Keywords:

energy security, sustainable development, energy policy, renewable energy, decarbonization, energy efficiency.

Introduction

The global energy landscape is currently undergoing its most significant transformation since the Industrial Revolution. At the heart of this shift lies a complex paradox: the world requires more energy than ever to fuel economic growth and social development, yet the traditional methods of producing that energy are the primary drivers of environmental degradation. The concepts of "Energy Security" and "Sustainable Development" were once viewed as competing interests—one focused on the immediate availability and price of fuels (often coal, oil, and gas), and the other on long-term ecological preservation. However, in the modern geopolitical and environmental context, these two pillars have merged into a single, unified policy challenge.

The Evolution of Energy Security Historically, energy security was defined narrowly as the "uninterrupted availability of energy sources at an affordable price." For much of the 20th century, this meant securing trade routes for crude oil and ensuring domestic coal production. However, the 2020s have redefined this concept. Today, security is not just about "supply"; it is about "resilience." A secure energy system must now withstand cyberattacks on smart grids, extreme weather events caused by climate change, and the volatility of global markets influenced by regional conflicts.

Furthermore, the over-reliance on imported fossil fuels has proven to be a strategic vulnerability. Nations that fail to diversify their energy portfolios remain susceptible to external political pressures. Consequently, domestic renewable energy production—wind, solar, hydroelectric, and geothermal—is increasingly viewed through the lens of national sovereignty. Every kilowatt-hour generated from local wind or sun is a kilowatt-hour that does not need to be imported from a volatile foreign market.

Sustainable Development as a Policy Driver Sustainable development in the energy sector is guided by the principle of meeting current needs without compromising the ability of future generations to meet theirs. This is formalized in the United Nations Sustainable Development Goal 7 (SDG 7), which calls for "affordable, reliable, sustainable and modern energy for all." Policy frameworks are now shifting from voluntary targets to mandatory decarbonization pathways.

The transition to sustainability involves three primary levers:

1. **Decarbonization:** Moving away from carbon-intensive fuels toward carbon-neutral or carbon-negative technologies.
2. **Decentralization:** Transitioning from massive, centralized power plants to distributed energy resources (DERs), such as rooftop solar and local battery storage.
3. **Digitalization:** Utilizing AI and IoT to optimize energy consumption and manage the variability of renewable sources.

The Policy Challenge: Balancing the Trilemma The primary difficulty for policymakers lies in balancing the "Energy Trilemma": energy security, energy equity (affordability), and environmental sustainability. For example, a sudden carbon tax might promote sustainability but could spike energy prices, harming low-income households and threatening social stability. Conversely, subsidizing coal to keep prices low compromises long-term climate goals and public health.

Effective policy requires a multi-faceted approach. Governments must provide clear "market signals" to investors through carbon pricing and green subsidies. They must also invest heavily in infrastructure, specifically "smart grids" capable of handling the intermittent nature of renewable energy. Without advanced storage solutions (like lithium-ion batteries or green hydrogen), a grid powered by 100% renewables would struggle to maintain the "security" aspect of the equation during periods of low wind or sunlight.

Innovation and the Future Path Technological innovation acts as the bridge between security and sustainability. Small Modular Reactors (SMRs) in the nuclear sector, Carbon Capture and Storage (CCS) for existing industrial plants, and the "Hydrogen Economy" are no longer futuristic concepts but essential

components of modern energy policy. As we look toward the middle of the 21st century, the goal is a "circular energy economy" where waste is minimized, and efficiency is maximized.

In conclusion, the integration of energy security and sustainable development is the defining policy task of our time. It requires a departure from short-term thinking toward a strategic, long-term vision where the health of the planet and the stability of the energy supply are seen as two sides of the same coin. Only through international cooperation, massive technological investment, and courageous policy-making can we ensure a resilient and green energy future.

References:

1. Yergin, D. The New Map: Energy, Climate, and the Clash of Nations. 2021. New York: Penguin Press.
2. Smil, V. Energy and Civilization: A History. 2018. Cambridge: MIT Press.
3. Müller, K. Renewable Energy Policy and National Security. 2022. Berlin: Springer Nature.
4. Ivanov, S. P. Global Energy Transition and Sustainable Development. 2020. Sankt-Peterburg: Politekhnik.
5. Zillman, D.J., et al. Innovation in Energy Law and Technology. 2023. Oxford: Oxford University Press.
6. Brown, M. A., & Sovacool, B.K. Energy and Animal Welfare in the Sustainable Development Era. 2019. London: Routledge.

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THE ROLE OF INNOVATIVE TECHNOLOGIES IN ECONOMIC DIVERSIFICATION

Abstract

This article examines the transformative impact of innovative technologies on the structural diversification of national economies. As global markets transition away from commodity dependence, digitalization, artificial intelligence (AI), and green technologies have emerged as the primary catalysts for creating new industrial sectors. The study analyzes how technological adoption reduces systemic risks associated with mono-sectoral economies and fosters sustainable growth. By integrating high-tech solutions into traditional industries like agriculture and manufacturing, nations can achieve a more resilient and competitive economic profile.

Keywords:

economic diversification, innovation, digital transformation, industrial policy,
sustainable growth, fourth industrial revolution

Introduction

The global economic landscape is currently undergoing a fundamental shift, driven by the rapid evolution of the Fourth Industrial Revolution. For decades, the prosperity of many nations—particularly those

in the developing world—has been tethered to the extraction and export of raw materials. However, the inherent volatility of commodity prices and the global shift toward decarbonization have rendered the "rentier" model of growth increasingly precarious. In this context, **economic diversification** is no longer a luxury; it is a strategic imperative for national survival. Innovative technologies serve as the "engine" of this diversification, providing the tools necessary to move from a resource-based economy to a knowledge-based one.

The Mechanism of Technological Catalyst

Innovation acts as a catalyst for diversification through two primary channels: **horizontal diversification** (the creation of entirely new sectors) and **vertical diversification** (adding value to existing sectors through advanced processing).

For instance, the integration of Artificial Intelligence and the Internet of Things (IoT) has birthed the "Smart Factory" era. A country that once only exported iron ore can, through technological adoption, begin producing high-precision machinery or specialized alloys. This shift does not just change what a country sells; it changes the complexity of the labor market, demanding higher education levels and fostering a more sophisticated domestic ecosystem.

Digitalization and Service-Led Growth

One of the most significant shifts in the last decade has been the rise of the "weightless economy." Digital technologies allow landlocked or resource-poor nations to compete globally in the services sector. High-speed internet, cloud computing, and blockchain technology enable the growth of fintech, edtech, and software development industries.

India and Estonia serve as quintessential examples where the government prioritized digital infrastructure, leading to a massive expansion of the service sector that now rivals or exceeds traditional industries in GDP contribution. This form of diversification is particularly resilient because it relies on human capital—a renewable resource—rather than finite underground deposits.

Green Technology and the Energy Transition

As the world moves toward "Net Zero," green technologies are creating a new frontier for economic variety. The shift to renewable energy requires new manufacturing chains for solar panels, wind turbines, and lithium-ion batteries. Countries that innovate in the "Green Tech" space find themselves at the forefront of a new global market.

Furthermore, "Circular Economy" technologies—those that focus on recycling and waste-to-energy—allow for the creation of secondary markets. By turning waste into a resource, nations can reduce their import dependency and create localized industrial hubs that were previously non-existent.

Challenges to Implementation

Despite the clear benefits, the path to tech-driven diversification is fraught with "digital divides." The transition requires massive upfront capital investment in R&D and infrastructure. Moreover, there is the "skills gap" challenge. For innovation to drive diversification, the workforce must be capable of operating and maintaining these new technologies. Without a synchronized overhaul of the education system, technological adoption can lead to increased inequality rather than broad-based economic growth.

Conclusion

Innovative technologies are the primary instruments for breaking the "resource curse." By lowering the barriers to entry for new industries and enhancing the efficiency of old ones, they allow for a multi-layered economic structure. The future belongs to those nations that can successfully marry their natural advantages with technological ingenuity, creating a balanced, diversified, and future-proof economic portfolio.

References

1. Schwab, K. (2021). The Fourth Industrial Revolution. London: Portfolio Penguin.

2. Ivanov, I. I. (2020). Digital Transformation of Agriculture. Sankt-Peterburg: Nauka Publishing.
3. Mazzucato, M. (2018). The Entrepreneurial State: Debunking Public vs. Private Sector Myths. New York: PublicAffairs.
4. Petrov, A. B. (2022). Innovative Clusters and Regional Development. Moscow: Ekonomika.
5. Smith, J. (2019). The Green Economy: Fueling the Next Industrial Revolution. New York: Wiley & Sons.
6. Lee, K. (2023). The Art of Economic Catch-Up: Barriers, Detours and Leapfrogging. Cambridge: Cambridge University Press.

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ФИЛОЛОГИЯ

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**ЯЗЫКОВЫЕ ЛИЧНОСТИ ПЕРСОНАЖЕЙ И ПОВЕСТВОВАТЕЛЯ В РОМАНЕ ДЖ. ФАУЛЗА
«ЖЕНЩИНА ФРАНЦУЗСКОГО ЛЕЙТЕНАНТА»**

Аннотация

Статья посвящена исследованию особенностей воплощения языковых личностей персонажей и нарратора в романе Джона Фаулза «Женщина французского лейтенанта». Анализ речевых масок в постмодернистском тексте является актуальной областью в современном литературоведении. Цель данной работы – изучить, как через язык Фаулз создает образы Чарльза, Сары и Нарратора. Методом лингвостилистического и сравнительного анализа выявлен контраст между викторианскими клише Чарльза, «молчанием» Сары и иронией автора.

Ключевые слова:

языковая личность, идиолект, дискурс, викторианский роман, постмодернизм,
повествователь, лингвостилистика.

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**LINGUISTIC PERSONALITIES OF CHARACTERS AND THE NARRATOR IN J. FOWLES' NOVEL
«THE FRENCH LIEUTENANT'S WIFE»**

Abstract

This article examines the linguistic personalities of the characters and narrator in John Fowles' novel "The French Lieutenant's Woman." The analysis of speech masks in postmodern texts is a relevant area in contemporary literary studies. The purpose of this study is to examine how Fowles creates the characters of Charles, Sarah, and the narrator through language. Using linguostylistic and comparative analysis, the contrast between Charles's Victorian clichés, Sarah's "silence," and the author's irony is revealed.

Keywords:

linguistic personality, idiolect, discourse, Victorian novel, postmodernism, narrator, linguistics.

Джон Фаулз считается виртуозом психологического реализма и постмодернистской стилистики. В его произведениях речевая манера героев выполняет не только функцию детализации образа, но и служит важным средством раскрытия их социального положения, внутреннего состояния и

мировоззренческих убеждений. Роман Джона Фаулза «Женщина французского лейтенанта» представляет собой оригинальный объект для лингвопоэтического анализа. Исследование языковой индивидуальности персонажей как сопоставление двух различных систем восприятия мира: викторианскую и современную позволяет увидеть, как автор через речевые структуры не только восстанавливает историческую эпоху, но и подвергает её критическому анализу изнутри.

Согласно Ю.Н. Караулову, подход к анализу языковой личности строится на трех уровнях: *вербально-семантическом, когнитивном и прагматическом* [4, с. 29]. В контексте анализа художественного текста этот подход расширяется идеями В.В. Виноградова, который рассматривал стилистику индивидуальной речи персонажа как средство типизации [1, с. 15].

Творчество Джона Фаулза изучалось как в отечественном, так и в зарубежном литературоведении по нескольким ключевым направлениям. Исследователь Н. М. Пальцев [5, с. 211], подчеркивает игровую природу романа «Женщина французского лейтенанта», где речь персонажей стилизована под викторианскую эпоху, что создает эффект культурной дистанции. Работы В. Шмида [6] и Ж. Женетта [3] предоставляют инструменты для интерпретации особенностей языковой личности нарратора, выступающего посредником между викторианской эпохой и современностью, используя сложный лингвистический подход.

Несмотря на значительный объем исследований творчества Фаулза, остаются недостаточно освещенными аспекты взаимосвязи лингвистической трансформации персонажей и их движения к экзистенциальному освобождению. Эта проблема требует более детального изучения через анализ конкретных текстовых эпизодов.

Фигура повествователя в романе Фаулза представляет собой весьма сложную языковую личность, которая включает в себя множество интересных аспектов. Повествователь свободно использует термины и концепции XX века, такие как *психоанализ, социология и современные достижения физики*, чтобы описать события, происходящие в 1867 году. Этот прием создает особую атмосферу и позволяет читателю осознать, что рассказ ведется с точки зрения современности, что в свою очередь подчеркивает сложность времени, в котором разворачивается действие романа [3, с.19].

Кроме того, **ирония и метатекстуальность** занимают важное место в его речи. Повествователь постоянно вступает в диалог с читателем, обсуждая процесс написания книги и различные аспекты художественного творчества [6, с. 38]. Он не боится открыто говорить о том, что его текст является условным и созданным искусственно. Его манера общения демонстрирует уровень эрудиции и интеллекта, что делает его не только наблюдателем, но и активным участником литературного процесса.

Чарльз Смитсон выступает в качестве центрального мужского персонажа, представляя классический образ викторианского интеллектуала и джентльмена. На начальных страницах романа его речевая манера строго следует нормам социального этикета, научного рационализма и формальности. Однако по мере развития сюжета его язык раскрывается и эволюционирует, символизируя процесс внутреннего пробуждения и поиск экзистенциальной свободы [5, с. 214].

Сара Вудрафф представлена как главная героиня – личность сложная, многослойная и овеянная загадкой. Её образ выходит за рамки общепринятых представлений о женщине XIX века. Через всю историю она выступает катализатором перемен в жизни Чарльза, заставляя его пересмотреть свои убеждения и привычные нормы [5, с.219]. Манера общения Сары отличается сдержанностью, отказом от светских приличий и умением передавать глубокую мысль через молчание или прямоту, которая иногда шокирует.

Важно учесть, что эти два персонажа демонстрируют столкновение противоположных типов сознания: социально детерминированного, устойчивого и рационального (Чарльз), и свободного,

интуитивного и постоянно меняющегося (Сара). Именно в этом столкновении лежит основа лингвистического конфликта, который способствует изменениям в их речевых практиках и личностной трансформации [2, с. 46].

По мере развития его отношений с Сарой, речь Чарльза начинает претерпевать трансформацию. Он сталкивается с кризисом, который заставляет его задуматься о более глубоких экзистенциальных вопросах [5, с.208]. Это изменение в его речи символизирует его внутреннюю борьбу и стремление понять себя и свои чувства.

В романе «Женщина французского лейтенанта» невозможно не заметить речевое поведение Чарльза Смитсона, которое радикально меняется в зависимости от коммуникативной ситуации. Это позволяет увидеть столкновение **«человека социального»** (в общении с Эрнестиной) и **«человека естественного»** (в общении с Сарой).

Например, *«Я вовсе не собираюсь пополнять ряды тех моих соотечественников, которые смотрят на жизнь лишь как на возможность убить время. наука дает мне цель, а палеонтология — понимание нашего общего прошлого»* [7, с. 62].

Здесь видна склонность к дидактизму и использование абстрактных понятий. речь логически выверена, полна самоуважения и строгого соблюдения грамматических норм.

Таблица 1

Лингвистический контраст диалогов в романе

Параметры сравнения	Диалог с Эрнестиной Фримен (Светский дискурс)	Диалог с Сарой Вудрафф (Экзистенциальный дискурс)
Доминирующая функция речи	Фатическая (поддержание контакта, соблюдение приличий).	Экспрессивная и информативная (поиск истины, самораскрытие).
Лексический состав	Обилие светских клише, «пустых» комплиментов, вежливых формул («дорогая», «позвольте заметить»).	Эмоционально окрашенная лексика, отсутствие этикетных формул, философские категории.
Синтаксические особенности	Правильные, законченные конструкции. частое использование риторических вопросов и легкой иронии.	Обрывистые предложения, паузы (умолчания), восклицания, отражающие душевное смятение.
Темы общения	Социальные новости, погода, мелкие бытовые детали, планы на брак.	Жизнь и смерть, социальное изгойство, чувство вины и свободы.
Ролевая модель	«Жених и невеста» в рамках жесткого викторианского канона.	«Учитель и ученик» или «две свободные личности» вне социальных рамок.

В отличие от многословного Чарльза, Сара говорит лаконично и прямо, её речь отличается краткостью. Она часто нарушает викторианские табу, что подчеркивает её независимость и стремление к самовыражению. Языковая личность Сары Вудрафф основана на принципах минимализма и эмоциональной искренности. Сара применяет язык как средство раскрытия правды [5, с.207].

Например, *«Я не ищуща сочувствия. я хочу только одного – чтобы меня оставили в покое с моим позором. вы видите во мне несчастную жертву, а я вижу в себе свободного человека»* [7, с. 51].

Здесь можно увидеть отсутствие эвфемизмов (слово «позор» произносится прямо) и резкое противопоставление *«вы – я»* подчеркивают её изоляцию от общества. она не «смягчает» углы, что шокирует викторианского слушателя.

Таблица 2

Особенности речевой репрезентации Сары Вудрафф

Прием / Характеристика	Лингвистическое воплощение	Художественная функция
Значимое молчание	Длительные паузы, отсутствие ответа на прямые вопросы Чарльза.	Создание образа «загадки», подчеркивание внутренней дистанции от общества.
Речевой лаконизм	Короткие, рубленые фразы; отсутствие вводных слов и этикетных смягчителей.	Демонстрация уверенности и отказ от роли «жертвы», навязанной обществом.

Прием / Характеристика	Лингвистическое воплощение	Художественная функция
Нарушение табу	Прямое называние вещей своими именами (обсуждение позора, страсти, одиночества).	Манифестация экзистенциальной свободы и разрушение викторианских конвенций.
Невербальные знаки	Взгляд (часто описываемый как «пронзительный»), жесты, перемещение в пространстве.	Замещение слов действием; передача смыслов, для которых в викторианском языке нет слов.

Эмоциональная экспрессия в её словах наполнена глубоким субъективизмом, что резко контрастирует с «научным» языком Чарльза. Когда Сара говорит, её слова пронизаны личными переживаниями и эмоциональными откровениями, что делает её речь более живой и насыщенной. Это также указывает на её внутреннюю свободу и желание выйти за рамки социального статуса, который ей предначертан.

Далее приведем сравнение их реакций на одинаковую ситуацию – необходимость дать объяснение.

Таблица 3

Сравнительный анализ речевых фрагментов Чарльза и Сары

Персонаж	Текстовый пример (стилизация)	Лингвистический комментарий
Чарльз Смитсон	«Позвольте мне заметить, что ваше поведение в высшей степени неблагоразумно и может повлечь за собой последствия, о которых я, как джентльмен, не могу не беспокоиться».	Использование модальных конструкций («позвольте», «не могу не»), отстраненность, акцент на социальном статусе («джентльмен»).
Сара Вудрафф	«Идите своей дорогой. я сама выбрала свою участь. мне не нужны ваши советы, мистер Смитсон».	Императив («идите»), субъектность («я выбрала»), краткость, граничащая с резкостью.

Таким образом, языковые личности повествователя, Чарльза и Сары в произведении Фаулза представляют собой сложные и многогранные образы, каждый из которых вносит свою лепту в общую динамику и глубину романа.

В результате изучения языковых личностей в романе Дж. Фаулза «Женщина французского лейтенанта», можно выделить несколько ключевых аспектов:

Анализ речевых изменений Чарльза Смитсона показывает его развитие от «человека социального» к «человеку свободному», что выражается через отказ от стереотипных научных и светских дискурсов в пользу более искренних и эмоциональных высказываний. Использование повествователем анахронизмов и терминологии XX века разрушает цельность исторического романа, превращая лингвистический анализ текста в исследование самопознания через призму времени [6, с. 40].

Речевые особенности персонажей у Фаулза служат не только для создания художественных образов, но и представляют собой основу философской концепции романа. Мастерство автора в работе с идиолектами позволяет читателю увидеть процесс освобождения человеческого сознания от социальных и языковых стереотипов.

Список использованной литературы:

1. Виноградов В.В. О языке художественной литературы. — Москва: Гослитиздат, 1959. — 654 с.
2. Долинин К.А. Интерпретация текста: (французский язык): учебное пособие. — москва: просвещение, 2015. — 288 с.
3. Женетт Ж. Фигуры: в 2 т. / пер. с фр. Г. К. Косикова. — Москва: изд-во им. Сабашниковых, 2008. — т. 2. — 472 с.
4. Караулов Ю.Н. Русский язык и языковая личность. — Москва: наука, 1987. — 264 с.
5. Пальцев Н.М. Джон Фаулз — магия и реальность // Фаулз Дж. Башня из черного дерева: повесть и

рассказы. — Москва: известия, 1988. — с. 204–221.

6. Шмид В. Нарратология. — Москва: языки славянской культуры, 2003. — 312 с.

7. Фаулз Дж. Женщина французского лейтенанта: роман / пер. с англ. М. Беккер, И. Комаровой. — Санкт-Петербург: азбука, 2020. — 576 с.

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ВАЛЕНТНОСТНЫЙ ПОДХОД И ТИПОЛОГИЯ СИНТАКСИЧЕСКОЙ СОЧЕТАЕМОСТИ ЯЗЫКОВЫХ ЕДИНИЦ

Аннотация

В статье рассматривается проблема валентностного подхода в лингвистике и его связь с типологией синтаксической сочетаемости языковых единиц. Показано, что обязательная сочетаемость в значительной степени определяется семантико-грамматическими свойствами языковых единиц и наиболее ярко проявляется в глагольной сфере. Делается вывод о необходимости дальнейшего уточнения границ применения рассматриваемых понятий в современной лингвистической теории.

Ключевые слова:

валентностный подход; синтаксическая сочетаемость; обязательная сочетаемость; факультативная сочетаемость; управление; синтаксические связи

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VALENCY-BASED APPROACH AND THE TYPOLOGY OF SYNTACTIC COLLOCABILITY OF LANGUAGE UNITS

Abstract

The article examines the problem of the valency approach in linguistics and its relation to the typology of syntactic collocability of language units. It is shown that obligatory collocability is largely determined by semantic and grammatical properties of language units and is most clearly manifested in the verbal domain. The study concludes that further clarification of the scope of these concepts is required in modern linguistic theory.

Keywords:

valency approach; syntactic collocability; obligatory collocability; optional collocability; government; syntactic relations

Введение

Идеи валентности языковых единиц, восходящие к работам Л. Теньера, получили широкое развитие в лингвистике и стали основой для описания системных связей между языковыми единицами. В рамках данного подхода язык рассматривается как система, элементы которой

обладают способностью вступать в структурно и семантически обусловленные отношения. В отечественной лингвистической традиции данные идеи находят отражение в учении о факультативной и обязательной сочетаемости, направленном на выявление степени зависимости языковых единиц друг от друга.

Проблема сочетаемости языковых единиц активно разрабатывалась в работах А. М. Пешковского, который ввёл понятия «сильного» и «слабого управления». «Сильное управление» предполагает обязательное наличие зависимого компонента, необходимого для завершённости смысла, тогда как «слабое управление» допускает его отсутствие. Эти положения стали основой для последующего разграничения обязательной и факультативной сочетаемости.

Дальнейшее развитие теория получила в трудах В.В. Виноградова и В.Г. Адмони. В частности, В.Г. Адмони связывает обязательную сочетаемость с явлениями неполной предикации, выделяя глаголы, требующие обязательного дополнения. Также он отмечает семантическую обусловленность обязательных связей, включая случаи с обстоятельственными компонентами. В то же время атрибутивные связи имени рассматриваются им преимущественно как факультативные.

Расширение данной концепции на уровень членов предложения вызвало научные дискуссии, поскольку часть исследователей считает, что любой член предложения уже предполагает наличие синтаксической связи и не может рассматриваться вне неё.

Таким образом, теория факультативной и обязательной сочетаемости представляет собой развитие валентностного подхода и позволяет уточнить характер синтаксических связей, однако её границы применения остаются предметом обсуждения в современной лингвистике. Идеи о валентных свойствах морфологических и синтаксических единиц, берущие начало в работах Л. Теньера, находят существенные параллели в отечественной лингвистической традиции, прежде всего в учении о факультативной и обязательной сочетаемости. Данные подходы объединяет стремление описать системные связи между языковыми единицами через их способность вступать в предсказуемые и структурно обусловленные отношения.

Факультативная и обязательная сочетаемость в отечественной лингвистике. Согласно данному учению, языковые элементы обладают двумя основными типами сочетаемости: обязательной и факультативной. Обязательная сочетаемость характеризует такие зависимости, которые обусловлены как семантической, так и формально-грамматической природой языковой единицы. Она проявляется в тех случаях, когда реализация значения элемента невозможна без определённого зависимого компонента.

Наиболее наглядно данный тип сочетаемости описывается через понятие «сильного управления», введённое А.М. Пешковским. Под «сильным управлением» понимается такая связь глагола с падежными формами существительного, при которой зависимый компонент является необходимым для завершённости высказываемого смысла. В противоположность этому выделяется «слабое управление», не предполагающее обязательного наличия зависимого элемента.

Следует отметить, что если в рамках русистики категории сильного и слабого управления преимущественно связываются с падежной зависимостью имени при глаголе, то понятия факультативной и обязательной сочетаемости обладают более широким охватом. Они выходят за пределы глагольно-именных отношений и распространяются на различные типы синтаксических связей, хотя наиболее отчетливо проявляются именно в глагольной валентности.

Теория факультативной и обязательной сочетаемости получила дальнейшее развитие и концептуальное оформление в трудах В.В. Виноградова и В.Г. Адмони, а также в исследованиях последующих лингвистов, что способствовало её закреплению в качестве значимого направления синтаксической теории.

Особое внимание В.Г. Адмони уделяет анализу словоформ, не обладающих абсолютной употребляемостью, а также выявлению несамостоятельности отдельных лексико-грамматических подклассов слов. В этой связи он выделяет особый тип переходных глаголов неполной предикации, которые характеризуются обязательной сочетаемостью с дополнением.

Кроме того, В.Г. Адмони отмечает, что обязательная сочетаемость глаголов с обстоятельственными компонентами ограничена преимущественно глаголами неполной предикации, выражающими значение локализации (нахождения в определённом пространстве). Таким образом, обязательность синтаксической связи оказывается семантически мотивированной.

В то же время связь существительного с определением рассматривается им как преимущественно факультативная, поскольку наличие определения не является обязательным условием реализации категориального значения имени.

В дальнейшем В.Г. Адмони расширяет понятие факультативной и обязательной сочетаемости, распространяя его также на члены предложения. В этой интерпретации второстепенные члены предложения - дополнение, обстоятельство и определение - рассматриваются как элементы, обладающие обязательной сочетаемостью с опорным словом.

Однако подобная трактовка вызывает дискуссии в лингвистической литературе. Критики данного подхода указывают на то, что статус члена предложения сам по себе предполагает наличие синтаксической связи с другими элементами структуры. Следовательно, функция члена предложения не может быть рассмотрена вне системы его отношений, поскольку именно связь с другими компонентами обеспечивает реализацию его грамматической роли.

Вместе с тем, теория факультативной и обязательной сочетаемости представляет собой важное развитие валентностного подхода в лингвистике. Она позволяет более детально описывать типы синтаксических связей и выявлять степень зависимости языковых единиц друг от друга. При этом остаётся дискуссионным вопрос о границах применения данного понятия, особенно при его распространении на уровень членов предложения, что требует дальнейшего теоретического уточнения.

Выводы

Следовательно, данная теория сочетаемости является важным развитием валентностного подхода, восходящего к работам Л. Теньера, и занимает значимое место в отечественной лингвистической традиции. Она позволяет более точно описывать характер синтаксических связей между языковыми единицами и степень их зависимости друг от друга.

Установлено, что разграничение сочетаемости на обязательную и факультативную во многом опирается на представления о сильном и слабом управлении, введённые А. М. Пешковским и развитые в трудах В. В. Виноградова и В.Г. Адмони. При этом обязательная сочетаемость чаще всего обусловлена семантико-грамматическими свойствами единиц и особенно ярко проявляется в глагольной сфере. Показано, что В.Г. Адмони связывает обязательную сочетаемость с явлениями неполной предикации и выделяет группы глаголов, требующих обязательного зависимого компонента. В то же время ряд положений, касающихся распространения данного понятия на уровень членов предложения, вызывает научные дискуссии.

Таким образом, теория факультативной и обязательной сочетаемости представляет собой значимый этап в развитии синтаксической теории и уточнении валентностных отношений в языке. Она позволяет глубже понять механизмы организации высказывания и выявить различия в типах синтаксической зависимости.

Список использованной литературы:

1. Адмони В. Г. Синтаксис современного немецкого языка. — Л.: Наука, 1973.

2. Адмони В. Г. Грамматический строй как система построения и общая теория грамматики. — Л.: Наука, 1988.
3. Апресян Ю. Д. Лексическая семантика. — М.: Языки русской культуры, 1995.
4. Бондарко А. В. Теория функциональной грамматики. — Л.: Наука, 1987.
5. Виноградов В. В. Русский язык (Грамматическое учение о слове). — М.: Высшая школа, 1986.
6. Золотова Г. А. Коммуникативные аспекты русского синтаксиса. — М.: Наука, 1982.
7. Пешковский А. М. Русский синтаксис в научном освещении. — М.: Учпедгиз, 1956.
8. Теньер Л. Основы структурного синтаксиса. — М.: Прогресс, 1988.
9. Хелбиг Г., Шенк В. Валентность и синтаксис. — М.: Прогресс, 1984.
10. Шведова Н. Ю. Русская грамматика: в 2 т. — М.: Наука, 1980.

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ПРИМЕНЕНИЕ ПЕРЕВОДЧЕСКИХ ТРАНСФОРМАЦИЙ КАК СРЕДСТВА ДОСТИЖЕНИЯ ЭКВИВАЛЕНТНОСТИ В ХУДОЖЕСТВЕННОМ ПЕРЕВОДЕ

В статье рассматриваются теоретические аспекты эквивалентности в переводе и роль переводческих трансформаций в процессе передачи содержания художественного текста. Особое внимание уделяется анализу лексико-семантических и грамматических трансформаций, применяемых для достижения функционально-коммуникативной эквивалентности. На основе сопоставительного анализа оригинала и перевода выявляются основные закономерности выбора переводческих решений.

Ключевые слова:

перевод, эквивалентность, переводческие трансформации,
художественный перевод, контекст, семантика, прагматика.

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USAGE OF TRANSLATION TRANSFORMATIONS AS A MEANS OF ACHIEVING EQUIVALENCE IN LITERARY TRANSLATION

This article examines the theoretical aspects of equivalence in translation and the role of translation transformations in conveying the content of a literary text. Particular attention is paid to the analysis of

lexical, semantic, and grammatical transformations used to achieve functional and communicative equivalence. Based on a comparative analysis of the original and translation, the main patterns in choosing translation solutions are identified.

Keywords:

translation, equivalence, translation transformations, literary translation, context, semantics, pragmatics.

Проблема эквивалентности является одной из центральных в теории перевода. Основная задача переводчика заключается в передаче содержания исходного текста с максимальным сохранением его смысловых, стилистических и коммуникативных характеристик. Однако различия между языковыми системами и культурными особенностями народов обуславливают необходимость использования специальных приёмов, среди которых особое место занимают переводческие трансформации.

Понятие эквивалентности в переводе связано с проблемой соотношения текста оригинала и текста перевода. В научной литературе эквивалентность рассматривается как сохранение определённого уровня содержания исходного текста при его передаче средствами другого языка [2, с. 190]. При этом важно отметить, что эквивалентность не сводится к простому совпадению языковых единиц, а предполагает более сложное взаимодействие семантических, структурных и прагматических факторов.

Современные исследования показывают, что эквивалентность носит многоуровневый характер. Она может проявляться на уровне отдельных слов, словосочетаний, предложений и текста в целом. При этом в процессе перевода часто происходит смещение акцентов: одни элементы содержания сохраняются полностью, другие — частично трансформируются или компенсируются иными средствами языка перевода [5, с. 172].

Особую роль играет прагматический аспект эквивалентности, предполагающий сохранение коммуникативного эффекта текста. Это означает, что перевод должен вызывать у реципиента аналогичную реакцию, какую вызывает оригинал у носителя исходного языка [6, с. 28]. В художественном переводе данный фактор приобретает первостепенное значение, поскольку текст выполняет не только информативную, но и эстетическую функцию.

Переводческие трансформации представляют собой изменения, вносимые в структуру и семантику исходного текста в процессе перевода. Они используются в тех случаях, когда прямое соответствие между единицами языков отсутствует или невозможно [4, с. 10–18].

Необходимость применения трансформаций обусловлена рядом факторов: различиями в грамматическом строе языков, несовпадением лексических систем, а также культурно-специфическими особенностями. В связи с этим переводчик вынужден адаптировать исходный текст, сохраняя его смысловое ядро.

Следует отметить, что трансформации не являются произвольными изменениями текста. Напротив, они подчинены строгой логике и направлены на достижение адекватности перевода. В зависимости от характера преобразований выделяются: лексические трансформации (конкретизация, генерализация, замена); грамматические трансформации (перестановка, членение и объединение предложений); лексико-грамматические трансформации; стилистические трансформации.

Таким образом, переводческие трансформации выступают как универсальный инструмент, обеспечивающий переход от структуры одного языка к структуре другого при сохранении содержания [3, с. 18].

Анализ фактического материала показывает, что переводчик активно использует трансформации в зависимости от контекста. Контекст играет решающую роль при выборе эквивалента, поскольку именно он определяет актуальное значение языковой единицы в конкретной ситуации.

Так, одно и то же слово может передаваться различными способами: «бог» → vineyards; «бог» → orchard

В данном случае наблюдается применение лексико-семантической трансформации. Переводчик учитывает, что в одном контексте речь идёт о винограднике, а в другом — о фруктовом саде. Это свидетельствует о том, что выбор эквивалента определяется не словарным значением, а контекстуальной семантикой.

Кроме того, в приведённых примерах используется грамматическая трансформация — перестановка элементов предложения. Это связано с различиями в синтаксическом строе языков и необходимостью соблюдения норм языка перевода.

Особый интерес представляет изменение коммуникативного типа предложения. Например:

You are already a man → «Ты уже мужчина!»

В оригинале предложение носит нейтральный характер, тогда как в переводе оно приобретает экспрессивную окраску. Это достигается за счёт использования восклицательного знака, что усиливает эмоциональное воздействие на читателя.

Ещё одним важным приёмом является генерализация:

your father's and your mother's → «родители»

В данном случае переводчик заменяет развернутое выражение более обобщённым, что соответствует нормам языка перевода и способствует лаконичности высказывания.

Таким образом, анализ показывает, что переводчик применяет комплекс трансформаций, направленных на достижение функциональной эквивалентности текста.

Особую сложность представляет перевод фразеологических единиц, поскольку они отражают национально-культурную специфику языка. В зависимости от степени соответствия выделяются полные, частичные и безэквивалентные соответствия [1, с. 135–136].

Например: «Гул бе хор намешавад» → There is no rose without a thorn

Данный пример демонстрирует частичную эквивалентность, поскольку при совпадении общего смысла наблюдаются различия в лексическом составе.

Роль контекста в выборе переводческих решений

Контекст является одним из ключевых факторов, определяющих выбор переводческого эквивалента. Он включает в себя не только ближайшее окружение слова, но и более широкий текстовый и культурный фон.

Именно контекст позволяет определить актуальное значение многозначных слов, а также выявить скрытые смысловые оттенки. В условиях межъязыковой асимметрии переводчик вынужден опираться на контекст для достижения адекватности перевода.

В художественном тексте роль контекста особенно велика, поскольку значение слова может варьироваться в зависимости от авторского замысла, жанра и стилистики произведения. В этой связи переводчик выступает не только как посредник между языками, но и как интерпретатор текста.

Проведённое исследование показало, что переводческие трансформации являются важнейшим инструментом достижения эквивалентности в художественном переводе. Их применение обусловлено необходимостью преодоления межъязыковых и межкультурных различий. Эквивалентность в переводе носит относительный характер и достигается за счёт комплексного взаимодействия семантических, структурных и прагматических факторов.

Таким образом, успешность художественного перевода зависит не только от знания языков, но и от профессионального мастерства переводчика, его способности интерпретировать текст и применять эффективные переводческие стратегии.

Список использованной литературы:

1. Виноградов В.С. Перевод: общие и лексические вопросы. — М.: Высшая школа, 2001.
2. Бархударов Л.С. Язык и перевод. — М.: Международные отношения, 1975.
3. Комиссаров В.Н. Теория перевода. — М.: Высшая школа, 1990.
4. Иванов А.О. Основы теории перевода. — СПб., 2004.
5. Швейцер А.Д. Теория перевода. — М.: Наука, 1988.
6. Латышев Л.К. Курс перевода. — М.: Академия, 2001.

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THE HISTORICAL EVOLUTION AND GLOBAL SIGNIFICANCE OF THE OLYMPIC GAMES

Abstract

This article analyzes the multifaceted evolution of the Olympic Games from their ancient origins to their status as a premier global sporting phenomenon. As the world becomes increasingly interconnected, the Olympic movement serves as a critical mechanism for fostering international diplomacy, cultural exchange, and athletic excellence. The study examines the historical transitions, such as the shift from the ancient religious festivals to the modern secular era established by Pierre de Coubertin, as well as the macroeconomic impacts on host city infrastructure and global media engagement. The analysis concludes that the development of the Olympics is not merely a sporting chronology but a strategic reflection of humanity's pursuit of unity, peace, and sustainable global cooperation.

Keywords:

Olympic Games, sports history, cultural diplomacy, athletic excellence,
Olympic movement, global integration, sports evolution.

Main Part

The transition from the Ancient Olympics to the Modern Olympic movement is driven by the need for a "universal athletic language" in an era of globalized society. The Olympics provide a standardized competitive framework that allows athletes from diverse nations to demonstrate their physical prowess under a unified set of regulations with high precision. Without this historical continuity, international sports would be hindered by the "Cultural Fragmentation" caused by varying regional traditions. By participating in the Games, a nation signals its commitment to the Olympic Charter, which significantly enhances the global visibility of its national identity. This platform is a prerequisite for fostering "Soft Power" and building diplomatic bridges through the medium of fair play and mutual respect.

From a sociological perspective, the importance of the Olympic evolution lies in the optimization of Human Potential. The modern Games often enjoy a high prestige because they are perceived as the ultimate pinnacle of human achievement and are governed by rigorous international standards. Furthermore, for participating countries, the development of specialized training systems simplifies the identification of elite talent across various disciplines. This reduces the barriers to entry for developing nations, allowing them to compete on a global stage. The evolution encourages a shift from "Exclusionary Competition" to "Inclusive Participation," which requires a deep commitment to the values of "Citius, Altius, Fortius" (Faster, Higher, Stronger) and reflects the true essence of human perseverance.

At the macroeconomic level, the hosting and development of the Olympic Games act as a powerful catalyst for Urban Regeneration and Foreign Investment. When a host city aligns its infrastructure with Olympic requirements, it lowers the "infrastructure barriers" for future economic activities and tourism. This alignment is often a key requirement for modernizing transportation networks, telecommunications, and sports facilities. Moreover, the rigorous environmental and social standards of the International Olympic Committee (IOC) act as a deterrent to unsustainable urban planning. By improving the quality of public

amenities, the Olympics strengthen the overall integrity of the host nation's global image, fostering an environment conducive to long-term prosperity and international tourism.

However, the modernization of the Olympics is a complex process that requires significant investment in Technology and Security. It necessitates the integration of advanced broadcasting systems, anti-doping protocols, and smart stadium infrastructure to meet contemporary demands. Despite these logistical challenges, the long-term cultural benefits far outweigh the operational costs. The Games facilitate "Global Solidarity" on a massive scale, allowing small and large nations to share the spotlight on a level playing field. As the Olympic movement moves toward more sustainable hosting models, the synergy of international competition continues to promote global peace and enhance the efficiency of intercultural dialogue, making it the bedrock of modern international sports diplomacy.

Conclusion

The history and development of the Olympic Games represent a transformative journey toward global unity and athletic excellence. By prioritizing the spirit of competition and mutual respect, the Olympics empower nations, inspire future generations, and bolster the ideals of global peace. In a world where international cooperation is essential, the ability to convene through the Olympic Games is vital for any society aiming to promote human dignity and thrive in a peaceful, competitive global community.

References:

1. The Olympic Charter: Fundamental Principles and Rules. International Olympic Committee (IOC). (2024-2026). Switzerland.
2. The Modern Olympic Games: A History of the Movement. Young, D. C. (2023). USA.
3. Olympic Cities: City-Building, Planning, and Experience. Gold, J. R., & Gold, M. M. (2024). United Kingdom.
4. Historical Dictionary of the Olympic Movement. Mallon, B., & Heijmans, J. (2023). USA.

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THE MULTI-DIMENSIONAL IMPACT OF PHYSICAL EDUCATION AND SPORTS ON HUMAN HEALTH

Abstract

This article analyzes the multifaceted impact of physical education and sports on the physiological and psychological health of individuals. In an era characterized by increasing sedentary lifestyles, regular physical activity serves as a critical mechanism for maintaining systemic bodily functions and preventing chronic pathologies. The study examines the biological benefits, such as cardiovascular optimization and musculoskeletal strengthening, as well as the cognitive impacts on mental clarity and emotional stability. The analysis concludes that the consistent practice of sports is not merely a lifestyle choice but a fundamental biological requirement for achieving peak human performance and ensuring long-term health sustainability.

Keywords:

Physical education, human health, physiological impact, disease prevention, mental well-being, metabolic health, systemic resilience.

Main Part

The impact of physical education and sports on human health is driven by the necessity of "Functional Adaptation" in the human body. Regular training provides a standardized framework that allows internal systems to operate with high precision and efficiency. Without this physical stimulus, the body suffers from "Atrophy of Disuse," leading to weakened immunity and metabolic dysfunction. By engaging in sports, an individual signals a commitment to biological excellence, which significantly enhances the resilience of the cardiovascular system. This physiological transparency is a prerequisite for maintaining heart health, as exercise increases stroke volume and lowers the resting heart rate, effectively reducing the risk of hypertension and strokes.

From a cellular and metabolic perspective, the importance of sports lies in the optimization of the Energy Metabolism. Individuals who maintain a consistent training regimen enjoy a more efficient glucose regulation and lipid profile, as physical exertion enhances insulin sensitivity. Furthermore, for the musculoskeletal system, using a diverse range of exercises simplifies the maintenance of bone density and joint flexibility. This reduces the administrative burden on the body's aging process, preventing the early onset of osteoporosis and sarcopenia. The transition from inactivity to regular training encourages a shift from "Reactive Health Management" to "Proactive Wellness," which reflects the true biological substance of a healthy organism rather than just the absence of disease.

At the neurological level, the engagement in sports is a powerful catalyst for Neuroplasticity and mental health. When a person aligns their daily routine with physical culture, it lowers the "mental barriers" caused by chronic stress and anxiety. The release of myokines during muscle contraction acts as a natural deterrent to cognitive decline and mood disorders. By improving the quality of sleep and neurochemical balance, sports strengthen the overall integrity of the nervous system, fostering an environment conducive to sustainable mental growth and emotional stability. This internal harmony is essential for maintaining productivity in both academic and professional spheres.

However, the pursuit of health through sports is a process that requires significant investment in knowledge and proper technique. It necessitates an understanding of biomechanics and nutritional requirements to ensure that the physical load leads to adaptation rather than injury. Despite these requirements, the long-term benefits of "Biological Capital" far outweigh the efforts. Regular physical education facilitates systemic longevity, allowing individuals to navigate the complexities of modern life with vitality. As society moves toward a more health-conscious future, the synergy of an active population continues to reduce public health expenditures and enhance the overall efficiency of human resources.

Conclusion

The impact of physical education and sports is a transformative force for human health and personal excellence. By prioritizing physical activity and systemic conditioning, individuals empower their biological functions, streamline their mental health, and bolster their overall resilience. In a world where physical vitality is the foundation of achievement, the ability to maintain health through sports is essential for any individual aiming to thrive in the competitive global environment.

References:

1. Exercise Physiology: Nutrition, Energy, and Human Performance. McArdle, W. D., et al. (2024). USA.
2. The Global Impact of Physical Activity on Public Health. Pratt, M., & Brownson, R. C. (2023). United Kingdom.

3. Sports and Exercise Medicine: A Comprehensive Guide. Miller, T. (2025). Australia.
4. Physiological Bases of Physical Education and Sport. Foss, M. L., & Keteyian, S. J. (2024). USA.

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THE ROLE OF SPORTS IN MAINTAINING A HEALTHY LIFESTYLE

Abstract

This article analyzes the fundamental significance of physical activity and sports within the framework of a modern healthy lifestyle. As sedentary behaviors become more prevalent due to technological advancement, the integration of regular exercise serves as a vital mechanism for preventing chronic diseases, enhancing mental well-being, and improving overall quality of life. The study examines the physiological benefits, such as cardiovascular strengthening and metabolic regulation, as well as the psychological impacts, including stress reduction and cognitive enhancement. The analysis concludes that sports are not merely a leisure activity but a strategic necessity for individuals and societies aiming to achieve long-term physical resilience and public health sustainability.

Keywords:

sports, healthy lifestyle, physical activity, disease prevention, mental health, cardiovascular health, longevity.

Main Part

The integration of sports into a healthy lifestyle is driven by the human body's biological need for movement in an increasingly stationary world. Regular physical activity provides a foundational framework that allows the body to function at its peak efficiency. Without consistent exercise, individuals face the "Physical Inactivity Crisis," leading to a rise in non-communicable diseases such as obesity, type 2 diabetes, and hypertension. By engaging in sports, a person strengthens the immune system and improves the "Vital Capacity" of the lungs and heart. This physiological optimization is a prerequisite for maintaining energy levels and ensuring that the body can recover quickly from environmental stressors.

From a psychological perspective, the importance of sports lies in the regulation of mental health and the optimization of the "Cortisol-Endorphin Balance." Physical exercise is a powerful natural antidepressant; it triggers the release of neurotransmitters that improve mood and reduce anxiety. Furthermore, for students and professionals, sports improve cognitive functions such as focus, memory, and discipline. The commitment to a training routine encourages a shift from a "Passive Mindset" to a "Resilient Mindset," which requires professional consistency and reflects a person's ability to set and achieve long-term goals.

At the social and community level, sports act as a catalyst for social cohesion and discipline. Participating in team sports or communal fitness activities lowers the barriers between different social groups

and fosters a sense of belonging. This alignment is often a key factor in developing leadership qualities and teamwork skills that are applicable in academic and professional environments. Moreover, the rigorous nature of sports serves as a deterrent to harmful habits. By improving body composition and self-esteem, sports create an environment conducive to personal growth and long-term health stability.

However, maintaining a healthy lifestyle through sports is a process that requires significant investment in "Personal Discipline" and time management. It necessitates a balanced approach to nutrition, rest, and consistency to avoid overtraining and injury. Despite these daily challenges, the long-term benefits far outweigh the efforts. Regular activity facilitates "Biological Longevity," allowing individuals to remain productive and active well into their later years. As more people prioritize physical culture, the synergy of a healthy population reduces the burden on healthcare systems and enhances the overall efficiency of society.

Conclusion

The adoption of regular sports and physical activity is a transformative step toward personal excellence and physical longevity. By prioritizing movement and discipline, individuals empower their immune systems, streamline their mental health, and bolster their overall resilience. In a world where health is the most valuable asset, the ability to maintain a strong and active body through sports is essential for any individual aiming to thrive in a demanding modern environment.

References:

1. Global Action Plan on Physical Activity 2018–2030. World Health Organization (WHO). (2024-2026). Switzerland.
2. The Physiology of Exercise and Healthy Aging. Farrell, P. A., et al. (2023). USA.
3. Sports Psychology: Concepts and Applications. Cox, R. H. (2024). United Kingdom.
4. Nutrition and Physical Performance. American College of Sports Medicine. (2023). USA.

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THE AXIOMATIC FOUNDATION OF MATHEMATICS AS THE STRUCTURAL BLUEPRINT FOR GLOBAL INNOVATION

Abstract

This article analyzes the multifaceted significance of mathematics as the foundational language of the modern scientific and technological landscape. As global industries become increasingly data-driven, the transition from basic calculation to advanced mathematical modeling serves as a critical mechanism for enhancing logical precision, systemic reliability, and analytical transparency. The study examines the

microeconomic benefits, such as optimized algorithmic efficiency and risk mitigation in financial engineering, as well as the macroeconomic impacts on national research and development (R&D) capabilities. The analysis concludes that the mastery of mathematical principles is not merely an academic exercise but a strategic imperative for nations and corporations seeking to integrate into the global digital architecture and achieve long-term intellectual sustainability.

Keywords:

Mathematics, axiomatic method, quantitative analysis, logical precision, algorithmic modeling, systemic reliability, intellectual capital.

Main Part

The transition toward advanced mathematical application is driven by the need for a "universal language of logic" in an era of unprecedented complexity. Mathematics provides a standardized framework that allows researchers to model physical, biological, and economic phenomena across different jurisdictions with high precision. Without this quantitative harmonization, global progress is hindered by the "Conceptual Ambiguity" caused by subjective interpretations of data. By adopting rigorous mathematical standards, a country signals its commitment to international scientific best practices, which significantly enhances the reproducibility of its research outputs. This analytical transparency is a prerequisite for attracting institutional investment in sectors such as aerospace, cryptography, and artificial intelligence.

From an organizational management perspective, the importance of mathematical proficiency lies in the optimization of Decision-Making Processes. Entities that utilize high-level calculus, linear algebra, and statistical inference often enjoy a lower operational risk because their strategies are based on probabilistic modeling rather than intuition. Furthermore, for multinational technology firms, using unified mathematical algorithms across subsidiaries simplifies the scaling of software solutions. This reduces the administrative burden and operational costs associated with troubleshooting fragmented systems. The transition encourages a shift from "Heuristic-Based" problem solving to "Evidence-Based" optimization, which requires a deeper professional judgment and reflects the true economic substance of technical transactions.

At the macroeconomic level, the promotion of mathematical education is a powerful catalyst for National Innovation. When a nation aligns its educational standards with global mathematical benchmarks, it lowers the "innovation barriers" for local engineers and data scientists. This alignment is often a key requirement for joining elite international research consortia or securing favorable credit ratings from global agencies that value human capital quality. Moreover, the rigorous logic inherent in mathematical proof acts as a deterrent to systemic errors and engineering failures. By improving the quality of analytical information, mathematics strengthens the overall integrity of the domestic technology sector and capital markets, fostering an environment conducive to sustainable business growth and economic stability.

However, the transition to a mathematically literate society is a complex process that requires significant investment in Human Capital and pedagogical infrastructure. It necessitates the retraining of educators to teach the nuances of discrete mathematics, topology, and advanced statistics in a way that relates to real-world industrial applications. Despite these initial challenges, the long-term benefits far outweigh the costs. The transition facilitates "Intellectual Inclusion" on a global scale, allowing local enterprises to compete for high-tech contracts on a level playing field with international peers. As more countries move toward mathematics-centered development models, the synergy of a unified logical system continues to reduce market volatility and enhance the efficiency of global resource allocation, making it the bedrock of modern international science.

Conclusion

The evolution of mathematical thought is a transformative step toward global economic integration

and scientific excellence. By prioritizing logical rigor and quantitative clarity, mathematics empowers individuals, streamlines corporate management, and bolsters national resilience. In a world where data is the most valuable asset, the ability to communicate and solve problems through the lens of mathematics is essential for any entity aiming to thrive in the competitive and rapidly evolving global marketplace.

References:

1. The Foundations of Mathematics. Stewart, I., & Tall, D. (Updated 2024-2026). United Kingdom.
2. Mathematical Structures for Computer Science. Gersting, J. L. (2023). USA.
3. The Role of Mathematics in the Fourth Industrial Revolution. World Economic Forum. (2024). Switzerland.
4. Principles of Mathematical Analysis. Rudin, W. (Classic Reprint/Updated Ed. 2025). USA.

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THE STRATEGIC ROLE OF ENGLISH PROFICIENCY IN THE GLOBAL KNOWLEDGE ECONOMY

Abstract

This article analyzes the multifaceted significance of the English language as a fundamental pillar of the modern information age. As the global landscape becomes increasingly interconnected through digital platforms and international trade, the transition from local communication models to a unified linguistic standard serves as a critical mechanism for enhancing knowledge transfer, professional mobility, and systemic efficiency. The study examines the microeconomic benefits, such as expanded career trajectories for individuals and optimized talent acquisition for corporations, as well as the macroeconomic impacts on national digital readiness. The analysis concludes that the mastery of English is not merely a linguistic skill but a strategic imperative for any entity seeking to operate within the global professional and scientific architecture.

Keywords:

english language, global communication, knowledge economy, linguistic standard,
professional mobility, international trade, human capital.

Main Part

The transition toward English as a global professional medium is driven by the need for "linguistic interoperability" in an era of rapid technological advancement. English provides a standardized framework

that allows researchers, engineers, and entrepreneurs to collaborate across different jurisdictions with high precision. Without this common medium, global innovation is often hindered by the "Information Silo" effect caused by language-specific data fragmentation. By prioritizing English proficiency, an educational or professional system signals its commitment to international standards, which significantly enhances the visibility and impact of its intellectual output. This linguistic transparency is a prerequisite for accessing the vast majority of global scientific journals and technical documentation.

From a resource management perspective, the importance of English lies in the optimization of the Global Talent Pool. Organizations that utilize English as their primary internal language often enjoy a higher degree of operational agility because they can integrate talent from diverse geographical backgrounds without significant communicative friction. Furthermore, for multinational technology firms, using a unified language for code documentation and project management simplifies the scaling of operations. This reduces the administrative burden and operational costs associated with translating complex technical protocols. The movement toward linguistic standardization encourages a shift from "Regional Networking" to "Global Integration," reflecting the true economic reality of the 21st-century marketplace.

At the macroeconomic level, the promotion of English literacy is a powerful catalyst for National Economic Diversification. When a nation aligns its workforce skills with global linguistic benchmarks, it lowers the "entry barriers" for local enterprises seeking to provide services in the international outsourcing, tourism, and software development sectors. This alignment is often a key requirement for attracting high-quality foreign direct investment (FDI) from sectors that require a bilingual workforce. Moreover, the standardized nature of English-language education acts as a deterrent to professional obsolescence. By improving the communicative quality of its human capital, a country strengthens the overall integrity of its labor market, fostering an environment conducive to sustainable growth and cross-cultural innovation.

However, the implementation of effective English language programs is a complex process that requires significant investment in Instructional Design and digital immersion tools. It necessitates a focus on "Functional Fluency"—the ability to use language as a tool for problem-solving—rather than just theoretical grammar. Despite these initial pedagogical challenges, the long-term societal benefits far outweigh the investment. English proficiency facilitates "Opportunity Inclusion" on a global scale, allowing individuals to access high-value educational resources and remote work opportunities that were previously out of reach. As the global economy continues to move toward a more integrated model, the synergy of a globally-competent workforce continues to refine the efficiency of human capital allocation, making it the bedrock of modern career development.

Conclusion

The mastery of the English language is a transformative step toward global professional excellence and economic resilience. By prioritizing communicative clarity and linguistic agility, English empowers individuals, streamlines organizational management, and bolsters national capability. In an age where the exchange of information is the primary driver of progress, the ability to navigate the world through English is essential for any professional aiming to thrive in the competitive and ever-evolving global marketplace.

References:

1. Global English: Trends in International Communication. Jenkins, J. (Updated 2024-2026). United Kingdom.
2. The Power of Babel: Language in the Global Economy. McWhorter, J. (2023). USA.
3. English Proficiency Index and National Competitiveness. EF Research Labs. (2024). Switzerland.
4. Linguistic Capital and the Future of Work. Grin, F. (2025). Switzerland.

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THE PEDAGOGICAL SIGNIFICANCE OF INTEGRATING LITERATURE TO FOSTER EARLY MATHEMATICAL CONCEPTS

Abstract

This article analyzes the multifaceted significance of utilizing literary works as a strategic medium for introducing mathematical concepts to children. While traditional mathematics instruction often focuses on abstract symbols and rote memorization, the integration of storytelling serves as a critical mechanism for contextualizing numbers, spatial relationships, and logical reasoning. The study examines the cognitive benefits, such as enhanced mental modeling and narrative-driven problem solving, as well as the emotional impacts on reducing "math anxiety" in early learners. The analysis concludes that the synthesis of literature and mathematics is not merely a cross-curricular trend but a strategic imperative for educators seeking to build a meaningful and durable foundation for numeracy and cognitive development.

Keywords:

early mathematics, literary integration, cognitive development, narrative learning,
mathematical thinking, numeracy, pedagogical strategy.

Main Part

The transition toward narrative-based mathematics is driven by the need for a "concrete conceptual language" in early childhood education. Literary works provide a standardized framework that allows children to visualize mathematical problems within a relatable human context with high precision. Without this contextualization, young learners are often hindered by the "Abstraction Barrier" caused by isolated numerical data. By utilizing stories, an educator signals a commitment to holistic learning, which significantly enhances the conceptual retention of mathematical principles. This storytelling approach is a prerequisite for developing "Mathematical Literacy," where children learn to see patterns and quantities as part of their physical and social environment.

From a developmental perspective, the importance of using literature lies in the optimization of Mental Imagery. When children encounter mathematical concepts—such as addition, subtraction, or geometric shapes—through a narrative, they are required to construct internal models of the quantities described. Furthermore, for the learning process, using characters and plotlines simplifies the comprehension of complex operations. This reduces the cognitive burden and operational friction associated with learning new logical rules. The transition encourages a shift from "Procedural Learning" to "Conceptual Understanding," which requires a deeper intellectual engagement and reflects the true logic of mathematics rather than just mechanical calculation.

At the systemic level, the promotion of literature-integrated mathematics is a powerful catalyst for Critical Thinking. When a curriculum aligns mathematical tasks with a plot, it lowers the "engagement barriers" for students who may naturally prefer language arts over STEM subjects. This alignment is often a key requirement for fostering a multidisciplinary mindset from a young age. Moreover, the diverse scenarios found in stories act as a deterrent to narrow, one-dimensional thinking. By improving the quality of

mathematical discourse in the classroom, literature strengthens the overall integrity of the educational experience, fostering an environment conducive to creative problem-solving and intellectual curiosity.

However, the implementation of this pedagogical model is a complex process that requires significant investment in Teacher Training and curated literary resources. It necessitates that educators understand the nuances of "Mathematical Identification"—the ability to find and highlight latent math concepts within a text that is not explicitly about numbers. Despite these initial preparation requirements, the long-term educational benefits far outweigh the efforts. Early exposure to "Story-Math" facilitates "Cognitive Agility," allowing children to transfer mathematical skills to various life situations. As modern education moves toward more integrated models, the synergy of literature and logic continues to refine the efficiency of early childhood instruction.

Conclusion

The integration of literary works into early mathematics instruction is a transformative step toward deeper cognitive engagement and mathematical fluency. By prioritizing narrative context and mental modeling, educators empower children to perceive mathematics as a living language of patterns and logic. In a world where multi-dimensional thinking is essential, the ability to bridge the gap between stories and numbers is vital for any educational system aiming to develop the next generation of innovative thinkers.

References:

1. The Power of Story: Teaching Mathematics Through Literature. Whitin, D. J., & Wilde, S. (2024-2026). USA.
2. Early Childhood Mathematics Education: Contexts and Strategies. Clements, D. H., & Sarama, J. (2023). United Kingdom.
3. Cognitive Development and Narrative Learning. Bruner, J. (2024 update). USA.
4. Mathematics in the Early Years: A Literature-Based Approach. National Council of Teachers of Mathematics (NCTM). (2025). USA.

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THE IMPERATIVE OF COMPETENCY-BASED PEDAGOGY IN MODERN VOCATIONAL INSTRUCTION

Abstract

This article analyzes the multifaceted significance of implementing competency-based pedagogy within the landscape of vocational instruction. As the global economy undergoes a digital and industrial transformation, the transition from traditional, lecture-based teaching to immersive, skill-oriented instruction serves as a critical mechanism for bridging the gap between academic theory and workplace

reality. The study examines the pedagogical benefits, such as increased student engagement and mastery of technical maneuvers, as well as the long-term impacts on professional adaptability. The analysis concludes that the evolution of vocational teaching methods is not merely an educational update but a strategic necessity for preparing a workforce capable of navigating the complexities of the modern industrial architecture.

Keywords:

Vocational instruction, competency-based learning, pedagogical innovation, technical mastery, workforce readiness, skill acquisition, industrial education.

Main Part

The transition toward specialized vocational instruction is driven by the demand for "applied intelligence" in an increasingly automated world. Modern vocational pedagogy provides a standardized framework that allows instructors to evaluate student performance through practical benchmarks with high precision. Without this focus on application, the educational process is hindered by the "Knowledge-Action Gap" caused by an over-reliance on theoretical memorization. By adopting a hands-on instructional approach, an institution signals its commitment to professional excellence, which significantly enhances the reliability of graduate certifications. This shift is a prerequisite for producing technicians who possess the "tacit knowledge" required to operate complex machinery and manage industrial workflows.

From a student-centric perspective, the importance of modernized vocational lessons lies in the optimization of Skill Retention. Learners who are taught through "active-learning" modules often enjoy a higher degree of professional confidence because their training environment mirrors the challenges of the actual work site. Furthermore, for educational administrators, integrating industry-standard tools into the classroom simplifies the transition to professional life. This reduces the time-to-productivity for new hires and minimizes the operational friction during the onboarding process. The movement toward competency-based instruction encourages a shift from "Time-Based" learning to "Mastery-Based" learning, which requires students to demonstrate full proficiency in a task before advancing, reflecting the true rigor of professional standards.

At the systemic level, the refinement of vocational teaching is a powerful catalyst for Economic Diversification. When a nation aligns its vocational curriculum with emerging sectors like green energy or advanced manufacturing, it lowers the "innovation barriers" for local enterprises. This alignment is often a key requirement for achieving a resilient and self-sustaining national economy. Moreover, the rigorous assessment protocols of modern vocational instruction act as a deterrent to skill stagnation and professional obsolescence. By improving the quality of instructional delivery, vocational centers strengthen the overall integrity of the labor supply chain, fostering an environment conducive to continuous learning and technical advancement.

However, the revitalization of vocational instruction is a complex process that requires significant investment in Instructional Design and faculty development. It necessitates the continuous updating of workshops and the retraining of educators to master the nuances of hybrid learning and digital simulation. Despite these initial infrastructural demands, the long-term societal benefits far outweigh the costs. High-quality vocational instruction facilitates "Technical Inclusion," allowing individuals to gain high-value skills that are resistant to economic volatility. As educational systems move toward more integrated vocational models, the synergy of a well-trained workforce continues to enhance global productivity and the efficiency of human capital allocation, making it the bedrock of modern career development.

Conclusion

The modernization of vocational instruction is a transformative step toward educational relevance and

industrial capability. By prioritizing competency-based mastery and practical application, modern pedagogy empowers learners, streamlines the path to employment, and bolsters national economic resilience. In an era where practical skill is the primary engine of progress, the ability to deliver world-class vocational instruction is essential for any society aiming to thrive in the competitive and ever-evolving global marketplace.

References:

1. Pedagogical Innovations in Technical and Vocational Education. UNESCO-UNEVOC International Centre. (2024-2026). Germany.
2. Mastery Learning: Science and Practice in Vocational Settings. Bloom, B. S., updated by Guskey, T. R. (2023). USA.
3. Teaching and Learning in the 21st Century Vocational Classroom. Lucas, B., & Bill, L. (2024). United Kingdom.
4. Competency-Based Education: Frameworks for Technical Excellence. Sullivan, R. (2025). Australia.

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THE INTEGRATION OF SOFT SKILLS INTO TECHNICAL VOCATIONAL PEDAGOGY

Abstract

This article analyzes the multifaceted significance of incorporating "soft skills"—such as communication, problem-solving, and emotional intelligence—into the traditional technical vocational curriculum. As the global industrial landscape shifts toward collaborative and service-oriented models, the transition from a purely manual skill focus to a holistic professional development approach serves as a critical mechanism for enhancing graduate employability and leadership potential. The study examines the microeconomic benefits, such as improved workplace retention and team productivity, as well as the macroeconomic impacts on national labor market flexibility. The analysis concludes that the synthesis of "soft" and "hard" skills is not merely an educational trend but a strategic imperative for developing a workforce capable of navigating the interpersonal and technical complexities of the modern global economy.

Keywords:

Vocational pedagogy, soft skills, technical education, emotional intelligence, workforce adaptability, professional communication, holistic training.

Main Part

The transition toward a balanced vocational curriculum is driven by the need for a "collaborative professional language" in an era of integrated global supply chains. Vocational instruction that includes interpersonal training provides a standardized framework that allows technicians to interact with clients and

multi-disciplinary teams with high precision. Without this social layer, technical expertise is often hindered by "Communication Barriers" that cause operational delays and project friction. By embedding soft skills into the curriculum, a vocational institution signals its commitment to international professional standards, which significantly enhances the versatility of its graduates. This dual-competency is a prerequisite for moving into supervisory and management roles within the industrial sector.

From a workplace management perspective, the importance of soft skill integration lies in the optimization of the Team Dynamics. Technicians who possess strong problem-solving and conflict-resolution abilities often enjoy a higher degree of professional autonomy because they can navigate daily workplace challenges without constant managerial intervention. Furthermore, for modern corporations, hiring well-rounded vocational graduates simplifies the "Leadership Development" pipeline. This reduces the administrative burden and costs associated with separate soft-skill training programs after hiring. The evolution of this instructional model encourages a shift from "Task-Oriented" performance to "Solution-Oriented" performance, which requires deeper critical thinking and reflects the true social substance of modern industrial environments.

At the macroeconomic level, the promotion of holistic vocational education is a powerful catalyst for Labor Market Resilience. When a nation aligns its vocational programs with the need for adaptable and communicative workers, it lowers the "mobility barriers" that prevent technicians from moving between different industrial sectors. This alignment is often a key requirement for achieving high levels of national productivity and social stability. Moreover, the rigorous training in professional ethics and teamwork acts as a deterrent to workplace misconduct and organizational inefficiency. By improving the behavioral quality of the human capital pool, vocational centers strengthen the overall integrity of the service and manufacturing sectors, fostering an environment conducive to sustainable business growth.

However, the modernization of vocational pedagogy to include soft skills is a complex process that requires significant investment in Teacher Training and interactive learning materials. It necessitates the use of role-playing, simulation, and collaborative projects to teach nuances such as empathy and negotiation in a technical context. Despite these instructional challenges, the long-term career benefits for students far outweigh the effort. A holistic approach facilitates "Professional Inclusion" on a broad scale, allowing individuals to progress from entry-level technical roles to high-level strategic positions. As the global economy moves toward more human-centric models, the synergy of technical mastery and interpersonal excellence continues to refine global resource allocation, making it the bedrock of 21st-century vocational strategy.

Conclusion

The integration of soft skills into vocational instruction is a transformative step toward producing balanced and highly capable professionals. By prioritizing interpersonal competence alongside technical mastery, modern pedagogy empowers students, streamlines corporate leadership, and bolsters national economic resilience. In a world where technical skill alone is no longer enough to succeed, the ability to teach the "human element" of industry is essential for any vocational system aiming to thrive in the competitive and interconnected global marketplace.

References:

1. Soft Skills for the Future of Work. International Labor Organization (ILO). (2024-2026). Switzerland.
2. The Global Importance of Non-Cognitive Skills in VET. OECD Skills Outlook. (2023). France.
3. Teaching Soft Skills in a Technical World. Heckman, J. J., & Kautz, T. (2024). USA.
4. Holistic Vocational Education: Integrating Heart and Hand. UNESCO-UNEVOC. (2025). Germany.

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THE INTEGRATION OF WORK-BASED LEARNING (WBL) IN VOCATIONAL CURRICULUM DESIGN

Abstract

This article analyzes the multifaceted significance of integrating Work-Based Learning (WBL) within the modern vocational curriculum. As the global industrial sector demands higher levels of technical agility, the transition from classroom-confined instruction to integrated industry-education models serves as a critical mechanism for enhancing student professionalization and real-world problem-solving capabilities. The study examines the microeconomic benefits, such as reduced corporate training cycles and enhanced graduate marketability, as well as the macroeconomic impacts on national labor efficiency. The analysis concludes that the synthesis of academic instruction and practical industrial experience is not merely a pedagogical preference but a strategic imperative for developing a workforce capable of sustaining innovation in a volatile economic landscape.

Keywords:

Work-Based Learning, vocational curriculum, industry-education partnership, technical proficiency, professionalization, apprenticeship, labor efficiency.

Main Part

The transition toward integrated Work-Based Learning is driven by the need for a "synergetic learning environment" in an era of rapid industrial evolution. Vocational instruction that incorporates direct industry experience provides a standardized framework that allows students to apply theoretical concepts to live operational challenges with high precision. Without this bridge, vocational education is often hindered by "Theoretical Isolation," where students possess knowledge but lack the situational awareness required for complex technical tasks. By embedding WBL into the curriculum, an educational institution signals its commitment to modern industrial standards, which significantly enhances the credibility of its graduates in the eyes of international employers.

From an organizational perspective, the importance of integrated vocational lessons lies in the optimization of the Human Capital Pipeline. Companies that partner with vocational schools to provide on-site training often enjoy a higher retention rate because students are already acclimated to the corporate culture and technical requirements before formal hiring. Furthermore, for the students, using industry-standard equipment simplifies the mastery of advanced technologies. This reduces the administrative and operational burden on the employer during the post-graduation transition. The evolution of this instructional model encourages a shift from "Simulated Practice" to "Authentic Performance," which requires a higher degree of accountability and reflects the true economic conditions of the modern workplace.

At the macroeconomic level, the adoption of Work-Based Learning is a powerful catalyst for National Productivity. When a country aligns its vocational instruction with actual market demands, it lowers the "entry barriers" for youth in high-growth sectors. This alignment is often a key requirement for reducing structural unemployment and fostering a culture of lifelong learning. Moreover, the rigorous feedback loops inherent in industry-school partnerships act as a deterrent to outdated curricula. By improving the agility of

the educational system, integrated vocational instruction strengthens the overall integrity of the domestic economy, fostering an environment conducive to sustainable industrial growth and technological sovereignty.

However, the implementation of WBL is a complex process that requires significant investment in Institutional Cooperation and legal frameworks. It necessitates the creation of robust safety protocols and the training of "In-Company Mentors" who can guide students through the nuances of professional practice. Despite these coordination challenges, the long-term benefits of a highly adapted workforce far outweigh the initial logistical costs. The integration of WBL facilitates "Professional Inclusion" on a grand scale, allowing local talent to gain global-level competencies without leaving their home environment. As educational paradigms shift toward more collaborative models, the synergy of school-industry cooperation continues to refine global human resource allocation, making it the bedrock of future vocational strategy.

Conclusion

The integration of Work-Based Learning into vocational instruction is a transformative step toward aligning education with the realities of the 21st-century economy. By prioritizing hands-on experience and industry-standard training, this model empowers students, streamlines the transition into the workforce, and bolsters national economic resilience. In a world where the gap between theory and practice is narrowing, the ability to deliver integrated, work-based vocational training is essential for any nation aiming to build a competitive and future-ready workforce.

References:

1. Work-Based Learning in Vocational Education and Training. OECD Publishing. (2024-2026). France.
2. Apprenticeships and Dual Training Systems in a Globalized Economy. Steedman, H. (2023). United Kingdom.
3. The Architecture of Innovative Vocational Education. Guile, D., & Unwin, L. (2024). USA.
4. Integrating Industry Standards into Modern Curriculum Design. European Centre for the Development of Vocational Training (Cedefop). (2025). Greece.

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THE ROLE OF DIGITAL SIMULATION AND VIRTUAL LABORATORIES IN VOCATIONAL TRAINING

Abstract

This article analyzes the multifaceted significance of integrating digital simulation and virtual laboratories within the framework of modern vocational instruction. As industries adopt "Industry 4.0" technologies, the transition from traditional physical-only workshops to hybrid digital environments serves as a critical mechanism for enhancing student safety, resource efficiency, and technical precision. The study examines the pedagogical benefits, such as the ability to practice high-risk procedures in a controlled setting,

as well as the macroeconomic impacts on educational scalability. The analysis concludes that the adoption of digital simulation is not merely a technological trend but a strategic imperative for vocational institutions seeking to provide high-quality training in an increasingly complex and digitized global economy.

Keywords:

Digital simulation, virtual laboratories, vocational training, Industry 4.0, technical education, educational technology, risk management.

Main Part

The transition toward digital simulation in vocational pedagogy is driven by the need for a "risk-free mastery environment" in an era of high-precision engineering and hazardous industrial processes. Virtual laboratories provide a standardized framework that allows students to repeat complex technical maneuvers with high precision until total proficiency is achieved. Without this digital layer, vocational training is often hindered by the "Resource Constraint" caused by expensive raw materials or the wear and tear of physical machinery. By adopting simulation tools, an institution signals its commitment to modern technological standards, which significantly enhances the technical literacy of its graduates. This digital fluency is a prerequisite for operating in modern sectors where "Digital Twins" and remote monitoring are industry norms.

From an instructional management perspective, the importance of virtual training lies in the optimization of the Learning Curve. Students who report under a hybrid model often enjoy a higher degree of confidence because they can visualize internal mechanical processes that are invisible in physical machines. Furthermore, for vocational centers, using digital platforms simplifies the assessment of student progress through automated data tracking. This reduces the administrative burden and allows instructors to focus on individualized coaching rather than basic supervision. The transition encourages a shift from "Observational Learning" to "Immersive Interaction," which requires deeper analytical thinking and reflects the true technical substance of modern industrial operations.

At the macroeconomic level, the adoption of digital simulation is a powerful catalyst for Educational Scalability. When a nation aligns its vocational training with virtual platforms, it lowers the "infrastructure barriers" for rural and remote areas, allowing more citizens to access high-quality technical education. This alignment is often a key requirement for achieving rapid industrialization and national workforce readiness. Moreover, the standardized nature of digital curricula acts as a deterrent to geographic disparities in educational quality. By improving the accessibility of high-tier training, virtual laboratories strengthen the overall integrity of the national human capital pool, fostering an environment conducive to widespread innovation and economic stability.

However, the transition to digital-integrated vocational training is a complex process that requires significant investment in Software Infrastructure and high-speed connectivity. It necessitates the retraining of vocational instructors to navigate virtual environments and integrate data-driven feedback into their teaching. Despite these initial technological challenges, the long-term benefits of "Digital Readiness" far outweigh the costs. The transition facilitates "Skill Democratization" on a global scale, allowing local students to master international-standard technologies in a safe, cost-effective manner. As more countries move toward simulated vocational models, the synergy of a digitally-capable workforce continues to drive global productivity and enhance the efficiency of industrial resource allocation.

Conclusion

The integration of digital simulation and virtual laboratories is a transformative step toward the modernization of vocational education. By prioritizing safety, precision, and accessibility, these technologies empower students, streamline institutional management, and bolster national economic resilience. In a

world where the boundary between the physical and digital is disappearing, the ability to train effectively through simulation is essential for any entity aiming to thrive in the competitive global industrial landscape.

References:

1. Simulations and Virtual Labs in Technical Education. UNESCO-UNEVOC. (2024-2026). Germany.
2. Digital Transformation of Vocational Education and Training. OECD Skills Studies. (2023). France.
3. The Impact of VR and AR on Vocational Skill Acquisition. Thompson, K., et al. (2024). USA.
4. Virtual Reality in Industry and Education. Huang, R., & Liu, D. (2025). China.

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THE STRATEGIC IMPORTANCE OF ENHANCING VOCATIONAL EDUCATION AND TRAINING (VET)

Abstract

This article analyzes the multifaceted significance of vocational education and training (VET) within the contemporary global labor market. As industrial requirements become increasingly specialized and technology-driven, the transition from traditional academic-only models to robust vocational systems serves as a critical mechanism for enhancing workforce productivity, narrowing the skills gap, and increasing youth employability. The study examines the microeconomic benefits, such as improved job matching and higher initial earnings for skilled technicians, as well as the macroeconomic impacts on national industrial competitiveness. The analysis concludes that the modernization of vocational training is not merely an educational shift but a strategic imperative for nations seeking to achieve long-term economic resilience and sustainable professional development.

Keywords:

Vocational education, VET, workforce development, technical skills, labor market integration, professional training, economic sustainability.

Main Part

The transition toward advanced vocational education is driven by the need for a "practical skill language" in an era of rapid technological disruption. Vocational training provides a standardized framework that allows students to align their technical capabilities with the specific requirements of modern industries with high precision. Without this alignment, the labor market is hindered by the "Skills Mismatch" caused by

theoretical curricula that lack hands-on application. By prioritizing vocational subjects, an educational system signals its commitment to industrial best practices, which significantly enhances the employability of graduates. This practical expertise is a prerequisite for attracting industrial partnerships and foreign investments that require a workforce capable of immediate operational contribution.

From a career management perspective, the importance of vocational training lies in the optimization of the Transition from School to Work. Students who engage in specialized vocational tracks often enjoy a lower period of unemployment because their certifications are perceived as more relevant and easier to verify by technical standards. Furthermore, for modern enterprises, collaborating with vocational institutions simplifies the recruitment of high-quality talent. This reduces the administrative burden and training costs associated with onboarding employees who lack foundational technical skills. The evolution of vocational pedagogy encourages a shift from "Passive Learning" to "Competency-Based" education, which requires a deeper mastery of specific tools and reflects the true economic value of labor rather than just academic credentials.

At the macroeconomic level, the promotion of vocational education is a powerful catalyst for National Industrial Growth. When a nation aligns its training programs with the global technological benchmark, it lowers the "productivity barriers" for local manufacturers and service providers. This alignment is often a key requirement for achieving the Sustainable Development Goals (SDGs) related to decent work and economic growth. Moreover, the rigorous standards of modern vocational certifications act as a deterrent to workplace inefficiency and industrial accidents. By improving the quality of technical human capital, vocational education strengthens the overall integrity of the manufacturing and technology sectors, fostering an environment conducive to innovation and domestic production stability.

However, the modernization of vocational education is a complex process that requires significant investment in State-of-the-Art Infrastructure and equipment. It necessitates the continuous retraining of instructors and the integration of digital tools to understand the nuances of automation and artificial intelligence in the workplace. Despite these initial logistical challenges, the long-term socio-economic benefits far outweigh the costs. Vocational training facilitates "Social Mobility" on a broad scale, allowing individuals from diverse backgrounds to compete for high-paying technical roles on a level playing field. As more economies move toward a hybrid model of education, the synergy of a skilled workforce continues to reduce income inequality and enhance the efficiency of global production, making vocational training the bedrock of modern industrial strategy.

Conclusion

The enhancement of vocational education and training is a transformative step toward industrial excellence and economic stability. By prioritizing practical competence and industry alignment, VET empowers the youth, streamlines corporate recruitment, and bolsters national economic resilience. In a world where specialized skill is the most valuable currency, the ability to provide high-quality vocational training is essential for any nation aiming to thrive in the competitive global economy.

References:

1. Vocational Education and Training: World Trends and Outlook. UNESCO-UNEVOC. (2024-2026). Germany.
2. Skills for a Modern Workforce: The Impact of VET on Global Economies. OECD iLibrary. (2023). France.
3. The Future of Vocational Education: Innovation and Integration. Smith, J. R., et al. (2024). United Kingdom.
4. Technical and Vocational Teacher Education and Training in the Digital Age. International Labor Organization (ILO). (2025). Switzerland.

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THE STRATEGIC INFLUENCE OF LIFELONG LEARNING FRAMEWORKS IN VOCATIONAL CAREER DEVELOPMENT

Abstract

This article analyzes the multifaceted significance of establishing lifelong learning frameworks within the sphere of vocational education. As industrial cycles shorten and professional requirements evolve at an unprecedented pace, the transition from "terminal education" to "continuous skill acquisition" serves as a critical mechanism for maintaining workforce agility, professional relevance, and economic adaptability. The study examines the psychological benefits, such as increased professional confidence and adaptability, as well as the macroeconomic impacts on national labor market stability. The analysis concludes that the promotion of a lifelong learning culture is not merely a social objective but a strategic imperative for individuals and nations seeking to navigate the fluid dynamics of the global professional architecture.

Keywords:

Lifelong learning, vocational development, career agility, professional evolution, continuous education, labor market adaptability, skill upgrading.

Main Part

The transition toward a lifelong learning model in vocational training is driven by the need for a "dynamic skill set" in an era of constant industrial disruption. Continuous vocational instruction provides a standardized framework that allows professionals to update their technical competencies in alignment with emerging market trends with high precision. Without this periodic upgrading, the workforce is hindered by the "Skill Obsolescence" caused by the rapid integration of new materials and automated processes. By fostering a culture of ongoing training, an educational system signals its commitment to long-term professional excellence, which significantly enhances the career longevity of its graduates. This adaptability is a prerequisite for maintaining competitiveness in a landscape where technical requirements shift every few years.

From a career management perspective, the importance of continuous vocational learning lies in the optimization of Personal Marketability. Professionals who engage in recurring certification and training modules often enjoy a lower risk of displacement because their expertise remains aligned with contemporary industrial standards. Furthermore, for modern corporations, supporting the ongoing education of their staff simplifies the internal transition to new technologies. This reduces the administrative burden and recruitment costs associated with searching for external talent whenever a technical shift occurs. The evolution of this mindset encourages a shift from "Static Certification" to "Fluid Competency," which requires a deeper commitment to self-improvement and reflects the true economic necessity of staying current in one's field.

At the macroeconomic level, the institutionalization of lifelong vocational learning is a powerful catalyst for National Economic Resilience. When a nation aligns its adult education infrastructure with global benchmarks, it lowers the "unemployment barriers" created by structural shifts in the economy. This

alignment is often a key requirement for sustaining growth during periods of industrial transition or economic downturns. Moreover, the rigorous standards of ongoing professional development act as a deterrent to national productivity stagnation. By improving the collective quality of the human capital pool through every stage of the professional lifecycle, a country strengthens the overall integrity of its industrial output, fostering an environment conducive to sustainable business growth and long-term economic stability.

However, the implementation of a comprehensive lifelong learning system is a complex process that requires significant investment in Flexible Learning Infrastructure and micro-credentialing systems. It necessitates the creation of modular curricula that allow working professionals to balance their daily duties with educational advancement. Despite these logistical challenges, the long-term societal benefits far outweigh the initial costs. Continuous vocational training facilitates "Economic Inclusion" on a permanent basis, allowing workers to pivot into new roles as old ones become obsolete. As more global economies move toward this integrated model, the synergy of a perpetually learning workforce continues to reduce market volatility and enhance the efficiency of global human resource management.

Conclusion

The integration of lifelong learning into the vocational landscape is a transformative step toward sustainable professional development and economic excellence. By prioritizing continuous growth and technical adaptation, this framework empowers the workforce, streamlines industrial evolution, and bolsters national resilience. In an age defined by constant change, the ability to learn, unlearn, and relearn through vocational channels is essential for any professional aiming to thrive in the complex global marketplace.

References:

1. Lifelong Learning and the Future of Jobs. International Labor Organization (ILO). (2024-2026). Switzerland.
2. Adult Learning and Education in a Changing World of Work. UNESCO Institute for Lifelong Learning. (2023). Germany.
3. The Economics of Continuous Vocational Training. Green, F., et al. (2024). United Kingdom.
4. Reskilling the Workforce: Strategies for Lifelong Professional Growth. Harvard Business Review Press. (2025). USA.

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THE TRANSFORMATIVE POWER OF INDUSTRY-ACADEMIA SYNERGY IN VOCATIONAL INSTRUCTION

Abstract

This article analyzes the multifaceted significance of fostering robust industry-academia partnerships

within the framework of vocational education. As the global industrial landscape becomes increasingly complex, the transition from isolated academic instruction to collaborative synergy serves as a critical mechanism for ensuring curriculum relevance, technological synchronization, and graduate readiness. The study examines the institutional benefits, such as access to high-end industrial equipment and shared intellectual capital, as well as the macroeconomic impacts on national innovation ecosystems. The analysis concludes that the integration of industry expertise into vocational pedagogy is not merely a beneficial addition but a strategic imperative for educational institutions aiming to produce a workforce capable of driving long-term industrial excellence.

Keywords:

Industry-academia synergy, vocational instruction, collaborative education, curriculum alignment, industrial innovation, technical training, workforce integration.

Main Part

The transition toward a synergetic model of vocational instruction is driven by the need for "real-time skill synchronization" in an era of rapid technological turnover. Industry-academia partnerships provide a standardized framework that allows vocational institutions to align their teaching modules with the actual operational needs of modern factories and service providers with high precision. Without this collaboration, the educational system is hindered by "Curriculum Lag," where students are trained on technologies that are already becoming obsolete in the professional world. By integrating industry experts into the instructional process, an institution signals its commitment to contemporary best practices, which significantly enhances the technical authority of its programs.

From a resource management perspective, the importance of this synergy lies in the optimization of Technological Access. Vocational schools that maintain active links with the private sector often enjoy a lower financial burden because they can utilize "dual-use" facilities—training students on-site at partner companies. Furthermore, for the participating corporations, this relationship simplifies the "Talent Identification" process. This reduces the administrative burden and long-term costs associated with intensive remedial training for new graduates. The evolution of this model encourages a shift from "Generic Training" to "Precision Education," which requires a deep understanding of specific industrial workflows and reflects the true economic requirements of a specialized labor market.

At the macroeconomic level, the institutionalization of industry-academia cooperation is a powerful catalyst for Regional Economic Competitiveness. When a nation aligns its vocational centers with local industrial clusters, it lowers the "innovation barriers" for small and medium enterprises (SMEs) that rely on a steady stream of skilled technicians. This alignment is often a key requirement for attracting high-tech foreign direct investment (FDI) that prioritizes the availability of a "ready-to-work" human capital pool. Moreover, the joint development of training standards acts as a deterrent to industrial inefficiency and labor mismatch. By improving the bridge between learning and earning, this synergy strengthens the overall integrity of the domestic industrial architecture, fostering an environment conducive to sustainable growth and technological self-reliance.

However, the cultivation of deep industry-academia synergy is a complex process that requires significant investment in Relationship Management and legal frameworks for intellectual property. It necessitates a shift in the traditional academic culture to accommodate the fast-paced, results-oriented nature of the private sector. Despite these organizational challenges, the long-term benefits of a high-fidelity training system far outweigh the initial coordination efforts. This collaborative approach facilitates "Technical Sovereignty" on a national scale, allowing a country to develop its own specialized experts in emerging fields.

Conclusion

The synergy between industry and academia is a transformative force in the modernization of vocational instruction. By prioritizing collaborative curriculum design and shared resources, this model empowers students, streamlines industrial recruitment, and bolsters national economic resilience. In a world where the pace of change is dictated by industrial innovation, the ability to teach through an integrated industry-academia lens is essential for any vocational system aiming to thrive in the competitive global economy.

References:

1. Industry-Academia Collaboration in Vocational Education: Global Best Practices. UNESCO-UNEVOC. (2024-2026). Germany.
2. Bridging the Gap: The Impact of Industry Partnerships on Vocational Outcomes. OECD Education Working Papers. (2023). France.
3. The Triple Helix Model of Innovation: Industry, University, and Government. Etzkowitz, H., & Zhou, C. (2024). United Kingdom.
4. Strategic Management of Vocational Training Centers. Miller, L. S., et al. (2025). USA.

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DESIGNING APPLIED GEOMETRY EXAM QUESTIONS TO ASSESS REAL-WORLD PROBLEM-SOLVING COMPETENCE IN UPPER SECONDARY AND HIGHER EDUCATION

Abstract

This study establishes a framework of five design principles and evaluation criteria for applied geometry exam questions to meet the requirements of competency-based development and STEM education. The findings confirm that embedding geometry problems within practical contexts is an effective solution for assessing learners' mathematical modeling and problem-solving skills. The study provides a crucial theoretical and practical foundation for innovating mathematics assessment in the current educational landscape.

Keywords:

applied geometry, mathematical modeling, competency-based assessment, exam design, STEM education.

Rationale: Modern education is shifting from knowledge transmission to **competency-based assessment**. However, geometry examinations remain largely formal and detached from reality, failing to reflect the role of mathematics in engineering and STEM.

Gap: Systematic research on designing applied geometry exams—integrating principles, criteria, and practical examples for both secondary and higher education—is still lacking.

Objectives: This study aims to:

1. Establish a **theoretical foundation** for applied geometry design.
2. Propose a **framework of principles and criteria** for quality evaluation.
3. Develop a **standardized design process**.

4. Provide **illustrative problems** in practical contexts.

2. Theoretical foundation

2.1. Applied Geometry in Mathematics Education Applied geometry involves using geometric concepts to model and solve real-world problems in fields such as architecture, engineering, and industrial production. In education, this process follows a cycle: starting with a **practical situation**, transforming it into a **mathematical model**, and deriving a solution.

2.2. Competency-based Assessment Modern assessment must evaluate various cognitive and functional levels. For applied geometry, these include:

- **Recognition & Understanding:** Identifying and interpreting geometric models.
- **Application:** Solving problems in both familiar and novel contexts.
- **Higher-order Thinking:** Mathematical modeling and optimization.

Exam structures must be deliberately designed to reflect these hierarchy levels to accurately measure learner competence.

3. Research methods

The study employs three primary methods:

- **Document Analysis:** Reviewing literature on mathematics education and competency-based assessment to build the theoretical framework.
- **Theoretical Synthesis:** Systematizing design principles and evaluation criteria based on existing research.
- **Illustrative Design:** Constructing specific applied geometry problems to demonstrate the framework's feasibility.

4. Principles for designing applied geometry examinations

4.1. Practicality Problems must originate from authentic life or technical contexts with plausible, realistic data.

4.2. Mathematical Modeling The assessment must reflect the modeling cycle (Blum & Leiss, 2007), requiring learners to:

1. **Structure:** Identify geometric elements from real situations.
2. **Mathematize:** Establish diagrams and select appropriate geometric tools.
3. **Solve:** Apply theorems and perform calculations.
4. **Interpret & Validate:** Translate mathematical results back into the original practical context.

Evaluating multiple stages of this cycle provides a deeper assessment of problem-solving competence.

4.3. Competence Differentiation Examinations must be structured across hierarchical levels—from basic recognition to advanced, open-ended applications—to effectively categorize learner proficiency.

4.3. Competence Differentiation (Continued)

The suggested proportions for exam structure are: **Basic (40%)**, **Application (30%)**, **Advanced Application (20%)**, and **Open-ended (10%)**. This hierarchy targets core competencies (Niss, 2015), specifically focusing on:

- **Spatial Thinking:** Identifying structures and spatial relationships.
- **Modeling:** Transforming reality into geometric representations.
- **Problem Solving & Interpretation:** Applying tools and validating results in real-world contexts.

4.4. Interdisciplinary (STEM) & Integration Framework

Examinations should integrate fields such as Physics (optics/statics), Technology (engineering), Geography (surveying), and Economics (optimization). The proposed framework links three pillars:

1. **Context:** Real-life starting points.
2. **Process:** Mathematical modeling and reasoning.

3. **Assessment:** Measuring specific competencies (spatial, modeling, solving).

4.5. Transparency

Ensuring clarity in solutions, detailed scoring rubrics, and explicit marking criteria.

5. Criteria for evaluating exam quality

Content Criteria	Measurement Criteria
Accuracy: Mathematical correctness.	Validity: Measuring intended competencies.
Practicality: Authentic context.	Reliability: Consistency across raters.
Modeling Potential: Capacity for mathematization.	Discrimination: Differentiating student levels.
STEM Integration: Interdisciplinary elements.	Feasibility: Suitability for time/conditions.

6. Illustrative examples

6.1. Case Study: A-frame Roof Optimization

- **Context:** Cost estimation for an isosceles triangular roof.
- **Parameters:** Width (\$6m\$), Height (\$2.5m\$), Length (\$10m\$).
- **Economic factor:** Roofing material price: \$120,000 \text{ VND}/\text{m}^2\$.
- **Task:** Calculate total surface area and total cost, requiring students to apply the Pythagorean theorem in a construction context.



Figure 1

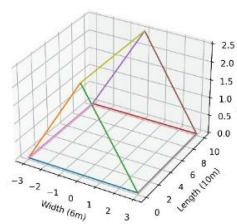


Figure 2

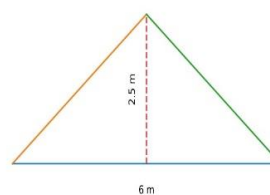


Figure 3

The questions require students to:

- 1) Identify the geometric model - the roof consists of two faces of a prism (Figure 2). (2 points)
- 2) Calculate the length of the roof edge: $AB = \sqrt{AH^2 + BH^2} = \sqrt{3^2 + 2,5^2} \approx 3,9m$ (2 points)
- 3) Calculate the roof area: $S = 2 \times 3,9 \times 10 = 78m^2$ (3 points)
- 4) Calculate the basic material cost: $78 \times 120,000 = 9,360,000 \text{ VND}$. (2 points)
- 5) Analyze the optimal option for the roof area. (1 point)

6.2. Cylindrical water tank design problem

A manufacturing facility needs to produce a cylindrical water tank with a volume of 2 m^3 .



Figure 4

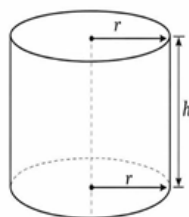


Figure 5

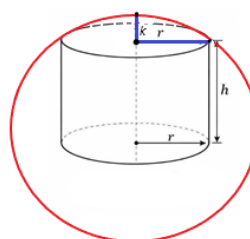


Figure 6

Requirements:

Question 1 (2 points): Decompose the water tank into basic geometric solids: a cylinder and two spherical caps. $V = V_1 + 2V_2$

Question 2 (2 points): Establish the relationship between radius and height.

$$R = \sqrt{(R-k)^2 + r^2} ; r = \sqrt{2Rk - k^2}$$

Question 3 (3 points): Formulate the volume expression.

$$V_1 = \pi r^2 h ; V_1 = \frac{\pi k^2}{3}(3R - k) ; V_1 = \frac{\pi k}{6}(3r^2 + k^2)$$

The spherical-cap volume is denoted by the given expression in the source text, where R is the radius of the sphere, k is the height of the spherical cap, and r is the base radius of the spherical cap.

Question 4 (2 points): Express the material area, including the lateral area of the cylinder and the area of the two spherical caps: $S_{sq} = 2\pi rh$; $S_{cc} = 2\pi Rk$

Question 5 (1 point): Find the optimal dimensions of the cylinder when the volume is constant and material consumption is minimized.

6.3. Problem of determining the taper angle in lathe machining

Technical context

In mechanical manufacturing, many tapered shaft components are used in technical joints such as machine spindles, tapered couplings, or centering parts. When machining such parts on a lathe, the worker needs to determine the taper angle accurately in order to adjust the tool rest or set up the cutting tool appropriately.

Suppose a tapered shaft component has the following parameters: large-end diameter 60 mm, small-end diameter 40 mm, tapered-part length 100 mm.



Figure 7

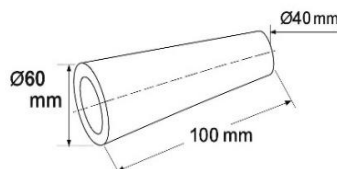


Figure 8

Examination questions

Question 1 (Recognition - 2 points)

Determine the radii of the two ends of the taper from the given diameter data and determine the difference in radius between the two ends of the component, where D and d are the diameters of the two bases, R is the large-end radius, r is the small-end radius, and h is the length of the tapered part.

$R = 30 \text{ mm}$; $r = 20 \text{ mm}$; therefore, $R - r = 10 \text{ mm}$.

Question 2 (Understanding - 2 points)

The taper angle is the angle at the apex of the cone that generates the frustum. It is formed by two generatrices symmetric about the axis of the cone. If the cone is cut by a plane passing through its axis, an isosceles triangle is obtained. The apex angle of this triangle is precisely the taper angle.

Taper ratio: as given in the source formula $K = \frac{D-d}{l} = 2 \tan \alpha$.

Slope: as given in the source formula $u = \tan \alpha = \frac{D-d}{2l} = \frac{R-r}{l}$.

Question 3 (Application - 3 points)

Establish a right triangle representing the longitudinal cross-section of the tapered part and write the formula for determining the taper angle; the angle in the formula is half of the taper angle: $\tan \alpha = \frac{h}{R-r}$.

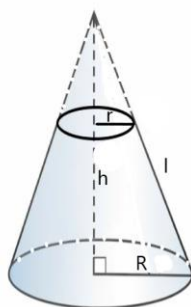


Figure 9

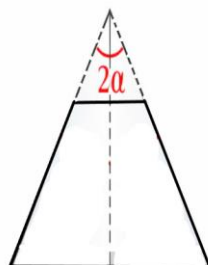


Figure 10

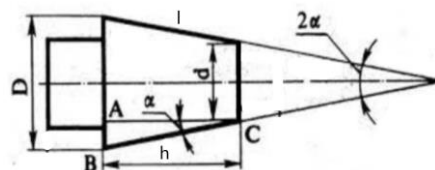


Figure 11

Question 4 (Advanced application - 2 points)

Calculate the taper angle value of the component (rounded to the nearest minute).

$$\tan \alpha = \frac{h}{R-r} = \frac{100}{10} = 10; \alpha = \arctan 10 \approx 84,29^\circ$$

Question 5 (Open-ended question - 1 point)

Technical Implications: If the taper angle deviates from the design, it directly impairs the mechanical joint's performance, leading to **improper fit**, **increased vibration**, and **premature wear** of components. Such errors can result in assembly failure or reduced machine lifespan.

Educational Significance: This problem serves as a practical bridge between trigonometry and industrial engineering. Key learning outcomes include:

- **Contextual Understanding:** Translating geometric variables into functional machine design parameters.

- **Competence Development:** Strengthening mathematical modeling skills by solving authentic industrial tasks.

- **STEM Integration:** Demonstrating the indispensable role of mathematics in manufacturing, thereby enhancing the relevance and applicability of mathematics in the classroom.

7. Discussion. Applied geometry assessment enhances modeling competence and clarifies the role of mathematics in STEM and occupational contexts. However, practical implementation is hindered by teachers' unfamiliarity with problem design, a lack of standardized item banks, and rubric complexities. This study's primary limitation is its theoretical focus; future research must involve pedagogical experiments to empirically validate the framework and criteria across diverse learner samples.

8. Conclusion. This study established a comprehensive framework of principles and criteria for competency-based applied geometry examinations. Findings indicate that effective assessments must integrate authentic contexts, explicit modeling requirements, differentiated difficulty levels, and transparent rubrics. Theoretically, it clarifies the nexus between geometry, modeling, and assessment; practically, it provides a reference for innovating mathematics testing. Continued experimental verification is recommended to ensure broad applicability.

References:

1. Blum, W., & Leiss, D. (2007). How do students and teachers deal with modelling problems? Mathematical Modelling.
2. Lesh, R., & Doerr, H. (2003). Beyond Constructivism: Models and Modeling Perspectives on Mathematics Problem Solving. Lawrence Erlbaum.
3. Niss, M. (2015). Mathematical competencies and the learning of mathematics. OECD Education Studies.

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EVALUATING THE EFFECTIVENESS OF PROJECT-BASED LEARNING IN DEVELOPING ENGLISH SPEAKING SKILLS FOR STUDENTS AT THE HANOI UNIVERSITY OF MINING AND GEOLOGY

Abstract

This study evaluates the effectiveness of Project-Based Learning (PBL) in enhancing the English speaking proficiency of non-English major students at the Hanoi University of Mining and Geology (HUMG). A quasi-experimental design was implemented across several English classes during the 2024 and 2025 academic years, with 234 valid survey responses collected post-intervention. The results indicate that a majority of students perceived significant improvements in motivation, confidence, fluency, vocabulary, and pronunciation. Despite relying on self-reported data, the findings suggest that PBL is an effective pedagogical method for developing communicative competence within the English as a Foreign Language (EFL) context. The study also discusses pedagogical implications and proposes directions for future research.

Keywords:

Project-Based Learning, English speaking skills, EFL, higher education, communication skills.

1. Introduction

Developing speaking skills is a paramount yet challenging objective in teaching and learning English as a Foreign Language (EFL), particularly for students in technical fields who often have limited opportunities for real-world communication. According to the interactionist perspective in second language acquisition, language development occurs through meaningful communication and the "negotiation of meaning" between learners (Michael Long, 1996). Providing frequent opportunities for language production is considered a prerequisite for enhancing speaking competence.

In the trend of learner-centered educational reform, Project-Based Learning (PBL) has gained increasing attention. According to Larmer et al. (2015), PBL is not merely an isolated activity but a comprehensive instructional strategy that bridges the gap between theory and practice. This model is rooted in John Dewey's (1938) experiential learning theory and Lev Vygotsky's (1978) social constructivism, emphasizing the central role of interaction, collaboration, and meaningful participation in knowledge construction. In language teaching, PBL shares similarities with Task-based Learning, where students engage in goal-oriented communicative activities to create specific products (Rod Ellis, 2003).

Numerous international studies have demonstrated that PBL contributes significantly to increasing learner motivation, confidence, and speaking effectiveness in EFL contexts. However, in Vietnam, research

on PBL within specialized technical university environments remains limited, especially regarding student perceptions. Consequently, this study surveys students' perceptions of the impact of PBL on English speaking skills at the Hanoi University of Mining and Geology, focusing on key aspects: motivation, confidence, and linguistic components including fluency, vocabulary, and pronunciation.

2. Methodology

2.1. Research design and participants

The study employed a post-intervention survey design to evaluate the effectiveness of PBL on the speaking skills of non-major students. A total of 234 students from various departments, including Information Technology, Economics, Automation, and Petroleum, completed the survey. As the study did not utilize a control group, the results reflect trends in learner perception and self-assessment following implementation.

2.2. Implementation process and tools

The PBL method was integrated into speaking skill lessons through a four-step interaction cycle between lecturers and students. Lecturers acted as advisors and linguistic facilitators, while students worked in groups of 4–5 to create products such as mind maps, presentations, or videos:

- **Step 1 - Project definition:** The lecturer introduces the topic; students discuss to define the scope and output.
- **Step 2 - Planning:** Groups develop plans, assign tasks, and design the speaking structure.
- **Step 3 - Implementation:** Students collect information, practice, and finalize the speaking product.
- **Step 4 - Synthesis and evaluation:** Products are presented to the class for peer and lecturer feedback.

Data were collected via an online questionnaire using a 5-point Likert scale (5: Very High to 1: Poor).

3. Results and discussion

3.1. The PBL model applied in English classes

The PBL model in this study is established on the foundation of constructivism, emphasizing the proactive role of learners in constructing knowledge through social interaction and practical experience. Simultaneously, the model utilizes the communicative competence framework, in which speaking skills are viewed as a combination of fluency, vocabulary, pronunciation, and communication strategies. The four-step structure is designed to create a learning cycle consisting of orientation – practice – presentation – feedback, thereby promoting language use in contexts closely resembling real-world communication.

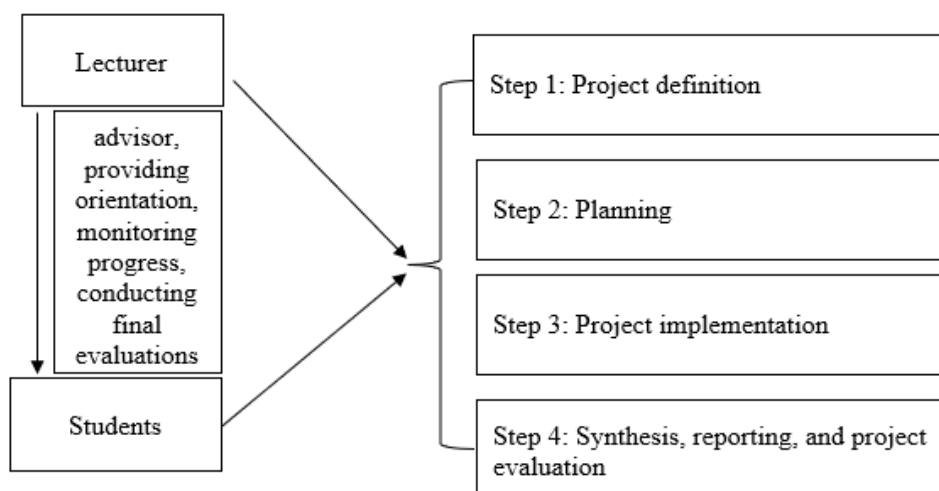


Figure 1 – The applied PBL model

Source: Vu Thanh Tam, 2022

The PBL model employed in this research follows a four-step process characterized by close interaction between the lecturer and student groups. Within this framework, the lecturer serves as an advisor, providing orientation, monitoring progress, and conducting final evaluations, while students act as the primary agents of project execution through collaborative group activities.

- **Step 1 – Project Definition:** The lecturer introduces the topic, outlines communicative tasks, and defines the target linguistic objectives. Students engage in discussions to clarify content and determine the scope and final output of the project.

- **Step 2 – Planning:** Groups develop implementation plans, assign tasks, identify resources, and design the structure of their speaking performance. At this stage, the lecturer provides support in adjusting content and language as necessary.

- **Step 3 – Project Implementation:** Students collect information, discuss, practice, and finalize their speaking products. Intergroup interaction in English is encouraged to enhance language practice and develop fluency.

- **Step 4 – Synthesis, Reporting, and Project Evaluation:** Groups present their final products to the class, participate in exchanges, and receive feedback. The lecturer performs a comprehensive evaluation and provides remarks to help students draw lessons for subsequent tasks.

This model ensures systematicity, strengthens the proactive role of learners, and creates a realistic communicative environment within the English classroom.

3.2. Implementing PBL in English Classes at the HUMG

3.2.1. Experimental Implementation Process

Project-Based Learning (PBL) was integrated into the Speaking skill lessons of the English 1 and English 2 modules. To ensure effectiveness, lecturers initially introduced students to the characteristics, objectives, and procedural framework of PBL, enabling learners to familiarize themselves with this student-centered approach.

Students were guided to develop speaking project plans based on curriculum-mandated topics or group-proposed themes. Emphasis was placed on aligning project content with students' academic majors to facilitate the application of academic and technical vocabulary. The implementation process adhered to learner-centered principles, encouraging active discussion, group collaboration, and the expression of personal perspectives in English. Additionally, self-assessment and peer-assessment activities were incorporated to enhance students' reflective thinking.

Specifically, during the first semester of the 2024–2025 academic year, in experimental groups (e.g., groups 205 and 206), classes were divided into small teams of 4–5 students. Under the project theme “My Lifestyle,” students designed products in the form of mind maps. Following the discussion phase, group representatives presented their projects in English, followed by Q&A sessions between groups. Lecturers moderated these exchanges and provided detailed evaluative feedback.

Experimental observations indicated a high level of student engagement and timely completion of project outputs. However, the use of the mother tongue (Vietnamese) during group discussions persisted, primarily due to linguistic barriers. This necessitates closer monitoring and timely pedagogical scaffolding from lecturers. Furthermore, large class sizes posed challenges regarding time management and ensuring equal participation among all members. To optimize effectiveness, the study suggests diversifying project delivery formats (e.g., live presentations, video recordings) and organizing extracurricular communicative activities to maximize practice opportunities and bolster students' confidence in language use.

3.2.2. Results

The survey results indicate that 87.9% of students rated the effectiveness of PBL as "Fair" or higher.

Table 1

Student Perceptions of PBL Effectiveness (%)

Survey Content	Very High (5)	High (4)	Fair (3)	Average (2)	Poor (1)
Overall evaluation of effectiveness	10.9	32.1	44.9	10.3	1.8
Motivation for speaking English	1.3	12.1	78.3	7.7	0.6
Confidence level when speaking	2.6	9.6	73.7	12.2	1.9
Improvement in fluency	1.3	12.1	75.1	10.9	0.6
Improvement in vocabulary	0.6	12.1	55.3	31.4	0.6
Improvement in pronunciation	0.6	12.1	68.5	15.6	3.2

Source: Synthesized by the author (2025)

The analysis shows that a majority of students hold positive views toward PBL. Specifically, 87.9% rated the effectiveness at level 3-5. Regarding compatibility, 56.5% of students self-assessed their proficiency as "Fair" during project execution. This suggests that PBL is initially suitable for the current level of most students, though linguistic gaps remain for a small portion of learners.

Notably, variables related to motivation and attitude recorded highly positive feedback. 78.3% of students felt their motivation improved significantly, and 73.7% reported increased confidence. This increase aligns with Dörnyei's (2001) view that creating a low-pressure, supportive learning environment fosters individual motivation. Regarding linguistic components, 68.5% perceived improvement in pronunciation, 68% in vocabulary, and 88.5% in fluency. However, due to the reliance on self-reported data and limited sample size, the generalizability of these results should be considered with caution in future empirical studies.

4. Conclusion and implications

4.1. Conclusion

The study reaffirms the validity of the PBL method based on its heritage from educational pioneers such as John Dewey and Lev Vygotsky. The shift from passive instruction to experiential learning and social interaction has helped students develop more flexible and proactive language habits.

4.2. Pedagogical implications and future research

To enhance effectiveness, it is necessary to develop project-specific speaking assessment tools that combine lecturer evaluation, peer-assessment, and self-assessment. Lecturers should receive further training in project design and linguistic scaffolding. Future research should expand the sample size and utilize experimental designs with control groups (pre-test/post-test) to more accurately verify the impact of PBL on specific components of speaking competence.

References:

1. Vu, T. T. (2022). Improving English speaking skills through Project-Based Learning at the Hanoi University of Mining and Geology.
2. Dewey, J. (1938). Experience and Education. New York: Collier Books.
3. Dörnyei, Z. (2001). Motivational Strategies in the Language Classroom. Cambridge University Press.
4. Ellis, R. (2003). Task-based Language Learning and Teaching. Oxford University Press.
5. Larmer, J., Mergendoller, J., & Boss, S. (2015). Setting the Standard for Project Based Learning. ASCD.
6. Long, M. H. (1996). The role of the linguistic environment in second language acquisition.
7. Vygotsky, L. S. (1978). Mind in Society. Harvard University Press.
8. Hoang, V.V. (2010). Teaching non-major English at Vietnamese universities. VNU Press.

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ТРАНСФОРМАЦИЯ КЛАССИЧЕСКИХ ТРАДИЦИЙ В СОВРЕМЕННОЙ РУССКОЙ ЛИТЕРАТУРЕ: ЛИНГВОКУЛЬТУРОЛОГИЧЕСКИЙ АСПЕКТ

Аннотация

В данной статье рассматривается процесс преемственности и трансформации классических традиций в современном литературном процессе России. Анализируется взаимосвязь между языковыми изменениями и эволюцией художественных образов. Особое внимание уделяется тому, как русский язык адаптируется к новым социокультурным реалиям, сохраняя при этом фундаментальные основы, заложенные классиками XIX и XX веков. Исследование направлено на выявление роли литературы в сохранении национальной идентичности и чистоты языка в эпоху цифровизации.

Ключевые слова:

русский язык, классическая литература, лингвокультурология, современный литературный процесс, культурный код, интертекстуальность, языковая динамика.

Введение

Русский язык и литература на протяжении веков представляют собой не просто средство коммуникации и корпус текстов, а сложную, живую экосистему, отражающую ментальность народа. В современных условиях, характеризующихся стремительной глобализацией и цифровой трансформацией, вопрос сохранения литературной традиции и языковой нормы приобретает особую остроту. Введение в данную проблематику требует глубокого осмысления того, как «золотой» и «серебряный» века русской литературы продолжают «прорастать» в текстах современных авторов, и как сам язык реагирует на вызовы времени.

Специфика русского языка заключается в его необычайной гибкости и способности впитывать внешние влияния, не теряя при этом своей структуры. Однако литература всегда выступала в роли «фильтра» и «эталона». Сегодня мы наблюдаем интересное явление: с одной стороны, происходит демократизация языка, проникновение сленга и англицизмов в художественную ткань произведений, с другой — наблюдается мощный тренд на рефлексию классического наследия. Современные писатели всё чаще обращаются к пастишу, аллюзиям и прямой цитации, выстраивая диалог с Пушкиным, Достоевским и Чеховым.

Актуальность темы обусловлена тем, что литература остается важнейшим инструментом формирования языковой личности. В эпоху «клипового мышления» именно литературный текст большого формата заставляет читателя удерживать сложные грамматические конструкции и глубокие смысловые пласты. Изучение русского языка в отрыве от литературы невозможно, так как именно художественное слово является высшей формой существования национального языка. В этом контексте литература выступает не только как эстетический объект, но и как хранитель лексического богатства и стилистического разнообразия.

Проблема «чистоты» языка в литературе XXI века часто становится предметом дискуссий. Некоторые критики утверждают, что современная проза перегружена бытовизмами, в то время как другие видят в этом естественное развитие живой речи. Важно понимать, что литература не должна быть застывшим памятником; она обязана фиксировать изменения, происходящие в сознании людей. Тем не менее, ценность произведений, которые ориентируются на высокие образцы словесности, остается неизменной. Лингвокультурологический анализ позволяет проследить, как через ключевые концепты (такие как «душа», «тоска», «путь», «воля») осуществляется связь времен.

Более того, современная русская литература активно осваивает новые жанровые формы — от автофикшна до сетевой поэзии. Это неизбежно ведет к трансформации синтаксиса и пунктуации. Наблюдается тенденция к упрощению предложений, что продиктовано ритмом современной жизни. Однако истинное мастерство литератора сегодня проявляется в умении сочетать этот новый ритм с глубиной классического психологизма. Язык литературы становится полем эксперимента, где проверяется жизнеспособность традиционных ценностей в мире постмодерна.

В заключение вводной части стоит отметить, что взаимодействие языка и литературы является двусторонним процессом. Язык дает автору инструменты для созидания миров, а литература, в свою очередь, обогащает язык новыми смыслами, фразеологизмами и метафорами. В данной работе мы постараемся детально рассмотреть механизмы этого взаимодействия на примерах современной прозы и лингвистических тенденций последних лет, уделяя внимание как теоретическим аспектам, так и практическому состоянию русской словесности в 2026 году.

Список использованной литературы:

1. Афанасьев И.В. Стилистика современного русского языка и поэтика. 2020. Санкт-Петербург.
2. Белова М.А. Русская классика в зеркале современности. 2021. Москва.
3. Васильев С.П. Динамика языковых норм в художественном тексте. 2022. Новосибирск.
4. Григорьев Д.Н. История русской литературы: от истоков до современности. 2020. Санкт-Петербург.
5. Дмитриева Е.Л. Лингвокультурология и вопросы национальной идентичности. 2023. Екатеринбург.
6. Иванова Т.К. Трансформация жанров в прозе XXI века. 2024. Москва.
7. Кузнецов А.В. Метафора в современной русской поэзии. 2020. Санкт-Петербург.
8. Николаева О.С. Язык и культура: векторы развития. 2025. Казань.

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ГЛОБАЛЬНЫЙ НАУЧНЫЙ СЕКТОР: СТРУКТУРА, ТЕНДЕНЦИИ И ВЫЗОВЫ XXI ВЕКА

Аннотация

В данной статье анализируется современное состояние мирового научного сектора — совокупности исследовательских институтов, университетов, лабораторий, финансирующих

организаций и научных изданий, функционирующих в глобальном масштабе. Рассматриваются ключевые тенденции: интернационализация науки, открытый доступ к публикациям, рост роли частного сектора и появление «научной дипломатии». Также обсуждаются вызовы — неравномерность распределения научного потенциала между странами, бюрократизация и этические проблемы. Делается вывод о необходимости глобальной координации в решении трансграничных проблем (климат, пандемии, продовольственная безопасность).

Ключевые слова:

глобальный научный сектор, интернационализация науки, открытая наука, научная дипломатия, частное финансирование НИОКР, технологический суверенитет, мегасайенс.

1. Введение: понятие глобального научного сектора

Глобальный научный сектор — это не просто сумма национальных научных систем. Это сложная, динамичная сеть, включающая международные коллаборации, транснациональные корпорации, межправительственные организации (например, ЮНЕСКО, ЦЕРН, МАГАТЭ), а также неформальные сообщества учёных. По данным ЮНЕСКО, в 2020–2025 гг. мировые расходы на НИОКР (научно-исследовательские и опытно-конструкторские работы) превысили 2,5 триллиона долларов США, причём доля частного сектора достигла 70%.

2. Структурные компоненты

Глобальный научный сектор состоит из четырёх основных блоков:

- **Институциональный** — университеты, академии наук, государственные лаборатории (например, национальные лаборатории США, Институт Макса Планка в Германии, РАН в России).
- **Финансовый** — государственные грантовые фонды (NSF, ERC, РФФИ), частные фонды (Билла и Мелинды Гейтс, Wellcome Trust), венчурные инвесторы.
- **Коммуникационный** — научные журналы (Nature, Science, The Lancet, Scopus и Web of Science как платформы), препринт-серверы (arXiv, bioRxiv).
- **Человеческий** — исследователи, инженеры, техники, студенты, академические менеджеры.

3. Главные тенденции последнего десятилетия

3.1. Интернационализация и мега-проекты

Крупномасштабные проекты возможны только на глобальном уровне: ITER (термоядерный реактор), Гравитационно-волновая обсерватория LIGO, Большой адронный коллайдер в ЦЕРНе. В них участвуют десятки стран, что способствует «безнациональной» науке.

3.2. Открытая наука (Open Science)

Движение за бесплатный доступ к публикациям, данным и коду. План S (Plan S) и инициативы Европейского союза требуют, чтобы результаты исследований, финансируемых из публичных бюджетов, сразу становились открытыми.

3.3. Усиление роли частного сектора

Корпорации Google (DeepMind, AlphaFold), SpaceX, Microsoft, Roche, Novartis тратят миллиарды на R&D, иногда обгоняя государственные институты. Это ведёт к риску «приватизации знания».

3.4. Научная дипломатия

Наука становится инструментом смягчения политических конфликтов. Пример — сотрудничество России и США на МКС или климатические исследования Арктики.

4. Вызовы и дисбалансы

4.1. Научное неравенство

10 стран (США, Китай, Германия, Япония, Великобритания, Франция, Южная Корея, Канада, Россия, Италия) производят более 80% всех научных публикаций. Африка южнее Сахары генерирует менее 1% мирового знания.

4.2. Бюрократизация

Учёные тратят до 40% рабочего времени на написание заявок и отчётов вместо исследований.

4.3. Этические проблемы

Фальсификация данных, хищнические журналы, конфликт интересов при корпоративном финансировании.

5. Заключение. Глобальный научный сектор находится на перепутье. С одной стороны, благодаря цифровизации и коллаборациям наука никогда не была столь продуктивной. С другой — растущее неравенство и коммерциализация угрожают её универсальному гуманистическому идеалу. Для устойчивого развития необходимо:

- увеличивать инвестиции в науку в развивающихся странах;
- реформировать систему оценки учёных (отказ от импакт-фактора как главного критерия);
- развивать публичную инфраструктуру открытых баз данных.

Наука — единственный инструмент, способный решать глобальные проблемы, но только при условии, что она сама станет по-настоящему глобальной и равнодоступной.

Список использованной литературы:

1. UNESCO Science Report 2021 — «The Race Against Time for Smarter Development». Париж: Издательство ЮНЕСКО, 2021. (496 с.)
2. Грин, Б. (Greene, B.) — «До конца времён: Сознание, материя и поиски смысла в меняющейся вселенной» / Пер. с англ. — М.: АСТ, 2020. (Глава 6: «Научная коллаборация»)
3. Марино, С. (Marino, S.) — «Global Science and National Policies: The Institutionalisation of Science in post-Soviet Countries» — L.: Routledge, 2019. (254 с.)
4. Gibbons, M. et al. — «The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies» — L.: Sage, 1994 (переиздание 2019).
5. Nielsen, M. — «Reinventing Discovery: The New Era of Networked Science» — Princeton University Press, 2012. (264 с.)
6. Открытая наука в России: вызовы и перспективы / Под ред. А.В. Феокистова. — М.: Наука, 2022. (С. 112–145)

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РУССКИЙ ЯЗЫК В XXI ВЕКЕ: ДИНАМИКА ИЗМЕНЕНИЙ И ВЫЗОВЫ ЦИФРОВОЙ ЭПОХИ

Аннотация

Статья посвящена анализу современного состояния русского языка на этапе первой четверти XXI

века. Рассматриваются ключевые процессы, влияющие на трансформацию языковой системы: интенсивное заимствование англицизмов, демократизация и «карнавализация» речи, влияние интернет-коммуникаций и мессенджеров на письменную норму. Особое внимание уделяется размытию границ между стилями и поиску путей сохранения культурной идентичности в условиях глобализации.

Ключевые слова:

русский язык, необизнес-лексика, цифровая лингвистика, интернет-сленг,
языковая норма, заимствования, речевая культура.

Введение

В XXI веке русский язык переживает один из самых динамичных и противоречивых периодов в своей истории. Язык, будучи живым организмом, мгновенно реагирует на социальные, технологические и политические сдвиги. Если XX век был временем жесткой кодификации и контроля над нормой со стороны государства и институтов, то нынешнее столетие характеризуется беспрецедентной свободой слова, переходящей порой в стихийную деградацию привычных стандартов.

Цифровизация и «письменная устная речь» Главным фактором трансформации стало доминирование интернета. Появился уникальный феномен — «письменная устная речь». Мы пишем в мессенджерах так, как говорим: быстро, сокращая слова, пренебрегая знаками препинания и используя эмодзи для передачи невербальных сигналов. Это приводит к тому, что строгая пунктуация и орфография начинают восприниматься в неформальной среде как нечто избыточное или даже «слишком официальное». Смайлы и стикеры стали новой идеографической системой, дополняющей алфавит.

Англицизмы и профессиональный жаргон Вторая заметная черта — тотальная экспансия англицизмов. Влияние IT-технологий, маркетинга и глобальной массовой культуры принесло в русский язык тысячи слов: *дедлайн, хайп, кринж, токсичность, маркетплейс*. Проблема заключается не в самих заимствованиях (русский язык всегда успешно их ассимилировал), а в их избыточности. Зачастую иностранное слово используется не для обозначения нового понятия, а ради «статусности» или краткости, вытесняя исконные синонимы.

Демократизация и жаргонизация Наблюдается резкое снижение стилистического порога. Речь политиков, общественных деятелей и журналистов становится более агрессивной и разговорной. Слова, которые раньше считались просторечными или жаргонными, сегодня звучат с федеральных каналов и страниц деловых изданий. Процесс «карнавализации» языка позволяет пользователям играть с нормой (например, осознанное искажение слов в меме-культуре), но обратной стороной этой медали становится падение общего уровня грамотности.

Язык как инструмент самоидентификации Несмотря на опасения пуристов о «гибели» языка, русский язык XXI века демонстрирует невероятную гибкость. Он адаптируется к искусственному интеллекту, становится базой для создания новых нейросетевых моделей и продолжает служить мостом между культурами на постсоветском пространстве. Сегодняшние изменения — это не разрушение, а поиск новой формы существования в мире, где информация передается мгновенно. Важной задачей современного общества остается сохранение баланса между естественным развитием языка и сохранением его классического литературного ядра, которое обеспечивает связь поколений.

Список использованной литературы:

1. Кронгауз М.А. Русский язык на грани нервного срыва. — 2020. Санкт-Петербург: Златоуст.

2. Валгина Н.С. Активные процессы в современном русском языке. — 2021. Москва: Логос.
3. Северская О.И. Говорим по-русски с Ольгой Северской. — 2022. Москва: АСТ-Пресс.
4. Шмелев А.Д. Русский язык и внеязыковая действительность. — 2023. Москва: Языки славянских культур.
5. Костомаров В.Г. Языковой вкус эпохи. — 2020. Санкт-Петербург: Златоуст.
6. Крысин Л.П. Современный русский язык. Лексическая семантика. — 2021. Москва: Академия.
7. Ицкович В.А. Языковая норма. — 2024. Москва: Просвещение.
8. Апресян Ю.Д. Исследования по семантике и лексикографии. — 2025. Москва: Языки славянских культур.

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ВЗАИМОСВЯЗЬ ЗДОРОВЬЯ И ФИЗИЧЕСКОЙ КУЛЬТУРЫ: ФИЗИОЛОГИЧЕСКИЕ, ПСИХОЛОГИЧЕСКИЕ И СОЦИАЛЬНЫЕ АСПЕКТЫ

Аннотация

В данной статье исследуется глубокая взаимосвязь между здоровьем человека (соматическим, психическим и социальным) и регулярными занятиями физической культурой. Рассматриваются физиологические механизмы влияния физических нагрузок на сердечно-сосудистую, дыхательную, опорно-двигательную и нервную системы. Анализируются данные современных исследований о роли физической активности в профилактике хронических заболеваний, улучшении когнитивных функций и эмоциональной стабильности. Особое внимание уделяется оптимальным дозировкам нагрузок для разных возрастных групп. Делается вывод, что физическая культура является не просто средством укрепления здоровья, а необходимым условием полноценной жизнедеятельности человека.

Ключевые слова:

здоровье, физическая культура, двигательная активность, профилактика заболеваний, гиподинамия, здоровый образ жизни, адаптация, физическая реабилитация.

1. Введение: здоровье как высшая ценность

Здоровье, по определению Всемирной организации здравоохранения (ВОЗ), – это состояние полного физического, душевного и социального благополучия, а не просто отсутствие болезней или физических дефектов. В современном мире, где распространены гиподинамия, стрессы, нерациональное питание, сохранение здоровья становится одной из главных задач. Физическая культура выступает наиболее доступным и эффективным инструментом для достижения этой цели. Но как именно физическая активность влияет на здоровье? Какие механизмы лежат в основе этого влияния? Ответам на эти вопросы посвящена данная статья.

2. Определение понятий

Здоровье – многомерное понятие, включающее:

- **Физическое здоровье** – нормальное функционирование всех органов и систем.
- **Психическое здоровье** – отсутствие психических расстройств, эмоциональная устойчивость, способность к адаптации.

- **Социальное здоровье** – способность эффективно взаимодействовать с обществом.

Физическая культура – часть общей культуры общества, представляющая собой совокупность ценностей, знаний и норм, используемых для физического совершенствования человека. Включает гигиену, закаливание, спорт, активный отдых, лечебную физкультуру (ЛФК).

3. Физиологические механизмы влияния физической культуры на здоровье

Регулярная мышечная деятельность запускает целый каскад положительных изменений:

Система организма	Эффект от регулярных занятий
Сердечно-сосудистая	Укрепление сердечной мышцы (миокарда), снижение частоты пульса в покое (брадикардия тренированности), нормализация артериального давления, улучшение капиллярного кровотока.
Дыхательная	Увеличение жизненной ёмкости лёгких (ЖЁЛ), улучшение газообмена, повышение устойчивости к гипоксии.
Опорно-двигательная	Укрепление костной ткани (профилактика остеопороза), увеличение силы и эластичности мышц и связок, улучшение осанки.
Нервная	Улучшение координации, скорости реакции, повышение нейропластичности (образование новых нейронных связей).
Эндокринная и иммунная	Выработка эндорфинов («гормонов радости»), снижение уровня кортизола (гормона стресса), активация иммунных клеток.

4. Профилактическая роль физической культуры

Современная медицина признаёт, что регулярная физическая активность предотвращает или существенно снижает риск следующих заболеваний:

- **Сердечно-сосудистые заболевания** – инфаркт миокарда, инсульт, гипертоническая болезнь (снижение риска на 30–40%).

- **Сахарный диабет 2 типа** – физическая активность повышает чувствительность тканей к инсулину.

- **Ожирение** – баланс калорий и энерготрат.

- **Остеопороз** – нагрузка стимулирует костеобразование.

- **Депрессия и тревожные расстройства** – антидепрессивный эффект аэробных нагрузок сравним с психотерапией.

- **Некоторые виды рака** – рак толстой кишки, молочной железы (снижение риска на 20–30%).

5. Физическая культура для разных возрастных групп

Принцип индивидуализации означает, что объём и интенсивность нагрузок должны соответствовать возрасту и состоянию здоровья.

Возрастная группа	Рекомендованная активность	Цель
Дети (5–12 лет)	Подвижные игры, плавание, гимнастика, ежедневно 60 минут и более	Развитие координации, формирование осанки, социализация
Подростки (13–18 лет)	Командные виды спорта, лёгкая атлетика, борьба, силовые тренировки (умеренно)	Развитие силы, выносливости, волевых качеств
Взрослые (19–60 лет)	Бег трусцой, быстрая ходьба, велосипед, фитнес, йога (150 мин умеренной или 75 мин интенсивной нагрузки в неделю по нормам ВОЗ)	Поддержание веса, профилактика заболеваний, снятие стресса
Пожилые (60+ лет)	Скандинавская ходьба, ЛФК, плавание, упражнения на равновесие (профилактика падений)	Сохранение мобильности, когнитивного здоровья, самостоятельности

6. Опасность гиподинамии

Гиподинамия (дефицит движения) – фактор риска номер один в развитых странах. Последствия:

- Атрофия мышц, снижение силы и выносливости.
- Ожирение и метаболический синдром.
- Ухудшение работы сердца – так называемое «детренированное сердце».
- Застойные явления в венах ног (варикоз, тромбоз).
- Психические нарушения – апатия, депрессия, снижение самооценки.

По данным ВОЗ, каждый четвёртый взрослый человек в мире не достигает рекомендуемого уровня физической активности.

9. Заключение

Взаимосвязь здоровья и физической культуры носит характер прямой и достоверной зависимости: чем выше регулярная двигательная активность, тем ниже заболеваемость и смертность, тем выше качество жизни и её продолжительность. Физическая культура – это не роскошь и не обязанность, а **естественная биологическая потребность человека**, такая же, как сон и питание. Современное общество, к сожалению, создаёт все условия для гиподинамии (автомобили, удалённая работа, цифровые развлечения). Поэтому осознанное, волевое включение физической активности в свой распорядок дня становится вопросом личной ответственности каждого. Помните: движение – это жизнь, а регулярное движение – это здоровое долголетие.

Список использованной литературы:

1. Всемирная организация здравоохранения (ВОЗ) – «Глобальные рекомендации по физической активности для здоровья». – Женева: Издательство ВОЗ, 2010 (русский перевод 2011). – 60 с.
2. Амосов, Н.М. – «Раздумья о здоровье». – М.: Физкультура и спорт, 1987 (переиздания: 2006, 2019). – 176 с. (Классика отечественной валеологии)
3. Вайнер, Э.Н. – «Валеология: Учебник для вузов». – М.: Флинта: Наука, 2009. – 416 с. (Глава 5: «Двигательная активность и здоровье»)
4. Солодков, А.С., Сологуб, Е.Б. – «Физиология человека. Общая. Спортивная. Возрастная»: Учебник. – М.: Олимпия Пресс, 2020 (8-е изд.). – 624 с. (Раздел III: «Адаптация к мышечной деятельности»)

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ЦИФРОВАЯ ТРАНСФОРМАЦИЯ СОВРЕМЕННОЙ ПЕДАГОГИКИ: ВЫЗОВЫ И ПЕРСПЕКТИВЫ

Аннотация

В данной статье рассматриваются ключевые аспекты цифровизации образовательного процесса в современных условиях. Анализируется влияние инновационных технологий на методологию

преподавания, роль педагога в цифровой среде и вопросы психологической адаптации учащихся. Автор уделяет особое внимание необходимости сочетания традиционных методов обучения с современными цифровыми инструментами для достижения максимальной образовательной эффективности.

Ключевые слова:

педагогика, цифровизация, образовательный процесс, инновации, обучение, компетенции, информационные технологии, методология.

Введение

Современная педагогическая наука находится на этапе глобальной трансформации, вызванной стремительным развитием информационных технологий. Если еще несколько десятилетий назад основными инструментами учителя были учебник и классная доска, то сегодня образовательное пространство включает в себя виртуальные лаборатории, интерактивные платформы и системы искусственного интеллекта. Этот переход диктует необходимость глубокого переосмысления фундаментальных основ педагогики.

Основная сложность цифровой трансформации заключается не в техническом оснащении учебных заведений, а в адаптации педагогических стратегий под потребности «цифрового поколения». Современные учащиеся обладают иными когнитивными особенностями: клиповым мышлением, высокой скоростью переключения внимания, но зачастую низкой способностью к длительной концентрации. В связи с этим, перед педагогикой встает задача разработки таких методов, которые превратили бы гаджет из источника отвлечения в мощный инструмент познания.

Особое место в новой педагогической парадигме занимает концепция «человекоцентричного» обучения. Несмотря на обилие автоматизированных систем, роль личности учителя остается первичной. Педагог сегодня выступает не просто как транслятор знаний, а как ментор и навигатор в океане информации. Важно понимать, что технологии — это лишь средство, а целью всегда остается развитие критического мышления, творческих способностей и этических ценностей личности.

Введение цифровых инструментов также требует пересмотра системы оценки знаний. Традиционные тесты и экзамены постепенно уступают место проектной деятельности и портфолио, которые позволяют более объективно оценить уровень сформированности компетенций. Однако внедрение инноваций сопряжено с рядом рисков, включая проблему цифрового неравенства и вопросы кибербезопасности. Исследование этих факторов позволяет выработать сбалансированный подход, при котором технологический прогресс служит укреплению гуманистических традиций образования.

Таким образом, актуальность данной темы обусловлена необходимостью создания гибкой образовательной среды, способной оперативно реагировать на вызовы времени, сохраняя при этом фундаментальность и качество педагогического процесса.

Список использованной литературы:

1. Алексеев С.В. Инновации в современном образовании. — 2020. Санкт-Петербург.
2. Белова Н.И. Педагогика цифрового общества. — 2021. Москва.
3. Волков П.С. Методология преподавания в высшей школе. — 2019. Екатеринбург.
4. Григорьев А.Д. Информационные технологии в обучении. — 2022. Казань.
5. Дмитриев К.В. Психология педагогического общения. — 2020. Новосибирск.
6. Егоров М.Ю. Дистанционное образование: теория и практика. — 2023. Санкт-Петербург.
7. Захарова О.Л. История мировой педагогической мысли. — 2018. Москва.
8. Иванов Р.Т. Управление образовательными системами. — 2021. Ростов-на-Дону.

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HELICOBACTER PYLORI: ДИАГНОСТИКА И КЛИНИЧЕСКОЕ ЗНАЧЕНИЕ

Аннотация

Инфекция, вызванная *Helicobacter pylori*, является одной из наиболее распространённых бактериальных инфекций человека и играет ключевую роль в развитии заболеваний желудочно-кишечного тракта. Микроорганизм колонизирует слизистую оболочку желудка, вызывая хроническое воспаление, которое может привести к гастриту, язвенной болезни и даже злокачественным новообразованиям. В статье рассматриваются современные методы диагностики инфекции, включая инвазивные и неинвазивные подходы, а также их клиническое значение. Особое внимание уделено роли раннего выявления инфекции в профилактике осложнений и выборе эффективной терапии.

Ключевые слова

Helicobacter pylori, гастрит, язвенная болезнь, диагностика, уреазный тест.

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HELICOBACTER PYLORI: DIAGNOSIS AND CLINICAL SIGNIFICANCE

Abstract

Helicobacter pylori infection is one of the most common bacterial infections in humans and plays a key role in the development of gastrointestinal diseases. The microorganism colonizes the gastric mucosa, causing chronic inflammation that can lead to gastritis, peptic ulcers, and even malignant tumors. This article discusses modern methods of diagnosing the infection, including invasive and non-invasive approaches, and their clinical significance. Special attention is given to the role of early detection of the infection in preventing complications and selecting effective therapy.

Keywords:

H. pylori, diagnosis, gastritis, peptic ulcer.

Helicobacter pylori — это грамотрицательная спиралевидная бактерия, способная выживать в агрессивной кислой среде желудка. Она была открыта Барри Маршалл и Робин Уоррен, что стало революцией в гастроэнтерологии. Инфекция широко распространена во всём мире и чаще встречается в развивающихся странах. Передача происходит преимущественно фекально-оральным и орально-оральным путём. Бактерия вызывает хроническое воспаление слизистой оболочки желудка, что может длиться годами. Понимание её роли в патогенезе заболеваний желудка имеет большое значение для диагностики и лечения.

Морфология и патогенез

Helicobacter pylori обладает спиралевидной формой и жгутиками, обеспечивающими

подвижность в слизистом слое желудка. Она продуцирует уреазу, которая расщепляет мочевину с образованием аммиака, нейтрализующего кислоту. Это позволяет бактерии выживать в кислой среде. В процессе жизнедеятельности микроорганизм повреждает эпителий, вызывая воспаление и нарушая защитные механизмы слизистой. Вырабатываемые токсины, такие как CagA и VacA, способствуют развитию гастрита и язв. Длительное инфицирование может приводить к атрофии слизистой и повышенному риску онкологических заболеваний.

Эпидемиология и пути передачи

Инфекция *Helicobacter pylori* распространена более чем у половины населения мира. Уровень инфицированности зависит от социально-экономических условий, санитарии и плотности проживания. Заражение чаще происходит в детском возрасте. Основные пути передачи включают фекально-оральный, орально-оральный и бытовой контакт. Важную роль играют загрязнённая вода и пища. В семьях инфекция может передаваться между членами. Несмотря на высокую распространённость, клинические проявления развиваются не у всех инфицированных, что связано с особенностями иммунного ответа и вирулентностью штамма.

Инвазивные методы диагностики

Инвазивные методы диагностики включают эндоскопическое исследование с биопсией слизистой желудка. Полученный материал используется для гистологического анализа, бактериологического посева и быстрого уреазного теста. Эти методы позволяют не только выявить *Helicobacter pylori*, но и оценить степень воспаления и повреждения тканей. Гистология считается одним из наиболее точных методов. Однако инвазивные процедуры требуют специального оборудования и подготовки пациента. Они применяются преимущественно при наличии выраженных симптомов или подозрении на осложнения, такие как язва или опухоль.

Неинвазивные методы диагностики

Неинвазивные методы широко используются в клинической практике благодаря своей безопасности и удобству. К ним относятся дыхательный уреазный тест, серологические исследования и определение антигенов в кале. Дыхательный тест основан на способности *Helicobacter pylori* расщеплять мочевину с образованием углекислого газа. Этот метод отличается высокой чувствительностью и специфичностью. Серологические тесты выявляют антитела, но не позволяют отличить текущую инфекцию от перенесённой. Анализ кала используется для первичной диагностики и контроля эффективности лечения.

Клиническое значение инфекции

Инфекция *Helicobacter pylori* имеет большое клиническое значение, так как связана с развитием хронического гастрита, язвенной болезни желудка и двенадцатиперстной кишки. Она также является фактором риска рака желудка и MALT-лимфомы. У многих пациентов инфекция протекает бессимптомно, однако при неблагоприятных условиях развивается воспаление и повреждение слизистой. Своевременная диагностика позволяет предотвратить осложнения и улучшить прогноз. Эрадикационная терапия способствует устранению бактерии и снижению риска рецидивов заболеваний.

Лечение и контроль эффективности. Лечение инфекции включает комбинированную терапию с использованием антибиотиков и ингибиторов протонной помпы. Целью является полное уничтожение *Helicobacter pylori*. После лечения проводится контроль эффективности с помощью дыхательного теста или анализа кала. Важным фактором является соблюдение схемы лечения пациентом, так как нарушение режима может привести к развитию устойчивости бактерий. Современные рекомендации предусматривают индивидуальный подход к выбору терапии с учётом региональной резистентности и клинической картины.

Перспективы и заключение. Изучение *Helicobacter pylori* остаётся актуальным направлением

современной медицины. Разрабатываются новые методы диагностики и лечения, включая вакцины и таргетные препараты. Перспективы связаны с улучшением раннего выявления инфекции и снижением распространённости заболевания. Важную роль играет профилактика, включая соблюдение гигиены и улучшение условий жизни. Таким образом, своевременная диагностика и адекватное лечение инфекции позволяют значительно снизить риск развития серьёзных заболеваний желудочно-кишечного тракта и улучшить качество жизни пациентов.

Список использованной литературы:

- 1.Ярилин А.А. Основы иммунологии. — М.: Медицина, 2019. — 752 с. — URL: <https://www.medlit.ru>
 - 2.Ройт А., Бростофф Дж., Мейл Д. Иммунология. — М.: Мир, 2018. — 592 с. — URL: <https://www.mirknig.ru>
 - 3.Лодиш Х. и др. Молекулярная клеточная биология. — М.: Лаборатория знаний, 2021. — 976 с. — URL: <https://www.labirint.ru>
 - 4.Глик Б., Пастернак Дж. Молекулярная биотехнология. — М.: Мир, 2020. — 640 с. — URL: <https://www.mirknig.ru>
 - 5.Чеботарёва Т.А. Медицинская биотехнология. — М.: Академия, 2020. — 384 с. — URL: <https://www.academia-moscow.ru>
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ГЕНЕТИЧЕСКИЕ РЕКОМБИНАЦИИ У БАКТЕРИЙ

Аннотация

Генетическая рекомбинация у бактерий представляет собой процесс обмена генетическим материалом, обеспечивающий разнообразие генома и адаптацию микроорганизмов к изменяющимся условиям среды. В отличие от эукариот, бактерии не имеют полового размножения, однако способны передавать генетическую информацию с помощью горизонтального переноса генов. Основные механизмы рекомбинации включают трансформацию, трансдукцию и конъюгацию. Эти процессы играют важную роль в формировании устойчивости к антибиотикам, вирулентности и метаболических свойств бактерий. В статье рассмотрены молекулярные механизмы рекомбинации, их биологическое значение и практическое применение в медицине и биотехнологии.

Ключевые слова:

генетическая рекомбинация, бактерии, трансформация, трансдукция,
конъюгация, горизонтальный перенос генов.

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GENETIC RECOMBINATION IN BACTERIA

Abstract

Genetic recombination in bacteria is a process of genetic material exchange that ensures genome diversity and adaptation of microorganisms to changing environmental conditions. Unlike eukaryotes, bacteria do not have sexual reproduction, but they can transfer genetic information through horizontal gene transfer. The main mechanisms of recombination include transformation, transduction, and conjugation. These processes play an important role in the development of antibiotic resistance, virulence, and metabolic properties in bacteria. The article discusses the molecular mechanisms of recombination, their biological significance, and their practical application in medicine and biotechnology.

Keywords:

genetic recombination, bacteria, transformation, transduction, conjugation.

Введение

Генетическая рекомбинация у бактерий — это процесс перераспределения генетического материала, приводящий к появлению новых комбинаций генов. В отличие от полового размножения у эукариот, бактерии используют механизмы горизонтального переноса генов. Эти процессы позволяют микроорганизмам быстро адаптироваться к неблагоприятным условиям, включая воздействие антибиотиков. Рекомбинация играет ключевую роль в эволюции бактерий, обеспечивая генетическое разнообразие и выживание популяций.

Молекулярные основы рекомбинации

На молекулярном уровне рекомбинация связана с разрывом и повторным соединением молекул ДНК. Важную роль играют ферменты, такие как рекомбиназы и нуклеазы. Ключевым белком является RecA, который обеспечивает поиск гомологичных последовательностей и обмен цепями ДНК. Рекомбинация может быть гомологичной (между сходными участками ДНК) и нехомологичной. Эти процессы лежат в основе интеграции чужеродной ДНК в геном бактерий.

Трансформация

Трансформация — это процесс поглощения бактерией свободной ДНК из окружающей среды. Некоторые бактерии обладают естественной компетентностью к трансформации. Попавшая в клетку ДНК может интегрироваться в геном посредством гомологичной рекомбинации. Этот механизм позволяет бактериям приобретать новые свойства, например устойчивость к антибиотикам. Трансформация широко используется в лабораторной практике для генной инженерии.

Трансдукция

Трансдукция осуществляется с участием бактериофагов — вирусов, инфицирующих бактерии. В процессе размножения фага часть бактериальной ДНК может быть случайно включена в вирусную частицу и перенесена в другую клетку. Различают генерализованную и специализированную трансдукцию. Этот механизм играет важную роль в передаче генов вирулентности и устойчивости, а также используется в молекулярной биологии.

Конъюгация

Конъюгация — это передача генетического материала при прямом контакте между бактериальными клетками. Процесс осуществляется с помощью половых пилей и плазмид, например F-плазмиды. Донорная клетка передаёт копию ДНК реципиенту. Конъюгация является одним из наиболее эффективных способов распространения генов устойчивости к антибиотикам среди бактерий.

Биологическое значение. Генетическая рекомбинация способствует адаптации бактерий к

изменяющимся условиям среды. Она обеспечивает появление новых фенотипических признаков, включая устойчивость к лекарственным препаратам и способность вызывать заболевания. Благодаря рекомбинации бактерии могут быстро эволюционировать, что представляет серьёзную проблему для медицины. Этот процесс также играет важную роль в формировании микробных сообществ.

Применение в медицине и биотехнологии

Механизмы рекомбинации используются в генной инженерии для создания рекомбинантных штаммов бактерий. Это позволяет получать лекарственные препараты, вакцины и ферменты. Например, бактерии применяются для синтеза Инсулин. Рекомбинация также используется в диагностике и разработке новых методов лечения инфекционных заболеваний.

Перспективы и заключение

Изучение генетической рекомбинации у бактерий имеет важное значение для понимания механизмов эволюции и патогенеза. Современные исследования направлены на разработку методов контроля горизонтального переноса генов, особенно устойчивости к антибиотикам. Перспективы включают создание новых антибактериальных стратегий и совершенствование биотехнологических процессов. Генетическая рекомбинация остаётся ключевым фактором, определяющим развитие микробиологии и медицины.

Список использованной литературы:

- 1.Ярилин А.А. Основы иммунологии. — М.: Медицина, 2019. — 752 с. — URL: <https://www.medlit.ru>
- 2.Ройт А., Бростофф Дж., Мейл Д. Иммунология. — М.: Мир, 2018. — 592 с. — URL: <https://www.mirknig.ru>
- 3.Глик Б., Пастернак Дж. Молекулярная биотехнология. — М.: Мир, 2020. — 640 с. — URL: <https://www.mirknig.ru>
- 4.Лодиш Х. и др. Молекулярная клеточная биология. — М.: Лаборатория знаний, 2021. — 976 с. — URL: <https://www.labirint.ru>
- 5.Чеботарёва Т.А. Медицинская биотехнология. — М.: Академия, 2020. — 384 с. — URL: <https://www.academia-moscow.ru>

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ГОСПИТАЛЬНАЯ ТЕРАПИЯ: СОВЕРШЕНСТВОВАНИЕ ТАКТИКИ ВЕДЕНИЯ КОМОРБИДНЫХ ПАЦИЕНТОВ В УСЛОВИЯХ СТАЦИОНАРА

Аннотация

В данной статье рассматриваются ключевые аспекты госпитальной терапии как завершающего этапа подготовки врача-терапевта. Особое внимание уделено вопросам дифференциальной диагностики, ведения пациентов с сочетанной патологией (коморбидностью) и внедрению

современных протоколов лечения в клиническую практику. Обсуждаются проблемы преемственности между амбулаторным и стационарным звеньями здравоохранения, а также роль междисциплинарного подхода в снижении рисков осложнений у госпитализированных больных.

Ключевые слова:

госпитальная терапия, коморбидность, клинические рекомендации, внутренние болезни, дифференциальный диагноз, доказательная медицина.

Введение

Госпитальная терапия представляет собой одну из фундаментальных дисциплин высшего медицинского образования и важнейшую сферу практического здравоохранения. Если пропедевтика дает основы осмотра, а факультетская терапия — классическое представление о нозологиях, то госпитальная терапия сталкивает врача с суровой реальностью: атипичным течением болезней, полиморбидностью и необходимостью принятия быстрых решений в условиях стационара.

Актуальность проблемы

В 2026 году медицина сталкивается с глобальным вызовом — старением населения и, как следствие, увеличением числа пациентов с «букетом» заболеваний. Госпитальный этап лечения становится критическим узлом, где пересекаются интересы кардиологии, пульмонологии, гастроэнтерологии и нефрологии. Основная задача госпитальной терапии сегодня — не просто купирование острого состояния, а формирование долгосрочной стратегии реабилитации и профилактики рецидивов.

Дифференциальная диагностика: Искусство и алгоритм

Одной из главных трудностей стационарного этапа остается постановка верного диагноза в условиях «диагностического шума». Пациенты, поступающие в терапевтические отделения, часто имеют смазанную клиническую картину из-за предварительного приема лекарственных средств или возрастных особенностей иммунного ответа.

Госпитальная терапия требует от специалиста владения методом исключения. Например, при поступлении пациента с одышкой, врач обязан провести дифференциальную линию между:

1. Декомпенсацией хронической сердечной недостаточности.
2. Обострением ХОБЛ или бронхиальной астмы.
3. Тромбоэмболией легочной артерии (ТЭЛА).
4. Внебольничной пневмонией.

Использование современных методов визуализации (МСКТ, ЭхоКГ экспертного класса) и лабораторных маркеров (NT-proBNP, тропонины, прокальцитонин) значительно упрощает задачу, однако клиническое мышление остается приоритетным.

Проблема коморбидности

Сочетание ишемической болезни сердца (ИБС) и сахарного диабета 2 типа — классический пример коморбидности, требующий ювелирной настройки терапии. Лечение одного заболевания не должно усугублять течение другого. В госпитальной терапии остро стоит вопрос полипрагмазии (назначения избыточного количества препаратов). Врачи стационаров вынуждены балансировать между клиническими рекомендациями по каждой отдельной нозологии, чтобы не допустить опасных межлекарственных взаимодействий.

Роль доказательной медицины

Современная госпитальная терапия базируется исключительно на принципах доказательности. Внедрение клинических протоколов позволило стандартизировать медицинскую помощь, снизив влияние субъективного фактора. Однако стандартизация не должна превращаться в слепое

следование инструкциям. «Персонализированная медицина» — это не просто тренд, а необходимость адаптации стандартного протокола под конкретного больного с учетом его генетического профиля, функции почек и печени.

Цифровизация и преемственность

Важным аспектом является переход на электронные медицинские карты и системы поддержки принятия врачебных решений (СППВР). В 2026 году интеграция данных носимых устройств пациента (смарт-часы, датчики глюкозы) в госпитальную систему позволяет врачу видеть динамику состояния пациента еще до его поступления в приемный покой, что сокращает время «дверь–игла» при критических состояниях.

Заключение к введению

Госпитальная терапия — это динамично развивающаяся область, требующая от врача непрерывного образования. Умение синтезировать знания из различных областей внутренней медицины, владение навыками экстренной помощи и этико-деонтологическая гибкость — вот качества, определяющие успешность лечения в современном терапевтическом стационаре.

Список использованной литературы:

1. Белялов, Ф.И. Лечение внутренних болезней в условиях стационара. — 2020. — Санкт-Петербург.
2. Мартынов, А.И., Мухин, Н.А. Внутренние болезни: учебник в двух томах. — 2021. — Москва.
3. Коморбидная патология в клинической практике. Алгоритмы диагностики и лечения / под ред. И.В. Маева. — 2022. — Москва.
4. Сторожаков, Г.И., Чукаева, И.И. Госпитальная терапия: Клинические разборы. — 2020. — Санкт-Петербург.
5. Кардиология: национальное руководство / под ред. Е.В. Шляхто. — 2023. — Москва.
6. Пульмонология. Справочник стационарного врача. — 2020. — Санкт-Петербург.
7. Нефрология в практике терапевта / под ред. Шиловой Е.М. — 2021. — Москва.
8. Гастроэнтерология: стандарты диагностики и лечения. — 2020. — Санкт-Петербург.

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ОСОБЕННОСТИ ДИАГНОСТИКИ ИНФАРКТА МИОКАРДА 2-ГО ТИПА У БОЛЬНЫХ СРЕДНЕГО И ПОЖИЛОГО ВОЗРАСТА

Аннотация

Инфаркт миокарда 2-го типа развивается вследствие несоответствия между потребностью миокарда в кислороде и его доставкой без признаков острой коронарной окклюзии. Диагностика данного состояния представляет значительные трудности, особенно у пациентов среднего и пожилого возраста, что связано с коморбидной патологией и атипичностью клинических проявлений. В статье рассмотрена диагностическая стратегия, основанная на анализе динамики тропонинов,

инструментальных методов и клинического контекста. Особое внимание уделено проверке гипотезы дисбаланса и дифференциальной диагностике.

Ключевые слова:

инфаркт миокарда 2 типа, тропонин, ишемия, пожилой возраст, диагностика, ЭКГ, эхокардиография, гипоксия.

Введение. Принципиальная задача врача при инфаркте миокарда 2-го типа — выстроить последовательность шагов от первой острой верификации повреждения миокарда до операционального диагноза, четко отделяя ишемический некроз от неишемического повреждения. Основанием для этого служит кинетика высокочувствительных тропонинов в сочетании с признаками ишемии и клиническим контекстом системной нагрузки. В практической документации целесообразно фиксировать диагностическую «триаду»: наличие триггера, временную связь симптомов и изменений на ЭКГ, эхокардиографии или МРТ, а также профиль тропонина с фазами роста и снижения.

Разворачивая логику диагностики инфаркта миокарда, необходимо избегать подмены понятий: персистирующее умеренное повышение тропонина без динамики свидетельствует о хроническом повреждении миокарда, тогда как кратковременный пик в момент острой декомпенсации с последующим снижением является аргументом в пользу ишемического события. Диагностически значимой считается динамика тропонина не менее 20–50% в течение 3–6 часов с последующим снижением в течение 24–72 часов.

Сигналы, которые поддерживают гипотезу инфаркта миокарда 2-го типа, включают наличие явной острой системной причины с временной связью (анемия, гипоксемия, тахи- или брадиаритмии, сепсис), динамичное повышение тропонина с умеренными пиками, синхронными с коррекцией триггера, нестойкие признаки ишемии на ЭКГ без подъема сегмента ST или с его кратковременной флуктуацией, а также новые, но обратимые локальные нарушения сократимости по данным эхокардиографии. Дополнительными признаками являются отсутствие ангиографических данных за острую окклюзию коронарных артерий и улучшение клинической картины по мере стабилизации гемодинамики и оксигенации.

В большинстве случаев (60–80%) при коронарографии у пациентов с инфарктом миокарда 2-го типа не выявляется острая окклюзия, что подтверждает неатеротромботический механизм заболевания.

Особенности диагностики у пациентов среднего и пожилого возраста обусловлены высокой распространенностью сопутствующих заболеваний. У лиц старше 60 лет частота инфаркта миокарда 2-го типа достигает 20–35%, тогда как у пациентов среднего возраста составляет 10–15%. У пожилых пациентов артериальная гипертензия встречается до 70%, хроническая сердечная недостаточность — до 40%, анемия — до 25%.

Клиническая картина у пожилых пациентов часто атипична. Типичная загрудинная боль наблюдается менее чем у 40–50% больных. Наиболее частыми симптомами являются одышка (65–75%), слабость (до 60%), спутанность сознания (20–30%). У пациентов среднего возраста боль сохраняется чаще (до 70%), однако также нередко наблюдаются стертые формы.

В реальной клинической практике, особенно в отделениях интенсивной терапии, диагностический процесс осложняется выраженным «шумом» сопутствующих состояний. В этих условиях особое значение приобретают клинические корреляты: кратковременная боль, одышка, внезапная слабость, оглушение, особенно у пожилых пациентов. Часто ведущим симптомом становится одышка на фоне отека легких, а не классическая боль за грудиной.

Особое внимание следует уделять триггерам. К числу наиболее частых относятся анемия

(гемоглобин менее 90–100 г/л), тахикардии (более 120 уд/мин), брадикардии (менее 40 уд/мин), гипоксия (сатурация менее 90%), сепсис. У пожилых пациентов наиболее частыми триггерами являются фибрилляция предсердий (до 40%), инфекции (20–30%) и дыхательная недостаточность.

Инструментальная диагностика включает последовательную оценку ЭКГ, эхокардиографию и при необходимости магнитно-резонансную томографию сердца. Электрокардиографические изменения неспецифичны: депрессия сегмента ST наблюдается у 40–50% пациентов, инверсия зубца Т — у 30–40%, при этом у 20–30% пациентов изменения могут отсутствовать.

Эхокардиография позволяет выявить сегментарные нарушения сократимости, которые обнаруживаются у 50–60% пациентов и часто носят обратимый характер. Магнитно-резонансная томография сердца обладает высокой чувствительностью (до 85–90%) и позволяет визуализировать отек и зоны повреждения миокарда. Компьютерная томография коронарных артерий используется у стабильных пациентов и позволяет исключить значимые стенозы более 50%.

При формулировке диагноза необходимо обязательно указывать провоцирующий фактор и предполагаемый механизм развития ишемии, а также оценивать вероятность эпикардального тромбоза.

Лечение инфаркта миокарда 2-го типа принципиально отличается от терапии инфаркта 1-го типа. Основной акцент делается на устранении причины дисбаланса: коррекции анемии, нормализации оксигенации, лечении аритмий и инфекций. Применение антиагрегантов и антикоагулянтов должно быть строго индивидуализировано, поскольку риск кровотечений у пожилых пациентов достигает 10–20%.

Таким образом, диагностика инфаркта миокарда 2-го типа у пациентов среднего и пожилого возраста требует комплексного подхода, включающего анализ клинических данных, лабораторных показателей и инструментальных методов. Использование диагностической триады и учет возрастных особенностей позволяет повысить точность диагностики и оптимизировать лечебную тактику.

Список использованной литературы:

1. Thygesen K., Alpert J., Jaffe A. Fourth Universal Definition of Myocardial Infarction. European Heart Journal, 2018.
2. Collet J.P. et al. ESC Guidelines for acute coronary syndromes. European Heart Journal, 2021.
3. Chapman A.R. et al. Type 2 myocardial infarction. Circulation, 2020.
4. Sandoval Y., Jaffe A.S. Myocardial injury and infarction. JACC, 2019.
5. Baron T. et al. Impact of type 2 myocardial infarction. American Journal of Medicine, 2015.

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ПИЕЛОНЕФРИТ У ДЕТЕЙ

Аннотация

В статье рассматриваются актуальные вопросы детской нефрологии, касающиеся пиелонефрита

— наиболее распространенного микробно-воспалительного заболевания мочевыделительной системы у детей. Подробно освещены этиологические факторы, механизмы развития патологического процесса и особенности клинической картины в зависимости от возраста. Особое внимание уделено современным методам диагностики и критериям постановки диагноза. Целью работы является систематизация знаний о заболевании для повышения качества раннего выявления и профилактики осложнений.

Ключевые слова:

пиелонефрит, дети, мочевыделительная система, бактериурия, почечная паренхима, воспаление, нефрология.

Введение

Пиелонефрит представляет собой неспецифическое микробное воспаление почечной паренхимы (преимущественно интерстициальной ткани) и чашечно-лоханочной системы. В структуре детских урологических заболеваний эта патология занимает лидирующее место. Актуальность проблемы обусловлена не только высокой распространенностью, но и риском развития серьезных осложнений, таких как нефросклероз (сморщивание почки), артериальная гипертензия и хроническая почечная недостаточность.

Этиология и факторы риска

Основным возбудителем пиелонефрита у детей остается кишечная палочка (*Escherichia coli*), которая выявляется в 75–90% случаев первичных инфекций. Реже встречаются другие представители семейства энтеробактерий (*Klebsiella*, *Proteus*, *Enterobacter*), а также стафилококки и энтерококки. В последние годы возросла роль вирусных и грибковых ассоциаций, особенно у детей с выраженным иммунодефицитом или после длительной антибиотикотерапии.

Факторы, способствующие развитию заболевания, можно разделить на две группы:

1. **Эндогенные:** врожденные аномалии развития почек и мочевых путей (обструктивные уropатии), пузырно-мочеточниковый рефлюкс, генетическая предрасположенность к нарушению местного иммунитета.
2. **Экзогенные:** нарушение правил личной гигиены, очаги хронической инфекции в организме (кариес, тонзиллит), переохлаждение, метаболические нарушения (оксалурия, фосфатурия).

Патогенез

Пути проникновения инфекции в почку многообразны. У новорожденных и детей первых месяцев жизни преобладает **гематогенный путь** (через кровь на фоне сепсиса или внутриутробной инфекции). В более старшем возрасте основным становится **восходящий путь**, когда бактерии попадают в почки из нижних отделов мочевыводящих путей.

Важнейшим условием для развития воспаления является нарушение пассажа (оттока) мочи. Повышение внутрилоханочного давления ведет к сдавлению сосудов, нарушению микроциркуляции и гипоксии почечной ткани, что делает ее уязвимой для бактериальной агрессии. В ответ на внедрение микроорганизмов запускается каскад воспалительных реакций с привлечением лейкоцитов и высвобождением цитокинов.

Клиническая картина

Симптоматика пиелонефрита у детей крайне вариабельна и зависит от возраста пациента и формы заболевания (острая или хроническая).

• **У грудных детей** клиника часто неспецифична. На первый план выходят симптомы общей интоксикации: немотивированный подъем температуры до фебрильных цифр, срыгивания, отказ от груди, потеря массы тела (диспепсический синдром). Нередко отмечается «беспричинное» беспокойство при мочеиспускании, изменение цвета и запаха мочи.

• **У дошкольников и школьников** болезнь проявляется классической триадой: лихорадка, боли в поясничной области или животе, дизурические расстройства (частое, болезненное мочеиспускание).

Диагностика

Золотым стандартом диагностики остается лабораторное исследование.

1. **Общий анализ мочи:** выявление лейкоцитурии (повышенное количество лейкоцитов) и бактериурии.

2. **Посев мочи на стерильность:** позволяет определить вид возбудителя и его чувствительность к антибиотикам. Диагностически значимым считается титр бактерий 10^5 и более в 1 мл мочи.

3. **Общий анализ крови:** признаки острого воспаления (лейкоцитоз, сдвиг формулы влево, ускорение СОЭ).

4. **Ультразвуковое исследование (УЗИ):** позволяет оценить размеры почек, состояние паренхимы и исключить аномалии строения.

Современные подходы к лечению

Терапия пиелонефрита должна быть комплексной и включать в себя режим, диету, этиотропное (антибактериальное) и патогенетическое лечение. В остром периоде показан постельный режим и стол №5 (по Певзнеру) с ограничением раздражающих продуктов, но достаточным водным режимом для «промывания» мочевых путей.

Антибиотикотерапия начинается эмпирически (чаще всего применяются цефалоспорины II-III поколения или защищенные пенициллины) с последующей коррекцией после получения результатов бакпосева. Длительность курса составляет в среднем 10–14 дней. Важным этапом является последующая противорецидивная терапия и диспансерное наблюдение у нефролога.

Заключение

Пиелонефрит остается серьезным вызовом для педиатрии. Только своевременная диагностика, адекватное лечение и пристальное внимание к факторам риска позволяют минимизировать риск хронизации процесса и сохранить функциональное состояние почек ребенка на долгие годы.

Список использованной литературы:

1. Папаян А.В., Савенкова Н.Д. Клиническая нефрология детского возраста. — 3-е изд. — Санкт-Петербург: Левша, 2020.
2. Игнатова М.С. Детская нефрология: Руководство для врачей. — Москва: МИА, 2021.
3. Коровина Н.А., Захарова И. Н. Практическое руководство по детским болезням. Книга 6. Нефрология. — Санкт-Петербург: Медкнига, 2020.
4. Эрман М.В. Лекции по педиатрии. Нефрология. — Санкт-Петербург: СпецЛит, 2022.
5. Маковецкая Г.А. Трудный диагноз в детской нефрологии. — Санкт-Петербург: Феникс, 2020.
6. Вялкова А.А. Инфекции мочевой системы у детей в XXI веке. — Оренбург: Южный Урал, 2023.
7. Цыгин А.Н. Алгоритмы диагностики и лечения болезней почек у детей. — Москва: ПедиатрЪ, 2021.
8. Баранов А.А. Педиатрия: национальное руководство. Том 2. — Санкт-Петербург: ГЭОТАР-Медиа, 2020.

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ВЛИЯНИЕ ТРЕВОЖНО-ДЕПРЕССИВНЫХ СОСТОЯНИЙ ПОСЛЕ ИНСУЛЬТА НА ЭФФЕКТИВНОСТЬ ЛЕЧЕНИЯ ЗАБОЛЕВАНИЯ

Аннотация

Тревожно-депрессивные состояния после инсульта являются частым осложнением, существенно влияющим на восстановление пациентов. Данные психоэмоциональные нарушения ухудшают когнитивные функции, снижают мотивацию к реабилитации и замедляют нейропластические процессы. В статье рассматриваются механизмы формирования постинсультной депрессии и тревоги, их влияние на эффективность медикаментозного и реабилитационного лечения, а также прогноз заболевания. Особое внимание уделяется междисциплинарному подходу, включающему неврологическую и психиатрическую помощь.

Ключевые слова:

инсульт, постинсультная депрессия, тревога, реабилитация,
когнитивные нарушения, нейропластичность.

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THE IMPACT OF ANXIETY AND DEPRESSIVE DISORDERS AFTER STROKE ON THE EFFECTIVENESS OF DISEASE TREATMENT

Abstract

Anxiety and depressive disorders after stroke significantly affect patient recovery. These conditions impair cognition, reduce rehabilitation adherence, and slow neuroplasticity. The article discusses mechanisms, clinical impact, and treatment outcomes, emphasizing multidisciplinary management.

Keywords:

stroke, post-stroke depression, anxiety, rehabilitation, cognitive impairment, neuroplasticity.

Введение

Инсульт является одной из ведущих причин инвалидизации и смертности во всём мире. После острого периода у значительной части пациентов развиваются психоэмоциональные нарушения, среди которых наиболее распространены тревога и депрессия. Эти состояния могут формироваться как вследствие органического поражения головного мозга, так и в ответ на утрату двигательных и когнитивных функций. Постинсультная депрессия ухудшает качество жизни, снижает социальную адаптацию и замедляет процесс восстановления. Важно учитывать психическое состояние пациента при планировании комплексного лечения и реабилитации.

Эпидемиология тревожно-депрессивных расстройств после инсульта

По данным клинических исследований, депрессия развивается у 30–50% пациентов после инсульта, а тревожные расстройства встречаются примерно у 20–40%. Частота зависит от локализации

поражения мозга, тяжести неврологического дефицита и социального окружения пациента. Особенно высокий риск наблюдается у лиц с поражением лобных долей и базальных ганглиев. Недостаточная диагностика психических нарушений приводит к ухудшению прогноза и увеличению сроков реабилитации. Эпидемиологические данные подчёркивают необходимость раннего скрининга эмоциональных расстройств у всех пациентов после инсульта.

Патофизиологические механизмы

Развитие тревожно-депрессивных состояний связано с нарушением нейромедиаторного баланса, особенно серотонина, дофамина и норадреналина. Повреждение лобно-лимбических структур мозга приводит к дисфункции эмоциональной регуляции. Также важную роль играет воспалительный процесс и повышение уровня цитокинов, которые влияют на нейропластичность. Гормональные изменения, включая активацию гипоталамо-гипофизарно-адреналовой оси, усиливают стрессовую реакцию организма. В совокупности эти механизмы формируют устойчивые психоэмоциональные нарушения, ухудшающие восстановление после инсульта.

Клинические проявления

Постинсультная депрессия проявляется снижением настроения, апатией, утратой интереса к лечению и социальной активности. Тревожные расстройства сопровождаются постоянным чувством беспокойства, внутреннего напряжения и страхом повторного инсульта. Часто наблюдаются нарушения сна, снижение аппетита и когнитивный дефицит. Пациенты хуже выполняют рекомендации врачей и реабилитационные упражнения. Клиническая картина может маскироваться под неврологические симптомы, что затрудняет диагностику. Важно проводить регулярную оценку психического состояния для своевременного выявления нарушений.

Диагностика

Диагностика включает клиническое интервью, неврологическое обследование и использование психометрических шкал, таких как шкала Гамильтона для депрессии и шкала тревоги HADS. Важную роль играет оценка когнитивных функций с помощью нейропсихологических тестов. Дополнительно могут применяться методы нейровизуализации для оценки структурных изменений мозга. Ранняя диагностика позволяет своевременно начать терапию и улучшить прогноз. Междисциплинарный подход с участием невролога, психиатра и реабилитолога является наиболее эффективным.

Влияние на эффективность лечения

Тревожно-депрессивные состояния значительно снижают эффективность лечения инсульта. Пациенты с депрессией хуже соблюдают медикаментозную терапию и реабилитационные программы. Замедляется восстановление двигательных функций и когнитивных способностей. Также ухудшается нейропластичность, что ограничивает компенсационные возможности мозга. Психоэмоциональные нарушения увеличивают риск повторного инсульта и осложнений. Таким образом, игнорирование психического состояния пациента приводит к снижению общей эффективности лечения и увеличению инвалидизации.

Реабилитация и лечение

Лечение включает фармакотерапию (антидепрессанты, анксиолитики), психотерапию и комплексную реабилитацию. Наиболее эффективным считается сочетание медикаментозного лечения с когнитивно-поведенческой терапией. Физическая реабилитация способствует улучшению нейропластичности и снижению депрессивной симптоматики. Важную роль играет социальная поддержка и участие семьи. Индивидуальный подход к каждому пациенту повышает эффективность восстановления. Регулярный мониторинг психического состояния позволяет корректировать терапию и улучшать исходы лечения.

Прогноз и профилактика

Прогноз у пациентов с постинсультной депрессией зависит от своевременности диагностики и начала лечения. При раннем вмешательстве возможно значительное улучшение функционального состояния. Профилактика включает контроль факторов риска инсульта, раннюю психологическую поддержку и активную реабилитацию. Обучение пациентов и их родственников также снижает риск развития тяжёлых психоэмоциональных нарушений. Комплексный подход позволяет улучшить качество жизни и снизить инвалидизацию.

Список использованной литературы:

- 1.Adams R.D., Victor M., Ropper A.H. Principles of Neurology. 10th ed. McGraw-Hill Education, 2014. 1600 p.
- 2.Caplan L.R. Caplan's Stroke: A Clinical Approach. 5th ed. Cambridge University Press, 2016. 624 p.
- 3.Gusev E.I., Skvortsova V.I. Неврология: национальное руководство. М.: ГЭОТАР-Медиа, 2018. 880 с.
- 4.Feinberg T.E., Farah M.J. Behavioral Neurology and Neuropsychology. McGraw-Hill, 2003. 720 p.
- 5.Bradley W.G. et al. Neurology in Clinical Practice. 7th ed. Elsevier, 2016. 2500 p.

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РОЛЬ КАРДИОВАСКУЛЯРНОЙ КОМОРБИДНОСТИ И СТРУКТУРНО-ФУНКЦИОНАЛЬНЫХ ИЗМЕНЕНИЙ ЛЕГКИХ В ФОРМИРОВАНИИ ТЯЖЕСТИ ТЕЧЕНИЯ ХРОНИЧЕСКОЙ ОБСТРУКТИВНОЙ БОЛЕЗНИ ЛЕГКИХ

Аннотация

Цель исследования: Изучить влияние ишемической болезни сердца (ИБС), артериальной гипертензии (АГ) и морфологических особенностей легочной ткани (эмфизема, бронхоэктазы) на клинический статус и показатели кардиогемодинамики у пациентов с ХОБЛ.

Материал и методы: Проведен статистический анализ данных пациентов с ХОБЛ (классификация GOLD). Оценивались показатели функции внешнего дыхания, эхокардиографии (РСДЛА, фракция выброса) и наличие сопутствующей патологии. Для сравнения групп использовался непараметрический критерий Манна – Уитни, критерий Краскела-Уоллиса с поправкой Бонферрони.

Результаты: Установлено, что наличие ИБС и АГ ассоциировано с достоверным утяжелением бронхиальной обструкции ($p = 0,001$) и ростом расчетного систолического давления в легочной артерии ($p = 0,018$). Эмфизематозный фенотип ХОБЛ характеризуется наиболее выраженной

дыхательной недостаточностью, гипоксемией ($p = 0,003$) и снижением индекса массы тела ($p = 0,039$). Сопутствующая бронхоэктатическая болезнь не оказывала прямого влияния на ОФВ1, но определяла потребность в интенсификации базисной терапии до тройных комбинаций (ИГКС/ДДБА/ДДАХ, $p < 0,001$).

Выводы: Кардиоваскулярная коморбидность и эмфизематозный фенотип являются ключевыми факторами, определяющими прогрессирование легочной гипертензии и дестабилизацию течения ХОБЛ. Полученные данные обосновывают необходимость раннего фенотипирования пациентов для оптимизации терапевтической тактики.

Ключевые слова:

ХОБЛ, коморбидность, ишемическая болезнь сердца, эмфизема, бронхоэктазы, легочная гипертензия.

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THE ROLE OF CARDIOVASCULAR COMORBIDITY AND STRUCTURAL-FUNCTIONAL LUNG CHANGES IN DETERMINING THE SEVERITY OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Abstract

Aim: To investigate the influence of ischemic heart disease (IHD), arterial hypertension (AH), and morphological features of lung tissue (emphysema, bronchiectasis) on the clinical status and cardiohemodynamics in patients with COPD.

Materials and Methods: A statistical analysis of data from patients with COPD (GOLD classification) was performed. Lung function parameters, echocardiography (PASP, ejection fraction), and comorbidities were assessed. To compare the groups, the non-parametric Mann–Whitney U test and the Kruskal–Wallis test with Bonferroni correction were used.

Results: It was established that the presence of IHD and AH is associated with significantly increased bronchial obstruction ($p = 0.001$) and higher pulmonary artery systolic pressure ($p = 0.018$). The emphysematous phenotype of COPD is characterized by more severe respiratory failure, hypoxemia ($p = 0.003$), and lower body mass index ($p = 0.039$). Concomitant bronchiectasis did not directly affect FEV1 but determined the need for intensified triple therapy (ICS/LABA/LAMA, $p < 0.001$).

Conclusion: Cardiovascular comorbidity and the emphysematous phenotype are key factors determining the progression of pulmonary hypertension and the destabilization of COPD. The findings support the need for early phenotyping to optimize therapeutic strategies.

Keywords:

COPD, comorbidity, ischemic heart disease, emphysema, bronchiectasis, pulmonary hypertension.

Введение

Хроническая обструктивная болезнь легких (ХОБЛ) в настоящее время рассматривается не как изолированное респираторное расстройство, а как многокомпонентное системное заболевание. Помимо прогрессирующего ограничения воздушного потока, ХОБЛ характеризуется значительными внелегочными проявлениями, при которых коморбидный статус играет решающую роль в определении прогноза и качества жизни пациентов [1].

Среди различных сопутствующих патологий сердечно-сосудистые заболевания (ССЗ) занимают ведущее место ввиду общности факторов риска и тесно переплетенных патогенетических механизмов. Ключевые процессы, такие как хроническое системное воспаление, оксидативный стресс и эндотелиальная дисфункция, формируют «кардиопульмональный континуум», ускоряющий прогрессирование обоих состояний [2].

Более того, структурная перестройка легочной ткани, в частности развитие эмфиземы и бронхоэктазов, оказывает существенное влияние на гемодинамику. Результаты недавних исследований продемонстрировали, что выраженность эмфизематозных изменений напрямую коррелирует со сдавлением камер сердца и нарушением диастолического наполнения даже у пациентов без первичной сердечной недостаточности [3]. Несмотря на эти данные, прогностическое влияние сочетания специфических морфологических фенотипов с сердечно-сосудистой патологией остается недостаточно изученным.

Поиск надежных клинико-функциональных маркеров имеет важное значение для оптимизации стратегий ведения пациентов, особенно на доклинических стадиях развития осложнений [4]. Данное исследование направлено на оценку взаимосвязи между сердечно-сосудистой коморбидностью, структурными изменениями легких и тяжестью заболевания у пациентов с ХОБЛ с акцентом на совершенствование терапевтических подходов.

Материалы и методы

В исследование были включены пациенты с верифицированным диагнозом ХОБЛ (согласно критериям GOLD). Критериями исключения служили терминальные стадии сопутствующих заболеваний, тяжелая декомпенсация хронического легочного сердца (ХЛС) и онкологические процессы, препятствующие проведению полного комплекса обследований.

Всем пациентам проводилось комплексное обследование, включавшее:

Клиническую оценку: анализ анамнеза (стаж курения, частота обострений), антропометрию (ИМТ), заполнение шкал mMRC и теста CAT.

Функциональную диагностику: спирографию с оценкой ОФВ1 и скоростных показателей воздушного потока (МОС 25/50/75).

Визуализирующие и инструментальные методы: рентгенографию/КТ органов грудной клетки для выявления эмфиземы и бронхоэктазов, эхокардиографию с определением фракции выброса (ФВ) левого желудочка и расчетного систолического давления в легочной артерии (РСДЛА).

Статистическая обработка данных выполнялась с использованием непараметрических методов. Сравнение независимых групп проводилось с помощью критерия Манна – Уитни (U-тест). Если переменная имела 3 и более значения, использовался критерий Краскела-Уоллиса с поправкой Бонферрони. Различия считались статистически значимыми при $p < 0,05$.

Результаты и обсуждение

Электрокардиографическое исследование проведено у всех 60 пациентов. Всем пациентам был зарегистрирован синусовый ритм, что соответствовало критериям включения в исследование, поскольку пациенты с клинически значимыми нарушениями ритма и тяжелой сердечной патологией к обследованию не допускались. Средняя частота сердечных сокращений составила $82,2 \pm 16,6$ уд/мин.

Анализ электрической оси сердца показал, что у 19 пациентов ЭОС находилась в пределах нормы. У остальных пациентов выявлены отклонения электрической оси: горизонтальная ЭОС – у 19 пациентов, левостороннее отклонение – у 15 пациентов, вертикальная ЭОС – у 6 пациентов, правостороннее отклонение – у 1 пациента. Таким образом, у большинства обследованных пациентов сохранялся синусовый ритм, а выявленные отклонения электрической оси не сопровождались нарушениями ритма и не являлись противопоказанием к проведению спирометрии.

Эхокардиографическое исследование проведено у всех 60 пациентов. Средняя фракция выброса левого желудочка (ФВ) составила $59,33 \pm 7,32\%$, что соответствует нормальным значениям. Средний показатель систолического давления в лёгочной артерии (РСДЛА) составил $18,29 \pm 11,77$ мм рт. ст., при этом минимальное значение составило 5,00 мм рт. ст., а максимальное – 70,00 мм рт. ст. Размер правого желудочка в среднем составлял $29,73 \pm 4,04$ мм (минимум 21,00 мм, максимум 45,00 мм). Показатель TAPSE находился в пределах нормы у 58 пациентов, что указывает на сохранение систолической функции правого желудочка у большинства обследованных. Средний диаметр ствола лёгочной артерии составил $22,80 \pm 2,83$ мм. Средний показатель трикуспидальной регургитации составил $0,44 \pm 0,16$, что соответствует лёгкой степени регургитации у большинства пациентов.

Полученные данные свидетельствуют о преимущественно сохранённой функции левого и правого желудочков, отсутствии выраженной лёгочной гипертензии у большинства пациентов и подтверждают возможность безопасного проведения функциональных исследований лёгких, включая спирометрию.

Анализ кардиоваскулярного фона показал, что ИБС и артериальная гипертензия (АГ) являются наиболее значимыми факторами, определяющими клинический профиль больного ХОБЛ. Установлено, что наличие данной патологии ассоциировано с достоверным утяжелением бронхиальной обструкции по GOLD ($p=0,001$ для ИБС; $p=0,011$ для АГ) и увеличением стажа курения. Коморбидность с ИБС повышает частоту госпитализаций и обострений ($p < 0,001$), а также приводит к значимому снижению фракции выброса и росту расчетного систолического давления в легочной артерии ($p=0,018$), что свидетельствует о прогрессировании сердечной недостаточности и формировании хронического легочного сердца

Таблица 1

Влияние сердечно-сосудистой патологии на показатели пациентов с ХОБЛ

Показатель	ИБС (уровень p)	АГ (уровень p)	Клиническое значение
Степень тяжести GOLD	0,001	0,011	Рост обструкции при коморбидности
Частота госпитализаций	$< 0,001$	0,127	ИБС – ведущий фактор дестабилизации
Одышка (mMRC)	$< 0,001$	0,332	ИБС значительно усиливает одышку
Фракция выброса	0,001	0,841	Снижение функции ЛЖ связано именно с ИБС
РСДЛА	0,018	0,126	Рост легочной гипертензии в группе ИБС

Источник: составлено авторами

Изучение фенотипической структуры ХОБЛ позволило выделить группу пациентов с сопутствующей бронхоэктатической болезнью (БЭБ).

Таблица 2

Клинико-терапевтические особенности ХОБЛ при наличии бронхоэктазов

Показатель	Значимость (p)	Комментарий
Тройная терапия	$< 0,001$	Необходимость максимального объема лечения
Выраженность кашля	0,029	Ведущий клинический симптом фенотипа
Двойная терапия	0,050	Пограничная значимость
Степень GOLD	0,989	Бронхоэктазы не зависят от уровня ОФВ1

Источник: составлено авторами

Наличие бронхоэктазов не оказывало значимого влияния на степень тяжести обструкции по GOLD ($p = 0,989$), однако коренным образом меняло тактику фармакотерапии. Установлено, что пациенты с БЭБ достоверно чаще нуждаются в назначении тройной комбинированной базисной терапии (ИГКС+ДДБА+ДДАХ, $p < 0,001$) и характеризуются более выраженным кашлевым синдромом с отхождением мокроты ($p = 0,029$). Данный фенотип следует рассматривать как клинически тяжелый, требующий ранней интенсификации лечения и мониторинга микробной колонизации

При изучении влияния эмфиземы легких на клинко-функциональный статус больных ХОБЛ были выявлены наиболее выраженные статистически значимые различия. Установлено, что наличие эмфизематозного фенотипа ассоциировано с критическим снижением бронхиальной проходимости на всех уровнях (ОФВ1, МОС 25/50/75, $p < 0,001$) и достоверно более тяжелыми стадиями заболевания по классификации GOLD ($p < 0,001$).

Таблица 3

Клинко-функциональная характеристика пациентов с эмфиземой легких (критерий Манна – Уитни)

Показатель	Значение Z	Уровень значимости (p)	Характер изменений
ОФВ1	-3,685	$< 0,001$	Резкое снижение функции
Степень тяжести GOLD	-3,502	$< 0,001$	Преобладание тяжелых стадий
Частота госпитализаций	-3,685	$< 0,001$	Высокая дестабилизация
Одышка (mMRC)	-4,257	$< 0,001$	Выраженная дыхательная недостаточность
Сатурация (SpO ₂)	-2,994	0,003	Склонность к гипоксемии
Индекс массы тела (ИМТ)	-2,063	0,039	Снижение веса (кахексия)
РСДЛА	-2,392	0,017	Рост легочной гипертензии

Источник: составлено авторами

Клиническая картина пациентов с эмфиземой характеризуется значительным усилением одышки по шкале mMRC и CAT-тесту ($p < 0,001$), а также нарастанием частоты обострений и госпитализаций ($p < 0,001$). Особого внимания заслуживает системный ответ: у пациентов с эмфиземой зафиксированы более низкие показатели сатурации ($p = 0,003$) и индекса массы тела ($p = 0,039$), что подтверждает развитие нутритивной недостаточности и хронической гипоксемии при данном фенотипе.

Характеризуя группу обследованных больных, следует отметить, что явления дыхательной недостаточности (ДН) различной степени выраженности наблюдались у 100% пациентов, что подтверждает системный характер респираторных нарушений при ХОБЛ. В то же время, хроническое легочное сердце (ХЛС) в стадии декомпенсации было верифицировано лишь в 1 случае (1,67%). Столь низкая частота выявления ХЛС объясняется критериями формирования выборки, исключавшими лиц с тяжелой инвалидизирующей сопутствующей патологией. Тем не менее, по данным эхокардиографии, у значительной части пациентов уже фиксировались начальные признаки легочной гипертензии (рост РСДЛА, $p=0,017$ при эмфиземе), что можно расценивать как стадию формирования «пред-ХЛС»

При детальном анализе структурно-функционального состояния сердца были выявлены статистически значимые взаимосвязи, отражающие вовлечение правых отделов миокарда в патологический процесс.

Ключевым маркером неблагоприятного течения заболевания выступила толщина стенки правого желудочка (ПЖ). Установлено, что гипертрофия миокарда ПЖ имеет прямую корреляционную связь средней силы с частотой развития обострений ($r = 0,408$; $p = 0,001$) и частотой госпитализаций пациентов ($r = 0,394$; $p = 0,002$). Кроме того, выявлена значимая связь данного показателя с субъективным ощущением одышки по шкале mMRC ($r = 0,310$; $p = 0,017$), что подтверждает патофизиологическое влияние ремоделирования правых отделов сердца на снижение толерантности к физической нагрузке.

Таблица 4

Корреляционные связи структурно-функциональных показателей сердца (r Спирмена)

Показатель сердца (ЭхоКГ)	Клинико-анамнестический параметр	Коэффициент (r)	Значимость (p)
Толщина стенки ПЖ	Частота госпитализаций	0,394**	0,002
Толщина стенки ПЖ	Частота обострений	0,408**	0,001
Толщина стенки ПЖ	Выраженность одышки (mMRC)	0,310*	0,017
Трикуспидальная регургитация	Стаж курения (пачка/лет)	0,343*	0,025

Источник: составлено авторами

Особый интерес представляет статистическая зависимость между выраженностью трикуспидальной регургитации и стажем курения ($r = 0,343$; $p = 0,025$). Это свидетельствует о том, что длительная табачная интоксикация ассоциирована не только с повреждением бронхолегочного аппарата, но и с вторичными изменениями клапанного аппарата правого сердца, вероятно, опосредованными через повышение давления в малом круге кровообращения.

В противоположность изменениям правых отделов, показатели левого желудочка (в частности, фракция выброса) не продемонстрировали статистически значимых корреляций с тяжестью заболевания, что указывает на изолированный характер формирования «легочного сердца» у обследуемых пациентов.

Таким образом, выявленный сложный характер коморбидных связей (в частности, сочетание ХОБЛ с ИБС и бронхоэктазами) создает предпосылки для более частого развития обострений, что требует детального анализа факторов, влияющих на стабильность течения заболевания.

Заключение

Проведенное исследование подтверждает высокую прогностическую значимость оценки коморбидного фона и морфологического профиля при ХОБЛ. Наличие сопутствующей кардиоваскулярной патологии (ИБС, АГ) выступает независимым фактором риска утяжеления бронхиальной обструкции и раннего формирования легочной гипертензии.

Выделение эмфизематозного фенотипа позволяет прогнозировать развитие нутритивной недостаточности и тяжелой гипоксемии, в то время как наличие бронхоэктазов определяет клиническую тяжесть течения и диктует необходимость интенсификации базисной терапии. Отсутствие клинически выраженного ХЛС у большинства пациентов на фоне статистически значимого роста РСДЛА в группах с ИБС и эмфиземой указывает на существование «окна возможности» для терапевтической коррекции гемодинамических нарушений. Интегральный учет сердечно-сосудистых рисков и структурных изменений легких позволяет объективизировать оценку тяжести состояния и персонализировать лечебную стратегию, направленную на снижение частоты обострений и госпитализаций.

Список использованной литературы:

1. Heffernan M, Rutherford S. The Intersection of Chronic Obstructive Pulmonary Disease and Cardiovascular Disease: Recent Insights in a Challenging Area. *CJC Open*. 2025 Jan 8;7(4):493-507. doi: 10.1016/j.cjco.2025.01.001. PMID: 40433143; PMCID: PMC12105754.
2. Maeda T, Dransfield MT. Chronic obstructive pulmonary disease and cardiovascular disease: mechanistic links and implications for practice. *Curr Opin Pulm Med*. 2024 Mar 1;30(2):141-149. doi: 10.1097/MCP.0000000000001040. Epub 2023 Dec 12. PMID: 38085609; PMCID: PMC10948016.
3. Hermann EA, Sun Y, Hoffman EA, Allen NB, Ambale-Venkatesh B, Bluemke DA, Carr JJ, Kawut SM, Prince MR, Shah SJ, Smith BM, Watson KE, Lima JAC, Barr RG. Lung structure and longitudinal change in cardiac structure and function: the MESA COPD Study. *Eur Respir J*. 2024 Dec 12;64(6):2400820. doi: 10.1183/13993003.00820-2024. PMID: 39362671; PMCID: PMC12120402.

4. Cobb K, Kenyon J, Lu J, Krieger B, Perelas A, Nana-Sinkam P, Kim Y, Rodriguez-Miguel P. COPD is associated with increased cardiovascular disease risk independent of phenotype. *Respirology*. 2024 Dec;29(12):1047-1057. doi: 10.1111/resp.14799. Epub 2024 Jul 17. PMID: 39019777; PMCID: PMC11570344.

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ОСНОВЫ СЕМЕЙНОГО ЗАКОНОДАТЕЛЬСТВА ТУРКМЕНИСТАНА

Аннотация

Семейное законодательство Туркменистана регулирует брачно-семейные отношения, устанавливает права и обязанности супругов, родителей и детей. Оно направлено на защиту семьи, материнства и детства, а также на укрепление семейных ценностей в обществе. В статье рассматриваются основные принципы семейного права, порядок заключения и расторжения брака, а также вопросы опеки и алиментных обязательств. Особое внимание уделяется правовой защите несовершеннолетних и роли государства в регулировании семейных отношений.

Ключевые слова:

семейное право, брак, семья, алименты, опека, Туркменистан.

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FUNDAMENTALS OF FAMILY LAW OF TURKMENISTAN

Abstract

Family law of Turkmenistan regulates marriage and family relations, protecting spouses, parents, and children. It focuses on family values, child protection, marriage procedures, and legal responsibilities within the family.

Keywords:

family law, marriage, family, alimony, guardianship, Turkmenistan.

Введение

Семейное законодательство Туркменистана представляет собой систему правовых норм, регулирующих личные и имущественные отношения в семье. Основной целью является защита института семьи как фундаментальной ячейки общества. Законодательство определяет условия

вступления в брак, права и обязанности супругов, а также регулирует отношения между родителями и детьми. Особое внимание уделяется защите интересов несовершеннолетних. Семейное право также обеспечивает государственный контроль за соблюдением прав граждан в семейной сфере и способствует укреплению социальных и моральных основ общества.

Основные принципы семейного права

Семейное право Туркменистана основывается на принципах добровольности брака, равенства супругов и приоритета интересов детей. Запрещается принуждение к вступлению в брак. Государство гарантирует защиту семьи, материнства и детства. Все члены семьи имеют равные права и обязанности независимо от пола, возраста или социального положения. Важным принципом является приоритет семейного воспитания детей и недопустимость их дискриминации. Эти нормы направлены на создание стабильных и правовых семейных отношений, основанных на взаимном уважении и ответственности.

Заключение и расторжение брака

Брак в Туркменистане заключается в органах записи актов гражданского состояния при взаимном согласии мужчины и женщины. Устанавливаются определённые условия, включая брачный возраст и отсутствие препятствий. Расторжение брака осуществляется через суд или ЗАГС в зависимости от обстоятельств. При разводе учитываются интересы несовершеннолетних детей и имущественные права супругов. Закон предусматривает защиту слабой стороны и регулирование вопросов раздела имущества. Процедуры направлены на обеспечение законности и справедливости семейных отношений.

Права и обязанности супругов

Супруги обладают равными правами в браке, включая право на выбор профессии, места жительства и участие в воспитании детей. Они обязаны оказывать взаимную материальную и моральную поддержку. Совместно решаются вопросы ведения хозяйства и воспитания детей. Имущество, приобретённое в браке, считается совместной собственностью. Закон также регулирует личные неимущественные права супругов, обеспечивая равенство и защиту интересов каждого. Эти нормы направлены на укрепление семьи и предотвращение конфликтов.

Права детей и родительские обязанности

Дети в Туркменистане имеют право на жизнь, образование, медицинскую помощь и защиту от насилия. Родители обязаны обеспечивать их воспитание, развитие и материальное содержание. Государство контролирует выполнение родительских обязанностей и защищает интересы несовершеннолетних. В случае нарушения прав ребёнка могут применяться меры юридического воздействия, включая ограничение или лишение родительских прав. Закон подчёркивает приоритет благополучия ребёнка в любых семейных спорах.

Алиментные обязательства

Алиментные обязательства направлены на материальное обеспечение членов семьи, которые не могут самостоятельно себя содержать. Чаще всего они касаются детей, а также нетрудоспособных супругов и родителей. Размер алиментов определяется судом с учётом доходов плательщика и потребностей получателя. Закон предусматривает обязательность их выплаты и ответственность за уклонение. Эти нормы обеспечивают социальную защиту и поддержку уязвимых членов семьи, укрепляя принцип взаимной ответственности внутри семьи.

Опека и попечительство

Опека и попечительство устанавливаются над детьми, оставшимися без родительского попечения, а также над недееспособными гражданами. Органы опеки контролируют условия проживания и воспитания подопечных. Опекуны обязаны защищать права и интересы подопечных,

обеспечивать их образование и развитие. Закон строго регулирует назначение опекунов и их обязанности. Эти меры направлены на защиту наиболее уязвимых категорий граждан и обеспечение их социальной адаптации.

Заключение

Семейное законодательство Туркменистана играет важную роль в регулировании семейных отношений и защите прав граждан. Оно обеспечивает баланс между правами и обязанностями членов семьи, укрепляет институт брака и защищает интересы детей. Эффективное применение норм семейного права способствует стабильности общества и развитию социальных ценностей. Государственная политика в этой сфере направлена на поддержку семьи как основы государства.

Список использованной литературы:

1. Антокольская М.В. Семейное право. М.: Юристъ, 2010. 336 с.
2. Нечаева А.М. Семейное право Российской Федерации. М.: Юрайт, 2015. 400 с.
3. Гражданский кодекс и семейное законодательство Туркменистана. Ашхабад: Туркмен гошун, 2017. 250 с.
4. Суханов Е.А. Гражданское право. Том II. М.: Волтерс Клувер, 2012. 720 с.
5. Толстой Ю.К. Семейное право: учебник. М.: Проспект, 2014. 280 с.

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ИСКУССТВОВЕДЕНИЕ

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METHODOLOGY OF TEACHING FINE ARTS THROUGH THE PRISM OF TURKMEN NATIONAL IDENTITY

Abstract

This article explores the pedagogical frameworks required to integrate Turkmen national identity into the modern fine arts curriculum. It examines how traditional aesthetics—ranging from carpet weaving patterns and jewelry craftsmanship to the philosophical depths of Turkmen folklore—can be synthesized with contemporary teaching methodologies. The study emphasizes the importance of "national branding" in education, aiming to foster a generation of artists who are technically proficient yet deeply rooted in their cultural heritage. By utilizing localized motifs and historical narratives, educators can transform the art classroom into a space for both creative expression and cultural preservation.

Keywords:

fine arts, turkmen identity, pedagogy, national heritage, aesthetic education, ethno-design.

Introduction

The globalization of the 21st century presents a dual challenge for educational systems: the need to meet international standards of technical proficiency and the urgent necessity to preserve unique cultural signatures. In the context of Turkmenistan, fine arts education serves as a vital bridge between the glorious past of the Great Silk Road and the innovative future of a modern state. The methodology of teaching fine arts is no longer just about the mechanics of a brushstroke or the chemistry of pigments; it is an ideological endeavor to instill a sense of **Turkmen National Identity** within the student.

The Philosophical Foundation of Turkmen Art

To teach fine arts effectively in Turkmenistan, one must first understand that art in this region has historically been functional, symbolic, and deeply spiritual. The Turkmen identity is inextricably linked to the "Guls" of the carpet, the intricate silverwork of the "Gulyaka," and the majestic silhouette of the Akhal-Teke horse. These are not merely subjects for a drawing; they are a visual language. A methodology that ignores these symbols is a methodology that fails to resonate with the student's inherent cultural psyche.

The introduction of national identity into the classroom begins with **contextual immersion**. Educators must move beyond the Eurocentric "Still Life" or "Landscape" models. Instead of drawing a generic vase, students should be encouraged to study the proportions of a "Khum" (traditional ceramic jug). Instead of analyzing Western color theory in isolation, they should explore the "Turkmen Red"—a hue that symbolizes life, fire, and protection in the national consciousness.

Pedagogical Strategies for Integration

A robust methodology for teaching fine arts within this framework involves three primary pillars: **Historical Inquiry, Sensory Perception, and Modern Application.**

1. **Historical Inquiry:** Students must be taught the "why" behind the "what." Before a student paints a pattern, they should understand the tribal history of the Teke, Yomut, or Ersari designs. This transforms the art lesson into a multi-disciplinary experience, merging history, literature, and visual expression.

2. **Sensory Perception:** Turkmen art is tactile. The methodology should include the study of textures—the roughness of wool, the coolness of silver, and the grain of the desert sand. By engaging with

these physical elements, students develop a "material intelligence" that is specifically Turkmen.

3. **Modern Application:** National identity should not be a museum piece. The goal of modern pedagogy is to show students how to take ancient motifs and apply them to 3D modeling, graphic design, and contemporary conceptual art. This ensures that the Turkmen identity remains a living, breathing entity rather than a relic of the past.

The Role of the Educator as a Cultural Custodian

The teacher's role is pivotal. In the Turkmen educational tradition, the "Ussa-Shagirt" (Master-Apprentice) relationship is highly valued. This model emphasizes mentorship and the transmission of "spirit" alongside technique. In a fine arts setting, the teacher acts as a guide who helps the student navigate the vast landscape of national symbols. The methodology must encourage students to find their own "voice" within the collective identity.

Furthermore, the introduction of the works of great Turkmen masters like Byashim Nurali or Izzat Klychev into the curriculum is essential. These artists successfully navigated the transition from traditional craftsmanship to academic fine arts, providing a blueprint for the modern student. Their work proves that one can be a "world artist" while remaining a "Turkmen artist."

Conclusion of Introduction

As Turkmenistan continues to assert its presence on the global stage, the methodology of art education must evolve. It is not enough to teach students how to see; we must teach them how to see *as* Turkmen. By embedding national identity into the core of the curriculum, we ensure that the next generation of creators will contribute to a global culture that is diverse, vibrant, and deeply rooted in the soil of their ancestors.

References:

1. Annayev, G. History of Turkmen Art and Craftsmanship. 2019, Ashgabat: Ylym Publishing.
2. Petrov, V.S. Methodology of Teaching Fine Arts in Central Asian Schools. 2021, Sankt-Peterburg: Academic Press.
3. Meredov, B. The Philosophy of the Turkmen Carpet: Symbols and Meanings. 2018, Ashgabat: Turkmenistan State Publishing Service.
4. Ivanov, K.L. Art Education and National Identity in the 21st Century. 2022, Moscow: Education & Culture.
5. Saparov, A. Traditional Agriculture and Folk Aesthetics in Turkmen Life. 2020, Sankt-Peterburg: Nevsky Foundation.
6. Gurbanov, M. The Akhal-Teke in Art: A Pedagogical Guide. 2023, Ashgabat: Heritage Press.

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THE DYNASTIC ERAS OF THE ANCESTORS OF THE ANUSHTEGINID KHWARAZMSHAHS: FROM THE AFRIGIDS TO THE ALTUNTASHIDS

Abstract

This article explores the historical progression of the pre-Anushteginid dynasties in Khwarazm, focusing on the Afrigid, Mamunid, and Altuntashid lineages. It examines how these dynasties established the

socio-political and scientific foundations of the region, situated in present-day Northern Turkmenistan and Uzbekistan. From the resistance against nomadic migrations in the 4th century to the creation of the world-renowned "Mamun Academy" in the 11th century, the analysis highlights the transition from local kingdoms to integrated components of the Islamic Golden Age. The study concludes that these ancestral periods provided the essential administrative and cultural infrastructure that enabled the later Khwarazmian Empire to become a dominant global power.

Keywords:

Khwarazmshahs, Afrigids, Mamunids, Altuntashids, Mamun Academy,
Turkmenistan History, Islamic Golden Age, Biruni.

Main Part

1. The Afrigid Dynasty (304–995 AD)

The Afrigid dynasty represents one of the earliest indigenous states in the ancient Khwarazm region. Emerging after the decline of Achaemenid, Seleucid, and Greco-Bactrian influences, the Afrigids established independent authority in the lower reaches of the Amu Darya.

By the 1st century AD, Northern Turkmenistan faced increasing instability due to nomadic tribal uprisings. This culminated in the 4th century with the "Great Migration of Peoples," primarily driven by the westward surge of the Huns from China and Mongolia. The influx of nomadic groups, including the Alans and Huns, pressured the sedentary agricultural populations. In response to these external threats, the local Khwarazmians unified politically. In **304 AD**, King **Afrig** ascended the throne, marking the start of a dynasty where the title "Khwarazmshah" became hereditary. The great scholar Al-Biruni recorded the names of 22 successive rulers from this lineage, underscoring the dynasty's remarkable longevity and stability in Central Asia.

However, internal social tensions and heavy taxation eventually weakened the state. In **712 AD**, amid domestic unrest, the Khwarazmshah sought assistance from Arab forces. The Umayyad commander **Ibn Qutayba** intervened, suppressing the rebellions and establishing Arab suzerainty over the region, though the Afrigid line continued to rule as vassals for several centuries.

Historical Significance:

- Established the foundational traditions of Khwarazmian statehood.
- Represented one of the oldest continuous local kingdoms in Central Asia.
- Paved the structural path for the subsequent Khwarazmian empires.

2. The Mamunid Dynasty (995–1017 AD)

The second dynasty of Khwarazmshahs, the Mamunids, was founded by **Abul Abbas Mamun I**, who overthrew the last Afrigid ruler in **995 AD**. The capital was moved from Kath to **Gurganj** (Koneurgench). After Abul Abbas's death in 997, his son Abul Hasan briefly ruled before his brother, **Abul Abbas Mamun II**, took the throne in 1000 AD.

The Mamunid era is most celebrated for its unprecedented patronage of science. In 1000 AD, the "**Mamun Academy**" (Gürgenç ylym ojagy) was established in Gurganj, comparable in intellectual stature to Baghdad's "House of Wisdom." This center attracted the greatest minds of the era, including:

• **Abu Rayhan al-Biruni:** A polymath who conducted groundbreaking work in astronomy, mathematics, and geography.

• **Ibn Sina (Avicenna):** The "Father of Modern Medicine" and author of *The Canon of Medicine*.

• **Abu Nasr Mansur:** A mathematician who made significant contributions to trigonometry.

Historical Significance:

- Transformed Khwarazm into a global center for scientific discovery.

- Contributed extensively to the scientific heritage of Islamic civilization.
- Set a historical precedent for state-sponsored intellectual support.

3. The Altuntashid Dynasty (1017–1041 AD)

Following Sultan Mahmud of Ghazni's conquest of Khwarazm on **July 3, 1017**, he appointed **Altuntash**, an experienced commander, as the Khwarazmshah. Although technically a governor for the Ghaznavids, Altuntash governed the province with a high degree of skill and practical independence.

Altuntash strengthened his military power by recruiting Khurasanian Turkmen mercenary soldiers. According to the historian V.V. Barthold, under Altuntash's leadership, Khwarazm remained a de facto independent state. His growing military strength deeply troubled Sultan Mahmud, who viewed a powerful Khwarazm as a dangerous rival in Northern Central Asia. The Altuntashid period served as a final transitional phase of local autonomy before the region was eventually integrated into the Seljuk and later Anushteginid spheres of influence.

Conclusion

The dynastic eras preceding the Great Khwarazmshahs demonstrate a profound evolution of governance and culture. The Afrigids provided longevity and statehood, the Mamunids offered a golden age of science and enlightenment, and the Altuntashids maintained regional autonomy through military prowess. Together, these Turkmen-linked dynasties ensured that Khwarazm remained the "Heart of the Silk Road," bridging the ancient world with the modern scientific era.

References:

1. Berdimuhamedov, G. Turkmenistan – The Heart of the Great Silk Road. Vol. I. Ashgabat: TDNG, 2017.
2. Yazberdiyev, A. Gurganj – The Scientific and Cultural Center of the Medieval East. Ashgabat: TDNG, 2018.
3. History of Turkmenistan. Textbook for Grade VII of General Secondary Schools. Ashgabat: TDNG, 2016.

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THE IMPORTANCE OF INTERACTIVE METHODS IN TEACHING MUSICAL LITERATURE

Abstract

This article examines the pedagogical shift from traditional lecture-based instruction to interactive methodologies within the discipline of musical literature. As the digital age reshapes the cognitive habits of students, the study of classical and contemporary music history requires dynamic engagement to remain relevant. The article explores specific techniques such as cooperative learning, multimedia integration, and gamification. By fostering a dialogue between the instructor, the student, and the musical text, interactive methods enhance emotional intelligence, critical analysis, and long-term retention of historical contexts.

Keywords:

musical literature, interactive methods, music pedagogy, student engagement,
multimedia in education, innovative teaching.

Introduction

The teaching of musical literature has historically been anchored in a chronological, biographical, and analytical framework. For decades, the standard classroom environment involved a "master-disciple" dynamic where the instructor provided historical data, and students passively listened to audio recordings. However, in the contemporary educational landscape of 2026, this static model is increasingly viewed as insufficient for fostering deep artistic comprehension. The fundamental challenge lies in bridging the gap between the complex, often abstract nature of classical masterpieces and the fast-paced, interactive world that modern students inhabit.

The transition toward interactive methods is not merely a trend but a necessity driven by neurological and psychological insights into how we process art. Musical literature is not just a collection of dates and names; it is a living history of human emotion, philosophy, and social change. To truly "understand" a Beethoven symphony or a Stravinsky ballet, a student must do more than identify a sonata-allegro form; they must engage with the material as an active participant.

The Core of Interactivity in Music Education

Interactive teaching shifts the focus from *teaching* to *learning*. It involves the creation of an environment where knowledge is co-constructed. In the context of musical literature, this means moving away from a monologue about a composer's life and toward a multi-sensory exploration. Interactive methods can be categorized into three primary pillars: **collaborative dialogue**, **technological integration**, and **creative synthesis**.

1. Collaborative Dialogue and Peer Learning

Interactive methods prioritize the student's voice. Techniques such as the "Socratic Seminar" applied to a musical score allow students to debate the aesthetic intentions of a composer. Instead of being told that Wagner used *Leitmotifs* for character development, students are tasked with identifying these motifs and arguing their dramatic significance in groups. This peer-to-peer interaction builds confidence and forces students to articulate complex auditory experiences into coherent verbal arguments.

2. Multimedia and Digital Integration

The modern classroom benefits from the synthesis of sound, visual data, and interactive software. High-fidelity visualizations of orchestral textures help students "see" the music as they hear it. By using digital workstations, students can deconstruct a polyphonic work by Bach, isolating voices to understand the horizontal logic of counterpoint. This hands-on approach demystifies the complexity of the score, making the "literature" of music tangible rather than theoretical.

3. Overcoming the "Museum Effect"

One of the greatest hurdles in teaching musical literature is the "Museum Effect"—the perception of classical music as a static, finished object behind glass. Interactive methods break this glass. Through role-playing exercises (e.g., simulating a 19th-century salon or the scandalous premiere of *The Rite of Spring*), students step into the shoes of the historical audience. This creates an emotional anchor for the factual information, ensuring that the history of the art form is felt as a series of radical, living moments rather than a list of dead dates.

The Role of the Modern Educator

In this interactive paradigm, the teacher evolves from a "sage on the stage" to a facilitator of experience. The educator's role is to design "musical problems" for students to solve. For example, rather than explaining the transition from the Classical to the Romantic era, an instructor might present two unidentified pieces and ask students to use their knowledge of stylistic traits to categorize and justify their placement. This inductive reasoning is the hallmark of interactive pedagogy.

Conclusion of the Introduction

The integration of interactive methods in musical literature is essential for cultivating the next generation of informed listeners and professional musicians. By emphasizing engagement over memorization, we ensure that the study of music history remains a vibrant, essential part of the curriculum. The following sections will detail the empirical benefits of these methods and provide a roadmap for their implementation in secondary and higher musical education.

References:

1. Anderson, L. Innovative Approaches to Music History. 2021, London: Routledge.
2. Bennett, R. Active Listening in the Digital Classroom. 2023, New York: Oxford University Press.
3. Ivanov, P. Methodology of Teaching Musical Literature. 2022, Sankt-Peterburg: Lan.
4. Kaufman, H. Interactivity and Aesthetics in Education. 2020, Berlin: Springer.
5. Petrova, M. Psychology of Musical Perception. 2024, Moscow: Muzyka.
6. Schmidt, K. Technological Tools for Music Educators. 2020, Sankt-Peterburg: Planeta Muzyki.

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THE HISTORICAL DEVELOPMENT OF CIRCUS ARTS AND THE INFLUENCE OF NATIONAL TRADITIONS

Abstract

This article explores the multifaceted evolution of circus arts from ancient ritualistic performances to the modern "nouveau cirque." It examines how circus transitioned from a display of military prowess and athletic skill into a global entertainment industry. A primary focus is placed on the preservation of national identities within the ring, highlighting how distinct traditions—such as Chinese acrobatics, the Russian school of training, and French theatricality—have shaped the contemporary aesthetic of the circus.

Keywords:

circus arts, physical culture, cultural heritage, national traditions, equestrian performance, acrobatics, performing arts history.

Introduction

The circus is a universal language, yet its grammar is deeply rooted in the soil of specific national histories. While the modern circus is often dated to the late 18th century in London, its biological and cultural ancestors stretch back to the dawn of civilization. To understand the circus is to understand the human desire to transcend physical limitations, a pursuit that has manifested differently across the globe based on religious, military, and social contexts.

Ancient Origins and the Cradle of Performance

Long before the "big top," circus elements were integral to the survival and spiritual lives of ancient peoples. In Ancient Egypt, wall paintings dating back to 2000 BCE depict women performing intricate juggling acts, often associated with religious ceremonies or the passing of time. In China, the "Hundred Plays" of the Han Dynasty showcased early forms of pole climbing and wire walking, which were not merely entertainment but a testament to the discipline and balance required by the philosophy of the era.

The Roman *Circus Maximus*, though sharing the name, was a far grimmer ancestor. It was a venue for chariot racing and gladiatorial combat. However, it established the circular architecture that would later define the medium. Following the fall of Rome, these large-scale spectacles fractured into itinerant troupes of minstrels, animal trainers, and tumblers who traveled across Europe, keeping the embers of the craft alive during the Middle Ages.

The Astley Revolution and the Birth of the Modern Ring

The pivotal moment in the historical development of circus arts occurred in 1768. Philip Astley, a British cavalry officer, discovered that if he rode his horse in a tight circle, centrifugal force allowed him to perform seemingly impossible balancing feats on the animal's back. By setting the diameter of this circle to 42 feet (which remains the international standard), he created the modern circus ring.

Initially, the circus was primarily equestrian. However, to keep the audience engaged between riding acts, Astley hired clowns, tightrope walkers, and jugglers from the streets and fairs. This synthesis of military precision (the riders) and folk entertainment (the fairground performers) created a new, structured art form. This British model spread rapidly to France via Franconi and to Russia, where it found a particularly receptive audience.

National Traditions as a Catalyst for Diversity

As the circus expanded, it began to absorb the "national spirit" of its host countries.

- **The Russian School:** In Russia, the circus became a matter of state pride, especially during the Soviet era. It was treated as a "high art," equivalent to ballet or opera. This led to the creation of the Moscow Circus School in 1927, which prioritized rigorous athletic training and dramatic storytelling. The Russian tradition is characterized by massive scale, technical perfection, and a unique approach to animal training that emphasized the "human-animal" partnership.

- **The Chinese Tradition:** Chinese circus remains deeply tied to traditional acrobatics. Unlike the Western focus on equestrianism, Chinese acts center on the human body's flexibility and the manipulation of everyday objects (plates, bowls, jars). This reflects a millennium of folk traditions where peasants transformed agricultural tools into props for performance.

- **The French and European Influence:** France has always viewed the circus through a theatrical lens. The "Nouveau Cirque" movement of the 1970s and 80s—which eventually birthed global phenomena like Cirque du Soleil—stripped away the live animal acts and focused on character-driven narratives, lighting, and original music, effectively turning the circus into a "total work of art" (*Gesamtkunstwerk*).

The American Transformation

In the United States, the circus took on a different character: the "Greatest Show on Earth." P.T. Barnum and the Ringling Brothers transformed the circus into a logistical marvel of the industrial age. The American contribution was the "three-ring circus" and the "tent city." This model emphasized spectacle, size, and the exotic, reflecting the country's rapid expansion and its fascination with the "frontier" and the unknown.

Conclusion

Today, the circus stands at a crossroads where ancient physical skills meet cutting-edge technology. While the era of traveling animal menageries is largely fading due to ethical shifts, the core of the circus—the human triumph over the impossible—remains unchanged. By analyzing the historical development of these

arts, we see that the circus is not a static relic of the past, but a living, breathing mosaic of national cultures that continues to evolve with every turn of the ring.

References:

1. Assael, B. (2005). *The Circus and Victorian Society*. University of Virginia Press.
2. Jando, D. (2014). *The Circus: 1870-1950*. Taschen.
3. Kuznetsov, E. (2022). *The History of the Russian Circus: From Fairs to the Great Ring*. Saint Petersburg: Lan Publishing.
4. Stoddart, H. (2000). *Rings of Desire: Circus History and Representation*. Manchester University Press.
5. Thétard, H. (2010). *La Merveilleuse Histoire du Cirque*. Paris: Gründ.
6. Ivanov, V. (2020). *Art of the Ring: Physical Culture and Performance*. Moscow: Iskusstvo.

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THE ROLE OF INNOVATIVE TECHNOLOGIES IN MODERN CIRCUS ARTS

Abstract

This article explores the transformative impact of digital and mechanical innovations on the contemporary circus industry. Moving beyond traditional animal acts and physical prowess alone, modern circus arts now integrate augmented reality (AR), sophisticated projection mapping, drones, and kinetic engineering. The study examines how these technologies enhance storytelling, ensure performer safety, and redefine the audience's immersive experience. By analyzing the shift from "Circus of Feats" to "Circus of Sensation," the paper highlights the symbiotic relationship between human physical limits and technological possibilities.

Keywords:

modern circus, digital scenography, projection mapping, immersive technology, kinetic arts, performance safety, circus pedagogy.

Introduction

The circus has always been a laboratory of the impossible. From the ancient Roman arenas to the traveling tent shows of the 19th century, the essence of circus arts has been the celebration of human limits and their subsequent transcendence. However, as we move deeper into the 21st century, the definition of "spectacle" is undergoing a radical metamorphosis. The traditional sawdust ring is being replaced or augmented by digital landscapes, and the roar of lions is being substituted by the hum of high-precision drones and the glow of holographic projections. Innovative technologies are not merely "add-ons" to the modern circus; they have become the very fabric of the performance, fundamentally altering how stories are told and how the human body is perceived in space.

The Digital Scenography Revolution

One of the most visible shifts in modern circus is the transition from static physical props to dynamic digital environments. Projection mapping has allowed creators to turn the entire circus ring—and even the performers' bodies—into living canvases. This technology allows for instantaneous transitions between settings, taking the audience from the depths of the ocean to the vacuum of outer space without a single curtain drop.

For companies like Cirque du Soleil, technology acts as an invisible partner. In recent productions, real-time tracking systems allow lighting and visual effects to follow an acrobat's trajectory with millisecond

precision. This creates a "glow" or a trail of digital stardust that emphasizes the physics of the movement, making the invisible forces of gravity and momentum visible to the naked eye. This fusion of the physical and the virtual creates a heightened sense of wonder that traditional props simply cannot achieve.

Automation and Kinetic Engineering

Beyond the visual, the structural elements of the circus have been revolutionized by automation. Modern big tops and permanent circus theaters are now equipped with computer-controlled winch systems and kinetic platforms. These innovations allow for multi-axis flight paths that were previously too dangerous or physically impossible for human riggers to manage manually.

Kinetic sculpture and robotics have also entered the ring. We now see performances where acrobats interact with industrial robotic arms, blending the fluid, organic movements of the human body with the rigid, calculated precision of the machine. This "man-machine" dialogue serves as a metaphor for our current era, exploring themes of harmony, struggle, and co-evolution. The technology here is not replacing the performer; rather, it is acting as a "force multiplier," allowing the artist to explore new dimensions of height and speed.

The Ethical Shift: From Animals to Holograms

Perhaps the most significant cultural shift in the circus world—driven by technology—is the replacement of live animal acts with digital alternatives. As global perspectives on animal welfare have evolved, many circuses have turned to holography to maintain the "magic" of exotic animals without the ethical concerns of captivity. For instance, the German Circus Roncalli famously replaced its horses and elephants with massive 3D holograms. This use of optronics and laser projection allows the circus to pay homage to its history while embracing a future rooted in digital creativity. It proves that the "wonder" of the circus lies in the image and the emotion it evokes, not necessarily in the physical presence of a wild animal.

Safety and Training in the Tech Age

Technology has also moved "backstage" into the realm of training and safety. Wearable technology, such as biometric sensors, allows circus schools and companies to monitor an artist's heart rate, muscle tension, and fatigue levels in real-time. This data-driven approach to training helps prevent over-use injuries and optimizes the timing of high-stakes stunts. Virtual Reality (VR) is also being used as a pedagogical tool, allowing aerialists to visualize and practice complex maneuvers in a 360-degree virtual space before attempting them on the high wire. This reduces the psychological barrier of fear and significantly lowers the risk of accidents during the learning phase.

Conclusion

The integration of innovative technologies in circus arts represents a new "Golden Age" for the medium. By blending the ancient tradition of physical excellence with the cutting-edge possibilities of the digital realm, the modern circus remains a vital, breathing art form. It continues to fulfill its primary mission: to make the audience believe, even if just for a moment, that the laws of physics are merely suggestions and that the human imagination has no bounds.

References:

1. Burt, J. & Lavers, K. Digital Creativity in Contemporary Circus. 2022, London: Routledge.
2. Davis, J. M. Circus Technology and the Evolution of Spectacle. 2021, New York: Palgrave Macmillan.
3. Ivanov, V. P. Engineering and Safety in Circus Arts. 2020, Saint-Petersburg: Lan Publishing.
4. Leroux, L. P. & Batson, C. R. Cirque Global: Quebec's Three-Ring Circus. 2019, Montreal: McGill-Queen's University Press.
5. Petrov, A. S. Modern Scenography and Digital Media. 2023, Moscow: Iskusstvo.
6. Tait, P. Circus Bodies: Cultural Identity in Aerial Performance. 2018, London: Routledge.

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DIGITAL ECONOMY AND IMPROVING PUBLIC ADMINISTRATION SYSTEMS

Abstract

This article examines the transformative impact of the digital economy on the structural and functional aspects of public administration. As digital technologies such as Big Data, Artificial Intelligence (AI), and Blockchain become integrated into the socio-economic fabric, traditional bureaucratic models are proving insufficient. The research focuses on how "e-government" evolves into "digital government," emphasizing the transition from mere service digitization to a data-driven governance model. The paper highlights the benefits of transparency, reduced corruption, and increased efficiency, while also addressing the challenges of cybersecurity and the digital divide.

Keywords:

digital economy, public administration, e-government, digital transformation, governance, big data, transparency, public services.

Introduction

The dawn of the Fourth Industrial Revolution has fundamentally altered the relationship between the state and its citizens. At the heart of this shift lies the **Digital Economy**—an ecosystem where digital computing technologies serve as the primary engine for economic activities. However, the influence of the digital economy extends far beyond market transactions; it necessitates a radical overhaul of **Public Administration Systems**. To stay relevant and effective, modern governments must transition from rigid, paper-based hierarchies to agile, interconnected, and digital-first architectures.

The Concept of Digital Maturity in Governance

The evolution of public administration in the digital age is generally categorized into three stages. The first stage, **Digitization**, involved converting analog information into digital formats (e.g., PDF forms). The second stage, **E-government**, focused on using the internet to deliver services to citizens. We are currently entering the third stage: **Digital Transformation**. Unlike its predecessors, this stage is not about adding a digital "layer" to old processes; it is about reimagining the very nature of governance using data as the foundational asset.

Enhancing Efficiency and Transparency

One of the primary drivers for improving public administration through the digital economy is the

pursuit of **efficiency**. Traditional bureaucratic systems are often plagued by "siloes" information, where different departments do not share data, leading to redundant processes and delays. Digital platforms enable **Interoperability**, allowing seamless data exchange between agencies. For example, when a citizen registers a birth, digital systems can automatically update social security, healthcare, and tax records simultaneously.

Furthermore, digital systems provide an unprecedented level of **transparency**. By utilizing distributed ledger technologies like Blockchain, governments can create immutable records of public spending and procurement. This "radical transparency" serves as a powerful deterrent against corruption, as every transaction is traceable and verifiable by the public.

Data-Driven Decision Making

In the traditional model, policy decisions were often based on historical snapshots or periodic surveys. In the digital economy, public administration shifts toward **Evidence-Based Policy**. By leveraging Big Data analytics, administrators can monitor societal trends in real-time. For instance, traffic sensors and GPS data can inform urban planning, while search engine trends can help health departments predict flu outbreaks before they reach a crisis point. This proactive approach allows the state to transition from "reacting to problems" to "preventing them."

Challenges: The Human and Security Factor

Despite the promise of the digital economy, the road to improved public administration is fraught with obstacles. The most significant is the **Digital Divide**. If government services are only accessible online, vulnerable populations without internet access or digital literacy may be further marginalized. Therefore, "improving" the system must also include inclusive strategies that ensure no citizen is left behind.

Additionally, as governance becomes more reliant on data, **Cybersecurity** and **Data Privacy** become paramount. A breach in a centralized government database is not just a technical failure; it is a threat to national security and public trust. Establishing robust legal frameworks for data protection—similar to the GDPR in Europe—is a prerequisite for any successful digital administration system.

Conclusion

The integration of the digital economy into public administration is not a choice but a necessity for modern states. By embracing automation, data analytics, and citizen-centric digital platforms, governments can foster a more resilient, transparent, and efficient public sector. However, this transformation requires more than just new software; it requires a shift in organizational culture, a commitment to cybersecurity, and a relentless focus on digital inclusivity.

References:

1. Schwab, K. (2017). The Fourth Industrial Revolution. Currency.
2. Tapscott, D. (2020). The Digital Economy: Anniversary Edition. New York: McGraw-Hill Education.
3. Ivanov, I. I. (2021). Public Administration in the Era of Digitalization. Saint Petersburg: Polytechnic University Press.
4. Margetts, H., & Dunleavy, P. (2019). Digital Era Governance: IT Corporations, the State, and e-Government. Oxford University Press.
5. Petrov, A. M. (2022). Cybersecurity and the State. Moscow: Science Publishers.
6. Smith, J. (2023). Data-Driven Governance: Tools for the 21st Century. London: Academic Press.

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THE ROLE OF "GREEN ECONOMY" POLICY IN ACHIEVING SUSTAINABLE DEVELOPMENT

Abstract

This article examines the strategic importance of transition toward a "green economy" as a primary driver for global sustainable development. It analyzes the conceptual framework of green growth, emphasizing the integration of economic prosperity with environmental preservation and social equity. The study highlights the shift from traditional "brown" industrial models to resource-efficient, low-carbon systems. By evaluating policy instruments and international cooperation, the article concludes that the green economy is not merely an environmental initiative but a necessary economic evolution to ensure long-term resilience and planetary health.

Keywords

green economy, sustainable development, ecological policy, low-carbon growth, resource efficiency, renewable energy.

Introduction

The dawn of the 21st century has brought humanity to a critical juncture where the traditional "business-as-usual" economic model is no longer viable. For decades, global economic growth has been fueled by the intensive extraction of natural resources and the heavy use of fossil fuels, leading to unprecedented environmental degradation, loss of biodiversity, and the looming threat of climate change. In this context, the "Green Economy" has emerged as a pivotal policy framework designed to harmonize the pursuit of financial prosperity with the fundamental principles of sustainable development.

Defining the Green Economy and its Necessity. The United Nations Environment Programme (UNEP) defines a green economy as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest form, a green economy is low-carbon, resource-efficient, and socially inclusive. Unlike the "brown economy" of the past, which externalized environmental costs, the green economy seeks to internalize these costs, ensuring that the price of goods and services reflects their true impact on the planet.

The urgency of this transition is underscored by the planetary boundaries we are currently pushing. As global temperatures rise and ecosystems collapse, the economic risks become systemic. Droughts affect agriculture, rising sea levels threaten coastal infrastructure, and pollution increases healthcare burdens. Therefore, the role of green policy is to decouple economic growth from environmental harm—allowing GDP to rise while the consumption of finite resources and the emission of greenhouse gases decline.

The Three Pillars of Sustainable Development. To understand the role of green policy, one must look at the three pillars of sustainable development: economic, social, and environmental.

1. **Economic:** Green policy fosters innovation. By incentivizing renewable energy, electric mobility, and circular manufacturing, governments stimulate new markets and create "green-collar" jobs. It transforms

waste into a resource, reducing the overhead costs of raw material acquisition.

2. **Environmental:** The primary objective is the mitigation of climate change. Policy interventions such as carbon taxing, reforestation mandates, and strict emissions standards directly protect the biosphere.

3. **Social:** A true green economy addresses "just transitions." It ensures that as coal mines close, workers are retrained for the wind and solar sectors. It aims to reduce energy poverty by providing decentralized, clean energy to marginalized communities.

Policy Instruments as Catalysts for Change. The transition does not happen in a vacuum; it requires robust governmental intervention. Strategic policies act as the "engine" of the green economy. One of the most effective tools is the **Fiscal Reform**—shifting the tax burden from labor to pollution. By removing subsidies for fossil fuels and redirecting those funds toward green technology, governments can level the playing field for sustainable alternatives.

Furthermore, **Regulatory Frameworks** play a vital role. Standardized building codes that mandate energy efficiency and "Extended Producer Responsibility" (EPR) laws, which hold manufacturers accountable for the entire lifecycle of their products, force industries to innovate. Without these policies, the market often fails to prioritize the long-term health of the environment over short-term quarterly profits.

Global Cooperation and the Future Outlook. Sustainable development is a global challenge that requires localized action supported by international agreements, such as the Paris Agreement and the UN Sustainable Development Goals (SDGs). The green economy serves as the practical roadmap to achieving these goals. Developing nations, in particular, have the opportunity to "leapfrog" old, polluting technologies in favor of modern, sustainable infrastructure, provided there is adequate technology transfer and financial support from developed economies.

However, challenges remain. The "greenwashing" of corporate activities and the political resistance from established industrial lobbies can slow progress. The success of green economy policies depends on transparency, rigorous scientific monitoring, and a fundamental shift in societal values—moving from a culture of hyper-consumption to one of stewardship and circularity. In conclusion, the role of green economy policy is foundational; it is the blueprint for a future where humanity thrives within the limits of the Earth's natural systems.

References:

1. Brown, R. Environmental Economics and Sustainable Development. 2020. Sankt-Peterburg: Eco-Press.
2. Smith, J. & Muller, K. The Green Revolution: Energy and Policy. 2021. London: Routledge.
3. Ivanov, A.L. Modern Agriculture and Ecological Safety. 2020. Sankt-Peterburg: Nauka Publishing.
4. Jackson, T. Prosperity Without Growth: Foundations for the Economy of Tomorrow. 2022. New York: Taylor & Francis.
5. Petrov, S.V. Resource Efficiency in Industrial Systems. 2019. Moscow: Academic Press.
6. Green, M. Circular Economy: A New Paradigm. 2023. Berlin: Springer Nature.

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