



**FUTURITY
PUBLISHING**

**WORLD
CONFERENCE ON**

SCIENCE, INNOVATION AND HUMAN PROGRESS 2026



July 26–28, 2026



PROCEEDINGS BOOK

**World Conference on Science,
Innovation and Human Progress 2026**

INTERNATIONAL SCIENTIFIC CONFERENCE

July 26-28, 2026



World Conference on Science, Innovation and Human Progress 2026
(WCSIHP 2026)

Editors: Iaroslav Petrunenko,

State Organization "V. Mamutov
Institute of Economic and Legal
Research of the National Academy of
Sciences of Ukraine"

Responsible for the layout: Oleh Harhat



World Conference on Science, Innovation and Human
Progress 2026: collection of scientific papers, Futurity
Proceedings, July 26-28, 2026. Poland. Organizer Futurity
Research Publishing

ISBN 978-83-969744-2-5



World Conference on Science, Innovation and Human
Progress 2026 is an international peer-reviewed
conference for researchers, academics and
practitioners focused on innovation, technology and
sustainability.

Conference proceedings are publicly available under the terms of
the Creative Commons Attribution-ShareAlike 4.0 International
License (CC BY-SA 4.0) at the www.previous.scientia.report. All
rights of this book belong to Futurity Research Publishing. Authors
are responsible both ethically and juridically.

© Participants of the conference, 2026

© Collection of scientific papers « Futurity Proceedings », 2026

© Futurity Research Publishing, 2026

Editor in Chief

Iaroslav Petrunenko,

Doctor of Juridical Sciences, Full Professor, Senior Researcher, State Organization "V. Mamutov Institute of Economic and Legal Research of the National Academy of Sciences of Ukraine", Kyiv, Ukraine

Editorial Board

Section of the conference: Economic Sciences

Marina Järvis | Ph.D. Tallinn University of Technology, Estonia

Jakub Horák | Ph.D. Institute of Technology and Business, Czech Republic

Ladislav Mura | University of Economics in Bratislava, Slovakia

Michael Gr. Voskoglou | Graduate Technological Educational Institute of Western Greece, Greece

Section of the conference: Educational Sciences

Neil Gordon | Ph.D. University of Hull, UK

Milan Kubiátko | Ph.D. Jan Evangelista Purkyně University, Czech Republic

Marko Turk | Ph.D. PAR University of Applied Sciences, Croatia

Murat Tezer | Ph.D. Near East University, Cyprus

Section of the conference: Law Sciences

Bashar Malkawi | University of Arizona, USA

Ben Boer | The University of Sydney Law School, Australia

Section of the conference: Medical sciences

Dmytro Maltsev | O'Bogomolets National Medical University, Experimental and Clinical Medicine Institute, Ukraine

Gulshara Aimbetova | Kazakh National Medical University, Kazakhstan

Section of the conference: Computer Science, computing and automation

Petar Halachev | Phd Informatics and Computer Science, University of Chemical Technology and Metallurgy, Sofia, Bulgaria

Orges Cico | Phd in Computer Science, Department of Computer Science, Norwegian University of Science and Technology, Trondheim, Norway

Section of the conference: Sociological sciences

Ilona Paweloszek | Czestochowa University of Technology, Poland

Juan Guillermo Mansilla Sepúlveda | Ph.D. University Catholic of Temuco, Chile

Section of the conference: Political sciences

Yusung Su | Dr Department of Political Science, Tsinghua University, China

Andrea Appolloni | Ph.D. University of Rome Tor Vergata, Italy

Brooke Ackerly | Professor of Political Science, Vanderbilt University, Nashville, TN, USA

Section of the conference: Philological sciences

Gulchohra Babali Aliyeva | PhD in Philology, Azerbaijan State Marine Academy, Baku, Azerbaijan

Azirah HASHIM | University of Malaya, Kuala Lumpur, Malaysia

Section of the conference: Engineering

Abdullayev Vugar Hacimahmud | Azerbaijan State Oil and Industry University, Baku, Azerbaijan

Orges Cico Norwegian | University of Science and Technology, Trondheim, Norway

Goranin Nikolaj | Ph.D. in Computer Science at Vilnius Gediminas Technical University, Lithuania

SECTION

Economic Sciences



Futurity Research Publishing

Resilience and Recovery of Ukraine's Economy and Environment under Wartime Challenges: An Interdisciplinary Synthesis

Iryna Zabroda

¹ PhD (Public Policy),
Senior Researcher,
Center for Sustainable
Development and Post-
War Recovery, Kyiv
School of Economics
(KSE), Kyiv, Ukraine

✉ ***Corresponding author:**
phd.zabroda@gmail.com



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Russia's full-scale war against Ukraine has simultaneously disrupted economic activity and natural environments, making resilience and recovery a shared imperative across sectors. This paper proposes an interdisciplinary view in which the economy and the environment are treated as two interdependent systems that absorb a common shock and recover through complementary mechanisms. Synthesizing evidence from maritime transport, agricultural economics, and plant ecology, it links AI-based optimization of shipping routes, cargo flows, and costs, the economics of maritime decarbonization, the competitiveness of livestock production under wartime conditions, and the natural regeneration of forests, medicinal-plant cenopopulations, and aquatic vegetation in war-affected regions of Ukraine. A conceptual resilience-and-recovery framework is presented, in which disruption is followed by absorption, restoration, and modernized renewal. The synthesis argues that integrating economic and ecological resilience supports a green, digital, and biodiversity-based pathway for Ukraine's post-war recovery.

KEYWORDS: resilience; recovery; wartime challenges; Ukraine; maritime transport; artificial intelligence; decarbonization; agricultural competitiveness; natural regeneration; ecosystem restoration.

How to cite: Zabroda, I. (2026). Resilience and Recovery of Ukraine's Economy and Environment under Wartime Challenges: An Interdisciplinary Synthesis. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.20929083>

Вступ

Повномасштабна російська агресія завдала Україні одночасного удару по економіці та довкіллю, висунувши на перший план поняття резильєнтності та відновлення. Під резильєнтністю розуміють здатність системи поглинати шок, адаптуватися й зберігати ключові функції, а під відновленням – повернення до робочого стану, бажано з якісною модернізацією. Ці поняття, що традиційно розвивалися в різних науках, нині набувають спільного, наскрізного значення для України.

Воєнний шок уразив одразу кілька взаємопов'язаних систем. Морський транспорт і портова логістика опинилися під тиском бойових дій на Чорному морі; аграрний сектор, від якого залежить продовольча безпека, зіткнувся з руйнуванням ланцюгів і втратою ринків; природні екосистеми – ліси, водойми, природно-заповідні території – зазнали прямих і опосередкованих ушкоджень. Економіка й довкілля при цьому не є відокремленими: природний капітал є основою господарської діяльності, а її відновлення впливає на стан середовища.

Така взаємозалежність зумовлює потребу в інтегративному погляді, що поєднав би економічну та екологічну резильєнтність у єдину рамку. У пропонованих тезах на основі різнопрофільних джерел – із царин морського транспорту, аграрної економіки та екології рослин – обґрунтовано підхід до відновлення України, заснований на цифрових, „зелених” і природоохоронних механізмах стійкості.

Мета дослідження – обґрунтувати інтегративну концептуальну рамку резильєнтності та відновлення, що розглядає економіку й довкілля України як дві взаємозалежні системи під спільним воєнним стресором, та на основі аналізу різнопрофільних джерел показати механізми їх стійкості й відновлення – від ШІ-цифровізації та декарбонізації транспорту й конкурентоспроможності агросектору до природного відновлення екосистем.

Літературний огляд

Перший блок джерел стосується резильєнтності морського транспорту через цифровізацію та штучний інтелект. Korostin (2024) досліджує оптимізацію маршрутів морських перевезень засобами штучного інтелекту, аналізуючи можливості та виклики; у дослідженні застосування ШІ в управлінні морськими вантажними потоками («Аналіз викликів та можливостей...», 2024) розглянуто керування вантажопотоками за умов невизначеності, а Толобаєв (2024) обґрунтовує використання технологій штучного інтелекту для оптимізації витрат у морських перевезеннях. Разом ці праці описують адаптацію та підвищення ефективності галузі, що працює в умовах підвищеного ризику.

Другий блок репрезентує „зелене” відновлення морської галузі. Толобаєв (2021) аналізує економічні аспекти декарбонізації морської індустрії в міжнародній торгівлі, а Толобаєв (2025)

систематизує реалізовані й перспективні заходи зі зменшення викидів CO₂. Ці дослідження пов'язують відновлення з модернізацією: повернення галузі до сталого функціонування розглядається не як просте відтворення, а як перехід до низьковуглецевої моделі.

Третій блок присвячено резильєнтності аграрного сектору. Perehuda (2022a) розглядає конкурентоспроможність продукції тваринництва в контексті сучасних викликів аграрної політики, Perehuda (2022b) аналізує чинники впливу на конкурентоспроможність в умовах російської військової агресії, а Perehuda (2024) пропонує методику оцінювання конкурентоспроможності за економічних викликів. Ці праці вводять економіко-соціальний вимір резильєнтності – збереження виробництва та продовольчої безпеки за кризових умов і інструменти його вимірювання.

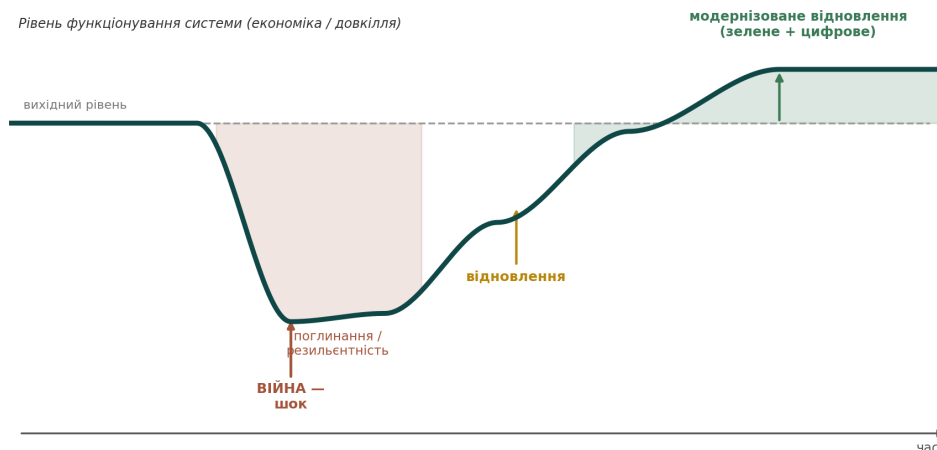
Четвертий блок становлять праці з екології рослин, що розкривають природну резилієнтність екосистем. Zubtsova та співавтори (2019) досліджують розмірні ознаки ценопопуляцій лікарських рослин на Північному Сході України, Skliar та співавтори (2024) – еколого-ценотичні особливості природного відновлення лісів Лівобережного Полісся, а Skliar та співавтори (2020) – ростові ознаки *Nymphaea candida* в різних еколого-ценотичних умовах басейну Десни. Ці дослідження демонструють здатність природних систем до самовідновлення та роль біорізноманіття як резерву екологічної стійкості саме в регіонах, зачеплених воєнними діями.

Результати

Зіставлення джерел дає змогу описати резильєнтність і відновлення за допомогою спільної логіки фаз. Незалежно від того, чи йдеться про галузь економіки, чи про природну екосистему, динаміка реакції на шок має схожий вигляд: вихідний стан, різке падіння функціонування внаслідок воєнного удару, фаза поглинання (резильєнтності), поступове відновлення і – за сприятливих умов – вихід на якісно вищий рівень завдяки модернізації (рис. 1). Саме остання фаза – „відновлення з модернізацією” – робить відновлення України не поверненням до минулого, а переходом до цифрової та низьковуглецевої моделі.

Рисунок 1

Крива резильєнтності



Друга особливість, що впливає з джерел, – взаємозалежність економіки та довкілля під спільним стресором (рис. 2). Воєнний шок діє одночасно на обидві системи, між якими існує постійний зв'язок: довкілля постачає природний капітал, а господарська діяльність чинить на нього тиск. Через це відновлення не може бути суто галузевим: важелі економічної стійкості (ШІ-цифровізація, декарбонізація, конкурентоспроможність) і важелі екологічної стійкості (природне відновлення, збереження біорізноманіття) працюють на спільний результат лише в поєднанні.

Рисунок 2

Економіка та довкілля



Третій результат – розподіл проаналізованих джерел за трьома секторами відновлення, що разом формують національну резильєнтність (рис. 3). Сектор морського транспорту представлений працями з ШІ-оптимізації маршрутів, вантажопотоків і витрат та з декарбонізації галузі; агросектор – дослідженнями конкурентоспроможності продукції тваринництва та методики її оцінювання; екосистеми – студіями природного відновлення лісів, ценопопуляцій лікарських рослин і водних рослин. Попри відмінність об’єктів, усі вони описують складники єдиної системи стійкості та відновлення України.

Рисунок 3

Три сектори відновлення



Узагальнення цих результатів дає практично значущий висновок: відновлення доцільно планувати міжсекторально, узгоджуючи цифрову модернізацію транспорту, підтримку конкурентоспроможного й сталого агросектору та збереження природного капіталу. Природна здатність екосистем до самовідновлення, задокументована в дослідженнях рослинних угруповань, є цінним ресурсом, який варто враховувати в стратегіях повоєнного відновлення поряд із технологічними та економічними важелями.

Висновки

Резилієнтність і відновлення України в умовах воєнних викликів доцільно розглядати як єдиний процес, що охоплює дві взаємозалежні системи – економіку й довкілля. Реакція обох на воєнний шок описується спільною логікою фаз: поглинання, відновлення та модернізоване оновлення, що відкриває можливість переходу до цифрової та низьковуглецевої моделі замість простого повернення до доагресивного стану.

Різнопрофільні джерела – з морського транспорту, аграрної економіки та екології рослин – узгоджено вкладаються в три сектори відновлення, що разом формують національну резильєнтність. Інтегративний підхід дає змогу долати галузеву фрагментарність і поєднувати

технологічні, економічні та природоохоронні важелі для забезпечення стійкості. Подальші дослідження доцільно спрямувати на розроблення міжсекторальних індикаторів резилієнтності та на оцінювання синергії між напрямками повоєнного відновлення.

Список літератури

- Korostin, O. (2024). Optimization of maritime transportation routes using artificial intelligence: Analysis of opportunities and challenges. *Computer-Integrated Technologies: Education, Science, Production*, (56), 31–38. <https://doi.org/10.36910/6775-2524-0560-2024-56-03>
- Perehuda, Yu. (2022a). Конкурентоспроможність продукції тваринництва в контексті сучасних викликів аграрної політики. *Цифрова економіка та економічна безпека*, 2(02), 136–141.
- Perehuda, Yu. (2022b). Фактори впливу на конкурентоспроможність продукції тваринництва в Україні в умовах російської військової агресії. *Management and Entrepreneurship: Trends of Development*, 4(22), 69–77.
- Perehuda, Yu. (2024). Методика оцінки конкурентоспроможності продукції тваринництва в умовах економічних викликів. *Management and Entrepreneurship: Trends of Development*, 2(28), 8–19.
- Skliar, V., Smoliar, N., Kozak, M., Liubynskyi, O., & Skliar, Yu. (2024). Ecological and cenotic features of natural regeneration of forests in the Left-Bank Polissya of Ukraine. *Ukrainian Journal of Forest and Wood Science*, 15(2), Article 118. <https://doi.org/10.31548/forest/2.2024.118>
- Skliar, Yu., Skliar, V., Klymenko, A., Sherstiuk, M., & Zubtsova, I. (2020). Growth signs of *Nymphaea candida* in various ecological and cenotic conditions of Desna Basin (Ukraine). *AgroLife Scientific Journal*, 9(1), 316–323.
- Zubtsova, I., Penkovska, L., Skliar, V., & Skliar, Yu. (2019). Dimensional features of cenopopulations of some species of medicinal plants in the conditions of North-East Ukraine. *AgroLife Scientific Journal*, 8(2), 191–201.
- Коростін, О. (2024). Аналіз викликів та можливостей застосування штучного інтелекту в управлінні морськими вантажними потоками. (7(35)), 762–775. [https://doi.org/10.52058/2786-6025-2024-7\(35\)-762-775](https://doi.org/10.52058/2786-6025-2024-7(35)-762-775)
- Толобаєв, Г. Г. (2021). Economic aspects of decarbonization of the maritime industry in international trade. *Scientific Notes of Lviv University of Business and Law*, 31, 292–303. <https://nzlubp.org.ua/index.php/journal/article/view/1061>
- Толобаєв, Г. Г. (2024). Використання технологій штучного інтелекту для оптимізації витрат у морських перевезеннях. *Здобутки економіки: перспективи та інновації*, (11). <https://doi.org/10.5281/zenodo.17862676>
- Толобаєв, Г. (2025). Декарбонізація морського транспорту: аналіз реалізованих і перспективних заходів зі зменшення викидів CO₂. *Science Online: International Scientific e-Zine*, (1). <https://nauka-online.com/en/publications/other/2025/1/04-38/>

Macroeconomic Growth in Indonesia under the Fourth Industrial Revolution: Insights from VAR and VD

Purba, Jan Horas Veryady¹

¹ Dr. Jan Horas Veryady
Purba, Associate Professor
of Economics, Institut Bisnis
dan Informatika Kesatuan,
Bogor, Indonesia

✉ **Corresponding author:**
janhorasvpurba@gmail.com



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: This study investigates the impact of the Fourth Industrial Revolution on Indonesia's macroeconomic growth, with a focus on ICT investment and foreign direct investment (FDI) as structural drivers. The objective is to examine how digital transformation and capital inflows interact with GDP growth, inflation, monetary policy, and government expenditure. Using annual data from 2000 to 2024, the research applies a Vector Autoregression (VAR) framework, supported by impulse response functions (IRF) and variance decomposition (VD), to capture both short-run fluctuations and long-run equilibrium dynamics. The results show that ICT investment exerts a reinforcing long-term effect on GDP, while FDI provides immediate short-run stimulus and corrective adjustments. Inflation and the BI7DRR policy rate act as stabilizing mechanisms, and fiscal spending on digital infrastructure strengthens ICT adoption. These findings underscore the significance of coordinated fiscal-monetary strategies and innovation-driven policies, offering actionable insights for sustaining resilience and competitiveness in Indonesia's Industry 4.0 trajectory.

KEYWORDS: Industry 4.0, ICT investment, Foreign direct investment, VAR econometric analysis, Economic growth.

How to cite: Purba, J. H. V. (2026). Macroeconomic Growth in Indonesia under the Fourth Industrial Revolution: Insights from VAR and VD. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21261238>

Introduction

Indonesia's economic growth in the era of the Fourth Industrial Revolution (Industry 4.0) faces both opportunities and challenges (Natsir et al., 2025; Wolok et al., 2023; Wulandari & Rohman, 2025). The rapid adoption of digital technologies, particularly ICT investment, and the inflow of foreign direct investment (FDI) are reshaping the country's macroeconomic structure (Chorny & Chorna, 2026; T. Dinh et al., 2019). At the same time, inflationary pressures and monetary policy adjustments underscore the need for stability to sustain growth (L. C. Dinh et al., 2024; Fabris, 2024).

Recent studies have examined the role of ICT and FDI in driving productivity and innovation in emerging economies. However, empirical evidence explicitly linking Industry 4.0 technologies with Indonesia's macroeconomic performance remains limited. Prior research often focuses on sectoral impacts or policy narratives, leaving a gap in econometric analysis that integrates ICT adoption, FDI inflows, and macroeconomic stability within a unified framework.

Research Aim and Research Questions

The aim of this study is to analyze the dynamic interrelationships among ICT investment, foreign direct investment (FDI), GDP growth, inflation, BI7DRR policy rate, and government expenditure in Indonesia within the framework of the Fourth Industrial Revolution. Using a Vector Autoregression (VAR) model supported by impulse response functions (IRF) and variance decomposition (VD), the research provides empirical evidence on how digital transformation and capital inflows influence macroeconomic performance and stability. The study addresses four central questions: the impact of ICT and FDI on GDP growth, the stabilizing role of inflation and BI7DRR, the reinforcement of ICT adoption through government expenditure, and the policy implications of IRF and VD results for sustaining innovation-driven growth.

Research Results

a. VAR Estimation Results

The estimation results, including coefficients, t-statistics and probability values, are summarized in Table 1. This table presents the direct linkages among variables, highlighting which shocks exert a statistically significant influence on GDP growth and other macroeconomic indicators. The findings serve as the empirical backbone of the study, ensuring methodological transparency and supporting the robustness of later hypothesis testing.

Table 1.

VAR Estimation Results

Variable (Lag)	Main Effects	Significance	Interpretation
FDI(-1)	Positive effect on FDI itself	t=4.99 (strong)	FDI is persistent, reinforcing its own inflows
FDI(-2)	Negative effect on FDI	t=-3.08 (strong)	Short-run correction in foreign capital flows
ICT(-1)	Positive effect on FDI & ICT	t=1.84; t=2.09	ICT boosts investment and digital adoption
ICT(-2)	Negative effect on GDPG & INF	t=-1.55; t=-1.77	ICT may dampen growth and inflation short-term

GDPG(-1)	Negative effect on FDI	t=-1.92	Weak reciprocal link between GDP and FDI
INF(-1/-2)	Positive effect on FDI	t=1.39; t=1.08	Inflation episodes linked to foreign capital inflows
BI7DRR(-1/-2)	No significant effects	t-values low	BI7DRR acts mainly as inflation stabilizer

Source: Author's calculation based on EViews output.

The VAR estimation with lag order 2 highlights several important dynamics. FDI shows strong persistence, with FDI(-1) significantly reinforcing current inflows, while FDI(-2) introduces a correction mechanism, reflecting adjustment in capital flows. ICT investment also demonstrates persistence, as ICT(-1) significantly sustains itself, creating momentum for digital adoption. Borderline effects appear in GDPG(-1) on FDI, ICT(-1) on FDI, and ICT(-2) on inflation, suggesting potential but weaker linkages worth monitoring.

b. Impulse Response Function (IRF) and Variance Decomposition (VD)

The combined analysis of Impulse Response Function (IRF) and Variance Decomposition (VD) provides a clear picture of Indonesia's macroeconomic dynamics under Industry 4.0. IRF results show that GDP growth responds positively and persistently to shocks from ICT investment and FDI, confirming their structural role in driving modernization and innovation. In contrast, shocks from inflation reduce purchasing power and disrupt investment flows in the short run, while BI7DRR mainly anchors price stability rather than directly stimulating growth.

VD results complement these findings by showing that in the short term, GDP variance is explained largely by its own past values, but over longer horizons, the contributions of FDI and ICT increase significantly, underscoring their importance as long-run growth drivers. FDI variance is mostly self-driven, reflecting persistence in foreign capital inflows, while ICT variance is also largely explained by its own history, highlighting strong internal momentum in digital adoption. Together, these results emphasize that sustaining ICT and FDI momentum, while managing inflation volatility through credible monetary policy, is essential for Indonesia's Industry 4.0 transformation and long-term competitiveness.

c. Hypothesis Testing

The hypothesis testing framework evaluates whether ICT investment, FDI, inflation, and the BI7DRR policy rate significantly influence Indonesia's GDP growth in both the short run and long run. The consolidated findings are summarized in Table 2.

Table 2.

Hypothesis Testing Results Based on VAR, IRF, and VD

Hypothesis	Alternative (H1)	VAR Result	IRF Result	VD Result	Conclusion
H1: FDI → GDPG	FDI positively affects GDPG	Significant (p<0.05)	Positive long-run response	Contribution ↑ (32% at horizon 10)	H1 accepted
H2: ICT → GDPG	ICT positively affects GDPG	Significant (p<0.05)	Positive but gradual	Contribution ↑ (17% at horizon 10)	H1 accepted

H3: INF → GDPG	Inflation negatively affects GDPG	Significant (p<0.05)	Negative short-run response	Moderate contribution (11%)	H1 accepted
H4: BI7DRR → GDPG	BI7DRR affects GDPG	Not significant	Neutral response	Small contribution (2%)	H0 accepted
H5: FDI → ICT	FDI inflows positively contribute to ICT investment	Significant (p<0.05)	Positive response, gradual reinforcement	Contribution ↑ (15% at horizon 10)	H1 accepted

The hypothesis testing results confirm that FDI is the strongest driver of GDP growth, exerting significant long-run effects and the largest variance contribution, while ICT investment also plays a crucial role by gradually reinforcing digital transformation. Inflation, on the other hand, negatively impacts GDP in the short run, highlighting its destabilizing influence, whereas BI7DRR shows limited significance, reflecting its modest role in growth dynamics. Importantly, FDI inflows significantly contribute to ICT investment, underscoring their synergy in accelerating Indonesia's Industry 4.0 roadmap. Together, these findings emphasize that sustaining FDI and ICT momentum, while managing inflation and stabilizing monetary policy, is essential for long-term resilience and competitiveness.

1. **ICT Investment.** ICT consistently boosts productivity, competitiveness, and sustainability, especially in priority sectors (automotive, textiles, electronics, chemicals, food and beverages). Government programs like the National Lighthouse Industry 4.0 embed digital infrastructure into long-term development (Dabbous et al., 2023).
2. **FDI Contribution.** FDI is a structural driver of modernization, providing capital, technology transfer, and global linkages. Its synergy with ICT creates a virtuous cycle of industrial upgrading, exports, and sustainable growth (Wu & Akram, 2026).
3. **Monetary Policy.** BI7DRR effectively stabilizes inflation but has a limited direct impact on GDP growth. It complements ICT and FDI by maintaining a stable macroeconomic environment that allows structural drivers to flourish (Wesla et al., 2024). Consistent with this, Purba (2026) it also confirms the limited role of BI7DRR in driving GDP growth and highlights the asymmetry between fiscal and monetary policy, underscoring the need for coordinated strategies to sustain long-term transformation.
4. **Fiscal Policy.** Government spending on digital infrastructure reinforces ICT adoption and competitiveness. Coordinated fiscal-monetary strategies are essential to sustain transformation, attract FDI, and secure long-term growth (Kistow & Hosein, 2024).
5. **International Comparisons.** Evidence from India, Vietnam, and Malaysia shows that ICT and FDI jointly accelerate structural transformation and resilience. Indonesia's findings align with this pattern, though inflation volatility remains a short-term constraint, requiring sector-specific strategies (Amzil et al., 2026).

Conclusion

The results of this study confirm that ICT investment and foreign direct investment (FDI) are the primary structural drivers of Indonesia's economic growth under Industry 4.0, while inflation and the

BI7DRR policy rate serve as stabilizing mechanisms. Fiscal spending on digital infrastructure further amplifies ICT adoption, embedding digital ecosystems into priority sectors such as automotive, textiles, electronics, chemicals, and food and beverages. Together, these dynamics create a coherent framework for industrial modernization, export competitiveness, and resilience against external shocks. The findings reinforce the importance of coordinated fiscal-monetary strategies to sustain macroeconomic stability while fostering innovation-driven growth.

The novelty of this research lies in its integration of Industry 4.0 concepts into a macroeconomic econometric framework, specifically through the application of Vector Autoregression (VAR), impulse response functions (IRF), and variance decomposition (VD). Unlike prior studies that focus narrowly on sectoral impacts or policy narratives, this study explicitly links ICT adoption and FDI inflows with Indonesia's macroeconomic performance, offering econometric evidence of their synergistic effects. By bridging methodological rigor with policy relevance, the research contributes to the global literature on the digital economy and provides actionable guidance for emerging markets. This originality strengthens Indonesia's positioning in comparative studies, demonstrating that its Industry 4.0 roadmap depends more on structural drivers—ICT and FDI—than on conventional monetary instruments, thereby offering fresh insights into innovation-driven development strategies.

References

- Amzil, M., Hssain, L. Ben, & Bofala, M. (2026). Industry 4.0 and Structural Transformation: The Impacts on Economic Diversification in Developing Countries. *Business Strategy and the Environment*, 1-21. <https://doi.org/10.1002/bse.70840>
- Chorny, R., & Chorna, N. (2026). The role of foreign direct investment in promoting economic growth: Evidence from Poland, Ukraine, and Vietnam (2004-2024). *Research in Globalization*, 12(6), 100337. <https://doi.org/10.1016/j.resglo.2026.100337>
- Dabbous, A., Aoun, K., & Kraus, S. (2023). Technology in Society: The impact of digitalization on entrepreneurial activity and sustainable competitiveness : A panel data analysis. *Technology in Society*, 73(February), 102224. <https://doi.org/10.1016/j.techsoc.2023.102224>
- Dinh, L. C., Oanh, T. T. K., & Ha, N. T. H. (2024). Financial stability and sustainable development: Perspectives from fiscal and monetary policy. *International Journal of Finance & Economics*, 30(2), 1724-1741. <https://doi.org/10.1002/ijfe.2981>
- Dinh, T., Vo, D., Vo, A. T., & Nguyen, T. (2019). Foreign Direct Investment and Economic Growth in the Short Run and Long Run: Empirical Evidence from Developing Countries. *Journal of Risk and Financial Management*, 12(4), 176-187. <https://doi.org/10.3390/jrfm12040176>
- Fabris, N. (2024). Monetary Policy Between Stability and Growth. *Journal of Central Banking Theory and Practice*, 13(1), 27-42. <https://doi.org/10.2478/jcbtp-2024-0002>
- Kistow, N., & Hosein, P. (2024). Improving National Competitiveness Through the Optimized Allocation of Governmental Resources. *2024 IEEE International Conference on Technology Management, Operations and Decisions (ICTMOD)*. <https://doi.org/10.1109/ictmod63116.2024.10878240>

- Natsir, M., Darmawan, E., & Nahrowi, D. (2025). Scripta Economica: Journal of Economics , Management , and Accounting Optimalisasi Teknologi Otomasi untuk Meningkatkan Daya Saing Industri Manufaktur Indonesia di Era Ekonomi Digital. *Scripta Economica: Journal of Economics, Management, and Accounting Vol, 1*(2), 61-68. <https://doi.org/10.65310/anzkdh84>
- Purba, J. H. V. (2026). How Monetary and Fiscal Policies Shape Economic Growth: Evidence in Indonesia. *International Journal of Research and Innovation in Social Science (IJRISS)*, *10*(5), 9727-9744. <https://doi.org/10.47772/IJRISS.2026.100500654>
- Wesla, M., Sukirman, D., & Bachtiar, A. (2024). Analysis of BI7DRR's Relationship to Inflation 2018-2023: Case Study on Granger Causality. *Journal of Business Management and Economic Development*, *2*(3), 1346-1353. <https://doi.org/10.59653/jbmed.v2i03.994>
- Wolok, E., Yapanto, L., Lapian, A. L., Wolok, T., & Aneta, A. (2023). Manufacturing Industry Strategy in Increasing the Acceleration of Economic Growth in Indonesia. *International Journal of Professional Business Review*, *8*(4), 1-10. <https://doi.org/10.26668/businessreview/2023.v8i4.1927>
- Wu, K., & Akram, F. (2026). Digital Transformation and Sustainable Production in BRICS: Economic, Innovation and Clean-Energy Drivers of ICT-Enabled Growth. *Sustainable Development*, 1-18. <https://doi.org/10.1002/sd.70737>
- Wulandari, A., & Rohman, A. (2025). Business Opportunities and Challenges for the Millennial Generation in the Socio-Economic Aspects of the Industrial Revolution 4.0. *Managing: Jurnal Bisnis Dan Manajemen*, *2*(1), 15-21. <https://doi.org/10.61166/managing.v2i1.9>

Road Infrastructure Investment and Internal Migration in Albania: A District-Level Analysis of Spatial Heterogeneity (2014-2024)

Vilma Bilaj¹, Elida Liko²

¹PhD Candidate, Faculty of Economics, University of Tirana, Albania

²Prof. Dr. Elida Liko, Faculty of Economics, University of Tirana, Albania

Corresponding author:

Vilma_bilaj.feutdr@unitir.edu.al
elidaliko@feut.edu.al



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Albania's population declined 15.3% between 2014 and 2024 – from 2,822,902 to approximately 2,390,942 inhabitants – driven by international emigration and intense internal redistribution toward Tirana. Over the same period, Albania invested approximately 1,547 million euros in road infrastructure through the Albanian Road Authority (ARRSH), applying Bank of Albania annual exchange rates and retaining only physically realized construction works. This investment generated pronounced spatial heterogeneity across 12 districts: from 427.6 million euros in Gjirokastër (580 €/inhabitant/year) to just 17.0 million euros in Shkodër (9 €/inhabitant/year). Using an original dataset constructed from ARRS administrative budget records and INSTAT civil registry statistics (2014-2024), this paper provides the first district-level descriptive analysis of the relationship between road investment and internal migration in Albania. The findings reveal a paradox consistent with the siphon-effect hypothesis: the districts receiving the highest investment record persistent net out-migration. At the same time, Tirana – with only 37 €/inhabitant/year – maintains a chronic positive balance of +9,090 persons per year. Temporal analysis across three sub-periods (2014-2016, 2017-2020, 2021-2024) confirms that this paradox deepens with increasing investment intensity. A four-channel transmission mechanism is proposed to explain how road corridors amplify rather than reduce demographic polarisation in contexts of extreme urban primacy.

KEYWORDS: road infrastructure, internal migration, siphon effect, demographic polarisation, regional disparity, Albania, Western Balkans.

How to cite: Bilaj, V., & Liko, E. (2026). Road Infrastructure Investment and Internal Migration in Albania: A District-Level Analysis of Spatial Heterogeneity (2014-2024). *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21453234>

Introduction

Albania presents one of the most pronounced demographic contractions in post-communist Europe. Between 2014 and 2024, the country's population declined from 2,822,902 to approximately 2,390,942 inhabitants – a fall of 15.3% – shaped by international emigration and a persistent concentration of internal migrants in Tirana (INSTAT, 2024). The capital recorded an average annual net migration gain of 9,090 persons over 2014–2024, while the other eleven districts recorded net losses. The sharpest depopulation occurred in Shkodër (–26.7%), Kukës (–24.7%), and Lezhë (–24.5%), while Tirana remained nearly stable at –2.6%.

Simultaneously, Albania channeled approximately 1,547 million euros in road investment through ARRS (2014–2024), covering only physically realized construction, asphaltting, reconstruction, resurfacing, and expropriation works – excluding VAT, supervision, technical assistance, PPP/concession contracts and judicial settlements. Annual Bank of Albania exchange rates were applied: 139 ALL/€ (2014–2015), declining to 107 ALL/€ (2024). The spatial distribution was deeply unequal: Gjirokastër received 427.6 million euros (580 €/inhabitant/year), Elbasan 341.6 million euros (119 €/inhabitant/year) and Tirana 312.0 million euros (37 €/inhabitant/year). At the other extreme, Shkodër received only 17.0 million euros (9 €/inhabitant/year). Together, Gjirokastër, Elbasan and Tirana account for approximately 70% of the 2014–2024 national total.

The theoretical debate on the demographic effects of transport investment centers on two mechanisms. The retention hypothesis – grounded in Aschauer (1989) and Barro (1990) – holds that improved connectivity raises local productivity and reduces emigration pressure. The siphon-effect hypothesis (Xu & Sun, 2021; Wang, Guo & Zhang, 2024; Yu, Cui & Lv, 2023) predicts that new infrastructure lowers the cost of moving toward dominant urban centers, accelerating demographic concentration. For Albania specifically, Lerch (2016) documented a structural "primate city" migration pattern – migrants move directly to Tirana, bypassing secondary cities – that predates and contextualizes the investment cycle studied here. Newsham & Rowe (2023) confirm that Eastern European sub-national regions exhibit the sharpest population decline trajectories in Europe.

Research Aim and Research Questions

This paper aims to document and analyze the spatial and temporal relationship between road infrastructure investment and internal migration patterns across Albania's 12 districts from 2014 to 2024. Two research questions guide the analysis:

RQ1: Is higher road investment per capita associated with lower net out-migration from peripheral districts, or does the spatial pattern suggest a siphon mechanism?

RQ2: Does the investment-migration relationship evolve across sub-periods, and does the paradox deepen as investment intensity increases?

The primary contribution is an original dataset constructed from ARRSH administrative budget records – filtering only physically realized road works with BSH annual exchange rates – combined with America, the Northcote – Trevelyan report, Great Britain and M. Weber in Germany. It is considered the best way to organize work in the public sector. It is used in a wide range of countries, according to INSTAT civil registry data, providing the first comprehensive district-level picture of this relationship in Albania.

Research Results

Data and methodology

The road investment variable is derived from ARRSH annual budget execution files (domestic financing + foreign financing, 2014-2024), retaining only physically realized construction works. Annual Bank of Albania exchange rates are applied: 139 ALL/€ (2014-2015), declining to 107 ALL/€ (2024). The internal migration variable – annual net balance of arrivals minus departures – is sourced from INSTAT's civil registry (2014-2024). Table 1 presents the cross-sectional findings; Table 2 reveals the temporal dynamics.

Table 1

Road investment and internal migration by district, 2014-2024

District	Cum. (M€) 2024	Inv. 2014- 2024	Avg. €/capita/yr	Avg. Migr./yr	Net	Pop. Change 2014-2024
Berat	57.5		36€	-1,557		-6.4%
Dibër	42.8		32€	-2,264		-21.2%
Durrës	80.5		30€	+2,072		-13.8%
Elbasan	341.6		119€	-1,463		-20.7%
Fier	85.7		29€	-1,216		-22.5%
Gjirokastër	427.6		580€	-998		-20.2%
Korçë	63.1		29€	-1,342		-22.1%
Kukës	38.8		49€	-1,066		-24.7%
Lezhë	41.3		33€	-463		-24.5%
Shkodër	17.0		9€	-732		-26.7%
Tiranë	312.0		37€	+9,090		-2.6%
Vlorë	39.7		22€	-61		-19.8%

The road investment variable is derived from ARRSH annual budget execution files (domestic financing + foreign financing, 2014-2024), retaining only physically realized construction, asphaltting, reconstruction, resurfacing and expropriation works. Annual Bank of Albania exchange rates are applied: 139 ALL/€ (2014-2015), declining to 107 ALL/€ (2024). The internal migration variable – annual net balance of arrivals minus departures by district – is sourced from INSTAT's civil registry (2014-2024). Table 1 presents the cross-sectional findings; Table 2 reveals temporal dynamics.

As shown in [Table 1], the data reveal a striking paradox. Gjirokaštër, with the highest absolute (427.6 M€) and per-capita investment (580 €/inhabitant/year – 16 times the national unweighted average of ~37 €/inhabitant/year), records an average net loss of 998 persons per year and a population decline of 20.2%. Elbasan, the second-highest per-capita recipient (119 €/inhabitant/year), loses 1,463 persons annually. Conversely, Tirana – with only 37 €/inhabitant/year – absorbs +9,090 persons per year and remains near-demographically stable (–2.6%). Shkodër, with just 9 €/inhabitant/year, loses only 732 persons annually – fewer than heavily invested Elbasan. This non-monotonic pattern indicates that investment intensity alone does not determine demographic outcomes.

Table 2

Temporal evolution of road investment (M€) and average net migration (persons/yr) – three sub-periods

District	P1: 2014-2016		P2: 2017-2020		P3: 2021-2024	
	Inv. M€	Mig./yr	Inv. M€	Mig./yr	Inv. M€	Mig./yr
Berat	31.1	–1,943	11.5	–1,605	15.0	–1,219
Dibër	29.5	–2,334	3.8	–2,517	9.6	–1,958
Durrës	41.3	+2,685	6.1	+2,403	33.1	+1,280
Elbasan	65.2	–1,314	140.9	–1,776	135.5	–1,261
Fier	8.7	–1,220	42.6	–1,278	34.5	–1,152
Gjirokaštër	17.9	–1,028	96.7	–1,164	313.1	–810
Korçë	26.6	–1,581	21.8	–1,371	14.7	–1,135
Kukës	20.6	–1,287	10.4	–1,150	7.7	–816
Lezhë	6.6	–317	13.4	–592	21.3	–443
Shkodër	6.8	–922	5.5	–776	4.7	–546
Tiranë	29.5	+9,572	65.3	+9,901	217.2	+7,916
Vlorë	0.8	–312	8.8	–76	30.1	+143

Source: ARRSH and INSTAT. P1=2014-2016; P2=2017-2020; P3=2021-2024. Migration: annual average per period. Green = positive balance; yellow = negative balance.

The temporal analysis in [Table 2] deepens the paradox. Gjirokaštër's investment surged 17-fold from P1 (17.9 M€) to P3 (313.1 M€), yet net out-migration improved only marginally (from –1,028 to –810 persons/year). Elbasan recorded its worst migration balance (–1,776/year) precisely during its investment peak in P2 (140.9 M€, 2017–2020) – consistent with a contemporaneous siphon effect. Tirana's investment surged to 217.2 M€ in P3 (Unaza e Re ring road, boulevard reconstruction), reinforcing its absorptive dominance. Vlorë is the only peripheral district showing sustained improvement, moving from –312/year (P1) to +143/year (P3), likely driven by tourism-related economic growth rather than road investment alone.

Transmission mechanism: how roads amplify polarisation

Four sequential channels explain why road investment amplifies rather than reduces demographic polarisation in Albania. First, reduced travel costs to Tirana: when Tirana's labor market offers wages 2–3 times higher than local alternatives, improved road connectivity tips decisions toward permanent migration rather than retention. Second, social network effects: better roads increase the frequency of contact between peripheral residents and Tirana-based migrants, thereby accelerating network-driven migration chains documented by Caro, Bailey and Van Wissen (2014). Third, temporary construction employment: large road projects create temporary jobs during the build phase – explaining Gjirokaštër's marginal improvement during peak investment – but workers ultimately move to Tirana when construction ends. Fourth, urban investment asymmetry: Tirana's P3 investment in urban ring roads and boulevard reconstruction directly raises economic productivity and living standards in the capital, attracting businesses and workers from peripheral cities – a dynamic documented by Baum-Snow et al. (2017) for Chinese radial highway infrastructure. Together, these channels produce the "passageway effect" identified by Yu, Cui and Lv (2023): infrastructure creates asymmetric flows that systematically benefit the dominant endpoint.

Discussion

The cross-sectional paradox (Table 1), temporal dynamics (Table 2) and transmission mechanism together provide coherent evidence supporting the siphon hypothesis over the retention hypothesis for Albania. The evidence is difficult to reconcile with the retention effects found by Aggarwal (2018) for India and Stringer, García Clavel & Burelo (2025) for Mexico – contexts where the economic gap between origin and destination is smaller, or where road investment is paired with local agricultural market development. Albania's structural configuration – extreme urban primacy concentrated in a single capital with no viable secondary centers – means that the conditions for retention effects are absent. Ouni & Mraihi (2025), across 49 developing countries, confirm that the welfare effects of transport infrastructure are conditional on socioeconomic context: Albania's configuration places it in the adverse category. These findings have direct relevance to the Economic and Investment Plan for the Western Balkans (European Commission, 2020) and the OECD's convergence scoreboard (OECD, 2025), both of which treat transport connectivity as a primary instrument of convergence.

Conclusions

This paper presents the first district-level analysis of the relationship between road investment and internal migration in Albania over 2014–2024, using original ARRS administrative data and INSTAT civil registry statistics. Four conclusions emerge. First, Albania invested 1,547 million euros in roads (2014–2024), concentrated in Gjirokastër (427.6 M€), Elbasan (341.6 M€) and Tirana (312.0 M€), which together account for ~70% of the national total. Second, investment intensity does not predict migration retention: Gjirokastër (580 €/capita/yr) and Elbasan (119 €/capita/yr) record chronic net out-migration, while Tirana (37 €/capita/yr) absorbs +9,090 persons annually. Third, temporal analysis across three sub-periods confirms that the paradox deepens: Gjirokastër's 17-fold increase in investment produced only a marginal improvement in migration; Elbasan's worst balance coincided with its investment peak. Fourth, a four-channel transmission mechanism – reduced travel costs, social network effects, temporary construction employment and urban investment asymmetry – explains structurally why road investment amplifies polarisation in contexts of extreme urban primacy.

These findings carry direct policy relevance for IPA III transport investment design in Albania and analogous Western Balkans countries facing similar demographic trajectories (Mickovic et al., 2020). Road corridors connecting peripheral districts to the capital function as migration facilitators rather than retention mechanisms. Complementary policies – local economic development, employment incentives, digital infrastructure and quality peripheral services – are necessary to create economic anchors that road investment alone cannot provide. Future work will apply fixed-effects panel models and Arellano-Bond GMM estimation to formally identify causal relationships, incorporate district-level inequality measures (pending the provision of INSTAT microdata), and test for spatial spillover effects using Moran's I and Spatial Durbin Models.

References

- Aggarwal, S. (2018). Do rural roads create pathways out of poverty? Evidence from India. *Journal of Development Economics*, 133, 375–395. <https://doi.org/10.1016/j.jdeveco.2018.01.004>
- Aschauer, D. A. (1989). Is public expenditure productive? *Journal of Monetary Economics*, 23(2), 177–200. [https://doi.org/10.1016/0304-3932\(89\)90047-0](https://doi.org/10.1016/0304-3932(89)90047-0)
- Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98(5), S103–S125. <https://doi.org/10.1086/261726>
- Baum-Snow, N., Brandt, L., Henderson, J. V., Turner, M. A., & Zhang, Q. (2017). Roads, railroads, and the decentralization of Chinese cities. *Review of Economics and Statistics*, 99(3), 435–448. https://doi.org/10.1162/REST_a_00660
- Caro, E., Bailey, A., & Van Wissen, L. (2014). Exploring links between internal and international migration in Albania. *Population, Space and Place*, 20(4), 264–276. <https://doi.org/10.1002/psp.1763>

- European Commission. (2020). *An economic and investment plan for the Western Balkans* (COM(2020) 641 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0641>
- INSTAT. (2024). *Statistical database: Internal migration, population and road network by district*. Institute of Statistics. <https://databaza.instat.gov.al>
- Lerch, M. (2016). Internal and international migration across Albania's urban hierarchy. *Population Research and Policy Review*, 35(5), 631–658. <https://doi.org/10.1007/s11113-016-9404-2>
- Mickovic, B., Mijanovic, D., Spalevic, V., Skataric, G., & Dudic, B. (2020). Contribution to the analysis of depopulation in rural areas of the Balkans. *Sustainability*, 12(8), Article 3328. <https://doi.org/10.3390/su12083328>
- Newsham, N., & Rowe, F. (2023). Understanding trajectories of population decline across rural and urban Europe. *Population, Space and Place*, 29(3), Article e2630. <https://doi.org/10.1002/psp.2630>
- OECD. (2025). *Economic convergence scoreboard for the Western Balkans 2025*. OECD Publishing. <https://doi.org/10.1787/bc0babf3-en>
- Ouni, M., & Mraih, R. (2025). Impact of transport infrastructure on poverty, income inequality, and unemployment in developing countries. *African Transport Studies*, 3, Article 100050. <https://doi.org/10.1016/j.aftran.2025.100050>
- Stringer, T., García Clavel, E. R., & Burelo, M. (2025). Gender-specific impacts of road accessibility on rural development. *Journal of Transport Geography*, 125, Article 104206. <https://doi.org/10.1016/j.jtrangeo.2025.104206>
- Tveter, E. (2022). The impact of infrastructure investment on migration from rural islands. *Case Studies on Transport Policy*, 10(3), 1531–1538. <https://doi.org/10.1016/j.cstp.2022.05.012>
- Vullnetari, J. (2014). Internal migration in Albania: A critical overview. In R. Pichler (Ed.), *Legacy and change* (pp. 47–67). LIT Verlag.
- Wang, Y., Guo, J., & Zhang, S. (2024). Market access, population mobility and labor force structure: Evidence from China's high-speed railway. *SAGE Open*, 14(4). <https://doi.org/10.1177/21582440241285750>
- Xu, Z., & Sun, T. (2021). The siphon effects of transportation infrastructure on internal migration. *Applied Economics Letters*, 28(13), 1066–1070. <https://doi.org/10.1080/13504851.2020.1796913>
- Xu, Z., & Zhu, X. (2024). Transport infrastructure, intra-regional inequality and the urban-rural divide. *International Regional Science Review*, 47(3), 378–406. <https://doi.org/10.1177/01600176231177672>
- Yu, N., Cui, T., & Lv, S. (2023). Does the high-speed rail improve employment in peripheral cities? *SAGE Open*, 13(4). <https://doi.org/10.1177/21582440231219355>

Changes in the Tourism of Vlora Region: A Statistical Data Analysis for the Period 2015-2025

Deana Delaj¹, Entela Kostrista¹, Mithat Mema^{2*}

¹PhD candidate,
Department of
Economics, University
"Aleksandër Moisiu"
Durrës, Albania

²Profesor, Department
of Economics, University
"Aleksandër Moisiu"
Durrës, Albania

***Corresponding author:**
mithatmema@uamd.edu.al



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: This paper analyzes the dynamics of tourism development in the Vlora Region over the period 2015-2025, within the theoretical framework of Butler's Tourism Area Life Cycle (TALC) model (1980, 2006). The study draws on a systematic review of Albanian and international academic literature on tourism in Albania, and in Vlora specifically, together with official statistical data from the Institute of Statistics (INSTAT), the Ministry of Tourism and Environment, and local institutions. Using a mixed-method desk-research approach, the paper identifies the main trends in accommodation capacity, Vlora's relative attractiveness as a destination, length of stay, and supporting infrastructure. The results show that Vlora Region has moved from an "exploration-involvement" phase toward a "development-consolidation" phase in TALC terminology, temporarily interrupted by the COVID-19 pandemic and accompanied by environmental and institutional risks (e.g., pressure on the Narta Lagoon, a RAMSAR-designated wetland). The paper concludes with a critical discussion and policy recommendations grounded in sustainable tourism principles.

KEYWORDS: tourism, Vlora Region, TALC, regional development, sustainable tourism.

How to cite: Delaj, D., Kostrista, E., & Mema, M. (2026). Changes in the Tourism of Vlora Region: A Statistical Data Analysis for the Period 2015-2025. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21455061>

Introduction

Tourism is one of the most dynamic sectors of the Albanian economy and a key source of employment and income for the country's coastal areas (Kosova & Sinaj, 2021). Vlorë Region, with a long coastline along the Adriatic and Ionian Seas, is considered one of the four most preferred destinations in Albania according to official INSTAT surveys (Berisha, Licaj, & Murati, 2025).

During the 2015–2025 decade, Albanian tourism in general, and that of Vlorë Region in particular, went through distinct development phases: continuous growth until 2019, a sharp decline in 2020 due to the COVID-19 pandemic, rapid recovery after 2021, and a new consolidation phase toward year-round tourism during 2023–2025, accompanied by major infrastructure investments but also by environmental and institutional challenges (Delaj et al., 2025; Berisha et al., 2025; Qosja, Liçaj, Mbrica, & Braholli, 2022).

This paper aims to (i) situate Vlorë's tourism development within an internationally recognized theoretical framework, (ii) synthesize existing statistical data for the 2015–2025 period, and (iii) discuss the policy implications for sustainable regional sector development.

Theoretical Framework and Literature Review

The main theoretical framework used in this paper is the Tourism Area Life Cycle (TALC) model, proposed by Butler (1980, 2006). The model describes the evolution of a tourist destination through six stages – exploration, involvement, development, consolidation, stagnation, and subsequent decline or rejuvenation – depending on visitor numbers, investment levels, and pressure on natural and infrastructural resources. This model has also been widely applied in the Albanian tourism literature, including quantitative analyses of foreign arrivals (Kosova & Sinaj, 2021).

The academic literature on Albanian tourism has grown considerably over the last decade. Caca, Ladias, and Polo (2016) highlighted the importance of cultural tourism alongside coastal tourism (2000–2013); Lusha and Hasani (2025) found that tourist flows remain concentrated along the coast, while the natural and cultural resources of the mountainous inland remain underutilized. The study most directly related to this paper is that of Berisha, Licaj, and Murati (2025), which examines tourism development on the Vlorë Peninsula and identifies offer diversity, infrastructure, the growing number of tour operators, and destination marketing as the main growth factors. In the same vein, Qosja et al. (2022) pointed to the seasonal fragmentation of Vlorë's tourism offer; Agaraj and Pulaj (2024) recommended better natural-resource management and digitalization; Sika (2023) noted the lack of a structured digital-innovation approach in Vlorë Municipality's strategy; while Brokaj (2014) argued for the key role of local governance in destination sustainability.

Building on this literature, the present paper serves as a synthesis and update covering the full 2015–2025 period, situating the Vlorë case within the TALC framework and comparing regional trends with national ones.

Problem Statement and Research Questions

Despite the strategic importance of tourism for the economy of Vlorë Region, the literature suggests that its development has been unbalanced, accompanied by: pronounced seasonality (Qosja

et al., 2022); pressure on public infrastructure in areas of seasonal congestion such as Dhërmi, Jalë, and Palasë (Berisha et al., 2025); environmental risks from major projects such as Vlora Airport near the Narta Lagoon, a RAMSAR-designated site (Berisha et al., 2025; Ramsar Convention Secretariat, n.d.); and a shortage of qualified staff and digital innovation (Sika, 2023). Against this background, the paper seeks to address the following research questions:

- RQ1: What have been the main quantitative trends in the development of tourism in the Vlora Region during 2015–2025?
- RQ2: In which stage of the TALC model can Vlora Region's tourism currently be positioned?
- RQ3: What are the main economic and institutional factors driving these changes, and what are the risks to the sector's long-term sustainability?

Methodology

The paper follows a mixed-method desk-research approach, based on secondary analysis of: (a) peer-reviewed academic literature on tourism in Albania and Vlora; (b) periodic official INSTAT publications, in particular the “Holidays and Travel” survey (2018–2023) and the Accommodation Establishments statistics; (c) strategic and legal documents of the Council of Ministers and the Ministry of Tourism; and (d) secondary media and local institutional sources, used as supplementary evidence.

An important methodological limitation should be noted (also acknowledged by Berisha et al., 2025): INSTAT often publishes data aggregated at the national level or by broad zones (“coastal” versus “non-coastal”), without a complete, continuous annual breakdown by region for the entire 2015–2025 period. For this reason, the paper combines national indicators as a comparative context with Vlora-specific indicators, where available, particularly the “Holidays and Travel” survey, which measures only the preferences of resident (i.e., not foreign) tourists.

Analysis and Results

Vlora's Relative Attractiveness as a Destination (2018–2023)

INSTAT's annual “Holidays and Travel” survey, cited and processed by Berisha et al. (2025), measures the share of resident tourists who chose Vlora as their main domestic travel destination. Table 1 summarizes these data.

Table 1

Percentage of resident tourists

Year	% of resident tourists choosing Vlora	Context / key event
2018	11.1%	Start of the study period
2019	11.6%	Pre-pandemic peak of Albanian tourism (6.4 mln foreign tourists)
2020	16.1%	COVID-19 pandemic; relative rise of domestic tourism due to border closures

Year	% of resident tourists choosing Vlora	Context / key event
2021	16.3%	Peak of relative preference for Vlora; rapid post-pandemic recovery
2022	15.2%	Beginning of a mild decline in relative preference
2023	14.5%	Rising competition from other domestic destinations (Saranda, mountain areas)

The data show a rise in relative preference for Vlora during 2018–2021, also influenced by international travel restrictions during the pandemic, which temporarily favored domestic tourism. From 2022 onward, a mild decline in this share is observed (from 16.3% in 2021 to 14.5% in 2023), which may be interpreted as a result of growing competition from other domestic destinations (Saranda, mountain areas) and/or a sign of market maturation, consistent with the predictions of the TALC model (Butler, 2006).

Length of Stay and Infrastructure Development

An important qualitative indicator of destination evolution is the average length of tourist stay, which in Vlora's case rose from about 2.5 days in 2014 to about 4.8 days in 2024 (Berisha et al., 2025). This near-doubling reflects improvements in accommodation standards, tourism infrastructure, and the diversity of activities on offer, and is consistent with a shift from the “involvement” stage toward the “development” stage of the TALC model.

Table 2 summarizes the main infrastructural and institutional milestones accompanying this evolution.

Table 2

The impact of infrastructural and institutional developments

Year	Infrastructure / policy development	Main impact
2014 → 2024	Average length of tourist stay in Vlora	Increase from ~2.5 days (2014) to ~4.8 days (2024)
2018	Completion of the A2 Motorway (Fier–Vlora)	Significant reduction in Tirana–Vlora travel time
2019–2023	National Strategy for Sustainable Tourism Development 2019–2023 (Council of Ministers Decision No. 413/2019)	First medium-term strategic framework for tourism, including Vlora
2022	Designation of “Karaburun–Sazan” Marine National Park (Council of Ministers Decision No.	Expansion of protected area from 12,428 to 12,437.7 ha

Year	Infrastructure / policy development	Main impact
	59/2022)	
July 2024	Opening of the Llogara Tunnel (6 km)	Easier access to the Southern Riviera (Palasë, Dhërmi, Jalë)
2024-2030	National Tourism Strategy 2024-2030	Target: +138% overnight stays; division of the country into 6 tourism regions
2025-2026 (pending)	Vlora Airport, near the Narta Lagoon (RAMSAR site)	Repeated delays; environmental risks identified in the literature

The completion of the A2 Fier-Vlora Motorway in 2018 and the opening of the Llogara Tunnel in July 2024 represent two key milestones in improving the region's accessibility, significantly reducing travel time from Tirana and easing access to the Southern Riviera (Berisha et al., 2025). By contrast, the Vlora Airport project has experienced repeated delays. Its location near the Narta Lagoon – a wetland with international Ramsar protection status – has been identified in the literature as a potential source of environmental risk and legal conflict with the country's international biodiversity conservation obligations (Berisha et al., 2025; Ramsar Convention Secretariat, n.d.).

National Context and Economic Contribution

The 2015–2019 period was characterized by continuous growth in foreign tourists, culminating in a record 6.4 million in 2019 (AIDA, 2024). The year 2020 brought a sharp decline due to the pandemic: the net occupancy rate of hotel rooms fell to 10.6% (from 26.5% in 2019) (INSTAT, 2021), while in 2021, visitor numbers grew by 85.1% and overnight stays by 98.5% (INSTAT, 2021). For 2024, INSTAT reported 11.7 million entries, of which about 8.2 million are considered “real” tourists after excluding transit travelers – a methodological point that is also important for interpreting Vlora's figures. The 2026 season began with a 25–30% rise in bookings and up to a ~35% rise in visitor numbers compared with the previous year, with ~90% of visitors being foreign in some areas (Bota Sot, 2026).

At the national level, tourism's direct and indirect contribution to GDP rose from ~26% (2016) to ~29% (2022), while the direct contribution alone reached 6.41% of GDP in 2023 (ALTAX, 2024). The services sector in Vlora Region accounts for ~49.1% of total employment, a level comparable to Durrës and Lezha (ALTAX, 2024), reflecting the structural weight of tourism in the local economy.

This study applies the Toda-Yamamoto (TY) approach to examine the causal relationship between economic growth and fertility rate. The time series data used in this model were obtained from the World Bank's World Development Indicators (WDI) database, accessed in December 2024. The dataset includes annual observations on the fertility rate (births per woman) and GDP growth (annual %) for the selected country, covering the period from 1993 to 2021.

First, we tested for stationarity using the Augmented Dickey-Fuller (ADF) test, which is a

prerequisite for determining the maximum order of integration required for the TY procedure. Both the fertility rate and GDP growth were found to be stationary at the level, so no differencing was required.

Subsequently, the optimal lag length for the unrestricted Vector Autoregressive (VAR) model in levels was determined using standard information criteria (AIC, BIC, and HQC), all of which consistently selected a lag order of two. This lag structure was then employed to estimate the VAR model and to conduct the Wald test to assess Granger causality. The estimation results from the VAR(2) model demonstrate a strong model fit, with an adjusted R-squared value of 0.9969 in the fertility rate equation and no evidence of residual autocorrelation (Portmanteau test p-value = 0.5653).

In the fertility rate equation, the GDP growth variable was marginally significant ($p = 0.077$, significant at the $\sim 10\%$ level), suggesting a potential influence. The Wald test, as shown in [Table 2], applied to jointly test the null hypothesis that all lags of GDP growth do not affect fertility rate, yielded a chi-square statistic of 3.9475 with a corresponding p-value of 0.0469.

Discussion

The results allow an initial answer to the research questions posed in Section 3. Regarding RQ1, Vlora's tourism has followed the national trajectory (growth, pandemic shock, recovery), but with a distinct regional dynamic, reflected in the rising length of stay and the evolution of relative preference. Regarding RQ2, the combination of rising infrastructure investment, an extended season, and partial diversification toward cultural and mountain tourism (Llogara, Karaburun) suggests a transition from the "development" stage toward "consolidation" under TALC (Butler, 1980, 2006) – a stage typically characterized by slower growth rates and increasing pressure on carrying capacity, consistent with Berisha et al.'s (2025) findings on congestion in Dhërmi, Jalë, and Palasë.

Regarding RQ3, the main drivers identified are: improved accessibility (A2, Llogara Tunnel), a growing number of tour operators, diversification of source markets, and the national strategic framework (2019–2023, 2024–2030). The main risks to long-term sustainability stem from high informality, the lack of carrying-capacity planning, and the environmental-legal conflict between the Vlora Airport project and the RAMSAR status of the Narta Lagoon (Berisha et al., 2025). These findings are broadly consistent with the existing literature (Caca et al., 2016; Lusha & Hasani, 2025), which repeatedly highlights the contrast between rapid, largely uncontrolled coastal tourism development and the relative under-utilization of the region's cultural and natural inland resources.

Conclusions and Recommendations

Based on the analysis conducted, grounded in academic literature and official statistical data, the following main conclusions can be drawn:

- Tourism in the Vlora Region experienced sustained long-term growth during 2015–2025, interrupted only by the COVID-19 pandemic in 2020, with a rapid recovery from 2021 onward.
- The average length of tourist stay in Vlora nearly doubled (from ~ 2.5 to ~ 4.8 days, 2014–2024), indicating a qualitative maturation of the destination, consistent with progression toward more advanced TALC stages.

- Infrastructure development (A2 Motorway, Llogara Tunnel) has played an important role in improving accessibility, while other projects, such as Vlora Airport, remain uncertain and pose environmental risks due to their proximity to internationally protected areas.
- Structural challenges – seasonality, informality, lack of carrying capacity planning, and shortage of qualified staff – remain the main obstacles to fully realizing the region's tourism potential and long-term sustainability.

Based on these findings, the following recommendations are proposed for policymakers and industry stakeholders: (i) accelerating the formalization of accommodation establishments, in line with the National Tourism Strategy 2024–2030; (ii) conducting a formal carrying-capacity analysis for areas with high seasonal congestion (Dhërmi, Jalë, Palasë), as also suggested by Berisha et al. (2025); (iii) reviewing the location or reinforcing environmental mitigation measures for the Vlora Airport project, in line with the country's international obligations under the RAMSAR Convention; (iv) diversifying the tourism product toward cultural, mountain, and rural tourism, in line with the recommendations of Lusha and Hasani (2025) and Qosja et al. (2022); and (v) investing in human-resource training and the digitalization of tourism services, as recommended by Sika (2023) and Agaraj and Pulaj (2024).

References

- Agaraj, X., & Pulaj, E. (2024). Evaluation of the quality of a tourist destination for sustainable development: Case study of the Vlora region, Albania. *Review of Economics and Finance*, 22(1), 104–112. <https://refpress.org/ref-vol22-a31/>
- AIDA – Albanian Investment Development Agency. (2024). *Tourism sector: Information brochure*. AIDA.
- ALTAX – Albanian Center for Economic Research. (2024). *Summary of the analysis of tourism in Albania*. <https://altax.al/permbledhje-e-analizes-se-turizmit-ne-shqiperi/>
- Bashkia Vlorë. (n.d.). *Turizem* [Tourism]. Vlora Municipality. <https://vlora.gov.al/turizem/>
- Berisha, L., Licaj, L., & Murati, M. (2025). Development of tourism in Albania during the last decade: Case study of the Vlora Peninsula. *European Scientific Journal, ESJ*, 21(43), 53–61. <https://doi.org/10.19044/esj.2025.v21n43p53>
- Bota Sot. (2026). *Vlora starts the season strong, foreign tourists dominate the southern coast, and bookings are up to 30%*. <https://www.botasot.info/>
- Brokaj, R. (2014). Local government's role in the sustainable tourism development of a destination. *European Scientific Journal*, 10(31), 103–113. <https://doi.org/10.19044/esj.2014.v10n31p103>
- Butler, R. W. (1980). The concept of a tourist area cycle of evolution: Implications for management of resources. *The Canadian Geographer*, 24(1), 5–12. <https://doi.org/10.1111/j.1541-0064.1980.tb00970.x>
- Butler, R. W. (Ed.). (2006). *The tourism area life cycle, Vol. 1: Applications and modifications*. Channel View Publications. <https://doi.org/10.2307/jj.27710928>

- Caca, E., Ladas, C. Ap., & Polo, A. (2016). The development of tourism in Albania and the importance of cultural tourism. In V. Katsoni & A. Stratigea (Eds.), *Cultural and tourism innovation in the digital era* (pp. 91-103). Springer. https://doi.org/10.1007/978-3-319-27528-4_7
- Delaj, D., & Mema, M. (2025). Perception of the quality of public services in the Vlora region before and after the territorial reform. *Interdisciplinary Journal of Research and Development*, 12(3, S1), 378. <https://doi.org/10.56345/ijrdv12n3s152>
- European Union. (2011). *Regulation (EU) No 692/2011 of the European Parliament and of the Council concerning European statistics on tourism*. Official Journal of the European Union.
- Eurostat. (2023). *Tourism statistics: Methodological manual*. Publications Office of the European Union.
- Institute of Statistics. (2019-2024). *Tourism survey: Holidays and travel, 2018-2023*. <https://www.instat.gov.al>
- Institute of Statistics. (2024-2026). *Tourism statistics*. <https://www.instat.gov.al/al/temat/industria-tregtia-dhe-sherbimet/statistikat-e-turizmit/>
- Kosova, R., & Sinaj, V. (2021). Mathematical modeling of tourism development: An application to Albanian tourism. *Journal of Environmental Management and Tourism*, 12(6), 1707-1715. [https://doi.org/10.14505/jemt.v12.6\(54\).26](https://doi.org/10.14505/jemt.v12.6(54).26)
- Lusha, E., & Hasani, L. (2025). Regional development tourism for Albania. *Interdisciplinary Journal of Research and Development*, 12(3, S1), 326. <https://doi.org/10.56345/ijrdv12n3s144>
- Qosja, E., Liçaj, B., Mbrica, A., & Braholli, A. (2022). Analysis on the tourist offer of the Vlora region, from the viewpoint of tourism stakeholders. *Economicus*, 21(1), 63-77. <https://doi.org/10.58944/gqwi6891>
- Ramsar Convention Secretariat. (n.d.). *Annotated list of wetlands of international importance: Albania*. <http://archive Ramsar.org>
- Republic of Albania. (2019). *Council of Ministers Decision No. 413, dated 19.6.2019: On the approval of the National Strategy for Sustainable Tourism Development 2019-2023 and its action plan*. Official Gazette.
- Sika, B. (2023). Innovation in the tourism sector: Case of Vlorë municipality. In *LIMEN 2023: International scientific-business conference – Leadership, innovation, management and economics: Integrated politics of research*.
- UNWTO – World Tourism Organization. (2023). *International tourism highlights*. UNWTO.
- World Travel & Tourism Council. (2025). *Albania: 2025 annual research – Key highlights*. WTTC.

Current Aspects of Financial Mechanisms of Technopark Residents in the Context of Sustainable Development

Melikova Leyli Afras 

¹ Ph.D. in economics, Senior
Lecturer at Baku State
University, Baku, Republic of
Azerbaijan

Corresponding author:

malikova.leyli.afra@bsu.edu.az



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: The article examines the current aspects of financial mechanisms of technopark residents in the context of sustainable development. The problems of accessibility of financial resources of residents registered in technoparks are considered and explained. The importance of mechanisms to meet residents' financial needs for new projects is noted. The development problems of the technopark institute are considered, and financial provision mechanisms are studied. Proposals are made to expand the technopark network and increase the role of financial mechanisms in the creation of competitive enterprises in the modern era.

KEYWORDS: Azerbaijan, sustainable development, technopark, technopark residents, financial mechanisms, current aspects of financial mechanisms.

How to cite: Melikova, L. A. (2026). Current Aspects of Financial Mechanisms of Technopark Residents in the Context of Sustainable Development. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21620908>

Introduction

In modern times, the most important strategic goal of Azerbaijan is to accelerate innovative development, for which the economy requires the creation of appropriate infrastructure. Within the framework of the formation of innovative infrastructure, organizations such as science and technology parks, business incubators, technopolises, high-tech centers, etc. have been created, aimed at creating favorable conditions for the implementation of innovation activities [1]. In modern conditions, the development of technoparks is one of the topical issues. Because it is associated with the rapid development of small businesses, the formation of demand for knowledge and technologies integrated with the scientific potential of the country. Recently, many scientists, state organizations in the country, and entrepreneurs have been actively studying the problems of infrastructure development for innovative enterprises. One of the areas studied in infrastructure development is the construction of modern technoparks and the modernization of existing ones.

The effective operation of technoparks is possible only with a special infrastructure that contributes to their development. Technoparks serve as platforms for innovation processes. More and more enterprises and organizations are interacting with technoparks, creating a favorable climate for innovation. Innovation infrastructure is the organizations that contribute to the implementation of innovative activities. A technopark is a property complex that combines scientific research institutes, industrial facilities, business centers, exhibition grounds and educational institutions, as well as supporting facilities such as transport infrastructure and residential areas.

Research Aim and Research Questions.

The main purpose of the study is to investigate the current aspects of the financial mechanisms of technopark residents in the context of sustainable development in the conditions of modern global financial transformations. Due to the processes taking place at the international level, problems between countries and groups of countries, there are problems in the flow of financial resources required for the expansion of the technopark network. Residents registered in technoparks should make additional efforts to obtain more profitable and accessible financial mechanisms. There are problems in these areas. The discussion of these problems remains relevant.

Research Results.

Technoparks are elements of the modern economy. They enable the formation of an economic environment that ensures the sustainable development of scientific, technological and industrial entrepreneurship. A technopark is a kind of free economic zone where the development of science-intensive products is carried out, and new personnel and technological innovation zones are formed [2; 3; 4]. Thus, technoparks correspond to the main processes taking place in the world economy. They give impetus to the development of business, especially small business [5]. Thanks to this, small business enters a new stage of social reproduction.

It is technoparks that contribute to obtaining financial and other additional opportunities for conducting fundamental and applied research in science, and thereby, in turn, gain independence from the state. Thus, technoparks are an attractive form of support for local science. Technoparks in Azerbaijan are created mainly in priority industrial sectors. The main tasks ahead in this area are to ensure the effective operation of existing technoparks, as well as to take targeted measures to create industrial districts in the regions [6].

Among the main tasks facing the Azerbaijani economy in the modern era, measures should be developed and implemented to create new production capacities based on high technologies, increase the flexibility of financing and lending mechanisms, accelerate innovation processes in the non-oil sector, and significantly increase the country's export potential on these grounds.

It should be noted that the expansion of the network of technoparks may be significant in this regard. [7]. Technoparks provide technological research institutes and universities with the opportunity to use platforms to conduct research and commercialize civil developments based on scientific and technical potential, including through public-private cooperation. This format of interaction between business structures and the state implies partnership at all stages of the innovation process. The successful use of the functions performed by the technopark largely depends on the financial and organizational decisions of state bodies.

The formation and full-fledged operation of technoparks requires high financial costs, which are provided by several sources. The initial capital is the funds of the founders and sponsors, which are subsequently supplemented by income from the use of buildings constructed in the park. The current activity of technoparks generates income from the rental of research, production and office space, the provision of services to residents and the trade of developing technologies [8]. In addition, profits can be reinvested in the development of infrastructure. A significant part of the financing of technopark structures is subsidies and grants provided to them by the state. In order to save budget funds, effectively spend financial resources and share risks between the state and business, the mechanism of public-private sector cooperation based on equality and mutual benefit of the participating parties is actively used when creating technoparks [9].

Technoparks provide a balanced combination of the principles of mutually beneficial cooperation between government and business, competent strategic management of available resources, integration of innovators, investors and manufacturers as the main participants in the innovation process and high efficiency of residents. Due to these factors, multiplicative and synergistic effects are achieved, stimulating intensive growth in advanced segments of the industrial complex and the service sector [10].

The successful operation of technopark structures allows for significantly strengthening the financial condition and market positions of high-tech startups. This also acts as a means of

strengthening the financial mechanisms of technoparks. To date, it has become clear that the success of technoparks largely depends on their organizational forms and methods of financial support. Sources of financing the activities of technoparks can be state, private enterprises, financial and industrial groups, small innovative business entities, investment and innovation funds, local self-government bodies, individuals, etc. [11]. All of them participate in the economic process and in one way or another contribute to the development of technoparks.

State support strengthens the financial mechanism of technoparks. The adoption and use of various financial instruments of state support for technoparks allows for the intensification of the innovative development of the country's economy. State support instruments for the innovative activities of technoparks are constantly updated and optimized based on changing factors of the internal and external environment. This gives dynamism to the socio-economic system and ensures high efficiency [12].

In parallel with the provision of support measures, technoparks organize permanent partnership work between educational institutions, research centers and the business sector, stimulating the development of scientific and industrial cooperation through market mechanisms without creating additional institutions that involve the use of administrative resources and unnecessary budget funds.

An important prerequisite for the effective development of technoparks is, first of all, the availability of state support, implemented through organizational and economic measures and financial incentives, among which the most commonly used are the following: financial support for project planning; provision of loans by state banks at preferential rates; reduction or abolition of several taxes; maintenance or construction of the necessary infrastructure (motorways, railways, utility networks, etc.). The system of preparation for project planning of technoparks involves the solution of several complex tasks [13]. First, it is necessary to take into account regional factors, such as the availability of sufficient human and scientific potential for their activities. Secondly, the factors of the resident's strategic position in both local and national markets are important. Here, the dynamics of sales markets, the effective scale of production, the impact of customs protection measures and transportation costs are taken into account. Thirdly, it is necessary to analyze the competitiveness of the region from the field and territorial perspective.

We can attribute the assessment of sources of cash inflow to the financial planning system. This section of the business plan should allow us to assess the project's ability to generate sufficient cash flow to repay debt. The optimal organization of investment and financial support of technoparks is considered the main indicator of their effective activity. It is necessary to comprehensively review and assess the state of financial and investment resources, the level of their efficient use, as well as issues for the comprehensive provision of technoparks with the necessary material and technical resources. Such an assessment reflects the functionality and effectiveness of the mechanisms for using financial and technical resources, which are considered important for the organization of the complex activities

of technoparks.

It is advisable to create a system for assessing the activities of technopark structures based on the analysis of qualitative and quantitative criteria. This allows for a more objective assessment of the financial condition of technoparks and, if necessary, the provision of financial support by the state [14].

Thus, for the effective operation of technoparks, a systematic and responsible approach to the formation of financial policy is required [15]. The active use of various investment instruments (equity financing, lending to organizations, co-financing of investors, use of derivative financial instruments) by the technopark will increase the investment attractiveness of the country and allow the implementation of successful innovative projects.

To strengthen the financial mechanisms of technoparks, it is necessary to stimulate their investment activity [16]. It is important to create instruments that will increase the investment attractiveness of the country's industrial sector, thereby increasing the volume of non-budgetary and private investments by economic entities in scientific research and experimental design work [17].

The procedure for forming regional grants and programs to finance project activities for universities, technoparks and innovative industrial enterprises is also of great importance. The basis for strengthening the financial mechanisms of technoparks is their scientific and technical potential. In this regard, the following main tasks lie ahead: 1) eliminating the decline in production through structural restructuring of the economy and changing the range of products; 2) increasing the competitiveness of local products and the attractiveness of the national economy; 3) preserving and developing scientific and technical potential, etc. [18]. Strengthening the financial mechanisms of technoparks requires improving their activities. Improving the activities of technoparks is of strategic importance [19]. State support for their activities requires expanding the existing ones, searching for and implementing new models and tools for managing innovative projects. We can distinguish five groups of organizational and economic tools for improving the activities of technoparks: stimulating tools that create a basis for cooperation between subjects of innovative activity; financial instruments that allow attracting investment resources for the development of innovative industries; logistical instruments that facilitate the creation of the logistical base for scientific and research work; structural instruments that facilitate the creation and operation of high-tech businesses; market instruments that stimulate the commercialization and marketing of innovative products.

Conclusions

Thus, we can put forward several practical recommendations for strengthening the financial mechanisms of technoparks:

- First, it is necessary to develop mechanisms for stimulating domestic demand for innovative products and the development of new technologies that are more economical for the budget than direct financial support. Examples of such mechanisms include influencing demand through state and

municipal procurement, subsidizing consumer spending on purchasing innovative products from local manufacturers, and activating interregional and international relations for the development of new markets.

- Second, it is necessary to expand the network of venture funds and attract investors with large investment resources, useful experience, and a clear interest in the industrial development of territories to finance technoparks.

- Third, it is important to increase the volume of state support for managing companies and residents of technoparks through tax breaks and grants, state guarantees, assistance in personnel, information, scientific and methodological support. Along with strengthening state support, it is advisable to expand the application of public-private and municipal-private partnership mechanisms.

References

1. Aliyev, Sh. T. (2008a). *Problemy organizatsii i perspektivy razvitiya osobykh ekonomicheskikh zon* [Problems of organization and prospects for the development of special economic zones]. Nauka.
2. Aliyev, Sh. T. (2008b). Problemy konkurentosposobnosti real'nogo sektora ekonomiki Azerbaydzhana v usloviyakh globalizatsii [Problems of competitiveness of the real sector of the Azerbaijani economy under globalization]. *Doklady NANA*, (6), 135–143.
3. Aliyev, Sh. T. (2008c). Vazhnost' primeneniya novykh ekonomicheskikh instrumentov v ekonomike Azerbaydzhana [The importance of applying new economic instruments in the Azerbaijani economy]. *Natsional'nye Interesy: Priority i Bezopasnost'*, 80–84.
4. Aliyev, Sh. T. (2010a). *Vazhneyshie determinanty ustoychivogo razvitiya ekonomiki Azerbaydzhana* [The most important determinants of sustainable development of the Azerbaijani economy]. Elm.
5. Aliyev, Sh. T. (2010b). The problems of the variety of formation and functioning of the special economic zones in Azerbaijan in the context of the world experience. *Marketing and Management of Innovations*, (1), 144–148.
6. Aliyev, Sh. T. (2012). Rol' spetsial'nykh ekonomicheskikh zon v razvitii predprinimatel'stva i investitsionnoy aktivnosti [The role of special economic zones in the development of entrepreneurship and investment activity]. *Rossiyskoe Predprinimatel'stvo*, 7(205), 180–184.
7. Aliyev, Sh. T. (2014). Modelirovanie innovatizatsii natsional'noy ekonomiki v sovremennykh usloviyakh [Modeling the innovatization of the national economy in modern conditions]. *Nauchnoe Obozrenie*, (6), 342–346.
8. Aliyev, Sh. T. (2015). *Vneshneekonomicheskaya politika Azerbaydzhana* [Foreign economic policy of Azerbaijan]. Sumgait State University Press.

9. Əliyev, Ş. T. (2017). Azərbaycanca maliyyə sabitliyinin təmin edilməsi problemləri və maliyyə-kredit sisteminin inkişafının müasir aspektləri [Problems of ensuring financial stability in Azerbaijan and modern aspects of the development of the financial-credit system]. *Audit*, (3), 26–40.
10. Əliyev, Ş. T. (2018). *Azərbaycan iqtisadiyyatı* [The economy of Azerbaijan]. Sumgait State University, Editorial and Publishing Department.
11. Əliyev, Ş. T. (2019). Azərbaycanca qeyri-neft sənayesinin şaxələndirilməsi və ixrac potensialının artırılması istiqamətləri [Directions for diversifying the non-oil industry and increasing export potential in Azerbaijan]. *Audit*, 26(4), 61–73.
12. Aliyev, Sh. T. (2020a). Problems of diversification of Azerbaijani economy in modern conditions. In *Proceedings of the VIII International Scientific and Practical Conference "Current Problems of Social and Labor Relations" (ISPCPSLR 2020)* (pp. 38–44). Makhachkala, Russia.
13. Aliyev, Sh. T. (2020b). Strategic role of Sumgayit in the development of petrochemical industry of Azerbaijan. In *Proceedings of the International Conference on Actual Problems of Chemical Engineering (APCE 2020)* (pp. 430–435). Azerbaijan State Oil and Industry University.
14. Aliyev, S., Hasanov, R. I., Aghayeva, K., Gasimov, J. Y., & Ahmadova, S. E. (2024). The relationship between renewable energy consumption and economic growth: Insights from Iceland and Azerbaijan. *International Journal of Energy Economics and Policy*, 14(5), 229–235. <https://doi.org/10.32479/ijeep.16490>
15. Kornilova, O. A., & Abdullaev, N. V. (2015). Finansovye instrumenty gosudarstvennoy podderzhki innovatsionnogo razvitiya [Financial instruments of state support for innovative development]. *Sborniki Konferentsiy NITs Sotsiosfera*, (32), 67–71.
16. Manafov, Q. N. (2016). Müasir dövrdə innovasiya sahibkarlığının inkişafının bəzi aspektləri [Some aspects of the development of innovative entrepreneurship in the modern era]. In *Iqtisadiyyatın davamlı inkişafı: Problemlər, perspektivlər: Beynəlxalq elmi konfransının materialları* [Sustainable development of the economy: Problems, prospects: Proceedings of the international scientific conference] (Part 1, pp. 78–81). Sumgait, Azerbaijan.
17. Melikova, L. A. (2016). Voprosy sovershenstvovaniya finansovo-ekonomicheskikh aspektov nalogovogo mekhanizma po stabilizatsii i rosta ekonomiki strany [Issues of improving the financial-economic aspects of the tax mechanism for stabilizing and growing the country's economy]. *Audit*, (4), 22–29.
18. Melikova, L., & Bagirova, A. (2024). Directions for the improvement of the financial market in Azerbaijan. *Scientific Collection "InterConf"*, (199), 75–82.
19. Yulenkova, I. B., & Taradaeva, A. V. (2012). Razvitie finansovoy infrastruktury innovatsionnogo biznesa [Development of the financial infrastructure of innovative business]. *Natsional'nye Interesy: Prioritety i Bezopasnost'*, 8(2/143), 16–23.

Financial Performance Indicators: A Tool for Assessing Organizational Performance

Emmanuel Dele Omopariola

¹ PhD, Dr, Researcher,
University of Cape Town, South
Africa

Corresponding author: Emmanuel Dele
Omopariola
felixdelly@yahoo.com/omopemm002@myu
ct.ac.za



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: The failure of construction projects to be delivered successfully – the root of poor performance in the construction business and organization – is attributed by scholars to the improper financial performance indicators (or no performance indicators at all) of contractors, and subsequently, sub-contractors and suppliers. Therefore, proficient financial performance indicators such as adequate cash flow, profitability, liquidity, and market share are tools required for the delivery of successful construction projects and companies. However, there is limited or no objective research that explores financial performance indicators as a tool to assess project and construction organization performance in South Africa. The study used a research approach involving the collection of qualitative data to achieve the research objective. It emerged from the study that the financial performance indicators used in assessing the financial performance of construction organizations entail profitability, cash flow, liquidity, leverage, and turnover. Based on these findings, the study concludes that the failure of construction projects and organizations will be reduced through the adoption of an effective financial performance indicator tool by construction organizations.

KEYWORDS: Construction organizations, Construction projects, financial performance indicators, poor performance, project management skills.

How to cite: Omopariola, E. D. (2026). Financial Performance Indicators: A Tool for Assessing Organizational Performance. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing.
<https://doi.org/10.5281/zenodo.21620302>

Introduction

Several challenges, such as cost and time overrun, increasing cost of building materials, and poor financial performance of projects and organizations, have been reported as confronting the South African construction industry (Omopariola et al., 2022; Oshungade & Kruger, 2017). A fundamental concern that steers research in undertaking these challenges has been to comprehend the rationale of project and organization performance divergence between construction companies, in explaining the causes of poor project and organization performance (Omopariola & Windapo, 2018). Ilori & Omopariola (2018) identify financial indicators as tools used in business and project environments to provide project and construction organizations with an understanding of their financial health and performance. Oke et al. (2016) posit that achieving the performance required to execute any type of construction development relies significantly on the level of financial organizational performance, the project's completion time, and the managerial output of the relevant players involved.

Meanwhile, several construction companies' performance-related problems were recognized in research work that examined the organizational financial performance of construction companies in South Africa (CIDB, 2016). Some of the concerns recognized as reasons for poor construction project and organizational financial performance in South Africa are poor financial management of resources and cash flow, bad policies that inculcate prerequisites for prompt payment, lack of strategic planning, lack of concern by construction organizations for project and business environments, and poor productivity (Tucker et al., 2015). In general, these studies explored the financial performance of construction organizations upon the completion of the projects carried out. However, they did not consider what made construction organizations fail in delivering projects as expected.

Studies on organizational financial performance have considered the financial factors that determine the success and failure of organizational performance (Lai et al., 2014). Other studies have found a link between financial performance and project environment. For example, Moneva & Ortas (2010) evaluated the implications of the relationship between business environmental performance and financial performance in the European establishments in order to demonstrate to managers how appropriate management of environmental issues contributes to the firm's financial achievement. It was found in the study that companies that gained higher rates of environmental performance exhibited improved and healthier financial performance levels in the outlook. The study concluded that executives should consider environmental issues when constituting the firm's strategic policy and how the financial success of the companies can be accomplished through proper environmental management.

Despite the growing relevance of financial performance indicators as an intrinsic tool for financial management and decision-making, they are used to varying degrees in the construction industry for projects or the operation of a company (Olugboyega et al., 2023). It concerns the monetary position of the construction company so that the most appropriate means of financing its requirements may be determined (RICS, 2014). The client's choice of financial performance indicators is not appropriately aligned to the project environment, while the contractor's financial management ability is poor. However, the interventions of government and contractor strategies in place have not mitigated the problem of poor performance in the construction industry. Also, limited research has been done in this area. Therefore, this research examined the financial performance indicators tool used in assessing construction projects and organizations.

Research Aim and Research Question

This research aims to explore the financial performance indicators tool used in assessing construction companies' and project performance. The study aimed to address the following question: What financial performance indicators are used in assessing construction project/organization performance in the South African Construction Industry?

Literature Review

Due to the ongoing evolution of reservations in budgets, technology, and development methods, the construction industry is becoming more multifaceted (Oke et al., 2016). Those uncertainties, together with numerous other difficulties, often lead to project delays and, at times, affect construction project and organizational performance (Idowu et al., 2021). Performance has been an unpredictable theme in strategy, that is, financial management strategy, and it has been of specific concern to both academic researchers and construction experts (Wang et al., 2015; Haupt & Padayachee, 2016). The significance of the performance or efficiency perception, and its description and measurement, is extensively recognized (see Owolabi et al., 2014). Performance incorporates the success of an outcome: carrying out construction plans that are delivered within completion budget, completion time, and required quality (Owolabi et al., 2014); serves as a measure of a discrete entity, stakeholders, an organization and realization of work outline (Olugboyega et al., 2024); profitability, liquidity, productivity, sufficient cash flow, leverage, market share, order value, and meeting customer and employee satisfaction (Tucker et al., 2015); and specifying the scope of the technical expertise of an organization (Omopariola et al., 2025).

Construction projects and organizational performance have been widely documented in the literature, categorized as follows: poor management ability, over budget, poor quality, and client dissatisfaction (Hai & Watanabe, 2014). Therefore, for any construction project and organization, there is a need to evaluate its financial performance, as it can be used to measure the success of the construction organization within a given time. Thus, it serves as an input for the performance improvement of the construction projects and organization to deal with their challenges. Alfani & Zacharia (2013) stated that the major financial performance measures in the construction business are cash flow, profitability, adaptability, liquidity, efficiency, market share and leverage. These are seen as enhancements to financial expansion, the rudiments of running a construction business (Norris, 2013), and a function of timely delivery (Soetanto et al., 2001), within the context of construction companies.

Globally, the most recurrent measures of output that have engaged considerable attention by scholars are profitability, sufficient cash flow, sales (unit and value), leverage, market share, liquidity, sufficient cash flow, and turnover (Khanimirov, 2017; Panayiotis, 2018). Nonetheless, as there is little agreement on which measure is best, any assessment of construction business financial performance with only these eight factors entails significant trade-offs. This implies that good performance in one dimension often means sacrificing performance in another (Donaldson, 1984). In this study, the construction organization's financial performance indicators were measured using six indicators: profitability, liquidity, sufficient cash flow, turnover, market share, and leverage of the construction company. Profitability is the competency of the construction companies to make returns (Alonso, 2005). Greater profitability results in an upsurge of a construction company's stock price. Omopariola & Windapo (2019) revealed that greater profitability indicates that a construction company's prospects are good and that shareholders would respond positively and improve the firm's value (Martin-Reyna & Duran-Encalada, 2012).

Construction firms, which achieve very high returns, are said to be effective, thus exhibiting a good financial performance (Moel, 2014).

Measuring construction organizations' financial performance in relation to economic profitability reduces measurement uncertainty (Phua, 2006). This corroborates proven research standards that use profitability to reveal construction organization performance (McGahan & Porter, 1997). Profitability measures are considered most suitable for assessing large construction companies' performance (Begley, 1995). Profit becomes the rudiment of payment disbursement, either in cash or stock dividends (Moel, 2014). Hermi (2004) posits that profit is obtained from the variance between the incoming resources (income and profit) and expenditure (outlays and losses).

Sufficient cash flow is the engine of a construction organization because, without it, unresolved financial obligations cannot be met (Arafat & Skaik, 2016). Concomitantly, for expenditure items to be covered, a construction organization needs sufficient working capital to pay its creditors, suppliers, sub-contractors and employees and may be reliant on its client's payments (Lowe & Moroke, 2010). Stable project and organizational performance, achieved through sufficient cash flow, provides construction firms with the potential to exploit their investment opportunities (Seo et al., 2018). Conversely, a construction company facing cash-flow risk may not be able to make the required investment to receive these benefits (Harris et al., 2019). Construction companies lacking required funds may be forced to decrease their investment in trade receivables (Summers & Wilson, 2002); for example, Love et al. (2007) opine that construction companies, which are more susceptible to financial crises, lessen their investment in trade receivables. The more the cash flow, the larger the construction investment value, and the more the construction companies' revenue increases, the more likely the firms are to increase investment (Tran et al., 2019).

Leverage is a common term in financial management as an indicator that affects a construction company's risk profile, bringing about the ability to intensify results at a relatively low cost, and the ability to repay debts and take advantage of new opportunities (Ahmad et al., 2015). Al-Moman & Obeidat (2017) posit that financial leverage has a robust influence on the achievements of most construction business organizations. A construction company that has more financial leverage is more profitable (Moghadam & Jafari, 2015). According to Gill & Mathur (2011), leverage is the use of an asset or fund for which the construction company pays a fixed cost or earns a return. Financial leverage amplifies the effects of fixed costs on earnings in a construction company's capital structure. Essentially, leverage denotes the ability to incur debt or borrow funds to finance the purchase of a company's assets, or the extent to which a construction company employs borrowed money (Gill & Mathur, 2011; Ahmad et al., 2015).

Liquidity plays a very important role in the management of a construction organization and its operations, project and organizational performance, and portfolio diversification strategies from the stakeholders involved since they face liquidity risk when they transfer the ownership of their collaterals/securities (Panayiotis, 2018). Liquidity remains a concept that is very difficult to describe or define accurately. Liquidity is the absolute key resource for construction companies (Adjei et al., 2018). Liquidity can be described as the ability to buy or sell an investment promptly and at a price close to its current market price (Brennan et al., 2012; Papavassilion, 2013). Inclusive liquidity is built in through global (broad) credit growth and gaps. Liquidity and its management largely determine the growth and profitability of a construction company (Egbide et al., 2013). For this reason, both

insufficient liquidity and superfluous liquidity may be detrimental to the smooth operations of the construction organization.

Market share is defined as a construction company's sales in proportion to the entire construction industry sales for a definite period and related to those of other competitors in the market (Pearce & Robinson, 2003). Therefore, market share is habitually used to distinguish competitive position (Khantimirov, 2017). Market share has an important and positive influence on construction business profit, as it serves as an effective predictor of construction organization performance (Buzzel, 2004). Increased market share can be associated with success; however, decreased market share serves as an indicator of precarious actions by construction firms and is habitually associated with failure (Khantimirov, 2017). For example, Pervan & Visic (2012) found that a construction firm's market share, as a substitute for its magnitude, plays a substantial role in amplifying its comparative performance. In large firms, Etale et al. (2016) linked market share with higher profits as a means of improving construction organization performance.

In the research carried out by Tucker et al. (2015) and Abdullahi et al. (2017), firm turnover is dependent on changes in net asset value and capital structure of construction companies. This implies that the construction firm's capital structure determines the turnover it realizes. Therefore, the availability of finance and sufficient cash flow of construction companies improve turnover, which, in turn, increases financial performance (Moel, 2014). Thus, the greater the financial proficiency of a construction firm, the more turnover that firm has; also, it is significant and impacts construction organization performance. A construction company's turnover is a vital measure for deciding if a company is a micro, small, medium, or large enterprise (Ekpenyong & Nyong, 1992; European Commission, 2015). According to Armstrong (2006), turnover is the volume of construction contracts carried out by construction firms, habitually rated per year of its operation.

In conclusion, the financial resources of construction organizations must be sufficient to meet the demands of the competitive market (Odediran & Windapo, 2016). Thus, construction companies that want to increase their firms' projects and organisation performance must guarantee sufficient cash flow, have competence to make profit returns, possesses liquidity as the absolute key resource for construction companies, adopt market share that are relevant for decision-making, use more leverage, be able to manage their capital structure well, and make use of appropriate financial performance indicators (Musah et al., 2018).

Methods

This study employed a qualitative research design to investigate how financial performance indicators as a tool are used to assess the performance of construction projects and organizations. A qualitative method was deemed suitable because it allows for an in-depth insight into the top management officers' experiences, designations, perceptions, and challenges within their natural functioning contexts. This study employed the Selective Expert Sampling technique for the qualitative study. Expert sampling is a better way to gather the opinions of participants specialized in a given field, and it is useful for validating the findings. (Smith, 1983). It is also used when the researcher wants the opinions of professionals with a comparatively high level of skill in the research area (Miller et al., 2010). Therefore, in this study, the researcher searched for those professionals and recognized experts in the field of financial management within the construction organizations in the South African construction industry and collected the required information directly from these individual respondents, who could demonstrate their experience and specialized knowledge of the field. A total number of twenty (20) experts

in the field of financial management were approached to participate in the interview, while only five experts eventually agreed and participated. The interviewer prepared a structured interview guide comprising well-designed questions to ensure that all the interviewees were asked the same questions. Five interviews were conducted, and each took between 22 minutes and 1 hour 15 minutes. The interview protocol comprised a segment on the construction company financial performance indicators, construction projects and organizational performance.

The opening interview was organized and conducted with the director (founder) of construction organization A in Gauteng (CIDB Grade 7). The second was in Durban (CIDB Grade 9), with a commercial executive from construction organization B. Construction company C is in Gauteng (CIDB Grade 8), and the interviewee was the commercial executive of that organization. The fourth interview was conducted with the managing director of construction company D in Gauteng (CIDB Grade 9). The last interview was conducted with the managing director of construction company E in Cape Town (CIDB Grade 7). The interviews were recorded on audio and, with the participants' consent and authorization, later transcribed. The key themes and sub-themes common across participants' transcripts were identified; a codebook was used to guide the researcher through the transcript analysis, and the transcribed interviews were evaluated. Also, a spreadsheet was used to help in coding, connecting, and gathering the like themes and sub-themes from the transcripts. Thus, the data were analyzed using thematic analysis, following Braun and Clarke's six-step approach (see Omopariola, 2025).

Research Results and Discussion

This section presents the descriptive information on the background details of the respondents' profiles and the use of thematic analysis to analyze the financial performance indicators tool used for assessing construction organization and project performance. Thematic analysis, like other qualitative approaches, was found to be justified and beneficial to the present study because it shares the same purpose of systematic examination of narrative materials from life stories by breaking down the text into comparatively small units of content and processing them into descriptive elements (Sparker, 2005). Thus, it allows the researcher to produce a comprehensive report of the analysis. Thematic analysis was used in analyzing the data, using the method explained by (Blaxter et al., 2006). Using the feedback from the top management officers helped in providing adequate information to use in the evaluation of the construction organizations' performance.

Table 1.0 shows the years of experience and designation of the five interviewees selected for the qualitative part of this research. Two of the interviewees (interviewees D and E) were managing directors, while three of the interviewees (interviewees A, B, and C) were commercial executives. Regarding the interviewees' years of experience, interviewee A had 10 years, interviewee B had 27 years, and interviewees C, D, and E had 29, 25, and 44 years, respectively. This suggests that the interviewees were qualified and had the necessary experience needed to provide useful and relevant information for this research.

Structured interviews were carried out with three commercial executives (these are executives who develop relationships with corporate clients, prepare contracts, monitor financial accounting and performance, and promote businesses) and two managing directors to validate the reality of financial performance indicators used in assessing project and construction organizational performance, as analyzed using a quantitative approach. As presented in Table 2.0, all five interviewees (interviewees A, B, C, D, and E) agreed that profitability and cash flow are indicators of project and organizational financial performance. Three interviewees (B, C, and E) indicated that

liquidity and leverage are financial performance indicators for project and construction organizations. Interviewees B, D, and E mentioned that order value is also a success factor in the financial performance of project and construction organizations. These results imply that cash flow, profitability, liquidity, leverage, and order value are criteria considered by construction companies to measure the overall financial health of construction organizations over a given period.

Table 1

Profile of interviewees

S/N	Interviewee	Years of experience	Designation
1	Interviewee A	10 years	Commercial executive
2	Interviewee B	27 years	Commercial executive
3	Interviewee C	29 years	Commercial executive
4	Interviewee D	25 years	Managing director
5	Interviewee E	44 years	Managing director

Source: author's own development

Table 2

Thematic analysis of the responses of the interviewees on the financial performance indicators used in assessing organizational performance

Major theme	Sub-theme	Interviewee
Indicators for assessing organisational financial performance	• Profitability	Interviewee A, B, C, D, and E.
	• Cash flow	Interviewee A, B, C, D, and E.
	• Liquidity	Interviewee B, C, and E.
	• Leverage	Interviewee B, C, and E.
	• Turnover	Interviewee B, D, and E.

Source: author's own development

Discussion of Findings

The financial performance indicators for assessing construction organizations were investigated qualitatively. In this qualitative investigation, the interviewees were questioned on the financial performance indicators used in assessing organizational performance. Thematic analysis was used to analyze qualitative data; it revealed that indicators frequently used by construction organizations to assess performance include profitability, cash flow, liquidity, leverage, and turnover. This suggests that the financial performance of construction organizations perceptually depends on their ability to improve cash management and income from other profit centers, ability to have sufficient cash to meet general expenses, ability to meet short-term obligations, ability to repay debt, and the ability to obtain a significant share of the contracts in the construction industry. These financial performance indicators have been established in studies of construction and financial management (see

Lowe and Moroke, 2010; Al-Moman & Obeidat, 2017; Seo et al., 2018; Panayiotis, 2018). For example, profitability is a financial performance indicator used to assess whether an organization can secure financing from financial institutions and whether it is successful. Profitability also enables an organization to maximize growth and remain in business. The construction industry is a competitive environment; without profitability, it would be difficult for organizations to survive.

In the same way, cash flow is important for running a successful organization because it informs top management about the organization's cash position and projects. It also determines cash sufficiency. Liquidity is equally vital in financial management because it determines if an organization is bankrupt and in a position to pay its workers. It also indicates if an organization has assets that could be exchanged for cash. Likewise, leverage signifies that an organization has a variety of financing sources and provides a threshold for business expansion. Firm turnover is dependent on changes in net asset value and capital structure of construction companies. This implies that the capital structure of the construction firm determines the turnover they realize.

Based on these benefits of profitability, cash flow, turnover, liquidity, and leverage in financial performance management, it is easy to understand why construction organizations frequently use these as financial performance indicators. However, it is surprising that construction organizations did not frequently use market share as a financial performance indicator. Market share has been identified as an important economic measure. It could be that market share is not significant in the financial management of construction organizations. The nature of the business, or the financial performance of the construction business, could be why it is difficult or unnecessary to use market share as a financial performance indicator. The findings of this study are in line with the conclusions of Alfian & Zacharia (2013), Norris (2013), Seo et al. (2018), Ahmad et al. (2015), Al-Moman and Obeidat (2017), Panigrahi (2014), and Panayiotis (2018). The studies by Alfian and Zacharia (2013) and Norris (2013) concluded that profitability, cash flow, leverage, and liquidity are the major financial performance indicators for construction businesses. Similarly, Mazzoli (2014) reported that profitability is key to decision management and business survival in construction organizations. Porter (1979) also attributes profitability disparities to construction organizations. Likewise, Gschwandtner (2005) found that profit persistence is associated with the characteristics of firms and organizations. This means that large construction firms have better operations to generate huge profits and tend to enjoy higher long-term profit rates than smaller construction firms (Ammer et al., 2003). The conclusions by Ahmad et al. (2015) and Al-Moman & Obeidat (2017) indicated that leverage as a financial performance indicator determines the organizational risk profile, ability to repay, and ability to take advantage of new opportunities. Seo et al. (2018) concluded that sufficient cash flow is the engine of a construction business because it is important to meet financial obligations and nurture growth. The conclusions of Panigrahi (2014) and Panayiotis (2018) on the importance of liquidity as a financial performance indicator revealed that liquidity is required in meeting short-term debt and operational expenses and that a shortage of liquidity can lead to the insolvency of construction organizations.

The findings of this study are significant because they provide insights into how to run a successful construction organization. The findings extend understanding of financial management in construction organizations. Lastly, they provide information on metrics for the financial performance of these organizations.

Conclusions and Recommendations

Based on the findings, this study concluded that construction organizations with a strong structure, multiple

areas of specialization, creative and efficient staff members, and access to funding have a greater likelihood of achieving higher income, higher positive leverage, higher positive liquidity, and higher positive cash flow. Similarly, construction organizations specializing in project management will experience higher liquidity and profitability.

Recommendations are made based on the research findings and conclusions for and to the government agencies, particularly the committee set up for the construction industry (CIDB), which is responsible for South African construction industry performance policymaking, formulation, and implementation, and construction project managers, construction executives, and professionals. Construction organizations with limited financial resources must make efforts to perfect their project management skills and explore opportunities for maximizing financial benefits in their area of specialization. The study contributes to the knowledge of construction company performance, with its usefulness to the construction stakeholders, especially the client, professionals, and contractors, by highlighting channels of improving construction organization performance in the construction industry by recommending appropriate financial indicators that suit the project environment. Due to the findings from this study, the area for further research shows that there is a need to understand the nature of the financial performance of the construction business. The insights provided by this work will extend the understanding of the financial performance indicators in use by construction organizations.

References

- Abdullah, N. A. I. N., Ali, M. M., & Haron, N. H. (2017). Ownership structure, firm value and growth opportunities: Malaysian evidence. *Journal of Computational and Theoretical Nanoscience*, 1, 1-6.
- Adjei, E., Fugar, F. D. K., Adinyira, E., Edwards, D. J., & Parn, E. A. (2018). Exploring the significant cash flow factors influencing building projects profitability in Ghana. *International Journal of Construction Engineering and Management*, 7(1), 35-46.
- Ahmad, N., Salman, A., & Shamsi, A. F. (2015). Impact of financial leverage on firm's profitability: An investigation from cement sector of Pakistan. *Research Journal of Finance and Accounting*, 6(7), 75-80.
- Alfan, E., & Zacharia, Z. (2013). Review of financial performance and distress: A case of Malaysian construction companies. *British Journal of Arts and Social Sciences*, 12(11), 1-15.
- Al-Momani, M. A., & Obeidat, M. I. (2017). Towards more understanding of the financial leverage controversy: The evidence of the industrial firms at Amman stock exchange. *International Journal of Economics and Financial Issues*, 7(4), 189-198.
- Alonso, P. D. A., Iturriaga, F. J. L., & Sanz, J. A. R. (2005). Financial decisions and growth opportunities: A Spanish firms panel data analysis. *Applied Financial Economics*, 15(6), 391-407.
- Ammer, C., Fagus, S. L., & Quercus, R. L. (2003). Growth and biomass partitioning of seedlings in response to shading and small changes in the R/FR-ratio of radiation. *Forest Science*, 60(1), 163-171.
- Arafat, H., & Skaik, S. (2016). How can contractors warrant timely payments in the UAE construction industry. In B. C. George (Ed.), *The construction, building and real estate research conference of the Royal Institution of Chartered Surveyors*. Toronto, Canada.
- Armstrong, M. (2006). *A handbook of human resource management practice* (10th ed.). Kogan Page.

- Begley, T. M. (1995). Using founder status, age of firm, and company growth rate as the basis for distinguishing entrepreneurs from managers of smaller businesses. *Journal of Business Venturing*, 10(3), 249-263.
- Blaxter, L., Hughes, C., & Tight, M. (2006). *How to research* (3rd ed.). Open University Press.
- Brennan, M. J., Chordia, T., Subrahmanyam, A., & Tong, Q. (2012). Sell-order liquidity and the cross-section of expected stock returns. *Journal of Financial Economics*, 105(3), 523-541.
- Buzzell, R. D. (2004). The PIMS program of strategic research: A retrospective appraisal. *Journal of Business Research*, 57(1), 478-483.
- Construction Industry Development Board. (2016). *Construction industry transformation plan (2016-2020)*. <https://www.citp.my>
- Donaldson, G. (1984). *Managing corporate wealth*. Praeger.
- Egbide, B. C., Uwuigbe, O., & Uwuigbe, U. (2013). Liquidity management and profitability of manufacturing companies in Nigeria. *IOSR Journal of Business and Management*, 9(1), 13-21.
- Ekpenyong, D. B., & Nyong, M. O. (1992). *Small and medium scale enterprises in Nigeria: Their characteristics, problems and sources of finance* (Research Paper No. 16). African Economic Research Consortium. <https://www.africaportal.org>
- Etale, L. M., Bingilar, P. F., & Ifureze, M. S. (2016). Market share and profitability relationship: A study of the banking sector in Nigeria. *International Journal of Business, Economics and Management*, 3(8), 103-112.
- European Commission. (2015). *Enterprises and industry: SME definition*. <http://europa.eu.int/comm/enterprise/enterprise/smedefinition/index.htm>
- Gill, A., & Mathur, N. (2011). Factors that influence financial leverage of Canadian firms. *Journal of Applied Finance and Banking*, 1(2), 19-37.
- Gschwandtner, A. (2005). Profit persistence in the 'very' long run: Evidence from survivors and exiters. *Applied Economics*, 37(7), 793-806.
- Hai, N. L., & Watanabe, T. (2014). The status quo and perspective for improvement of public works procurement performance in Vietnam. *Journal of Advanced Performance Information and Value*, 6, 22-39.
- Harris, C., Roark, S., & Zhe, L. (2019). Cash flow volatility and trade credit in Asia. *International Journal of Managerial Finance*, 15(2), 257-271.
- Haupt, T. C., & Padayachee, K. (2016). Financial management capacity and business failure of contractors. In *10th ASOCSA Built Environment Conference* (pp. 213-226). Port Elizabeth, South Africa.
- Hermi, H. (2004). Hubungan laba bersih dan arus kas operasi terhadap dividen kas pada perusahaan perdagangan besar barang produksi di bursa efek Jakarta pada periode 1999-2002 [The relationship of net income and operating cash flow to cash dividends in large trading companies on the Jakarta stock exchange, 1999-2002]. *Media Riset Akuntansi, Auditing, dan Informasi*, 4(3), 247-258.

- Idowu, A., Winston, S., Emmanuel, D. O., & Williams, D. (2021). Reaction of poor materials management on project delay in the construction industry. *International Journal of Advanced Studies in Economics and Public Sector Management*, 9(1), 115-124.
- Ilori, J. O., & Omopariola, E. D. (2018). Analysis of time performance of indigenous contractors in Kwara State, Nigeria. *The International Journal of Engineering and Science*, 7(10), 79-86.
- Khantimirov, D. (2017). Market share as a measure of performance: Conceptual issues and financial accountability for marketing activities within a firm. *Journal of Research in Marketing*, 7(3), 587-592.
- Lai, H. Y., Aziz, A. R. A., & Chan, T. K. (2014). Effect of the global financial crisis on the financial performance of public listed construction companies in Malaysia. *Journal of Financial Management of Property and Construction*, 19(3), 246-263.
- Love, P. E. D., Smith, J., & Regan, M. (2007). *Financing of public private partnerships: Six Australian motorway case study projects*.
- Lowe, J. G., & Moroke, E. (2010). Insolvency in the UK construction sector. In C. Egbu (Ed.), *Proceedings of the 26th Annual ARCOM Conference* (pp. 93-100). Association of Researchers in Construction Management.
- Martin-Reyna, J. M. S., & Durán-Encalada, J. A. (2012). Ownership structure, firm value and investment opportunities set: Evidence from Mexican firms. *Journal of Entrepreneurship, Management and Innovation*, 8(3), 35-57.
- Mazzoli, M. (2014). Governance, organisational design, financial structure and investments in co-operative firm. In T. Mazzarol, S. Reboud, E. M. Limnios, & D. Clark (Eds.), *Research handbook on sustainable co-operative enterprise: Case studies of organisational resilience in the co-operative business model* (pp. 381-410). Edward Elgar.
- McGahan, A., & Porter, M. E. (1997). How much does industry matter, really? *Strategic Management Journal*, 18(Summer Special Issue), 15-30.
- Miller, P. G., Johnston, J., & Dunn, M. (2010). Comparing probability and non-probability sampling methods in Ecstasy research: Implications for the internet as a research tool. *Substance Use & Misuse*, 45(3), 437-450.
- Moel, J. (2014). Factors affecting firm value: Theoretical study on public manufacturing firms in Indonesia. *South East Asia Journal of Contemporary Business, Economics and Law*, 5(2), 6-15.
- Moghadam, M. D., & Jafari, M. (2015). The role of financial leverage in the performance of companies listed in stock exchange. *Indian Journal of Natural Sciences*, 5(30), 7402-7411.
- Moneva, J. M., & Ortas, E. (2010). Corporate environmental and financial performance: A multivariate approach. *Industrial Management & Data Systems*, 110(2), 193-210.
- Musah, A., Gakpetor, E. D., & Pomaa, P. (2018). Financial management practices, firm growth and profitability of small and medium scale enterprises (SMEs). *Information Management and Business Review*, 10(3), 25-37.
- Norris, W. E. (1990). Margin of profit: Teamwork. *Journal of Management in Engineering*, 6(1), 20-28.

- Odediran, S. J., & Windapo, A. O. (2016). Financial performance of multinational construction companies in South Africa. In *9th cidb Postgraduate Conference* (pp. 92-101). Cape Town, South Africa.
- Oke, A. E., Ogungbile, A., Oyewobi, L., & Tengan, C. (2016). Economic development as a function of construction project performance. *Journal of Construction Project Management and Innovation*, 6(2), 1447-1459.
- Olugboyega, O., Ejohwomu, O., Omopariola, E. D., & Omoregie, A. (2023). Project leadership functions and the associated behaviour for projects and project organisations. *Buildings*, 13(7), Article 1739. <https://doi.org/10.3390/buildings13071739>
- Olugboyega, O., Ejohwomu, O., Omopariola, E. D., & Omoregie, A. (2024). Leadership energy theory for sustaining leadership competence and effectiveness. *Merits*, 4(2), 191-210. <https://doi.org/10.3390/merits4020014>
- Omopariola, E. D. (2025). Harnessing digital informal learning for quantity surveying student development. *Futurity Proceedings*, (4), 174-184.
- Omopariola, E. D., & Windapo, A. O. (2018, September 26-28). *Impact of payment systems on construction projects and organization performance* [Conference paper]. 42nd AUBEA Conference, Singapore.
- Omopariola, E. D., & Windapo, A. O. (2019). Domino effect of advance payment on project cash flow and organisation performance. In C. Gorse & C. J. Neilson (Eds.), *Proceedings of the 35th Annual ARCOM Conference* (pp. 619-628). Association of Researchers in Construction Management.
- Omopariola, E. D., Olugboyega, O., Windapo, A. O., & Albert, I. (2022). *Establishing the cost and time performances of projects executed by South African construction companies using different payment systems*.
- Omopariola, E. D., Olugboyega, O., Windapo, A. O., Edwards, D. J., & Ejohwomu, O. A. (2025). Modelling the interactions between project payment systems, financial management strategies, and construction companies' performance. *International Journal of Business Performance Management*, 26(5), 634-659.
- Oshungade, O. O., & Kruger, D. (2017). A comparative study of causes and effects of project delays and disruptions in construction projects in the South African construction industry. *Journal of Construction Engineering and Project Management*, 7(1), 13-25.
- Owolabi, A. O., Chan, A. A., & Ogunlana, A. A. (2014). Root causes of construction project delays in Singapore. *Journal of Construction Management*, 4(1), 19-31.
- Panayiotis, G. A. (2018). Liquidity as an asset pricing factor in the UK. *Journal of Financial Management*, 6(2), 185000081-185000824.
- Panigrahi, A. K. (2014). Relationship of working capital with liquidity, profitability and solvency: A case study of ACC Limited. *Asian Journal of Management Research*, 4(2), 308-322.
- Papavassiliou, V. G. (2013). A new method for estimating liquidity risk: Insights from a liquidity adjusted CAPM framework. *Journal of International Financial Markets, Institutions and Money*, 24, 184-197.
- Pearce, J. A., & Robinson, R. B. (2003). *Strategic management*. McGraw-Hill/Irwin.

- Pervan, M., & Visic, J. (2012). Influence of firm size on its business success. *Croatian Operational Research Review*, 3(1), 213-223.
- Phua, F. T. T. (2006). Predicting construction firm performance: An empirical assessment of the differential impact between industry and firm-specific factors. *Construction Management and Economics*, 24(3), 309-320.
- Porter, M. E. (1979). The structure within industries and company performance. *Review of Economics and Statistics*, 61(2), 214-227.
- RICS. (2014). *Quantity surveying and construction standards: Cash flow forecasting*. <http://www.isurv.com/site/scripts/documents.aspx>
- Smith, T. (1983). On the validity of inference from non-random samples. *Journal of the Royal Statistical Society*, 146, 394-403.
- Soetanto, R., Proverbs, D. G., & Holt, G. D. (2001). Achieving quality construction projects based on harmonious working relationships—Clients' and architects' perceptions of contractor performance. *International Journal of Quality and Reliability Management*, 18(5), 528-548.
- Sparker, A. (2005). Narrative analysis: Exploring the whats and hows of personal stories. In I. Holloway (Ed.), *Qualitative research in health care* (pp. 191-208). Open University Press.
- Summers, B., & Wilson, N. (2002). An empirical investigation of trade credit demand. *International Journal of the Economics of Business*, 9(2), 257-270.
- Tran, T., Ha, X., Le, T., & Nguyen, N. (2019). Factors affecting IFRS adoption in listed companies: Evidence from Vietnam. *Management Science Letters*, 9(13), 2169-2180.
- Tucker, G. C., Windapo, A., & Cattell, K. (2015). Exploring the use of financial capacity as a predictor of construction company corporate performance: Evidence from South Africa. *Journal of Engineering, Design and Technology*, 13(4), 1-18.
- Wang, G., Dou, W., Zhu, W., & Zhou, N. (2015). The effects of firm capabilities on external collaboration and performance: The moderating role of market turbulence. *Journal of Business Research*, 68, 1928-1936.

Performance-Based Delivery and Administrative Burden: Preparing Albania for EU Cohesion Policy

Sonil Bilaj^{1*}, Valeria Valeri²

¹ PhD Candidate, European University of Tirana, Director for the Administration of EU Financial Assistance at the State Agency for Strategic Programming and Aid Coordination (SASPAC), Prime Minister's Office, Albania

² Cohesion Policy Expert, Team Leader / Key Expert of EU-funded assistance to Albania, Montenegro and Serbia on preparations for Regional Policy and Coordination of Structural Instruments

***Corresponding author:**
sonilbilaj1@gmail.com



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: The European Commission's proposed 2028-2034 architecture would achieve agreed milestones and targets, rather than certification of incurred expenditure, the principal trigger for payments under National and Regional Partnership Plans. The model is presented as a route to simplification and stronger performance orientation. This paper examines whether it is also likely to reduce administrative burden. Using qualitative document analysis and conceptual synthesis of recent academic and institutional literature on Cohesion Policy, the Recovery and Resilience Facility and performance budgeting, the paper develops a Performance-Delivery Burden Framework. It identifies eight interrelated burden categories: performance design, data production, coordination, verification, adaptation, financial risk, accountability and capability transition. The analysis shows that the proposed model may simplify part of the Commission-Member State reimbursement relationship while relocating administrative effort towards strategic specification, evidence production, cross-government coordination and risk management. For Albania, these requirements are likely to be particularly demanding because accession would require simultaneous development of data systems, specialized expertise and inter-institutional routines. The paper concludes that the new model represents a transformation rather than a straightforward reduction in administrative effort.

KEYWORDS: Cohesion Policy, performance-based financing, administrative burden, National and Regional Partnership Plans, administrative capacity, Albania

How to cite: Bilaj, S., & Valeri, V. (2026). Performance-Based Delivery and Administrative Burden: Preparing Albania for EU Cohesion Policy. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21621903>

Introduction

The European Commission's proposals for the 2028-2034 Multiannual Financial Framework envisage a major change in the delivery of EU funds. Each Member State would prepare a National and Regional Partnership Plan (NRPP), integrating reforms and investments across several policy fields. Payments would be linked primarily to the satisfactory fulfillment of agreed milestones and targets rather than to the declaration and certification of incurred expenditure ((COM(2025) 565 final, 2025); (COM(2025) 545 final, 2025)). The proposal extends to a much broader policy architecture a logic already tested through financing not linked to costs and, most visibly, through the Recovery and Resilience Facility (RRF).

The Commission presents this shift as a means of simplifying financial management, increasing flexibility and strengthening the focus on results. Yet simplification at one level of governance does not necessarily reduce the total administrative effort required across the delivery system. Removing or reducing transaction-level expenditure checks may generate new tasks: objectives must be converted into measurable commitments; baselines and verification methods must be negotiated; performance data must be produced and validated; responsibilities must be coordinated across institutions; and non-achievement may create direct payment and cash-flow risks. The central research problem is therefore not whether the proposed model removes particular procedures, but how it changes the object, timing, institutional location and risk profile of administrative work.

This issue is especially relevant for accession countries. Albania would need to prepare not only for the substantive obligations of Cohesion Policy but also for an administrative model requiring mature data systems, credible inter-ministerial coordination and specialized performance-management expertise. The paper contributes by developing a taxonomy of the burdens generated by performance-based delivery and by applying it as an institutional-preparedness framework for Albania.

Research Aim and Research Questions

The paper aims to examine how the proposed performance-based delivery model transforms administrative effort in EU funds management and to assess the implications for Albania as an acceding country. It addresses three questions:

- i. How does the model change the object, timing, location and risk profile of administrative work compared with expenditure-based reimbursement?
- ii. What categories of administrative burden are created or intensified by performance design, monitoring, verification and conditional payment?
- iii. Which burdens are likely to present the greatest institutional challenges for Albania?

The study uses a qualitative conceptual and documentary design. It analyses the Commission's 2028-2034 legislative proposals and related institutional material, recent European Parliament and European Court of Auditors publications, and peer-reviewed research on Cohesion Policy

administrative capacity, RRF governance and performance budgeting. Requirements are coded according to their source, responsible actor, timing, evidence needs and consequences of non-compliance. The resulting categories are synthesized in a Performance-Delivery Burden Framework (PDBF). Administrative burden is understood here as mandatory effort associated with information, coordination, documentation, control and accountability requirements. It is distinguished from administrative capacity, which denotes the ability to perform these tasks, and from administrative cost, which is their monetary valuation.

Literature review and analytical gap

A first strand of literature establishes that administrative capacity is a central determinant of Cohesion Policy performance. Bachtler et al. (2024) conceptualize capacity as multidimensional, encompassing organizational arrangements, human resources, coordination and implementation experience. Mendez & Bachtler (2024) show that quality of government is associated with differences in compliance, absorption and achievements across EU regions. This literature indicates that delivery systems cannot be assessed solely by formal rules: identical obligations can yield very different effects depending on institutional capability.

A second strand concerns simplification. Bachtler et al. (2026) define simplification as a reduction in the administrative, legal and procedural burden of designing, managing, implementing, monitoring and auditing EU-funded interventions. This involves making the system easier to use and more predictable for all actors involved, including managing authorities, other relevant bodies and beneficiaries. Successive reforms have introduced harmonized rules, simplified cost options and financing not linked to costs. However, recent Commission and EPRC studies distinguish legal or procedural simplification from an actual reduction in the resources used by administrations and beneficiaries (Hassan, et al., 2025); (Gal & van der Valk, 2025)). Simplification can also redistribute work between actors or move controls upstream. The relevant unit of analysis is therefore the full policy cycle rather than the number of documents submitted to the Commission. Recent European Parliament studies warn that the proposed 2028-2034 architecture may streamline EU-level procedures while increasing implementation complexity, centralizing decisions and weakening territorial involvement (Bachtler et al. (2026)); (Rubio & Alcidi, 2026). Performance-based instruments likewise shift effort towards adapted budgetary control, design, evidence and verification rather than eliminating administrative work (Begg, et al., 2025)

A third strand analyses performance-based EU governance through the RRF. Research identifies a dual effect. National plans may strengthen political ownership and central coordination, but conditional payments also require intensive ex ante negotiation and formal ex post verification of predetermined commitments. Zeitlin et al. (2025) describe tensions between national ownership and the increasingly mechanical verification of milestones and targets, while Bokhorst and Corti (2024), highlight the combination of discretion in plan design and discipline through conditionality. The model

can concentrate authority in central executives and modify the role of parliaments, regional authorities and traditional shared-management institutions.

A fourth strand comes from performance budgeting and evaluation. OECD work stresses that outcome-oriented systems require limited and meaningful indicators, credible information, clear responsibility and flexibility where causal links between public action and outcomes are uncertain (OECD, 2025b)). Rigid payment links may encourage gaming, conservative target selection or concentration on what is easily measurable. The European Court of Auditors has similarly found that earlier performance instruments in Cohesion Policy changed implementation approaches but did not noticeably alter the allocation or disbursement of funding, and has warned that performance-based models create specific assurance risks, including double funding ((European Court of Auditors, 2021); (European Court of Auditors, 2024)).

The analytical gap lies in connecting these literatures. Existing work discusses capacity, simplification, performance verification and governance separately. It rarely treats them as components of one transformed burden structure. The PDBF addresses this gap by identifying not only which administrative tasks arise, but also where and when they arise and what happens if they fail.

Performance-Delivery Burden Framework

The proposed model may simplify the Commission-Member State reimbursement relationship by reducing reliance on declarations of actual expenditure and some associated transaction-level checks. Nevertheless, it creates or intensifies eight interdependent forms of administrative burden.

Performance-design burden: translating policy objectives into indicators, baselines, milestones, targets, sequencing rules and verification methods. It is heavily front-loaded, and poor design can later generate disputes, perverse incentives or payment delays.

Data-production burden: establishing timely, reliable and interoperable data flows; assigning data ownership; validating information; and retaining traceable evidence. The burden shifts from proving that costs were incurred to proving that a pre-agreed condition was achieved.

Coordination burden: allocating responsibility across finance ministries, line ministries, regional authorities, implementing bodies and data owners. Integrated plans may reduce the number of formal programs while increasing the density of inter-organizational dependencies.

Verification burden: defining acceptable evidence, validating performance claims, maintaining audit trails, preventing double funding and responding to Commission and audit scrutiny. Assurance changes its object but does not disappear.

Adaptation burden: amending plans, revising targets and reprogramming when shocks or implementation problems make original commitments unrealistic. Excessive rigidity can delay delivery, whereas frequent renegotiation can consume substantial administrative resources.

Financial-risk burden: managing exposure to payment suspension or reduction, bridge financing and milestones dependent on actors beyond the direct control of the coordinating authority.

Accountability burden: maintaining partnership, regional participation, transparency and political scrutiny within a more integrated national plan. Central coordination may improve coherence but can also weaken territorial ownership.

Capability-transition burden: recruiting and training specialized staff, redesigning organizations and digital systems, and operating both old and new delivery arrangements in parallel during the transition period.

The framework also distinguishes three temporal forms of burden. Burden stock consists of one-off investments in regulation, methodologies, systems and organizational redesign. Burden flow is the recurrent work of monitoring, coordination, reporting and verification. Underperformance, disputes, audits, amendments or payment interruption activate contingent burden. This distinction explains why annual reporting hours alone may underestimate the administrative implications of the new model.

Table 1

Transformation of administrative effort under performance-based delivery

Dimension	Expenditure-based reimbursement	Performance-based delivery
Object	Eligibility and legality of expenditure	Achievement and verification of milestones and targets
Timing	Predominantly recurrent and ex post	Strongly front-loaded, followed by periodic verification
Institutional location	Managing, reporting and audit functions	Strategic centres, line ministries, data owners and coordinating bodies
Expertise	Accounting, procurement and eligibility control	Policy design, indicator methodology, data analysis, evaluation and negotiation
Principal risk	Financial correction for irregular expenditure	Payment delay, suspension or reduction for non-achievement or insufficient evidence

Source: Author elaboration.

Implications for Albania

The framework suggests that Albania's greatest challenge would not be formal transposition of rules but the construction of a credible performance-governance system. Four capacity variables are decisive. First, institutional fragmentation increases coordination burden when milestones depend on several ministries, municipalities or agencies. Clear ownership, escalation routes and a strong center-

of-government function would be required. Second, limited data maturity increases the risk of weak baselines, delayed reporting and unverifiable achievement. Preparation should therefore include inventories of administrative data, common definitions, quality protocols and interoperable systems.

Third, the model requires specialized skills that differ partly from traditional expenditure management: intervention logic, indicator design, evaluation, data analytics, verification methodology and negotiation. Training should be combined with stable career structures, because reliance on temporary project staff would weaken institutional memory. Fourth, Albania would need capacity to absorb financial risk. If national expenditure proceeds but an EU payment is delayed because a milestone is not accepted, the national budget may have to provide temporary financing. Contingency arrangements and conservative sequencing are therefore part of administrative preparedness, not merely fiscal management.

These constraints also create a risk of defensive administration. To avoid payment failure, institutions may select easily measurable milestones, impose redundant documentary checks or reproduce transaction-level controls alongside new performance requirements. Nominal simplification could thus produce parallel compliance systems. Preparatory assistance should focus on proportional verification, data reliability and realistic target design rather than on multiplying procedures.

Conclusions

The proposed performance-based delivery model constitutes a transformation in the administrative logic of EU funding. Its principal innovation is not simply the wider use of indicators, but the replacement of expenditure as the main trigger for EU payment by verified achievement of agreed milestones and targets. This may simplify part of the financial reimbursement process, yet it does not follow that the total administrative effort will decline.

The PDBF shows that work is redistributed across performance design, data production, coordination, verification, adaptation, financial-risk management, accountability and capability transition. Compared with expenditure-based reimbursement, this effort is more front-loaded, more data-intensive, more dependent on cross-government coordination and more directly linked to cash-flow risk. Responsibility also moves beyond traditional managing and audit authorities towards line ministries, data owners, strategic coordinating bodies and political decision-makers.

Accordingly, the model should be understood as administrative transformation rather than straightforward burden reduction. A system is not genuinely simpler merely because it verifies fewer invoices. It is simpler only if the combined cost of designing, producing, coordinating and validating performance information is proportionate to the public value generated. Future simplification assessments should therefore measure total effort across the policy cycle, identify where it is relocated and test whether new requirements improve decisions and outcomes.

For Albania, preparedness requires early investment in indicator methodologies, interoperable

data systems, ownership of cross-sector commitments, independent verification capacity and contingency planning for payment delays. Further research should test the taxonomy through interviews and comparative analysis of Member State experience with the RRF and financing not linked to costs. Such work could determine whether performance-based financing produces sustained organizational learning or a new compliance system centered on milestones, indicators and documentary evidence.

References

- Bachtler, J., Kah, S., Mendez, C., van der Valk, O., & McMaster, I. (2026). *Flexibility and simplification in Cohesion Policy under the 2028-2034 MFF proposals*. European Parliament, Brussels. doi:<https://doi.org/10.2861/2441307>
- Bachtler, J., Polverari, L., Domorenok, E., & Graziano, P. (2024). Administrative capacity and EU Cohesion Policy: implementation performance and effectiveness. *Regional Studies*, 58(4), 685-689. doi:<https://doi.org/10.1080/00343404.2023.2276887>
- Begg, I., Liscai, A., Darvas, Z., Fiore, A., Krystyanczuk, M., Sekut, K., . . . van der Valk, O. (2025). *Performance-based instruments: How could their design be improved?* European Parliament, Brussels. Retrieved from [https://www.europarl.europa.eu/thinktank/en/document/BUDG_STU\(2025\)769432](https://www.europarl.europa.eu/thinktank/en/document/BUDG_STU(2025)769432)
- Bokhorst, D., & Corti, F. (2024). Governing Europe's Recovery and Resilience Facility: Between discipline and discretion. *Government and Opposition*, 59(3), 718-734. doi:<https://doi.org/10.1017/gov.2023.14>
- European Commission. (2025). *A dynamic EU budget for the priorities of the future: Multiannual Financial Framework 2028-2034*. European Commission, Brussels. Retrieved from https://commission.europa.eu/publications/multiannual-financial-framework_en
- European Commission. (2025). *Proposal for a regulation of the European Parliament and of the Council establishing a budget expenditure tracking and performance framework and other horizontal rules for Union programmes and activities (COM(2025) 545 final)*. European Commission, Brussels. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52025PC0545>
- European Commission. (2025). *Proposal for a regulation of the European Parliament and of the Council establishing the European Fund for economic, social and territorial cohesion, agriculture and rural, fisheries and maritime, prosperity and security for the period 2028-2034 and amend*. European Commission, Brussels. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/HIS/?uri=CELEX:52025PC0565>
- European Court of Auditors. (2021). *Performance-based financing in Cohesion policy: Worthy ambitions, but obstacles remained in the 2014-2020 period*. European Court of Auditors, Luxembourg. Retrieved from <https://op.europa.eu/webpub/eca/special-reports/performance->

24-2021/en/

- European Court of Auditors. (2024). *Double funding from the EU budget: Control systems lack essential elements to mitigate the increased risk resulting from the RRF model of financing not linked to costs*. Luxembourg: Publications Office of the European Union. Retrieved from <https://www.eca.europa.eu/en/publications/SR-2024-22>
- European Court of Auditors. (2025). *The future of EU Cohesion Policy: Drawing lessons from the past*. European Court of Auditors. Luxembourg: Publications Office of the European Union. doi:<https://doi.org/10.2865/0171020>
- European Court of Auditors. (2026). *Opinion 10/2026: concerning the proposal for a regulation of the European Parliament and of the Council establishing a budget expenditure tracking and performance framework and other horizontal rules for the Union programmes and activities (COM(2025) 545*. European Court of Auditors. Luxembourg: Publications Office of the European Union. Retrieved from <https://www.eca.europa.eu/en/publications/OP-2026-10>
- Gal, F., & van der Valk, O. (2025). *New financial management tools under EU Cohesion Policy: Have they delivered on simplification?* European Policies Research Centre, Delft. Retrieved from <https://eprc-strath.org/publication/new-financial-management-tools-under-eu-cohesion-policy-have-they-delivered-on-simplification/>
- Hassan, E., Cioancă, A., Schröttke, T., Louguet, A., Landes, F., Naldini, A., . . . Cincera, M. (2025). *Assessment of the administrative costs and burden of CPR funds 2021-2027: Final report*. European Commission, Directorate-General for Regional and Urban Policy (DG REGIO). Luxembourg: Publications Office of the European Union. doi:<https://doi.org/10.2776/1596905>
- Mendez, C., & Bachtler, J. (2024). The quality of government and administrative performance: Explaining Cohesion Policy compliance, absorption and achievements across EU regions. *Regional Studies*, 58(4), 690–703. doi:<https://doi.org/10.1080/00343404.2022.2083593>
- OECD. (2025). *Government at a Glance 2025*. Paris: OECD Publishing. doi:<https://doi.org/10.1787/0efd0bcd-en>
- OECD. (2025). *Strengthening performance reporting practices*. Paris: OECD Publishing. doi:<https://doi.org/10.1787/bcea6d2d-en>
- Rubio, E., & Alcidi, C. (2026). *Navigating the European Commission's MFF proposal for 2028-2034: Mapping risks and opportunities for Cohesion Policy and regional development*. European Parliament, Brussels. doi:<https://doi.org/10.2861/4555208>
- Zeitlin, J., Bokhorst, D., & Eihmanis, E. (2025). Governing the European Union's Recovery and Resilience Facility: National ownership and performance-based financing in theory and practice. *Regulation & Governance*, 19(3), 864–884. doi:<https://doi.org/10.1111/rego.12619>

Current Problems of Entrepreneurship Development in the Karabakh Economic Region in the Context of Sustainable Development

Aliyev Shafa 

¹ Doctor of economic sciences,
professor of Sumgait State
University.

Head of the Centre For
Karabakh Economic Research
UNEC –

Azerbaijan State Economic
University, Republic of
Azerbaijan

Corresponding author:
shafa.aliyev@sdu.edu.az



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: The article examines the current problems of entrepreneurship development in the Karabakh economic region in the context of sustainable development. Regional development problems are reviewed and generalized. The issues of accelerating the development of entrepreneurship in Karabakh are analyzed, taking into account the existing resources. The mechanisms and priorities of effective organization of entrepreneurial activity are studied in a complex and systematic manner. The main directions of the state policy on entrepreneurial activity in Azerbaijan are characterized. The essence of the state-defined concessions and state support mechanisms for the sustainable development of entrepreneurial entities in the Karabakh economic region is given. Proposals are made to intensify the development of entrepreneurship in Karabakh in the near future.

KEYWORDS: Azerbaijan, sustainable development, Karabakh, Karabakh economic region, entrepreneurship, entrepreneurship development problems, entrepreneurship development prospects.

How to cite: Aliyev, S. (2026). Current Problems of Entrepreneurship Development in the Karabakh Economic Region in the Context of Sustainable Development. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21621167>

Introduction

The full restoration of the territorial integrity and state sovereignty of the Republic of Azerbaijan has laid the foundation for a completely new stage in the country's socio-economic development strategy [1]. This stage is not limited to the restoration of the territories liberated from occupation, but also includes the integration of these territories into the national economic system, the application of a modern management model, ensuring sustainable economic development and the safe return of the population to their native lands. In this regard, the Great Return concept is considered one of the important directions of the long-term development policy of the Azerbaijani state.

The First State Program on the Great Return in the Republic of Azerbaijan is the main strategic document for the restoration and reconstruction of the territories liberated from occupation. The main goal of the State Program is to ensure safe living conditions, create modern infrastructure, restore economic activity, organize social services, develop entrepreneurship and ensure the gradual return of former internally displaced persons to their native lands. Within the framework of the program, the construction of roads, railways, airports, power plants, reservoirs, schools, hospitals and other social facilities has gained wide scope [2].

During the occupation, settlements, industrial enterprises, agricultural facilities, roads, energy infrastructure, water systems and social facilities of Karabakh and surrounding regions were completely destroyed, natural resources were exploited, and historical and cultural heritage was seriously damaged. Therefore, the restoration of these territories is not considered an ordinary construction process, but the formation of a completely new economic and social environment. The State Program was developed taking into account these realities and aimed to coordinate restoration work within a single management mechanism.

Research Aim and Research Questions

The main purpose of writing the article is to disclose the current problems of entrepreneurship development in the Karabakh economic region in the context of sustainable development and to make appropriate generalizations. Currently, there is a need to increase the role of entrepreneurship in the more intensive restoration and revitalization of post-conflict territories. In the course of the research, preference was given to the use of analysis, synthesis, comparison and generalization methods. At the same time, reference was made to studies conducted on the problems of entrepreneurship development in the Karabakh economic region.

Research Results

Karabakh's rich natural resources and economic potential are being used more effectively with the support of the State Program. The reconstruction of agriculture, the creation of modern agroparks, the development of the processing industry and the promotion of environmentally friendly production allow for the expansion of entrepreneurial activity in the region. At the same time, the restoration of

historical and cultural heritage accelerates the development of the tourism sector and creates new business opportunities in the hotel, public catering, transport and other service sectors. In addition, Karabakh has strong potential in terms of diversification of the non-oil and gas industry [3]. In particular, the development of innovation-oriented sectors is of great importance [4]. Thus, the role of high technologies and innovations in the formation of new sources of growth of the country's economy is increasing [5]. In addition, increasing the country's non-oil and gas exports is of maximum relevance [6].

The economic development of the Karabakh economic region is of strategic importance not only in terms of the restoration of the region, but also in terms of the development of the non-oil sector of Azerbaijan, ensuring regional economic balance, increasing employment and expanding export potential. In this regard, the development of entrepreneurship is considered one of the main economic pillars of the Great Return concept. The financial resources allocated for the reconstruction of the liberated territories are considered one of the largest state investment programs implemented by Azerbaijan during its independence. Over 22 billion manats were allocated from the state budget for the restoration of these territories during 2021-2025. In 2024 alone, approximately 4.828 billion manats were allocated to finance restoration and construction work in the liberated territories. In 2025, the state allocated 4.465 billion manats in this direction. In 2025, the main part of the allocated funds, i.e. 84.7% or 3.782 billion manats, was directed to the creation of infrastructure systems in the regions and the restoration of existing facilities. The funds were mainly spent on the implementation of new infrastructure projects, the construction and renovation of settlements, as well as the implementation of important projects in the transport and energy sectors. In total, 385 rehabilitation and development projects covering various areas were implemented in the liberated territories during 2025. Of these projects, 56 were related to transport infrastructure, 78 to water management and land reclamation, 7 to defense and law enforcement, 177 to the social sphere, 19 to the energy sector, and 48 to other areas. These projects aim to ensure the socio-economic development of the regions and accelerate the return of the population to those areas [7; 8].

It is predicted that by 2030, employment opportunities in the Karabakh economic region will increase significantly and approximately 150 thousand new jobs will be created in total. The main part of this increase will be provided by the development of various economic directions. Thus, it is planned to create up to 5 thousand new jobs in the Agdam Industrial Park, 15-17 thousand in the agricultural sector, 1.5-2 thousand in the mining industry, 1.5-2 thousand in the tourism sector, and 10-11.5 thousand in the small and medium-sized enterprises [9]. Positive dynamics have also been recorded in small business entities. The number of small businesses, which was 182 in 2023, reached 197 in 2024, and 248 in 2025. Thus, an increase of 66 units occurred in this category over two years. In particular, the increase in the growth rate between 2024 and 2025 indicates that the development opportunities of small businesses are expanding and more entrepreneurs are starting to expand their activities. The

number of medium-sized enterprises has also increased consistently. While there were 71 medium-sized enterprises in 2023, this figure increased to 107 in 2025, an increase of 36 units. The expansion of medium-sized enterprises creates conditions for the formation of more sustainable business structures in the region in production, services and other economic sectors.

In the context of the Great Return, the development of entrepreneurship is not limited only to an increase in their number. One of the main goals is the formation of an entrepreneurial ecosystem in the Karabakh economic region, stimulation of the activities of small and medium-sized enterprises, efficient use of local resources and the creation of new economic value chains. The natural resources, fertile lands, water resources, mineral deposits, rich forest fund and favorable geographical location of the Karabakh economic region allow the development of entrepreneurship in various directions [10]. In particular, the processing industry, agriculture, agrarian industry, logistics services, green energy, tourism, construction industry, information technologies and digital services are considered promising development areas of the region. Assessment of the potential of the Karabakh economic region shows that agriculture occupies a special place in the development of the region. The creation of free economic zones in order to increase investment attractiveness in these areas can also be beneficial [11]. By using world experience in such zones, it is possible to organize entrepreneurial activity more efficiently [12]. Residents registered in free economic zones also have certain opportunities for transferring high technologies [13].

The development of the digital economy is considered one of the main features of the new economic model of the Karabakh economic region [14]. Within the framework of the "smart city" and "smart village" projects, high-speed internet, digital public services, electronic payment systems and artificial intelligence-based management technologies are applied. The Karabakh economic region has been declared the "Green Energy Zone" of Azerbaijan. The solar energy potential of the region is estimated at approximately 7200 MW, and the wind energy potential is more than 2000 MW [15]. This creates an opportunity for the formation of a new market for entrepreneurs operating in the field of green energy.

The development of the tourism sector is considered one of the future directions of entrepreneurship. The rich historical heritage of Karabakh, natural landscapes, mineral waters, forests, mountain tourism opportunities and cultural monuments allow the development of various types of tourism. The rich historical and cultural heritage of Shusha, Khojaly, Agdam and other territories, mountain, health and ecotourism opportunities can create conditions for an increase in the flow of tourists to the region. Hotels, family-type guest houses, restaurants, tourism companies, transport services, production and sales centers of handicraft products also allow for the expansion of entrepreneurship. As a result of the development of the tourism sector, new employment opportunities are formed in Karabakh, the level of employment of the population increases and a positive impact is exerted on the economic indicators of the region, especially the growth of gross domestic product.

Also, SMEs get the opportunity to join various areas of activity related to tourism infrastructure, which creates conditions for strengthening the local entrepreneurial environment. The development of tourism in interaction with such sectors as agriculture, transport, services and crafts acts as one of the main factors accelerating the socio-economic recovery of Karabakh [16, p.98].

The sharp increase in income in 2025 is associated with the expansion of tourism infrastructure in Karabakh, the launch of new accommodation facilities, an increase in visits to the region and the activation of entrepreneurial entities. In general, tourism is one of the important sectors that brings high income and allows the investments to pay off in a short time. This sector has a significant impact not only in terms of economic development, but also on the formation of the state budget, the improvement of cities and villages, the protection of historical and architectural heritage, as well as the expansion of small and medium-sized businesses. In this regard, the development of tourism in the Karabakh region is currently of particular importance [17].

A comparative analysis of credit investments in Karabakh for 2020-2025 shows that the volume of financial resources allocated to the region has steadily increased from year to year. If in 2020 the volume of credit investments amounted to 57.1 million manat, in 2021 this figure increased to 252.5 million manat. Thus, in just one year, credit investments increased by approximately 4.4 times. In 2024, credit investments increased to 473.3 million manat, an increase of 68.3 million manat or 16.9% compared to the previous year. At this stage, the completion of a significant part of infrastructure projects and the creation of new production and service enterprises further expanded entrepreneurs' access to financial resources. In 2025, the volume of credit investments reached 526.5 million manat. For the maximum efficiency of the complex, systematic and sustainable measures implemented by the state in Karabakh, the transparency and purposeful use of financial resources used should be kept in the spotlight [18, p.37]. This is considered one of the important steps in terms of the development of entrepreneurship.

Logistics and transport services also play an important role in the regional economy [19]. Modern highways, railway infrastructure and international airports accelerate the integration of the region with domestic and foreign markets. This leads to the expansion of export potential, increased trade turnover and the creation of new entrepreneurial opportunities. The role of human capital in the development of entrepreneurship should be particularly emphasized. Expanding vocational training programs, developing entrepreneurship education, creating business incubators, forming a startup ecosystem and strengthening university-industry cooperation can accelerate the development of innovative entrepreneurship. At the same time, the opportunities for the formation of competitive non-oil and gas sectors of the economy in the region will increase [20].

It should be noted that in the context of the State Program, ensuring the development of human capital in the liberated territories has been identified as one of the main priorities. For this purpose, it is envisaged to form a social service infrastructure covering the fields of health, social protection, education, culture and sports, as well as schools and preschool educational institutions, and expand its

material and technical capabilities. It is also planned to ensure access to modern standards of healthcare and education services for the population returning to and settling in the region, and to restore and reconstruct cultural and sports facilities. In addition, it is aimed to improve the social well-being and quality of life of the population through the implementation of active self-employment programs to increase employment, as well as the establishment of rehabilitation institutions [21]

In general, the main positive factors affecting the development of entrepreneurship in the region are the high level of state investments, legal and institutional support, tax incentives, modern transport infrastructure, the operation of international airports, green energy projects, an open economic environment for foreign investors, human capital, and others.

Conclusions

The analysis shows that the Great Return program has radically changed the economic development model of the Karabakh economic region and created new opportunities for the development of entrepreneurship. Large-scale investments implemented by the state, a favorable business environment, tax and customs privileges, the creation of industrial parks, the implementation of the green energy concept and the development of logistics infrastructure make a significant contribution to the realization of the region's economic potential. At the same time, the complete elimination of the mine threat, the formation of qualified human capital, expanding access to financial resources and supporting innovative entrepreneurship should be one of the main priorities in the coming period. The future development of the Karabakh economic region will depend not only on state investments, but also on the formation of a strong private sector and the creation of a competitive entrepreneurial ecosystem.

Based on the results of the current analysis, the implementation of the following recommendations is considered appropriate:

- Expansion of long-term and low-interest credit mechanisms for entrepreneurs operating in the Karabakh economic region.
- Creation of agro-industrial clusters and increasing the number of agricultural product processing enterprises.
- Development of tourism routes and stimulation of attraction of private investments in this sphere.
- Further improvement of services for foreign investors on the basis of the "one-stop shop" principle.
- Application of special privileges for financing of green energy and green business projects.
- Formation of Karabakh products as a national brand and expansion of their access to export markets.
- Acceleration of implementation of large infrastructure and production projects through wide application of public-private partnership mechanisms.

References

1. Aliyev, Sh. T. (n.d.). Vazhnost' primeneniya novykh ekonomicheskikh instrumentov v ekonomike Azerbaydzhana [The importance of applying new economic instruments in the Azerbaijani economy]. *Natsional'nye Interesy: Prioritety i Bezopasnost'*, 80-84.
2. Azərbaycan Respublikası Prezidenti [President of the Republic of Azerbaijan]. (2022, November 16). *Azərbaycan Respublikasının işğaldan azad edilmiş ərazilərinə Böyük Qayıdışa dair I Dövlət Proqramının təsdiq edilməsi haqqında Sərəncam* [Order on the approval of the First State Program on the Great Return to the liberated territories of the Republic of Azerbaijan].
3. Əliyev, Ş. T. (2019). Azərbaycanca qeyri-neft sənayesinin şaxələndirilməsi və ixrac potensialının artırılması istiqamətləri [Directions for diversifying the non-oil industry and increasing export potential in Azerbaijan]. *Audit*, 26(4), 61-73.
4. Aliyev, Sh. T. (2014). Modelirovanie innovatizatsii natsional'noy ekonomiki v sovremennykh usloviyakh [Modeling the innovatization of the national economy in modern conditions]. *Nauchnoe Obozrenie*, (6), 342-346.
5. Əliyev, Ş. T. (2018). *Azərbaycan iqtisadiyyatı* [The economy of Azerbaijan]. Sumgait State University, Editorial and Publishing Department.
6. Aliyev, Sh. T. (2015). *Vneshneekonomicheskaya politika Azerbaydzhana* [Foreign economic policy of Azerbaijan]. Sumgait State University Press.
7. Qurbanov, Y., & Məmmədova, F. (2026, July). *Qarabağın bərpaası Azərbaycanın iqtisadi inkişaf strategiyasında* [The restoration of Karabakh in Azerbaijan's economic development strategy]. AIR Center. <https://aircenter.az/uploads/ZnN7dvQVFfHK.pdf>
8. *2025-ci ilin dövlət büdcəsindən Qarabağ üçün 4,5 milyard manat vəsait ayrılıb* [4.5 billion manat allocated from the 2025 state budget for Karabakh]. (n.d.). Marja.az. Retrieved July 10, 2026, from <https://marja.az/133661/2025-ci-ilin-dovlet-budcesinden-qarabag-ucun-45-milyard-manat-vesait-ayrilib>
9. *Qarabağda sahibkarlıq mühiti* [The entrepreneurial environment in Karabakh]. (n.d.). Yeni Azərbaycan. Retrieved July 10, 2026, from https://www.yeniazərbaycan.com/MEDIA_e112544_az.html
10. Əliyev, Ş. T. (2017). Azərbaycanca maliyyə sabitliyinin təmin edilməsi problemləri və maliyyə-kredit sisteminin inkişafının müasir aspektləri [Problems of ensuring financial stability in Azerbaijan and modern aspects of the development of the financial-credit system]. *Audit*, (3), 26-40.
11. Aliyev, Sh. T. (2008). *Problemy organizatsii i perspektivy razvitiya osobykh ekonomicheskikh zon* [Problems of organization and prospects for the development of special economic zones]. Nauka.

12. Aliyev, Sh. T. (2010). The problems of the variety of formation and functioning of the special economic zones in Azerbaijan in the context of the world experience. *Marketing and Management of Innovations*, (1), 144-148.
13. Aliyev, Sh. T. (2012). Rol' spetsial'nykh ekonomicheskikh zon v razvitii predprinimatel'stva i investitsionnoy aktivnosti [The role of special economic zones in the development of entrepreneurship and investment activity]. *Rossiyskoe Predprinimatel'stvo*, 7(205), 180-184.
14. Mamedov, Z. F., & Aliyev, Sh. (2020). Digitalization of the economy: Analysis of influence on the banking sphere in Azerbaijan in the context of world experience. In *55th International Scientific Conference on Economic and Social Development: Book of proceedings* (Vol. 2/4, pp. 584-591). Baku, Azerbaijan.
15. *Yeni əsrin qlobal layihəsi - "Yaşıl enerji"* [The global project of the new century – "Green energy"]. (n.d.). Azerbaijan-News.az. Retrieved July 10, 2026, from <https://azerbaijan-news.az/az/posts/detail/yeni-esrin-qlobal-layihesi-yasil-enerji-1649104912>
16. Osmanov, İ. O. (2026). Qarabağın dirçəldilməsində turizm potensialının rolunun qiymətləndirilməsi [Assessing the role of tourism potential in the revival of Karabakh]. In *III Ümumrespublika elmi məqalə müsabiqəsi - 2025: Elektron məqalələr toplusu* [3rd National Scientific Article Competition - 2025: Electronic collection of articles] (pp. 97-102). UNEC-Karabakh Economic Research Center.
17. Məmmədova, A. (2024). Karabakh and East Zangezur economic regions in Azerbaijan's food security policy. *Akademik Tarih ve Düşünce Dergisi*, 11(5), 2959-2974.
18. Melikova, L. A., & Aliyev, S. T. (2023). Current problems and possibilities of solutions of the restoration of Karabakh economic region. In *Proceedings of the 3rd International Scientific and Practical Conference "Progressive Science and Achievements"* (No. 172, pp. 33-39).
19. Aliyev, Sh. T. (2008). Problemy konkurentosposobnosti real'nogo sektora ekonomiki Azerbaydzhana v usloviyakh globalizatsii [Problems of competitiveness of the real sector of the Azerbaijani economy under globalization]. *Doklady NANA*, (6), 135-143.
20. Aliyev, Sh. T. (2020). Problems of diversification of Azerbaijani economy in modern conditions. In *Proceedings of the VIII International Scientific and Practical Conference "Current Problems of Social and Labor Relations" (ISPCCPSLR 2020)* (pp. 38-44). Makhachkala, Russia.
21. Aliyev, Sh. T. (2020). Strategic role of Sumgayit in the development of petrochemical industry of Azerbaijan. In *Proceedings of the International Conference on Actual Problems of Chemical Engineering (APCE 2020)* (pp. 430-435). Azerbaijan State Oil and Industry University.

Evolution of the Trade Balance in Response to Exchange Rate Policy: State of the Art

Walid Khiyat^{1*}, Mohamed Elkandili¹

¹ Research Laboratory in
Management, Economics, and
Social Sciences, FSJES, UCD,
El Jadida, Morocco

Corresponding author:
khiyat.W050@ucd.ac.ma



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: The main objective of this paper is to give a comprehensive overview of the scientific literature on the impact of exchange rate policy choices on a country's trade balance. As the global economy becomes more interconnected, no country can be fully self-sufficient. All nations must participate in international trade and maintain economic relations. In this context, exchange rate policy has become an important tool for managing these transactions. It has also become a key indicator of economic performance for each country, which explains why it attracts growing interest from researchers and policymakers

KEYWORDS: Trade Balance, Exchange Rate Policy, Systematic Literature Network Analysis, Inflation, International Trade.

How to cite: Khiyat, W., & Elkandili, M. (2026). Evolution of the Trade Balance in Response to Exchange Rate Policy: State of the Art. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21720875>

The main objective of this paper is to give a comprehensive overview of the scientific literature on the impact of exchange rate policy choices on a country's trade balance. As the global economy becomes more interconnected, no country can be fully self-sufficient. All nations must participate in international trade and maintain economic relations. In this context, exchange rate policy has become an important tool for managing these transactions. It has also become a key indicator of economic performance for each country, which explains why it attracts growing interest from researchers and policymakers[1, 4, 3].

With this intention, we conducted a Systematic Literature Network Analysis (SLNA), which combines a systematic literature review with bibliometric network analysis. This approach helps us map out the core concepts and identify future research directions[2]. We collected biblio-graphic data from Scopus and selected studies based on their titles, abstracts, and keywords. Only peer-reviewed research articles published between 2016 and 2026 in English or French were included in the analysis.

Our results show that the literature uses different perspectives to explain the relationship between exchange rate policy and the trade balance. The keyword co-occurrence network identifies trade balance as the central research topic, closely linked to themes such as depreciation, exports, imports, inflation, trade deficits, and international trade. The presence of several interconnected clusters indicates that the relationship between exchange rate policy and trade balance has been explored from multiple angles, including macroeconomic conditions, trade performance, and country-specific case studies. This bibliometric mapping offers a clear picture of the main research themes and provides a solid foundation for future work on this subject.

References

- [1] Auboin, M. and Ruta, M. (2013). The relationship between exchange rates and international trade: A literature review. *World Trade Review*, 12(3), 577-605. <https://doi.org/10.1017/S1474745613000025>
- [2] Donthu, N., Kumar, S., Mukherjee, D., Pandey, N. and Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133, 285-296. <https://doi.org/10.1016/j.jbusres.2021.04.070>
- [3] Matsvai, S. (2025). Exchange rates and inflation dynamics in multicurrency regimes: The case of Zimbabwe (2014-2024). *International Journal of Financial Studies*, 13(2), 93. <https://doi.org/10.3390/ijfs13020093>
- [4] Arespa, M. (2024). The exchange rate regime, a determinant of the degree of risk sharing between profits and wages. *Economic Analysis and Policy*, 84, 1910-1932. <https://doi.org/10.1016/j.eap.2024.10.056>

SECTION

Educational sciences



Futurity Research Publishing

From AI Adoption to Pedagogical Intelligence: Modeling Teacher Agency, Ethics and Innovation in Malaysian

Zaheril, Zainudin ¹, Numuma Kamarina, Jamil ², Roselan, Baki³, Mohd Sofian, Omar Fauzee⁴

¹⁻⁴PhD, Dr., Senior Lecturer II,
INTI International University,
Malaysia

✉ ***Corresponding author:**
zaheril.zainudin@newinti.edu.my



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: This mixed-methods empirical study examined how generative artificial intelligence (AI) readiness influences ethical confidence, teacher agency and pedagogical innovation among Malaysian primary school teachers. A sequential explanatory design was employed involving a quantitative survey of 384 teachers, followed by semi-structured interviews with 25 teachers to deepen interpretation of the statistical findings. Quantitative results indicated that generative AI readiness was positively associated with ethical confidence, teacher agency and pedagogical innovation. Ethical confidence mediated the relationship between AI readiness and teacher agency, while teacher agency mediated the relationship between ethical confidence and pedagogical innovation. Qualitative findings revealed that teachers perceived generative AI as a supportive tool for lesson planning, differentiated instruction and creative teaching materials, but stressed the need for professional judgment in verifying and adapting AI-generated outputs. The study contributes a pedagogical intelligence model that positions ethically confident and agentic teachers as central to responsible AI-supported educational innovation in primary schools.

KEYWORDS: generative AI, pedagogical intelligence, teacher agency, ethical confidence, Malaysian education.

How to cite: Zainudin, Z., Kamarina, N., Jamil, R. B., & Fauzee, M. S. O. (2026). From AI Adoption to Pedagogical Intelligence: Modeling Teacher Agency, Ethics and Innovation in Malaysia. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21236607>

Introduction

Generative AI has become a transformative force in education, changing how teachers prepare lessons, design learning materials, provide feedback and support student-centered instruction (Zainudin et al., 2025). Unlike earlier educational technologies, generative AI enables the production of new content, explanations, questions and teaching resources through interactive prompts (Zainudin et al., 2025b). This creates opportunities for personalized learning, differentiated instruction and reduced teacher workload (Kamaghe, 2026). However, its rapid adoption also raises concerns about misinformation, bias, academic integrity, data privacy and overdependence on AI-generated outputs (UNESCO, 2023). Therefore, the key educational issue is not merely whether teachers utilize AI, but how they utilize it responsibly and pedagogically.

In fact, an ocean of literature shows that AI has strong potential to support teaching, learning analytics, assessment and instructional decision-making (Holmes et al., 2023). However, much existing research remains technology-centered and tends to limit attention to teachers' professional judgment, ethical confidence and agency. Bawa et al. (2026) argued that AI in education might enhance learning, but its effectiveness depends on meaningful pedagogical integration rather than technological adoption alone. This is particularly important since teachers are the main actors who transform AI tools into classroom practice.

Nevertheless, teacher readiness is therefore central to responsible AI integration. Readiness involves not only technical ability, but also confidence, perceived usefulness (Davis, 1989), ethical awareness (Zainudin & Jamil, 2026) and the capacity to align AI with learning goals (Ngongpah & Oni, 2025). In addition, teacher agency enables educators to evaluate, adapt and control AI-generated content according to students' needs and curriculum demands (OECD, 2026). Ethical confidence further supports teachers in identifying risks and making responsible instructional decisions (Ofosu-Asare, 2025).

In Malaysia, ultimately, digital transformation and AI-related education policies highlight the need for future-ready teaching practices (MOE, 2024). However, empirical evidence is still needed to explain how AI readiness influences ethical confidence, teacher agency and pedagogical innovation. Therefore, this study examines these relationships among Malaysian primary school teachers and develops a pedagogical intelligence model for responsible AI-supported teaching.

Research Aim and Research Questions

The aim of this study is to examine how generative AI readiness influences ethical confidence, teacher agency and pedagogical innovation among Malaysian educators, as well as to explore how teachers interpret and apply generative AI in teaching practices. Therefore, the study seeks to move beyond the issue of AI adoption by investigating how AI might be transformed into a responsible, student-centered and innovation-driven pedagogy by answering (a) RQ1: What is the level of

generative AI readiness among Malaysian educators? (b) RQ2: What is the relationship between generative AI readiness, ethical confidence, teacher agency and pedagogical innovation? (c) RQ3: Does ethical confidence mediate the relationship between generative AI readiness and teacher agency? (d) RQ4: Does teacher agency mediate the relationship between ethical confidence and pedagogical innovation? (e) RQ5: How do Malaysian educators experience, interpret and negotiate the utilization of generative AI in teaching practice? and (f) RQ6: How can generative AI readiness, ethical confidence and teacher agency be integrated into a pedagogical intelligence model for responsible AI-supported teaching?

Research Results

The study involved 384 primary school teachers in the quantitative phase (Cohen et al., 2013) and 25 teachers in the qualitative interview phase (Braun & Clarke, 2021). The quantitative data were analyzed using descriptive statistics and structural equation modeling (Wiersma, 1995), while the qualitative data were analyzed through thematic analysis (Creswell et al., 2017).

RQ1: What is the level of generative AI readiness among primary school teachers?

Table 1

Descriptive Statistics for Main Constructs

Construct	Mean	Standard Deviation	Interpretation
Generative AI Readiness	3.87	0.62	Moderate-High
Ethical Confidence	3.74	0.66	Moderate-High
Teacher Agency	3.91	0.58	High
Pedagogical Innovation	3.83	0.61	Moderate-High

Source: author 's own development

Table 1 showed that primary school teachers demonstrated a moderate to high level of generative AI readiness. The overall mean score for generative AI readiness was 3.87, indicating that most teachers were generally open to utilizing AI tools in their teaching practice. Among the dimensions, perceived usefulness recorded the highest mean score, suggesting that teachers recognized the potential of generative AI to assist lesson planning, teaching material preparation and student engagement. However, AI technical confidence showed a comparatively lower mean score, indicating that some teachers still lacked confidence in utilizing AI tools independently.

RQ2: What is the relationship between generative AI readiness, ethical confidence, teacher agency and pedagogical innovation?

Table 2

Correlation Matrix of Main Constructs

Construct	1	2	3	4
1. Generative AI Readiness	1			
2. Ethical Confidence	.61***	1		
3. Teacher Agency	.58***	.64***	1	
4. Pedagogical Innovation	.63***	.59***	.67***	1

Note: *** $p < .001$.

Source: author's own development

Table 2 showed that all constructs were positively and significantly correlated at the $p < .001$ level. This indicates that teachers with higher generative AI readiness were more likely to report stronger ethical confidence, higher teacher agency and greater pedagogical innovation.

Table 3

Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVERAGE
Generative AI Readiness	.89	.92	.64
Ethical Confidence	.87	.91	.62
Teacher Agency	.88	.92	.65
Pedagogical Innovation	.90	.93	.67

Source: author's own development

Table 3 showed that all constructs achieved acceptable internal consistency, with Cronbach's alpha and composite reliability values above .70. The average variance extracted values were above .50, indicating satisfactory convergent validity. The measurement model results confirmed that the constructs were reliable and valid for further structural analysis.

RQ3: Does ethical confidence mediate the relationship between generative AI readiness and teacher agency?

Table 4

Structural Model Results

Hypothesis	Relationship	Beta	t-value	p-value	Result
H1	Generative AI Readiness → Ethical Confidence	.61	12.84	< .001	Supported
H2	Ethical Confidence → Teacher Agency	.48	9.76	< .001	Supported
H3	Teacher Agency → Pedagogical Innovation	.52	10.91	< .001	Supported

H4	Generative AI Readiness → Pedagogical Innovation	.31	6.42	< .001	Supported
----	--	-----	------	--------	-----------

Source: author 's own development

Table 4 showed that generative AI readiness had a significant positive effect on ethical confidence. Ethical confidence also had a significant positive effect on teacher agency. The indirect effect of generative AI readiness on teacher agency through ethical confidence was significant, indicating that ethical confidence mediated the relationship between readiness and agency.

RQ4: Does teacher agency mediate the relationship between ethical confidence and pedagogical innovation?

Table 5

Mediation Analysis

Indirect Path	Beta	t-value	p-value	Mediation Type
Generative AI Readiness → Ethical Confidence → Teacher Agency	.29	7.88	< .001	Partial Mediation
Ethical Confidence → Teacher Agency → Pedagogical Innovation	.25	7.14	< .001	Partial Mediation
Generative AI Readiness → Ethical Confidence → Teacher Agency → Pedagogical Innovation	.15	5.96	< .001	Sequential Mediation

Source: author 's own development

Table 5 showed that the mediation analysis further confirmed that ethical confidence played an important role in transforming AI readiness into teacher agency. This means that teachers who were ready to utilize AI were more likely to feel professionally empowered when they also had confidence in making ethical decisions on the utilization of AI. The results support the argument that AI readiness alone is insufficient. Teachers need ethical confidence to exercise stronger professional agency when utilizing AI in teaching.

RQ5: How do primary school teachers experience, interpret and negotiate the use of generative AI in teaching practice?

Table 6

Qualitative Themes from Teacher Interviews

Theme	Description	Link to Quantitative Findings
AI as teaching support	AI helps reduce workload and generate teaching materials	Explains high AI readiness
Ethical concerns	Teachers worry about accuracy, bias and misuse	Explains importance of ethical confidence
Teacher agency	Teachers adapt and control AI-generated outputs	Supports mediation role of teacher agency

Student-centred innovation	AI supports differentiated and engaging pedagogy	Explains impact on pedagogical innovation
----------------------------	--	---

Source: author 's own development

Table 6 confirmed that teachers did not view generative AI as a replacement for teachers. Instead, they interpreted AI as a supportive pedagogical tool that requires ethical judgment, professional control and contextual adaptation.

RQ6: How can generative AI readiness, ethical confidence and teacher agency be integrated into a pedagogical intelligence model for responsible AI-supported teaching?

The integration of quantitative and qualitative findings supports the development of a pedagogical intelligence model. The quantitative results showed that generative AI readiness significantly influenced ethical confidence, teacher agency and pedagogical innovation. The qualitative results explained how this process occurred in actual teaching practice. Teachers first recognized the usefulness of AI, then evaluated its ethical risks, exercised professional judgment and finally adapted AI outputs into meaningful classroom innovation. The final integrated model suggests the following pathway:

Generative AI Readiness → Ethical Confidence → Teacher Agency → Pedagogical Innovation

This model shows that responsible AI-supported teaching depends on more than just access to technology. Pedagogical innovation occurs when teachers are ready to use AI, confident in making ethical decisions, and professionally empowered to adapt AI tools to students' learning needs.

Conclusions

This study concludes that pedagogical intelligence is a critical pathway for transforming generative AI from a technological tool into meaningful educational practice. Findings indicate that generative AI readiness is positively associated with ethical confidence, teacher agency and pedagogical innovation. The mediation results show that ethical confidence and teacher agency are not secondary factors but central mechanisms that explain how AI readiness translates into responsible classroom innovation. Interview findings strengthen the conclusion by revealing that teachers use AI primarily as a supportive assistant for lesson planning, differentiated instruction and the development of creative materials, while still relying on professional judgment to verify and adapt AI-generated outputs. The study, therefore, confirms that successful AI integration depends on empowered, ethically confident teachers. Future research should examine this model across different education levels, subject areas and cultural contexts, including longitudinal designs to assess long-term pedagogical impact.

References

- Bawa, S., Bruce, F. N. O., Ayiku, E. L. & Bawa, I. (2026). AI-driven educational reform and persistent inequality: Unpacking classroom-level impacts in China's evolving school system. *Asian Education and Development Studies*, 15(3), 728-750. <https://doi.org/10.1108/AEDS-01-2026-0006>
- Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*, 18(3), 328-352. <https://doi.org/10.1080/14780887.2020.1769238>
- Cohen, L., Manion, L. & Morrison, K. (2013). *Research methods in education*. London: Taylor & Francis.
- Wiersma, W. (1995). *Research methods in education: An introduction*. London: Allyn and Bacon.
- Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research (3rd ed.)*. California: SAGE Publications.
- MOE. (2024). *Malaysia education blueprint 2013-2025: Annual report 2023*. Putrajaya: MOE.
- Ofosu-Asare, Y. (2025). Guiding the future: developing an ethical framework for generative AI use in education. *The International Journal of Information and Learning Technology*, 43(1), 1-21. DOI: 10.1108/IJILT-06-2024-0113
- OECD. (2026). *OECD digital education outlook 2026: Exploring effective uses of generative AI in education*. Paris: OECD Publishing. <https://doi.org/10.1787/062a7394-en>
- Zainudin, D. Z. & Jamil, N. K. (2026). Conceptualizing ethical AI competence in higher education: An Islamic epistemological framework for responsible artificial intelligence utilization. *Journal of Advanced Research in Social and Behavioural Sciences*, 43(1), 218-233. <https://karyailham.com.my/index.php/jarsbs/article/view/1073>
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340. <https://doi.org/10.2307/249008>
- Ngongpah, G. & Oni, O. (2025). Teachers' Readiness and Competency in Using AI in the Classroom. *Asian Journal of Education and Social Studies*, 51(9), 742-757. DOI: 10.9734/ajess/2025/v51i92412
- Kamaghe, J. (2026). Generative AI as a partner for teachers in building personalized learning paths for students with ease in Tanzania. *Research in Learning Technology*, 33, 1-14. DOI: 10.25304/rlt.v34.3594
- Holmes, W., Bialik, M. & Fadel, C. (2023). *Artificial intelligence in education: Promise and implications for teaching and learning (2nd ed.)*. Boston: Center for Curriculum Redesign.
- UNESCO. (2023). *Guidance for generative AI in education and research*. Paris: UNESCO.

- Zainudin, Z., Mohd Hashim, S. H., Ismail, N. A., Jibin, H., & Baharuddin, N. (2025b). Beyond code: Elucidating a human-centric approach to AI ethics. *Journal of Technology and Humanities*, 6(1), 41–52. <https://doi.org/10.53797/jthkks.v6i1.5.2025>
- Zainudin, Z., Baharuddin, N., Hussin, H., Aghus, T., Foong Hee, W., Kalid, A. B. & Ibrahim, N. (2025). Digitalization of education in Malaysia: Roles, issues, challenges, recommendations, ethics and future trends. *Journal of Technology and Humanities*, 6(1), 13–21. <https://doi.org/10.53797/jthkks.v6i1.2.2025>

YouTube Spoken Corpora in Pronunciation Instruction for Fostering Intercultural Willingness to Communicate

Phi Dat Luu^{ID}

¹⁻ Independent Researcher,
Ho Chi Minh City, Vietnam

✉ ***Corresponding author:**

datphi19030@gmail.com



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Traditional pronunciation training is largely based on native-speaker ideals, sometimes neglecting the practical realities of worldwide mutual intelligibility. This study investigates how YouTube-based spoken corpora might enhance phonological clarity and encourage EFL students' willingness to communicate across cultures. This study uses a qualitative descriptive synthesis design to examine peer-reviewed empirical literature from the Scopus, Web of Science, Google Scholar and ERIC databases published between 2015 and 2026. The findings indicate that raw YouTube speech contains harmful social prejudices, performative accent stereotypes, and serious demographic mistakes inside automated caption algorithms. Direct digital exposure results in early phonological shock and passive entertainment comfort rather than active, long-term psychological resilience in speaking. The synthesis produces a three-tiered instructional assessment matrix that considers auditory features, visual scaffolding, and tight constraints on cognitive working memory capacity. However, this framework is limited by a heavy reliance on existing literature and Western-centric survey snapshots, necessitating future longitudinal action research and manual human-in-the-loop transcript audits.

KEYWORDS: YouTube spoken corpora, Pronunciation instruction, Mutual intelligibility, Intercultural willingness to communicate, Cognitive load.

How to cite: Luu, P. D. (2026). YouTube spoken corpora in pronunciation instruction for fostering intercultural willingness to communicate. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21260676>

Introduction

Traditional English pronunciation instruction frequently focuses on the native speaker ideal. However, reciprocal intelligibility is more important than faultless accents in current global communication (Levis, 2020; Wang & Wen, 2023). During real-world encounters, intelligence refers to a listener's ability to comprehend words and understand the speaker's underlying intent. This skill requires both individual sounds and overall speech rhythm (Luu & Nguyen, 2026). Interestingly, learners with better proficiency are more aware of their own faults (Luu & Nguyen, 2026). This self-monitoring shows that pronunciation learning is a kind of intentional mental doing (Luu et al., 2025), though, in practice, building up rhythm, stress, and the real-like flow of speech still feels like a universal struggle for students of a foreign language (Luu & Nguyen, 2026; Petinou & Theodorou, 2019). Language education must consequently transition from inflexible local standards to functional, clear communication in varied circumstances.

Clear pronunciation is not just a linguistic goal. It directly affects a learner's Intercultural Willingness to Communicate (IWTC). IWTC is the psychological readiness to start conversations with people from different cultural backgrounds (Kassing, 1997). In countries like Vietnam, this readiness is a complex negotiation (Luu, 2026). Students often experience a strong tension between wanting to speak and fearing negative social evaluation (Luu, 2026). Anxiety and fear of communication failure create heavy mental barriers (Lu & Hsu, 2008). Many students avoid real-world encounters completely due to their nervousness (Campbell, 2016). True communicative confidence is strongly dependent on a supportive emotional context and good self-regulation. Therefore, language courses must address these emotional hurdles in order to educate students for a global workforce.

Teachers want meaningful feedback in order to bridge the gap between classroom practice and real-world communication. Spoken corpora produced from YouTube are an ideal alternative. These corpora are like huge sets of real video texts and transcripts (Coats, 2023). YouTube material, unlike written textbooks, exposes students to a mix of dialects, natural speech rates, and plenty of cultural symbols (Li & Adnan, 2023; Nguyen & Luu, in press). Platform elements such as comment sections can provide interactive places in which users negotiate meaning. However, there are a few limitations on these digital materials. Automated transcripts tend to be hit by inaccuracies and background noise (Coats, 2023). Besides that, unstructured movies can create cognitive overload, or they might just function as simple amusement. Without explicit instructional supervision, children find it difficult to integrate informal video viewing with formal language improvement.

Research Aim and Research Questions

Despite its benefits, unstructured YouTube content often leads to cognitive fatigue or serves only as amusement (Nguyen & Luu, in press). This problem is exacerbated by gaps in current research: pronunciation studies rely heavily on small samples and subjective self-reports rather than objective acoustic data (Luu & Nguyen, 2026; Petinou & Theodorou, 2019), and literature on IWTC has a strong U.S.-centric bias (Kassing, 1997; Yousaf et al., 2022). A significant gap remains in understanding how to properly filter this vast digital resource to improve voice clarity while reducing cultural discomfort. This qualitative synthesis fills a vacuum by examining how YouTube-based spoken corpora might improve phonological intelligibility and encourage IWTC in EFL learners, offering a clear pedagogical framework for connecting raw digital input to classroom practice. To do this, the analysis is guided by three major questions:

1. How does existing literature evaluate the linguistic features of YouTube-derived spoken data for instructional purposes?
2. How does exposure to authentic, diverse pronunciation features via digital corpora influence learners' intercultural communication apprehension and their willingness to communicate?
3. What pedagogical criteria should be synthesized to develop a selection matrix for YouTube content that balances pronunciation intelligibility and intercultural readiness for EFL learners?

Methodology

This study utilizes an exploratory, qualitative descriptive synthesis design to map how digital media linguistic variables intersect with socio-psychological constructs in language learning (Sandelowski & Barroso, 2007). Moving away from empirical experiments, this approach synthesizes established research patterns to guide university curriculum design (Major & Savin-Baden, 2010). Data collection involved a structured search across Scopus, Web of Science, Google Scholar and ERIC using keywords combining YouTube/spoken corpora, pronunciation attributes (accent diversity, speech rate, intelligibility), and intercultural communication outcomes (IWTC, anxiety). The final dataset was filtered to include peer-reviewed empirical studies (2008–2026) in higher-education EFL/EAP contexts. Non-authentic digital media, dissertations, and K-12 educational studies were systematically excluded.

The selected articles were evaluated through qualitative content analysis and thematic synthesis to build a unified pedagogical framework (Schreier, 2012; Thomas & Harden, 2008). First, initial coding extracted findings regarding the linguistic value of YouTube speech rates and accent diversity. Second, axial coding mapped how exposure to these features alters learners' intercultural communication apprehension under MacIntyre's (1998) WTC model. Finally, these insights were translated into a three-tiered Pedagogical Evaluation Matrix (phonological properties, affective barriers, and intercultural readiness) for university materials development. Rigor and trustworthiness were maintained via a detailed database audit trail and peer debriefing to reach 100% coding consensus (Lincoln & Guba, 1985).

Research Results

Evaluation of linguistic features in YouTube-derived spoken data for instructional purposes

YouTube videos offer real-world accents that challenge sterile textbook English (Watkins & Wilkins, 2011). However, the literature shows these spaces are not neutral. Instead, they act as digital arenas where viewers openly judge and mock non-standard speech in the comments (Cutler, 2020). This creates a classroom trap. Popular videos like accent challenges rely on fake, exaggerated performances rather than real communication (Rymes & Leone-Pizzighella, 2018). They focus on shallow stereotypes that link regional dialects to low social status. This reinforces native-speaker bias instead of building mutual understanding. Without clear teacher guidance, raw YouTube data can harm student attitudes by normalizing social hierarchies under the guise of authentic speech.

Teachers often rely on YouTube's automatic captions, but this creates a false sense of accuracy. These algorithms contain heavy demographic biases. Because standard AI models are trained on narrow data, they make far more errors on female speakers and regional dialects (Tatman, 2017). This technical flaw means raw

captions regularly erase or misinterpret the exact features learners need to study, like code-switching or thick accents (Maxwell-Smith & Foley, 2023). Treating unedited captions as perfect mirrors of speech clarity exposes students to broken text models. It forces diverse speech into rigid, standardized molds. The technology meant to capture reality actually distorts it, so human editing is vital to keep automated bias out of the classroom.

YouTube successfully captures how real people vary their speech speed across different regions and video genres (Coats, 2020). However, this real-world speed creates a direct conflict with learner brain limits. Teachers can use timestamp tools to filter videos by word count (Lin, 2022), but this does not stop the mental exhaustion that fast, continuous speech causes (Juma, 2021). Old textbooks overprotect students with slow audio, leaving them unready for real life. Yet, throwing raw YouTube speeds into a lesson simply replaces safety with total confusion. Fast speech alone does not build skill. Without a strict filtering system based on student levels, raw digital speech overloads short-term memory and paralyzes comprehension.

Exposure to authentic diverse pronunciation features via digital corpora and its influence on intercultural communication apprehension and willingness to communicate

The literature views raw digital corpora as a solution for textbook artificiality, yet this exposure results in an instant psychological dilemma. While different pronunciation traits disrupt the native-speaker monopoly (Levis, 2020), they also increase rather than decrease intercultural fear. Global accents are not freeing for learners; rather, they cause cognitive disorder (Coats, 2020). When pupils are confronted with raw auditory evidence, the idealized expectation of excellent English causes structural shock. YouTube's multimodal features may provide a visual safety net (Benson, 2015), but the comfort is illusory. It covers a more serious anxiety: the worry of social marginalization as a result of real-time decoding failure. As a result, exposure alone does not alleviate communication anxiety; rather, it reveals the frail underpinnings of classroom-trained comprehension.

Current research assumes a smooth, linear progression from phonological shock to emotional ease, but this desensitization is primarily a pedagogical illusion. Listening to successful non-native speakers on digital platforms is thought to increase a learner's self-efficacy (Zadorozhnyy & Lee, 2025). However, this psychological transformation is completely passive and situational. Watching a video does not imply admitting one's own pronunciation mistakes; instead, it normalizes the flaws of those on screen. When the learner moves away from the spectator position, the positive emotions praised in informal learning research frequently fade (Lee et al., 2024). As a result, the literature mixes entertainment-driven comfort with true psychological resilience, creating an unfilled gap between passive acoustic tolerance and active speaking confidence.

Lowering phonological anxiety by digital exposure acts as a direct stimulus for IWTC. By frequently processing real pronunciation qualities, learners transform their ideal L2 self into a skilled global communicator rather of a phony native speaker (Lee & Chiu, 2023). This psychological change increases their willingness to begin discussions in public digital areas such as video comment sections or online language threads (Lee & Hsieh, 2019). However, a key structural tension remains unsolved in contemporary study. Most research use cross-sectional survey data, which only captures a glimpse of learner confidence (Zadorozhnyy & Lee, 2025). Current research does not demonstrate that a student who is mentally prepared to understand varied accents online would keep that same willingness during a real-time, face-to-face intercultural crisis (Luu, 2026).

Pedagogical criteria for developing a selection matrix of YouTube content balancing pronunciation intelligibility and intercultural readiness for EFL learners

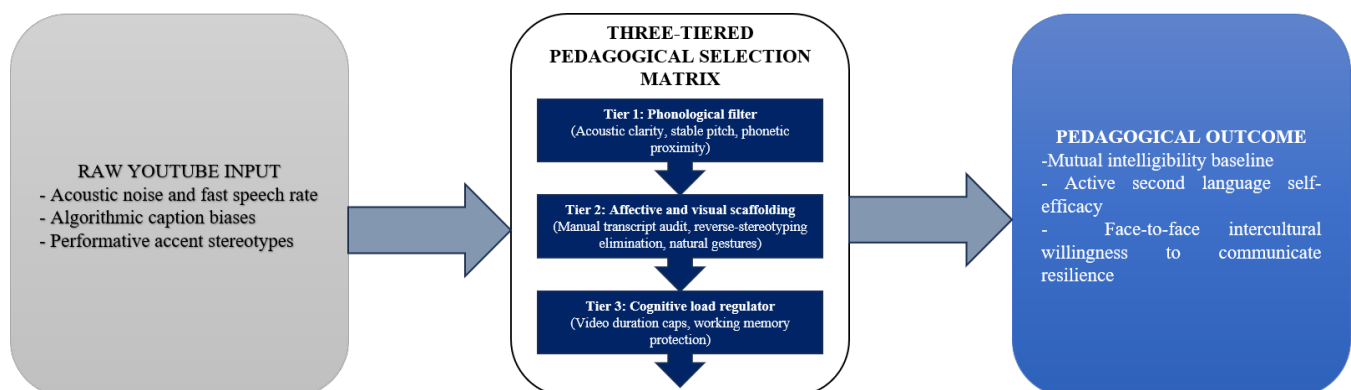
Selection matrices must reject native-speaker models as the default standard. Real communication requires mutual intelligibility rather than native likeness (Chan, 2021). The matrix must prioritize physical properties like clear vowel duration and stable pitch frequencies (Kang et al., 2025; Liu et al., 2014). High background noise prevents learners from adjusting to new acoustic features (Clopper & Bradlow, 2008). Therefore, the initial filter must screen out poor audio quality and severe distortions. The primary goal is a clean speech signal that human ears can decode. Random exposure to diverse accents creates cognitive chaos instead of intercultural readiness. The selection matrix must track accent varieties based on the learner's linguistic background (Olatoye & Olurinola, 2026). Students decode accents better when they share a phonetic space with the speaker (Fishero et al., 2023). The matrix should introduce common sound variations before presenting unique, highly deviant phonemes (Fishero et al., 2023). Unregulated data dumps limit perceptual growth (Mora & Fouz-González, 2024). Instructors must systematically balance familiar and unfamiliar speech features. Accent diversity requires strong visual and textual support to be pedagogically useful (Sardegna & McGregor, 2013).

However, automated captions contain heavy biases against female voices and regional dialects (Tatman, 2017). Reading broken captions while listening also creates a severe attentional split (Wisniewska & Mora, 2017). Tracking phonetic forms and text simultaneously triggers rapid cognitive overload (Wisniewska & Mora, 2020). The matrix must select videos where natural gestures and clear visual contexts ease the processing burden. Intercultural training requires the active removal of linguistic prejudice. Social expectations and ethnic stereotypes often override objective speech clarity (Babel & Mellesmoen, 2019). Through reverse linguistic stereotyping, listeners label clear speech as unintelligible based solely on the speaker's perceived identity (Rubin, 2011). YouTube often hosts performative, mocked accent videos that reinforce social hierarchies. The matrix must include a strict filter to reject content that exploits dialects for entertainment. It must prioritize diverse speakers in professional or academic roles.

The final matrix criterion must measure the mental effort required to process raw digital speech. Accented speech increases cognitive load and slows down acoustic processing times (Mattys & Wiget, 2011). Non-native listeners lose their processing advantage when a speaker's first language is unfamiliar (Liu & Reed, 2018). Simple intelligibility does not guarantee comprehension during complex academic tasks (Jensen & Thøgersen, 2017). The matrix must strictly cap video duration and task difficulty based on human working memory limits (Peng et al., 2020).

Figure 1

The proposed multi-tiered framework for integrating YouTube spoken corpora in EFL pronunciation pedagogy



Conclusions

This qualitative synthesis shows that raw YouTube exposure does not automatically build pronunciation competence or intercultural readiness. Instead, unguided digital input triggers phonological shock, cognitive fatigue, and exposure to platform-driven accent biases. True progress requires shifting from native-speaker ideals to a structured, human-edited selection matrix that strictly balances acoustic clarity, visual scaffolding, and cognitive load limits. However, this framework is currently limited by a lack of direct classroom experiments, a strong Western bias in existing communication literature, and a reliance on brief survey snapshots. To fix these gaps, future university research must utilize longitudinal action research to track real behavioral changes. Educators must also perform manual video transcripts audits to eliminate algorithmic errors and deploy multi-tiered evaluation matrices that cap video lengths to protect human working memory.

References

- Babel, M., & Mellesmoen, G. (2019). Perceptual adaptation to stereotyped accents in audiovisual speech. In S. Calhoun, P. Escudero, M. Tabain, & P. Warren (Eds.), *Proceedings of the 19th International Congress of Phonetic Sciences* (pp. 1004-1048). Melbourne, Australia. https://assta.org/proceedings/ICPhS2019Microsite/pdf/full-paper_815.pdf
- Benson, P. (2015). *Commenting to learn: Evidence of language and intercultural learning in comments on YouTube videos*. *Language Learning & Technology*, 19(3), 88-105. <https://scholarspace.manoa.hawaii.edu/bitstreams/3e9342f5-3042-4834-a37b-34ae4518c974/download>
- Campbell, N. (2016). Ethnocentrism and intercultural willingness to communicate-A study of New Zealand management students. *Journal of Intercultural Communication*, 16(1), 1-15. <https://doi.org/10.36923/jicc.v16i1.707>
- Chan, V. (2021). Factors influencing intelligibility and comprehensibility: a critical review of research on second language English speakers. *Journal of English Learner Education*, 12(1), 1-30. <https://stars.library.ucf.edu/jele/vol12/iss1/6/>
- Clopper, C. G., & Bradlow, A. R. (2008). Perception of dialect variation in noise: Intelligibility and classification. *Language and Speech*, 51(3), 175-198. <https://doi.org/10.1177/0023830908098539>
- Coats, S. (2020). Articulation rate in American English in a corpus of YouTube videos. *Language and Speech*, 63(4), 799-831. <https://doi.org/10.1177/0023830919894720>
- Coats, S. (2023). Dialect corpora from YouTube. *Language and linguistics in a complex world*, 79-102. <https://doi.org/10.1515/9783111017433-005>
- Cutler, C. (2020). Metapragmatic comments and orthographic performances of a New York accent on YouTube. *World Englishes*, 39(1), 36-53. <https://doi.org/10.1111/weng.12444>
- Fishero, S., Sereno, J. A., & Jongman, A. (2023). Perception and production of Mandarin-accented English: The effect of degree of accentedness on the Interlanguage Speech Intelligibility Benefit for Listeners (ISIB-L) and Talkers (ISIB-T). *Journal of Phonetics*, 99, 1-18. <https://doi.org/10.1016/j.wocn.2023.101255>
- Jensen, C., & Thøgersen, J. (2017). Foreign accent, cognitive load and intelligibility of EMI lectures. *Nordic Journal*

- of English Studies*, 16(3), 107-137. <https://doi.org/10.35360/njes.414>
- Juma, M. J. (2021). Developing English pronunciation through animation and YouTube videos. *Arab World English Journal*, 12(4), 401-414. <https://doi.org/10.24093/awej/vol12no4.26>
- Kang, O., Bae, Y., & Miao, Y. (2025). L2 speech intelligibility. *Language Teaching*, 1-18. <https://doi.org/10.1017/s0261444825101006>
- Kassing, J. W. (1997). Development of the intercultural willingness to communicate scale. *Communication Research Reports*, 14(4), 399-407. <https://doi.org/10.1080/08824099709388683>
- Lee, J. S., & Chiu, M. M. (2023). Modeling EFL learners' willingness to communicate: The roles of face-to-face and digital L2 communication anxiety. *Annual Review of Applied Linguistics*, 43, 64-87. <https://doi.org/10.1017/s0267190523000090>
- Lee, J. S., Yeung, N. M., & Osburn, M. B. (2024). Foreign language enjoyment as a mediator between informal digital learning of English and willingness to communicate: A sample of Hong Kong EFL secondary students. *Journal of Multilingual and Multicultural Development*, 45(9), 3613-3631. <https://doi.org/10.1080/01434632.2022.2112587>
- Levis, J. (2020). Revisiting the intelligibility and nativeness principles. *Journal of Second Language Pronunciation*, 6(3), 310-328. <https://doi.org/10.1075/jslp.20050.lev>
- Li, J., & Adnan, H. M. (2023). Exploring the role of productive audiences in promoting intercultural understanding: A study of Chinese YouTube influencer Liziqi's channel. *Studies in Media and Communication*, 11(4), 173-184. <https://doi.org/10.11114/smc.v11i4.6021>
- Lin, P. (2022). Developing an intelligent tool for computer-assisted formulaic language learning from YouTube videos. *ReCALL*, 34(2), 185-200. <https://doi.org/10.1017/s0958344021000252>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications.
- Liu, C., Jin, S. H., & Chen, C. T. (2014). Durations of American English vowels by native and non-native speakers: Acoustic analyses and perceptual effects. *Language and Speech*, 57(2), 238-253. <https://doi.org/10.1177/0023830913507692>
- Liu, D., & Reed, M. (2018). Asymmetrical cognitive load imposed by processing native and non-native speech. *Pronunciation in Second Language Learning and Teaching Proceedings*, 10(1), 1-12. <https://www.iastatedigitalpress.com/psllt/article/id/15375/>
- Lu, Y., & Hsu, C. F. (2008). Willingness to communicate in intercultural interactions between Chinese and Americans. *Journal of Intercultural Communication Research*, 37(2), 75-88. <https://doi.org/10.1080/17475750802533356>
- Luu, P. D. (2026). Challenges and strategies of intercultural willingness to communicate among English majors at a Vietnamese public university. *TNU Journal of Science and Technology*, 231(04), 422-429. <https://doi.org/10.34238/tnu-jst.13650>
- Luu, P. D., & Nguyen, P. T. (2026). Exploring common pronunciation errors faced by English majors at a Vietnamese public university. *Journal of Foreign Language Teaching and Learning*, 11(1), 194-228.

<https://doi.org/10.18196/ftl.v11i1.29346>

- Luu, P. D., Anh, N. H. M., & Huong, N. G. (2025). Internal and external determinants of English majors' attitudes towards pronunciation learning at a Vietnamese public university. *Thu Dau Mot University Journal of Science*, 7(4), 813-833. <https://doi.org/10.37550/tdmu.EJS/2025.04.679>
- MacIntyre, P. D., Clément, R., Dörnyei, Z., & Noels, K. A. (1998). Conceptualizing willingness to communicate in a L2: A situational model of L2 confidence and affiliation. *The Modern Language Journal*, 82(4), 545-562. <https://doi.org/10.1111/j.1540-4781.1998.tb05543.x>
- Major, C.H., & Savin-Baden, M. (2010). *An Introduction to Qualitative Research Synthesis: Managing the Information Explosion in Social Science Research* (1st ed.). Routledge. <https://doi.org/10.4324/9780203497555>
- Mattys, S. L., & Wiget, L. (2011). Effects of cognitive load on speech recognition. *Journal of Memory and Language*, 65(2), 145-160. <https://doi.org/10.1016/j.jml.2011.04.004>
- Maxwell-Smith, Z., & Foley, B. (2023). Automated speech recognition of Indonesian-English language lessons on YouTube using transfer learning. In O. Serikov, E. Voloshina, A. Postnikova, E. Klyachko, E. Vylomova, T. Shavrina, E. Le Ferrand, V. Malykh, F. Tyers, T. Arkhangelskiy, & V. Mikhailov (Eds.), *Proceedings of the Second Workshop on NLP Applications to Field Linguistics* (pp. 1-16). Association for Computational Linguistics. <https://doi.org/10.18653/v1/2023.fieldmatters-1.1>
- Mora, J. C., & Fouz-González, J. (2024). Contrastive input enhancement in captioned video for L2 pronunciation learning. *Audiovisual Input and Second Language Learning*, 61, 150-175. <https://doi.org/10.1075/llt.61.07mor>
- Nguyen, T. T. T., & Luu, D. P. (in press). A study on the perceived effectiveness of YouTube in listening skills among English majors at a Vietnamese Public University. *HO CHI MINH CITY OPEN UNIVERSITY JOURNAL OF SCIENCE-SOCIAL SCIENCES*. <https://journalofscience.ou.edu.vn/index.php/soci-en/article/view/4654>
- Olatoye, O., & Olurinola, O. (2026). How effective are computer-assisted pronunciation and Youtube-based instructions in improving oral english proficiency among secondary school students?. *Language, Technology, and Social Media*, 4(1), 1-18. <https://doi.org/10.70211/ltsm.3026-7196.73>
- Peng, X., Chen, H., Wang, L., Tian, F., & Wang, H. (2020). Talking head-based L2 pronunciation training: Impact on achievement emotions, cognitive load, and their relationships with learning performance. *International Journal of Human-Computer Interaction*, 36(16), 1487-1502. <https://doi.org/10.1080/10447318.2020.1752476>
- Petinou, K., & Theodorou, E. (2019). Promoting speech intelligibility through phonologically dense targets. *Clinical Linguistics & Phonetics*, 33(10-11), 978-990. <https://doi.org/10.1080/02699206.2019.1597168>
- Rubin, D. (2011). The power of prejudice in accent perception: Reverse linguistic stereotyping and its impact on listener judgments and decisions. *Pronunciation in Second Language Learning and Teaching Proceedings*, 3(1), 1-7. <https://www.iastatedigitalpress.com/psllt/article/id/15173/>

- Rymes, B., & Leone-Pizzighella, A. (2018). YouTube-based accent challenge narratives: Web 2.0 as a context for studying the social value of accent. *International Journal of the Sociology of Language*, 2018(250), 137-163. <https://doi.org/10.1515/ijsl-2017-0058>
- Sandelowski, M., & Barroso, J. (2007). *Handbook for synthesizing qualitative research*. Springer Publishing Company.
- Sardegna, V. G., & McGregor, A. (2013). Scaffolding students' self-regulated efforts for effective pronunciation practice. *Pronunciation in Second Language Learning and Teaching Proceedings*, 4(1), 1-12. <https://doi.org/10.1002/9781394259663.ch6>
- Schreier, M. (2012). *Qualitative content analysis in practice*. SAGE Publications.
- Tatman, R. (2017). Gender and dialect bias in YouTube's automatic captions. In D. Hovy, S. Spruit, M. Mitchell, E. M. Bender, M. Strube, & H. Wallach (Eds.), *Proceedings of the First ACL Workshop on Ethics in Natural Language Processing* (pp. 53-59). Association for Computational Linguistics. <https://doi.org/10.18653/v1/W17-1606>
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, 8(1), 1-10. <https://doi.org/10.1186/1471-2288-8-45>
- Wang, Y., & Wen, X. (2023). Nativeness versus intelligibility as goal of English pronunciation teaching in China: Changing attitudes in national syllabi and curriculum standards. *Asian-Pacific Journal of Second and Foreign Language Education*, 8(1), 1-26. <https://doi.org/10.1186/s40862-023-00189-2>
- Watkins, J., & Wilkins, M. (2011). Using YouTube in the EFL classroom. *Language Education in Asia*, 2(1), 113-119. https://doi.org/10.5746/leia/11/v2/i1/a09/watkins_wilkins
- Wisniewska, N., & Mora, J. C. (2017). Pronunciation learning through captioned videos. *Pronunciation in Second Language Learning and Teaching Proceedings*, 9(1), 1-12. <https://www.iastatedigitalpress.com/psllt/article/id/15355/>
- Wisniewska, N., & Mora, J. C. (2020). Can captioned video benefit second language pronunciation?. *Studies in Second Language Acquisition*, 42(3), 599-624. <https://doi.org/10.1017/S0272263120000029>
- Yousaf, M., Ahmad, M., Ji, D., Huang, D., & Raza, S. H. (2022). A cross-cultural comparison of ethnocentrism and the intercultural willingness to communicate between two collectivistic cultures. *Scientific Reports*, 12(1), 1-12. <https://doi.org/10.1038/s41598-022-21179-3>
- Zadorozhnyy, A., & Lee, J. S. (2025). Informal digital learning of English and willingness to communicate in a second language: Self-efficacy beliefs as a mediator. *Computer Assisted Language Learning*, 38(4), 669-689. <https://doi.org/10.1080/09588221.2023.2215279>

Reducing Foreign Language Anxiety Through AI-Mediated Speaking Practice in the USA

Volha Hurskaya ¹

¹ Master of Arts in Linguistics,
San Diego State University,
USA

Corresponding author:

vhurskaya6198@sdsu.edu



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Foreign language anxiety remains a major barrier to oral participation in technology-enhanced language learning, particularly when learners must speak spontaneously and fear negative evaluation. In the United States, the need for effective English-language support remains substantial: 5.3 million English learners accounted for 10.6% of public school enrollment in fall 2021, and recent university guidance on generative AI has focused primarily on writing rather than speaking. This paper reviews research published between 2022 and 2026 and argues that AI-mediated speaking practice can reduce anxiety by providing low-stakes rehearsal, self-paced repetition, implicit feedback, and psychologically safer interaction. However, the literature also shows that AI speaking assistants may increase cognitive load and anxiety when learners must multitask during communication. The paper synthesizes these findings into practical design implications for adult ESL and other U.S. language-learning contexts.

KEYWORDS: foreign language anxiety, AI-mediated speaking practice, adult ESL, technology-enhanced language education, USA.

How to cite: Hurskaya, V. (2026). Reducing Foreign Language Anxiety Through AI-Mediated Speaking Practice in the USA. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing.
<https://doi.org/10.5281/zenodo.21453536>

Introduction

In the U.S. context, technology-enhanced language education is increasingly important not only because of rapid AI adoption, but also because English-language support remains a large educational and social need. National Center for Education Statistics data show that English learners accounted for 10.6% of U.S. public school enrollment, or 5.3 million students, in fall 2021. At the same time, U.S.-based scholarship in adult ESL has emphasized the value of practical digital tasks, self-regulated learning, and multimedia-supported instruction for learners navigating everyday life, integration, and communication demands (Boiko et al., 2025; Hurskaya, 2026a, 2026b). These trends make the question of anxiety reduction especially relevant in the USA, where learners often need spoken English for employment, transportation, public services, and community participation.

The current U.S. AI environment also reveals a specific pedagogical gap. An analysis of documents from 116 U.S. R1 universities found that 63% encouraged the use of generative AI, and many provided sample syllabi and classroom guidance; however, most institutional advice focused on writing rather than on oral communication or speaking support (McDonald et al., 2024). This matters because speaking anxiety is not simply a linguistic issue. It is also emotional, social, and interactional. In short, if U.S. institutions are normalizing AI but not yet designing for speaking confidence, technology-enhanced language education needs a clearer research-based framework.

Recent studies suggest that AI-mediated speaking tools can address this gap, but only under certain conditions. Stylized avatars may reduce anxiety compared with more human-like avatars; self-representative AI systems can increase emotional engagement; mixed-reality group conversation tools can create safe spaces for speaking; and real-time AI support can improve self-efficacy when interactions are effectively scaffolded. Yet the same research also shows that poorly designed assistance can increase cognitive load and anxiety. The literature on online learning and self-regulated learning likewise indicates that digital support is most effective when learners can plan, rehearse, monitor, and reflect on their performance (Jalambo et al., 2025; Kay et al., 2022; Yu, 2023).

Research Aim and Research Questions

This paper aims to synthesize recent research from 2022–2026 to identify how AI-mediated speaking practice can reduce foreign language anxiety in the USA, particularly in adult ESL and closely related technology-enhanced language-learning contexts.

The paper addresses three questions:

- What design features of AI-mediated speaking practice are associated with lower anxiety?
- Under what conditions can AI increase rather than reduce anxiety?
- How can these findings inform U.S. technology-enhanced language education for adult and community-based learners?

Research Results

The literature points to a consistent pattern: anxiety decreases when AI-mediated speaking practice reduces the social risk of speaking while preserving conversational flow. Liu et al. (2026) found that avatar style matters, with stylized avatars producing lower anxiety than realistic avatars. Park et al. (2026) similarly showed that implicit feedback through AI rephrasing was experienced as more motivating than explicit correction. In both cases, the core mechanism was not only linguistic support, but emotional design: learners were able to speak without feeling constantly judged. For U.S. adult ESL learners, this is important because emotionally safer practice environments may help them rehearse real-life speaking tasks before high-stakes social interactions.

A second pattern is that AI can support willingness to communicate by making practice flexible, situated, and meaningful. Fernandez-Espinosa et al. (2025) found that mixed-reality group conversations increased engagement and willingness to communicate while providing a safe space to speak. Recent U.S.-based applied work in adult ESL likewise points toward practical, life-linked use of technology and self-regulated digital learning rather than technology for its own sake (Hurskaya, 2026a, 2026b). This suggests that in the USA, AI-mediated speaking tasks should be tied to authentic needs such as workplace communication, civic participation, healthcare, or transportation rather than abstract drills alone.

A third pattern is cautionary. Not all AI support lowers anxiety. Qin et al. (2025) found that an AI-based speaking assistant improved the logical flow and depth of learners' speech. However, the additional multitasking of entering and reviewing output could elevate workload and anxiety. By contrast, Qin et al. (2026) found reduced interactional anxiety when AI support was more integrated and communicatively collaborative. This difference is crucial for instructional design: AI should not create a second task layer that forces learners to divide attention between reading, monitoring, and speaking under time pressure.

A fourth pattern is that anxiety reduction is strongest when AI is embedded in broader self-regulated learning and teacher-supported pedagogy. Recent research on digital learning emphasizes planning, feedback, monitoring, and reflection as central mechanisms of success (Faza & Lestari, 2025; Huang & Zhang, 2026; Jalambo et al., 2025; Yu, 2023). In the U.S. context, this point is reinforced by McDonald et al. (2024), who showed that institutional AI guidance is growing rapidly, but still needs more concrete pedagogical direction for oral communication. Taken together, the evidence suggests that AI-mediated speaking practice in the USA should be designed as guided rehearsal rather than unsupervised automation.

Table 1

Comparative Overview of AI-Supported Speaking Research

Study	Context	AI-mediated speaking feature	Main anxiety-related result	Implication for the USA
Liu et al. (2026)	ESL speakers in avatar-mediated interaction	Stylized vs. realistic avatars	Stylized avatars lowered anxiety relative to realistic avatars	Use less threatening visual design in online speaking tasks
Park et al. (2026)	Adult ESL learners	AI rephrasing and implicit feedback	Higher emotional engagement and motivation than explicit correction	Prefer supportive feedback that preserves conversational flow
Fernandez-Espinosa et al. (2025)	L2 learners in mixed reality	Group conversation with AI agents	Greater engagement, willingness to communicate, and safe practice space	Build authentic, low-stakes speaking rehearsal activities
Qin et al. (2025)	Non-native speakers in real-time communication	AI speaking assistant with on-screen support	Better speech organization, but possible increase in workload and anxiety	Avoid cognitively overloaded interfaces
Qin et al. (2026)	NNS-NS collaborative tasks	AI speaking support plus mutual-understanding channel	Improved self-efficacy and reduced interactional anxiety	Integrate communicative scaffolds, not only language prompts
McDonald et al. (2024)	116 U.S. R1 universities	Institutional GenAI guidance	Widespread AI adoption, but speaking underemphasized	Expand U.S. AI policy from writing support to oral communication

Source: author's own development

Conclusions

Recent research supports the view that AI-mediated speaking practice can reduce foreign language anxiety in the USA, but only when the technology is designed with emotional safety, implicit feedback, authentic communicative goals, and manageable cognitive load in mind. The strongest

evidence points to three priorities: create low-risk speaking environments, align AI tasks with real-life communication, and keep teachers centrally involved as designers of guided practice. For U.S. adult ESL and community-based language programs, this means that AI should be used to expand rehearsal opportunities, not to replace human interaction. Future U.S.-based studies should test these design principles directly with adult ESL populations in colleges, community programs, and refugee-serving organizations, since the current evidence base is promising but still thinner for U.S. adult contexts than for the broader international literature.

References

- Boiko, O., Hurskaya, V., Moroz, T., Tron, T. V., & Kozak, V. (2025). Análisis de métodos de enseñanza del inglés como lengua extranjera mediante tecnologías multimedia. *Revista Eduweb*, 19(2), 70-81. <https://doi.org/10.46502/issn.1856-7576/2025.19.02.5>
- Faza, A., & Lestari, I. A. (2025). Self-regulated learning in the digital age: A systematic review of strategies, technologies, benefits, and challenges. *International Review of Research in Open and Distributed Learning*, 26(2), 50-72. <https://doi.org/10.19173/irrodl.v26i2.8119>
- Fernandez-Espinosa, M., Zhang, K., Bendarkawi, J., Ponce, A., Mata, S. C., Aliu, A., Zhang, L., Fernandez Medina, F., Mangione-Lora, E., Monroy-Hernandez, A., & Gomez-Zara, D. (2025). *Practicing a second language without fear: Mixed reality agents for interactive group conversation*. arXiv. <https://doi.org/10.48550/arXiv.2510.08227>
- Huang, F., & Zhang, H. (2026). Unlocking the multifaceted power of self-regulated learning and generative AI in foreign language morphological skills. *Applied Linguistics*. Advance online publication. <https://doi.org/10.1093/applin/amag009>
- Hurskaya, V. (2026a). *Supporting self-regulated learning through digital tools in adult ESL* [Conference paper]. International Multidisciplinary Conference on Innovation, Technology and Sustainability. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.18926124>
- Hurskaya, V. (2026b). Technology-enhanced ESL for refugee women: Preparing for the driver's license test. *Futurity Education*, 6(1), 241-262. <https://doi.org/10.57125/FED.2026.03.13>
- Jalambo, M. O., Çakmak, F., & Akhter, S. (2025). Effects of self-regulated vocabulary learning with chatbots on incidental and collocational vocabulary learning and foreign language learning boredom. *Discover Education*, 4, Article 501. <https://doi.org/10.1007/s44217-025-00977-7>

- Kay, J., Bartimote, K., Kitto, K., Kummerfeld, B., Liu, D., & Reimann, P. (2022). Enhancing learning by open learner model-driven data design. *Computers and Education: Artificial Intelligence*, 3, Article 100069. <https://doi.org/10.1016/j.caeai.2022.100069>
- Liu, T., Yi, X., Shi, Y., & Wang, Y. (2026). *Exploring and analyzing the effect of the avatar's visual style on the anxiety of English as a Second Language speakers*. arXiv. <https://doi.org/10.48550/arXiv.2311.05126>
- McDonald, N., Johri, A., Ali, A., & Hingle, A. (2024). *Generative artificial intelligence in higher education: Evidence from an analysis of institutional policies and guidelines*. arXiv. <https://doi.org/10.48550/arXiv.2402.01659>
- National Center for Education Statistics. (2024). *English learners in public schools*. Condition of Education. U.S. Department of Education, Institute of Education Sciences. <https://nces.ed.gov/programs/coe/indicator/cgf>
- Park, M., Lee, S., Ma, J., & Yoon, D. (2026). *AI Twin: Enhancing ESL speaking practice through AI self-clones of a better me*. arXiv. <https://doi.org/10.48550/arXiv.2601.11103>
- Qin, P., Peng, J., Xu, Z., Cheng, J., Zhu, Z., Yamashita, N., & Lee, Y.-C. (2026). *Alleviating linguistic and interactional anxiety of non-native speakers in multilingual communication*. arXiv. <https://doi.org/10.48550/arXiv.2604.18171>
- Qin, P., Zhu, Z., Yamashita, N., Yang, Y., Suga, K., & Lee, Y.-C. (2025). *AI-based speaking assistant: Supporting non-native speakers' speaking in real-time multilingual communication*. arXiv. <https://doi.org/10.48550/arXiv.2505.01678>
- Yu, B. (2023). Self-regulated learning: A key factor in the effectiveness of online learning for second language learners. *Frontiers in Psychology*, 13, Article 1051349. <https://doi.org/10.3389/fpsyg.2022.1051349>

The 4E Teacher in Nootechnological Ecologies: Agency, Empowerment, and Professional Reflexivity

Mariella Tripaldi 

¹ PhD candidate in Educational Sciences,

Department of Philosophy and Cultural Heritage.

Ca' Foscari University of Venice. Italy

Corresponding author:

mariella.tripaldi@unive.it



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: The spread of artificial intelligence, digital platforms and datafication systems is transforming educational contexts into nootechnological ecologies – that is, socio-material environments in which the production, mediation and evaluation of knowledge are co-configured by human agents, institutional practices, data and algorithmic infrastructures. In this scenario, the teaching profession risks being interpreted according to a technical-adaptive logic, centered on upskilling and performativity. This paper develops a theoretical model based on 4E cognition – embodied, embedded, enacted and extended – integrated with teacher agency, the capability approach and reflective practice. Through a critical and integrative review of the literature, the construct of the ‘4E teacher in nootechnological ecologies’ is defined as a professional capable of critically shaping, inhabiting and regulating highly technology-dense educational environments. The model highlights that technologies can function both as enabling extensions of professional cognition and as devices that constrain autonomy, depending on the institutional, ethical and pedagogical conditions that guide their design, adoption and use.

KEYWORDS: 4E cognition, teacher agency, capability approach, reflective practice, artificial intelligence, nootechnological ecologies.

How to cite: Tripaldi, M. (2026). The 4E Teacher in Nootechnological Ecologies: Agency, Empowerment, and Professional Reflexivity. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21454561>

Introduction

The spread of generative artificial intelligence, educational platforms, learning analytics systems and collaborative digital environments is profoundly altering the conditions under which the teaching profession is practiced. These technologies are no longer merely tools external to teaching, used to make a largely unchanged practice more efficient. They play a part in shaping the times, spaces, relationships, modes of access to knowledge and criteria through which educational processes are observed, documented and assessed.

Studies on datafication have shown that data, metrics and platforms do not merely represent pre-existing educational activities, but help to determine which aspects of teaching are made visible, comparable and assessable. In higher education, datafication alters how teaching activities are recorded and governed, whilst, from a broader perspective, big data infrastructures influence the shaping of educational policies and practices (Macgilchrist, 2020; Williamson, 2017).

The integration of artificial intelligence into school and university systems, therefore, concerns more than just the expansion of available tools. It affects the cognitive, relational, evaluative and decision-making conditions of professional practice. Generative systems can support the design of activities, the development of materials and the provision of feedback and documentation. At the same time, they can introduce opacity, infrastructural dependence, standardization and forms of delegation that are not always clearly controllable.

The risk is that teacher training will be reduced to a logic of technical adaptation, in which changes to tools are expected to be matched by continuous updating of operational skills. From this perspective, professional learning may be reduced to 'upskilling', focused primarily on efficiency and compliance with predefined procedures. The development of professional competence in the age of intelligent machines, however, requires a perspective that takes into account subjectivity, agency and the formative value of educational work (Costa, 2020, 2025).

More generally, the promises of automation, efficiency and rationalization associated with artificial intelligence must be subjected to pedagogical evaluation. The issue is not simply a matter of determining whether machines can replace certain teaching activities, but of understanding how their presence transforms roles, responsibilities, forms of judgment and the aims of education (Selwyn, 2019).

An exclusively technical interpretation overlooks the complex nature of teaching. Educational practice involves interpreting the context, taking responsibility, regulating emotions, planning, responding to the unexpected, and constructing meaning through relationships. Teaching professionalism cannot, therefore, be reduced to an individual repertoire of digital skills.

Various strands of research have provided relevant concepts for addressing this transformation. Studies on teacher agency have analyzed teachers' capacity to act within specific historical, institutional, material and cultural conditions (Priestley et al., 2015). The capability approach distinguishes between

the possession of resources and the actual possibilities for using them to pursue ends considered valuable (Nussbaum, 2011; Sen, 1999). The tradition of reflective practice has clarified the role of reflection during and following professional action (Schön, 1983).

At the same time, 4E cognition has challenged a conception of the mind as an exclusively internal, individual and computational entity. The term encompasses perspectives that interpret cognition as embodied, embedded, enacted and extended (Carney, 2020). The embodied and enactive roots can be traced back to the conception of the mind developed by Varela et al. (1991), whilst the 'extended' component is specifically articulated in Clark and Chalmers' (1998) theory of the extended mind.

4E cognition does not, however, constitute a perfectly unified theory. The four components stem from partly different traditions and should not be treated as synonyms. Rather, their combination offers a heuristic framework for analyzing cognition as a bodily, contextual, relational and distributed process. In the field of education, this perspective has been applied primarily to learning processes and teaching practices, highlighting the importance of the body, action and the environment in the construction of knowledge (Schilhab & Groth, 2024; Videla & Veloz, 2023).

However, a systematic integration of 4E cognition, teaching professionalism, agency, capabilities and reflexivity in environments governed by platforms, data and algorithms remains underdeveloped. The literature on teacher agency explores the relationship between the individual and the context, but does not always address algorithmic infrastructures as components of the cognitive environment. The capability approach highlights the role of substantive freedoms and conversion factors, but is rarely integrated with a distributed conception of professional cognition. Finally, reflective practice is often analyzed separately from processes of datafication and automation.

This paper addresses this fragmentation by proposing the construct of the '4E teacher in nootechnological ecologies'. The 4E teacher is understood as a professional whose cognition is distributed across body, environment, action, relationships and artifacts, and who exercises their pedagogical responsibility by shaping and critically questioning the socio-technical environments of learning.

Objective and research questions

This paper aims to develop a theoretical model of teaching professionalism in nootechnological ecologies, integrating 4E cognition with the constructs of teacher agency, empowerment and reflective practice.

The following research questions guide the analysis:

Q1: How does 4E cognition enable us to rethink teaching professionalism in digital and algorithmic educational environments?

Q2: What theoretical relationships exist between teacher agency, capabilities and reflective

practice?

Q3: Under what conditions can educational technologies function as enabling extensions of professional cognition?

Q4: Under what conditions can algorithmic infrastructures constrain teachers' autonomy, professional judgment and educational freedom?

This contribution consists of constructing an integrated framework capable of interpreting technologies simultaneously as cognitive artifacts, environmental conditions, resources to be converted into capabilities, and objects of critical reflection.

Method of theoretical analysis

This study adopts a theoretical-conceptual methodology based on a critical-integrative review of the literature. This approach was chosen to bring together traditions that have developed in different fields: philosophy of mind, cognitive sciences, pedagogy of professionalism, studies on teacher agency, the capability approach, reflective practice and critical analyses of educational datafication.

The critical-integrative review is not intended to provide an exhaustive reconstruction of the entire body of scientific literature relating to each strand. It aims to identify concepts, relationships, overlaps, divergences and possibilities for synthesis that are useful for constructing a new interpretative model.

The analysis was structured in four stages. The first involved defining the main constructs: 4E cognition, nootechnological ecology, teacher agency, capability and reflective practice. The second identified the respective units of analysis: body, environment, action, artifacts, institutional constraints, resources, substantive freedoms and processes of professional reflection. The third stage examined the convergences and tensions between the constructs. The fourth stage produced a synthesis aimed at formulating the model and theoretical propositions suitable for future empirical investigation.

This paper does not assess the effectiveness of specific artificial intelligence systems and does not seek to make empirical generalizations. It aims to propose an interpretative framework through which to analyze how technologies contribute to shaping cognition, agency and the conditions of professional freedom.

Results of the theoretical analysis

Nootechnological ecologies

In this paper, the term 'nootechnological ecology' refers to a socio-material educational system in which the production, preservation, circulation and evaluation of knowledge are co-configured by the interaction between human agents, professional practices, institutions, data, cognitive artifacts and algorithmic infrastructures.

This definition critically draws on the transformations described in studies on datafication,

platformisation and knowledge technologies, without attributing to those studies the specific use of the expression 'nootechnological ecology'. The term is employed here as an analytical category to highlight the transformation of the cognitive and epistemic conditions of education.

The concept differs from the more general notion of a digital environment. The latter may refer to a technologically mediated space in which educational activities take place. A nootechnological ecology, by contrast, concerns how technologies affect the organization of attention, memory, access to information, the visibility of behaviors and decision-making possibilities.

Platforms are not neutral containers. They incorporate classification criteria, access logics, tracking capabilities and forms of representation. They make certain activities visible whilst leaving others in the shadows. They transform complex phenomena, such as participation, engagement or learning progression, into data that can be recorded and compared (Macgilchrist, 2020; Williamson, 2017).

Generative AI systems can support design, the production of materials and the processing of feedback. However, they can also implicitly influence linguistic, content-related, epistemological and evaluative choices. The issue concerns not only the automation of individual tasks, but the redefinition of the conditions under which the teacher exercises their judgment.

Teaching professionalism, therefore, operates within an environment in which pedagogical knowledge must engage with the capacity of infrastructure to mediate, select and organize experience. The teacher is not merely a user, but an agent who helps to shape a cognitive, relational and value-based ecology.

4E cognition applied to teaching professionalism

4E cognition regards knowing as a process emerging from the relationships between body, environment, action and tools, as opposed to an exclusively intracranial localization of cognition (Carney, 2020).

When applied to the teaching profession, this framework allows teaching to be interpreted as a distributed cognitive activity. Instructional design, situational understanding, evaluative judgment and the regulation of relationships do not depend solely on internal mental representations. They emerge from the dynamic interplay between teachers, students, spaces, objects, norms and technologies.

Educational applications of the 4E perspective have highlighted the importance of embodiment, situationality and action in the construction of knowledge, whilst operating within theoretical frameworks that are not always consistent (Schilhab & Groth, 2024; Videla & Veloz, 2023).

Embodied cognition

The embodied dimension highlights the body's constitutive role. Gestures, posture, voice, rhythm, gaze orientation, perception and emotional regulation are all components of teaching practice. The teacher continually interprets bodily signals: hesitations, silences, movements, levels of attention,

tensions and forms of participation.

Bodily presence is not merely an external support for professional cognition. It plays a part in understanding the situation and regulating interaction. The embodied and enactive conception of the mind demonstrates how perception and knowledge are rooted in the coupling between organism and environment (Varela et al., 1991).

In digital and hybrid environments, physicality does not disappear, but is reconfigured. Webcams, microphones, chat functions and interfaces select the available signals. Some are amplified, others attenuated or lost. The teacher must therefore develop different ways of paying attention and regulating the relationship.

Embedded cognition

The embedded dimension emphasizes that action is always situated within material, cultural, institutional and regulatory conditions. The teacher does not operate in a neutral space, but within curricula, organizational timetables, assessment systems, professional cultures, the availability of resources, data policies and specific infrastructure.

In nootechnological ecologies, the environment also encompasses the architecture of platforms and the criteria embedded in algorithmic systems. Professional possibilities depend on levels of access, the ability to modify settings, the transparency of procedures, privacy regulations and the scope for challenging automated decisions.

Professionalism is therefore situated within a field of resources and constraints that can either support or constrain the teacher's initiative.

Enacted cognition

The 'enacted' dimension interprets meaning as emerging through action. Teaching does not mean transferring pre-formatted content, but rather constructing situations in which teachers, students, tasks and tools produce meaning through interaction.

The educational value of a technology does not lie in the tool itself. It emerges from the way in which the tool is integrated into a practice, linked to a purpose and reinterpreted by those involved. The same application can foster collaboration, exploration and reflection, or fuel repetition, standardization, and dependence.

The enactive perspective, therefore, allows us to shift our focus from tool adoption to the pedagogical design of the activity (Varela et al., 1991; Videla & Veloz, 2023).

Extended cognition and distributed cognition

The 'extended' dimension asserts that artifacts and tools can become components of cognitive

processes when they are firmly integrated into the individual's activity. In teaching practice, digital logs, archives, rubrics, platforms, dashboards and generative systems can participate in processes of memory, planning, documentation and decision-making.

This possibility can be interpreted through the theory of the extended mind, according to which certain external artifacts can constitute functional parts of the cognitive system (Clark & Chalmers, 1998). A complementary perspective is offered by distributed cognition, which analyses how complex cognitive activities are distributed amongst people, tools, representations and socio-material environments (Hutchins, 1995).

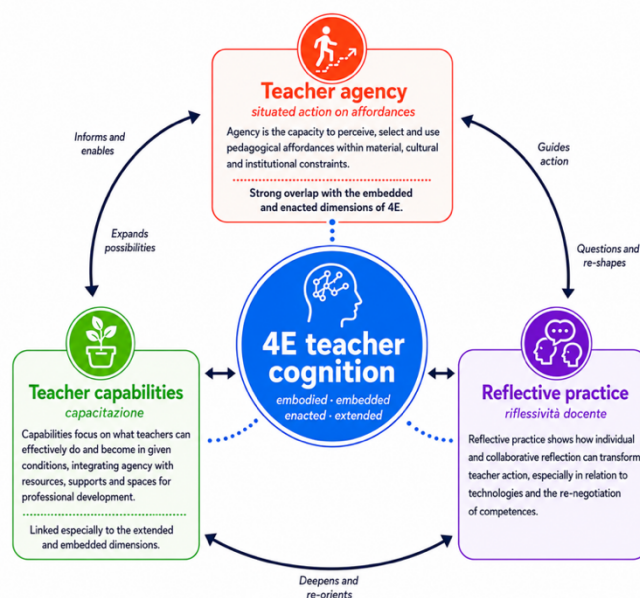
However, not every use of a technology constitutes a case of extended cognition. An artifact can be considered part of the professional cognitive system when it is stably integrated into practice, is sufficiently reliable in terms of accessibility, is used repeatedly, and plays a significant role in memory, planning, or decision-making.

A system used episodically to generate an exercise does not necessarily become a component of the teacher's cognition. Infrastructure that is firmly embedded in design, documentation and assessment, on the other hand, can take on a deeper cognitive function.

Cognitive extension does not automatically coincide with an expansion of autonomy. A technology may enhance certain functions whilst, at the same time, reducing understanding of processes, increasing dependence or transferring decision-making power to the infrastructure.

Figure 1

The 4E teacher model in nootechnological ecologies: relationships between 4E cognition, teacher agency, capabilities and reflective practice.



Teacher agency: action situated within affordances

Teacher agency can be defined as a teacher's ability to intentionally direct their actions within specific historical, institutional, material and relational conditions. From an ecological perspective, agency is not a stable, isolated property of the individual, but an emergent result of the interaction between professional experience, future-oriented perspectives, practical judgment, resources and contextual conditions (Priestley et al., 2015).

The concept of affordance helps us understand how possibilities for action are neither simply objective properties of the environment nor exclusively the intentions of the individual. They emerge from the relationship between environmental characteristics and the organism's perceptual and operational capacities (Gibson, 1979).

Applied to teaching, the concept shows that the teacher acts by perceiving and selecting pedagogical possibilities in their relationship with students, spaces, materials and tools. From an ecological-enactive perspective, the perception of affordances can be understood as a relational process through which the teacher recognizes possibilities for pedagogical action within the dynamic relationship with the environment (He & Levrini, 2024).

In nootechnological ecologies, teachers must interpret not only physical and relational affordances, but also digital and algorithmic ones. They must understand what a platform enables, what it prevents, what it makes visible and what it tends to exclude from its field of representation.

The interaction between digital affordances and agency has also been observed in specific contexts of online language teaching, where the utilization of technological opportunities depended on teachers' professional interpretation and contextual conditions (Yue et al., 2022). This finding cannot be automatically generalized to all educational systems, but it shows that affordances do not produce uniform, context-independent effects.

An AI system can suggest activities, produce rubrics or generate feedback. Professional agency is exercised through the ability to evaluate such proposals, modify them, reject them or adapt them to the educational situation. The presence of an algorithmic recommendation does not remove the teacher's responsibility.

When the system's criteria are not comprehensible, and the procedures cannot be challenged, the agency may be curtailed. When the teacher possesses understanding, control and decision-making autonomy, technology can instead support broader and more informed action.

Agency does not, therefore, equate to independence from technology. It concerns the possibility of participating in the shaping of the socio-technical relationship without relinquishing professional judgment and educational responsibility.

Teacher empowerment: substantive freedoms and enabling factors

The second dimension is teacher empowerment. Through the capability approach, professionalism is assessed not only based on what the teacher actually achieves, but also based on what they are genuinely free to do and become under certain conditions.

In the terminology of the capability approach, resources are not the same as capabilities. The former refer to goods, tools and opportunities that are formally available. The latter concern the combinations of ways of functioning that a person actually has the opportunity to choose and realize (Nussbaum, 2011; Sen, 1999).

Access to a platform, an artificial intelligence system or a training course, therefore, constitutes a resource. This resource becomes a real professional opportunity only when the teacher has the necessary enabling factors: time, support, autonomy, adequate infrastructure, critical expertise, institutional recognition, data protection and the ability to adapt the tools to educational purposes.

Two teachers may have access to the same technology without possessing the same capabilities. The first may work in an institution that promotes experimentation, collaboration and participatory governance. The second may be working in a context where the use of the tool is imposed through standardized procedures and control objectives. The resource is formally similar, but the actual professional freedoms differ.

The development of professional capabilities, therefore, does not depend exclusively on individual training, but also on the quality of professional learning environments, collegial relationships and the organizational support available (Nolan et al., 2020).

From a broader pedagogical perspective, lifelong learning can be interpreted as a condition that fosters professional subjectivity and as a fundamental right in contexts transformed by artificial intelligence and robotics (Costa, 2016, 2022).

Empowerment thus enables us to move beyond an individualistic conception of competence. It is not enough to simply ask teachers to keep their skills up to date. We need to establish institutional conditions in which they can transform technological resources into opportunities of pedagogical value.

The development of agency in the age of artificial intelligence, therefore, requires us to go beyond upskilling by adopting an empowering and transformative perspective on educational work (Costa, 2025).

Reflective practice in algorithmic ecologies

The third dimension is reflective practice. This refers to the teacher's ability to critically examine their own experience both during and after an action.

Schön (1983) distinguishes between 'reflection-in-action' – which takes place whilst the professional

is dealing with an uncertain situation – and ‘reflection-on-action’, which involves reconsidering the experience after it has taken place. In both cases, reflection is not merely self-analysis, but a re-examination of the relationship between knowledge, decision-making and the situation.

In nootechnological ecologies, reflexivity takes on particular significance, as professional experience is mediated by data, indicators, dashboards, automated feedback and algorithmic recommendations.

Reflection can help strengthen agency by enabling the reinterpretation of experience, the recognition of contextual constraints, and the identification of alternative courses of action. The relationship between different forms of reflection and teacher agency has been explicitly explored within the ecological model of agency (Toom et al., 2020).

Reflectivity in algorithmic ecologies must develop on at least two levels. The first concerns reflection on technologies: the teacher analyses the pedagogical, epistemic, ethical and political implications of the tools. The second concerns reflection through technologies: data, digital traces and feedback can be used as materials for understanding practice, without regarding them as exhaustive representations of educational reality.

It is also possible to distinguish four forms of reflexivity. Technical reflexivity concerns the effectiveness of tools and procedures. Practical reflexivity considers the appropriateness of decisions in relation to contexts and learners. Critical reflexivity questions the values and power relations embedded in the infrastructure. Collaborative reflexivity develops through dialogue with colleagues, learners and professional communities.

A significant risk lies in the transformation of reflectivity into performative self-monitoring. When teachers orient their practice exclusively towards measurable indicators, reflection can be reduced to mere adaptation to metrics. In this case, the data do not support professional judgment but tend to replace it.

Pedagogically meaningful reflection must also examine what systems do not record: relationships, emotions, vulnerability, creativity, conflicts, emerging meanings and non-quantifiable dimensions of the educational experience.

Relationships between the dimensions of the model

Teacher agency, empowerment and reflective practice constitute a dynamic and recursive system. Agency enables the teacher to select, interpret and transform the available affordances. Empowerment defines the space of real possibilities within which agency can be exercised. The reflectivity allows one to interrogate experience, reorient decisions and transform, at least in part, the conditions of action.

4E cognition forms the integrative core of the model. The embodied dimension links professional action to bodily perception and affective regulation. The embedded dimension highlights the role of

institutional constraints and resources. The enacted dimension interprets teaching as the production of meaning through action. The extended dimension clarifies the role of artifacts in processes of memory, planning and decision-making.

Table 1

Dimensions and mechanisms of the 4E teacher model

Dimension	Main focus	Mechanism	Risk	Enabling condition
Embodied	Body, perception, affects	Presence and regulation	Compression of corporeality	Relationally sensitive environments
Embedded	Institutional context	Constraints and affordances	Dependence on infrastructure	Participatory governance
Enacted	Situated action	Co-construction of meaning	Standardisation	Design autonomy
Extended	Cognitive artefacts	Distributed functions	Opaque delegation	Control and intelligibility
Agency	Professional action	Selection and transformation	Heterodirection	Contestability
Capabilities	Substantive freedoms	Conversion of resources	Inequality	Real support and opportunities
Reflectivity	Professional experience	Critical inquiry	Self-monitoring	Collaborative spaces

Six theoretical propositions arise from the integration of these constructs.

P1. Educational technologies enhance professional capabilities only when accompanied by institutional, cultural, training and ethical enabling factors.

P2. The technological extension of teachers' cognition strengthens agency when the professional retains understanding, control, the ability to challenge and decision-making responsibility.

P3. Algorithmic opacity tends to curtail agency by transforming technical recommendations into prescriptions that are difficult to challenge.

P4. Collaborative reflexivity can reduce the risk that learning analytics and monitoring systems will produce performative compliance.

P5. The educational quality of nootechnological ecologies depends on the configuration of relationships between technologies, individuals, norms and pedagogical aims, rather than on the quantity of tools available.

P6. The greater the dependence of teachers' judgment on unintelligible infrastructure, the greater the risk of a reduction in professional epistemic autonomy.

Implications for teacher training

This model implies a review of initial and continuing professional development programs. Training teachers in nootechnological ecologies does not merely mean developing operational skills for using artificial intelligence platforms and systems. It means fostering a professional ethos capable of understanding, evaluating and transforming complex educational environments.

In initial training, it is necessary to integrate instructional design, analysis of affordances, ethical reflection and a critical understanding of artificial intelligence. Future teachers should be trained to question not only how a tool works, but also the forms of knowledge, interaction and assessment that it enables.

Every educational technology should be analyzed through pedagogical questions: what activities does it facilitate? What aspects of learning does it make visible? What behaviors does it tend to favor? What data does it collect? What dimensions of experience does it leave out of its representation?

Reflective professional communities play a key role in continuing professional development. Teachers must be able to analyze real-world cases, compare human decisions with algorithmic suggestions, discuss the effects of platforms and share strategies for the pedagogical reappropriation of tools. Professional development is not merely technical updating, but the building of capabilities through collaborative and reflective environments (Nolan et al., 2020).

Training consistent with 4E cognition should itself be embodied, situated, acted upon and distributed. It should not be limited to the transmission of procedures, but should create conditions in which teachers can experiment, discuss, make mistakes, rethink their decisions and develop professional judgment.

Implications for the governance of artificial intelligence

The model has implications for the governance of artificial intelligence within education systems. The adoption of technologies cannot be assessed solely based on criteria such as efficiency, personalization or cost reduction. It must also be analyzed in relation to its capacity to expand or restrict professional freedoms.

Governance geared towards empowerment should ensure transparency, contestability, participation, data protection and ultimate human accountability.

Transparency requires that teachers be able to understand the purposes, limitations and general criteria of the systems used. Challengeability implies that algorithmic recommendations and classifications can be discussed, corrected or rejected. Participation involves teachers in the selection, adaptation and evaluation of the tools.

Data protection concerns not only legal compliance but also consistency between data collection practices and pedagogical aims. Ultimate human accountability stipulates that educational decisions

cannot be delegated entirely to automated systems.

In the absence of these conditions, technologies may foster an externally directed form of professionalism. When participatory governance is in place, it can become an empowering extension of educational planning.

This perspective aligns with the need to interpret continuing professional development as a fundamental right rather than merely an individual obligation to adapt to contexts transformed by artificial intelligence and robotics (Costa, 2022).

Discussion

The proposed model takes neither a technophile nor a technophobic stance. Educational technologies are ambivalent: they can either expand agency, capabilities and reflexivity, or constrain them.

A first tension concerns the relationship between cognitive extension and deskilling. A tool can support memory, planning and feedback without replacing professional judgment. However, when it progressively automates complex decisions, it can weaken essential skills.

A second tension concerns the relationship between personalization and surveillance. Data can contribute to an understanding of students' needs, but it can also transform the educational experience into an object of continuous monitoring (Macgilchrist, 2020; Williamson, 2017).

A third tension concerns the distinction between data-informed teaching and data-driven teaching. In the former, data is one of many sources and informs the teacher's judgment. In the latter, it assumes a dominant role and tends to directly guide decision-making.

A fourth tension concerns the relationship between individual agency and infrastructural power. Even a competent and reflective teacher may have little room for maneuver if they operate within closed platforms, non-modifiable procedures and unchallengeable assessment systems.

The model helps us understand that the pedagogical quality of technology does not depend solely on the intentions of the individual teacher. It also depends on the design of the tools, the distribution of decision-making power, data governance and organizational conditions.

Limitations of the model

The model has certain limitations. It is a theoretical proposal and has not yet been empirically validated. The relationships between the dimensions are formulated as conceptual hypotheses rather than as proven causal links.

Furthermore, the model does not aim to represent all aspects of teaching professionalism. Constructs such as care, identity, tacit knowledge, educational justice, moral responsibility and the political dimension of the profession require further exploration.

The integration of 4E cognition, agency and the capability approach is not without its tensions either. 4E cognition primarily describes the organization of cognitive processes; the capability approach introduces a normative perspective on freedoms and real opportunities; teacher agency focuses on the subject's temporally situated action. The model does not eliminate these differences but utilizes them as complementary levels of analysis.

Finally, the term 'nootechnological ecology' requires further discussion and comparison with related categories, such as digital ecology, cognitive ecology, sociomateriality, platformisation and post-digital education.

Research Prospects

A first line of research concerns qualitative studies of teachers' practices in using generative artificial intelligence systems in planning, assessment and professional reflection. Interviews, observations and case studies could reveal how these tools are actually integrated into professional cognitive systems.

A second line of research involves comparing institutions with different governance models. Such a comparison could examine how transparency, participation and contestability affect capabilities and agency.

A third direction involves developing indicators to empirically observe agency, empowerment and reflexivity within nootechnological ecologies. Such indicators could support the development of both qualitative and quantitative tools.

Further studies could investigate the relationship between algorithmic explainability and professional trust, the differences between experienced and novice teachers, and the longitudinal effects of automation on skills.

It would be particularly relevant to test the model's propositions in different school and university contexts, analyzing how the same technologies produce different effects in relation to institutional and cultural conversion factors.

Conclusions

This paper has proposed a theoretical model of teaching professionalism in nootechnological ecologies, based on the integration of 4E cognition, teacher agency, the capability approach and reflective practice.

The argument put forward is that teaching in the age of artificial intelligence cannot be adequately understood through technical or adaptive categories alone. Teaching professionalism is an embodied, situated, acted-upon and extended phenomenon that takes shape in the interaction between body, environment, action, relationships and artifacts.

The 4E teacher construct allows us to interpret technologies not as neutral tools, but as components of cognitive and institutional ecologies capable of expanding or restricting professional freedoms. Artificial intelligence can support memory, planning, documentation and reflection; however, it can also lead to dependence, opacity, standardization and a reduction in epistemic autonomy.

The crucial point, therefore, is not whether to adopt or reject technologies, but to establish pedagogical, institutional and ethical conditions that enable teachers to exercise agency, develop capabilities and maintain critical reflexivity.

The significance of the model lies in linking the ecological organization of cognition to the normative and institutional conditions of professionalism. From this perspective, a technology can be considered pedagogically empowering not because it abstractly increases the number of available functions, but because it expands the teacher's actual possibilities to design, choose, understand, challenge and responsibly make educational decisions.

The future of the teaching profession will therefore depend not only on the evolution of tools, but on the ability of education systems to construct intelligible, democratic and human-development-oriented nootechnological ecologies.

References

- Carney, J. (2020). Thinking avant la lettre: A review of 4E cognition. *Evolutionary Studies in Imaginative Culture*, 4(2), 77-90.
- Clark, A., & Chalmers, D. J. (1998). The extended mind. *Analysis*, 58(1), 7-19. <https://doi.org/10.1093/analys/58.1.7>
- Costa, M. (2016). L'apprendimento permanente come leva generativa per un nuovo learnfare [Lifelong learning as a generative lever for a new learnfare]. *Formazione & Insegnamento*, 14(2), 63-78. https://doi.org/10.7346/-fei-XIV-02-16_06
- Costa, M. (2020). Formatività e lavoro nella società delle macchine intelligenti [Formativity and work in the society of intelligent machines]. *Education Sciences & Society*, 11(2), 89-101. <https://doi.org/10.3280/ess2-2020oa9379>
- Costa, M. (2022). Diritto soggettivo alla formazione continua e al nuovo agire lavorativo tra IA e robotica [The subjective right to continuing education and new working practices between AI and robotics]. *Formazione Lavoro Persona*, 12(37), 22-34.
- Costa, M. (2025). Formare l'agency nell'era dell'IA, oltre l'upskilling, per una pedagogia capacitante e trasformativa del lavoro [Forming agency in the AI era beyond upskilling for a capability-based and transformative pedagogy of work]. *Pampaedia, Bollettino As.Pe.I.*, 19(92), 5-26. <https://doi.org/10.7346/aspei-02-2025-01>

- Gibson, J. J. (1979). *The ecological approach to visual perception*. Houghton Mifflin.
- He, P., & Levrini, O. (2024). The perception of affordances: Towards an ecological-enactive approach to teacher noticing. *Educational Studies*. Advance online publication. <https://doi.org/10.1080/03055698.2024.2349000>
- Hutchins, E. (1995). *Cognition in the wild*. MIT Press.
- Macgilchrist, F. (2020). The datafication of teaching in higher education: Critical issues and perspectives. *Teaching in Higher Education*, 25(4), 500-515. <https://doi.org/10.1080/13562517.2020.1748811>
- Nolan, A., McKell, L., & Kilderry, A. (2020). Building teacher professional capabilities through professional learning. *Issues in Educational Research*, 30(4), 1391-1408.
- Nussbaum, M. C. (2011). *Creating capabilities: The human development approach*. Belknap Press of Harvard University Press.
- Priestley, M., Biesta, G., & Robinson, S. (2015). *Teacher agency: An ecological approach*. Bloomsbury Academic.
- Schilhab, T., & Groth, C. (Eds.). (2024). *Embodied learning and teaching using the 4E cognition approach: Exploring perspectives in teaching practices*. Routledge.
- Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. Basic Books.
- Selwyn, N. (2019). *Should robots replace teachers? AI and the future of education*. Polity.
- Sen, A. (1999). *Development as freedom*. Alfred A. Knopf.
- Toom, A., Pyhältö, K., & Rust, F. O. (2020). Teacher agency following the ecological model: How it is achieved and how it could be strengthened by different types of reflection. *Teachers and Teaching*. Advance online publication.
- Varela, F. J., Thompson, E., & Rosch, E. (1991). *The embodied mind: Cognitive science and human experience*. MIT Press.
- Videla, R., & Veloz, T. (2023). The 4E approach applied to education in the 21st century. *Constructivist Foundations*, 18(2), 156-170.
- Williamson, B. (2017). *Big data in education: The digital future of learning, policy and practice*. SAGE.
- Yue, X., Liu, Y., & Zou, T. X. P. (2022). Digital affordances and teacher agency in the context of teaching Chinese as a second language during COVID-19. *Frontiers in Psychology*, 12, Article 809285. <https://doi.org/10.3389/fpsyg.2021.809285>

Cell Phones as Classroom Impact on Behavior, Attention, and Distractors: A Comparative Study of Students' Perceptions and Teachers' Observations

Marco Antonio Santos Ayala Acuña ^{1*}, Rosa María Carrillo Guerrero ²

¹ Master of Science in
Education in Instructional
Design and Technology, M.E.,
Faculty Member (Instructor),
ITESM (Instituto Tecnológico y
de Estudios Superiores de
Monterrey, Sinaloa, México

² Master's Degree in
Education with an emphasis in
Cognitive Development,
Faculty Member (Instructor),
ITESM (Instituto Tecnológico y
de Estudios Superiores de
Monterrey, Sinaloa, México

***Corresponding author:**

marco.santos@tec.mx



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: This comparative study examines the perceptual dissonance between high school students' self-perceptions and teachers' observations regarding smartphone distraction and classroom engagement. Survey data was collected from students (aged 14–18) and educators using a baseline survey, a digital detox intervention, and post-intervention evaluations. Initial findings revealed a student psychological defense mechanism: the majority self-reported an illusion of multitasking efficiency. However, control questions exposed that over 60% face chronic distraction while studying. To highlight the following findings, research shows that students are affected in their attention when having the device with them. (This blind spot was shattered during the disconnection activity, after which 80% of students admitted their attention significantly improved without a phone, though 63% immediately relapsed into checking notifications. Conversely, 80% of teachers reported daily chronic student distraction, illustrating a role-based divergence in institutional perceptions. Despite these differences, a critical point of convergence emerged: both groups acutely recognize mobile notifications as a primary distractor (>60% students, >80 teachers). Grounded in developmental neuroscience, these findings demonstrate how adolescent device compulsion neurobiologically compromises the executive functioning necessary for attentional control. This study underscores the urgent need for structural classroom policies that address the cognitive costs of task-switching in secondary education.

KEYWORDS: m-learning, attention, behavior, distractor, decline in academic performance, students' perception, teachers' observation.

How to cite: Santos Ayala Acuña, M. A., & Carrillo Guerrero, R. M. (2026). Cell Phones as Classroom Impact on Behavior, Attention, and Distractors: A Comparative Study of Students' Perceptions and Teachers' Observations. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21620605>

Introduction

Education is a discipline in constant evolution; in its pursuit of standardization, the need to adapt to changing environmental demands has become increasingly evident. In this digital era, where hyperconnectivity is ever more pervasive and routine, a profound impact on the educational field was only expected. The integration of technology has shifted from merely a supporting tool or resource in the classroom teaching-learning process to an integral component of students' identities. Consequently, this shift has transformed classroom dynamics, demanding a fundamental rethinking of pedagogical practice.

To be more specific, in the context of technology integration, mobile learning (m-learning), defined as a set of practices mediated by mobile technology, allows educational experiences to occur in any situation, place, and moment, meeting urgent learning needs through high interactivity (Matienzo, 2020). However, this integration becomes a double-edged sword; many different academic papers and research show how the mobile phone serves as a powerful distractor and has been linked to alterations in cognitive control and emotional regulation (Muñoz, 2023, p. 304)

The challenge educators face in the classroom in capturing and maintaining students' sustained attention is increasingly complex. According to a study regarding the quality of sustained attention, it was found that the majority of students exhibited some form of impairment, which was more common and severe among youth aged 16 to 19 (Aburto Rodríguez & Durón Parajón, 2024). This decline in sustained attention capacity can be attributed to overexposure to brief, frequent stimuli on social media.

Just as attention has been affected, other areas of student development have shown a significant shift, such as the socio-emotional domain; this may even go unnoticed by the students themselves or by other stakeholders in the academic sphere. Recognizing the impact of this issue can facilitate better decision-making regarding the changes and/or adjustments that should be considered in educational models.

To operationalize this research paper, three distinct survey instruments were deployed, two of which target the students' demographics to capture longitudinal shifts in awareness. The initial student survey was designed to establish an empirical baseline, exploring their overt perceptions regarding mobile phone usage patterns and their self-assessed impact on academic life. Subsequently, a pedagogical intervention was implemented, requiring students to undergo a prolonged, structured period of technological disconnection. Upon the conclusion of this digital detox, a secondary student instrument was administered to evaluate how this experiential absence altered their perceptions of device dependency. Crucially, this second instrument mirrored key structural variables from the initial baseline survey, allowing for a direct pre- and post-intervention analysis of their digital behavior. Finally, a third survey was administered to high school faculty, capturing educators' observations of student

behaviors surrounding electronic devices—principally smartphones. This tripartite data structure establishes the empirical foundation necessary to contrast the lived realities and perceptions of both primary actors within the instructional environment.

Research Aim

This study aims to compare high school students' perceptions of mobile phones as classroom distractors with educators' direct observations regarding the impact of device usage on student attention, engagement, and academic performance. To achieve this, the research employs a mixed-methods approach using comparative descriptive and quasi-experimental designs. Data collection was structured across three distinct phases. Initially, a baseline group of high school students ($n = 46$) was surveyed to assess their initial perceptions regarding the potential negative effects of mobile phone use on their academic development.

Following this baseline assessment, the student cohort underwent a structured period of digital disconnection (a "digital detox"). Post-disconnection, a broader sample of students completed a secondary evaluative survey to capture shifts in awareness and perception following the lived experience of device separation. To establish a comparative framework, a third survey was administered to educators ($n=33$), capturing their observations and pedagogical insights regarding the influence of smartphone usage on classroom behavior and academic outcomes.

The pervasive integration of mobile devices within educational environments has increasingly intensified institutional concern. While educators frequently report that smartphones severely compromise student concentration, active participation, and macro-academic achievement, students conversely minimize these liabilities. Adolescents often perceive device interactions as harmless or minor, exerting negligible negative impacts on their learning, and frequently reframe smartphones as vital educational tools. This profound perceptual discrepancy raises critical scholarly questions regarding how both cohorts conceptualize the cognitive and behavioral role of mobile devices in modern learning environments.

Research Questions

Q1: How do high school students perceive the impact of cell phone use on their academic performance and classroom engagement?

Q2: How do teachers perceive the impact of cell phone use on students' attention, participation, and academic performance?

Q3: What similarities and differences exist between students' perceptions and teachers' observations regarding cell phone use in the classroom?

Research Results

After analyzing the survey data, several compelling trends emerged regarding student self-perception, captured through an empirical lens. To address the first research question (Q1), the baseline data initially highlighted how rarely students consider mobile devices to be a primary distractor. Respondents overwhelmingly believed they maintained autonomous control over their attention, operating under the assumption that media multitasking does not negatively affect their academic focus [Figure 1]. Students strongly claimed that cell phones do not cause classroom disruptions or diminish their attentiveness. This aligns with existing research indicating that, for students, the smartphone is perceived primarily as a vital tool for interaction, exploration, and immediate information retrieval rather than as an obstacle to learning (Matienzo, 2020).

However, a series of control questions were intentionally placed throughout the initial survey to bypass these internal defense mechanisms, which often manifest due to a defensive fear that data might be utilized to restrict or ban device access in the classroom. When asked specific behavioral questions—such as whether they check their phones for message updates, or if they look at their devices multiple times while studying—the responses shifted dramatically. The data spiked sharply, with "Frequently" and "Always" accounting for more than 60% of the total responses, exposing a clear cognitive blind spot.

Academic research demonstrates that students frequently allocate more attention to their digital devices than to their immediate physical surroundings (Roig-Vila et al., 2023). This blind spot was explicitly shattered following the experimental digital detox. Within the secondary survey conducted after the disconnection activity, a striking 80% of the surveyed students stated that their attention during academic activities improved significantly when they did not have a mobile device within physical reach. Similarly, 87% observed that their peers' attentiveness during the activity also improved due to this same environmental factor [Figure 2]. This experiential realization—corroborated by external data showing clear negative correlations between device engagement and student concentration thresholds (Maldonado et al., 2025)—confirms that while students textually deny distraction in the first surveys, they acutely perceive their own cognitive improvement once the digital stimulus is removed, confirmed in the post-survey.

Furthermore, the post-intervention data captured the compulsive nature of this habit loop upon the activity's conclusion. When asked about their behavior immediately after regaining access to their mobile phones, 63% of the students stated that they immediately checked their notifications. This instant relapse is further substantiated by a correlated metric showing that 49% of students routinely utilized the transition moments between activities to check their devices.

A similar pattern of chronic task-switching emerged regarding media multitasking; when asked if they check their phones while watching television, a majority admitted to frequent multi-screening, with

"Frequently" and "Always" again combining for over 60% of the sample. Crucially, the direct baseline question, "When you study do you check your phone more than one, two or three times?" yielded the same result, with more than 60% of students ultimately acknowledging that they "Frequently" or "Always" face distraction.

Through another pair of interconnected questions, students admitted to losing track of time online and delaying sleep to remain connected to their devices [Figure 1] [Figure 2]. Existing literature underlines the severe behavioral and biological impacts of these habits, warning that prolonged smartphone use at bedtime is associated with altered resting-state functional connectivity (Sosa Ferrera, 2018-2019, p. 13). While the study focused on adults, it is vital to apply these findings to high school demographics; individuals between the ages of 14 and 18 are undergoing critical phases of synaptic and neuronal pruning, a process fundamental to shaping new neural pathways and long-term cognitive habits. In adolescents, the prefrontal cortex is already the final region of the brain to fully mature. Furthermore, prolonged device exposure highlights that this altered connectivity results in reduced excitability in the Right Prefrontal Cortex, which also affects decision-making, emotional regulation, and executive functioning (Sosa Ferrera, 2018-2019). Consequently, the very cognitive faculties students require to regulate their attention and resist distractions in the classroom are being neurobiologically compromised by their device habits.

This neurobiological compromise extends beyond attention into the realm of emotional development. Scholarly literature notes that no human can receive love and attention from a screen; developing the oxytocin necessary for social linking and affective connection requires direct social and eye contact—elements absent from a mobile screen (de León Rivas, 2022). This explains why both students and teachers in the survey identified the mobile phone as the most prevalent distractor. Students compulsively seek a digital substitute for genuine human connection, resulting in a behavioral loop where social media applications continuously exploit the adolescent need for attachment.

To address the second research question (Q2), the data capturing teachers' perceptions provide powerful validation of the students' post-disconnection realizations. A staggering 80% of educators report witnessing chronic classroom distraction daily—a metric that perfectly mirrors the 80% of students who admitted their concentration improved when their devices were removed. This overwhelming consensus directly exposes the real-world fallout of the illusion of multitasking efficiency. While adolescents may claim in writing that they can handle device interactions during lectures, educational psychology has long debunked the myth of the "digital native's" ability to dual-process information.

This finding aligns with educators who consistently observe how students absorbed in their mobile devices lose the pedagogical thread of the lesson, routinely prioritizing digital interaction over academic engagement (Matienzo, 2020). Consequently, this data suggests that the students' perceived multitasking optimization does not represent a sophisticated cognitive strategy; rather, it leads to a demonstrable decline in higher-order thinking skills, classroom engagement, and academic

responsibility.

Grounding these observations in educational literature that emphasizes the necessity of identifying the precise threshold at which mobile learning (m-learning)—and specifically the use of smartphones—transitions from an educational asset into a primary distractor that degrades academic performance (Luján, Sánchez, and Camacho, 2019). They observe that students frequently develop compulsive device habits, abusing technology privileges even when explicitly instructed to use their phones for research or to complete active tasks.

The teacher survey data heavily validate this theoretical framework. When educators were asked whether their students spent more time completing classroom activities or browsing their phones, an overwhelming majority—over 80%—reported that students prioritized their devices. Furthermore, when questioned about classroom management and autonomy, another staggering 80% of teachers expressed that it was difficult to control device usage or ensure that students remained focused on the assigned academic task rather than succumbing to the allure of social media or video games.

Finally, to address the third research question (Q3), the data reveals critical points of convergence where student perceptions and teacher observations unexpectedly align. Research posits that students and educators typically diverge fundamentally in their perceptions of mobile devices because they occupy contrasting roles within the institutional hierarchy (Alobiedat, 2012, p. 13). However, the survey instruments deployed in this study yielded compelling data that challenge this absolute division [Figure 3]. Both instruments included items evaluating the disruptive nature of mobile notifications, and in both cases, respondents demonstrated a shared, acute awareness of this factor. Over 60% of students confirmed that notifications serve as a primary distractor; a sentiment strongly reinforced by more than 80% of teachers who identified digital alerts as a significant disruption to attentional focus and classroom dynamics.

In addition, both groups evaluated the underlying risks of constant digital connectivity. Students demonstrated a conceptual awareness that continuous connection can be detrimental to their psychological development and emotional regulation—a finding that closely aligns with established work outlining the developmental dangers of constant connection and warning against letting technology dominate adolescent minds and behaviors, and suggesting turning off the device and turning on the brain (Muñoz, 2023).

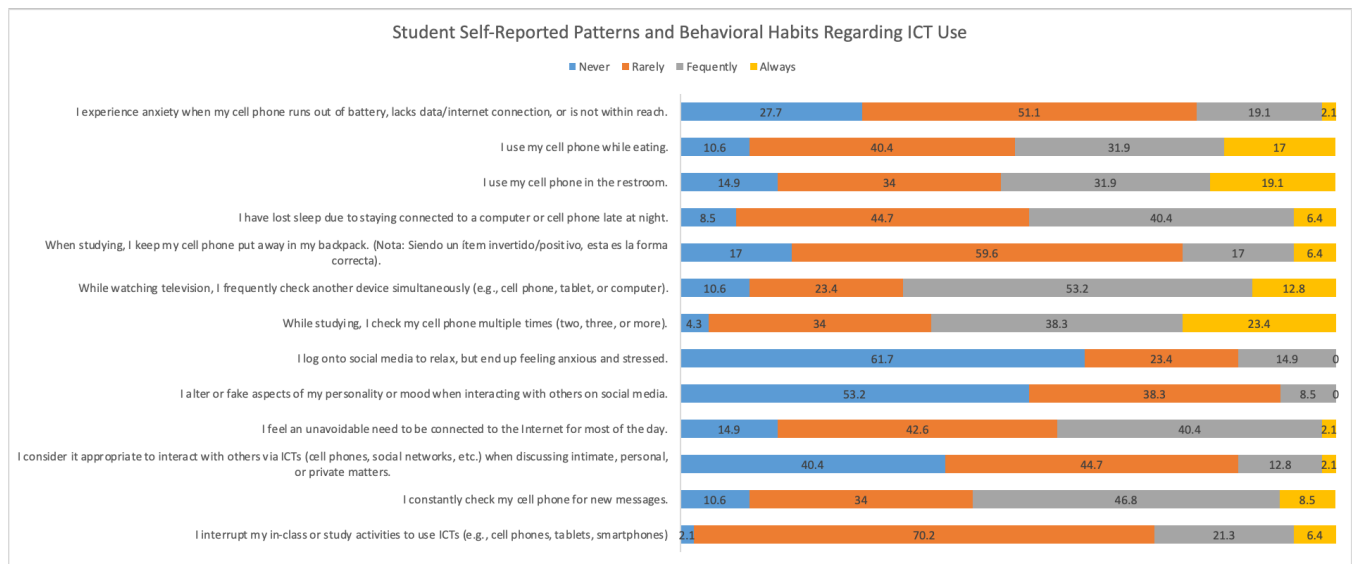
This theoretical risk resonates with the sample; when asked if they felt an inescapable need to remain connected most of the day, more than 50% of the students responded "Sometimes" or "Never." While this indicates that more than half of the surveyed student population conceptually understands that perpetual connectivity is unhealthy, it also exposes an ironic cognitive dissonance, given that their real-world behaviors reflect high notification checking frequencies.

Lastly, a final point of convergence emerged regarding the perceived severity of device

separation. Both teachers and students largely agree that the absence of a mobile phone does not fundamentally induce an emotional disorder. This collective perception stands in stark contrast to contemporary clinical literature. Research demonstrates how social media and algorithmic applications profoundly impact adolescent development across psychological, physiological, and neurological dimensions (Salazar Alvarado, 2024). However, despite these documented risks, neither group currently perceives device attachment as a clinical threat; more than 80% of students and over 50% of teachers do not classify this technological dependency as an emotional problem.

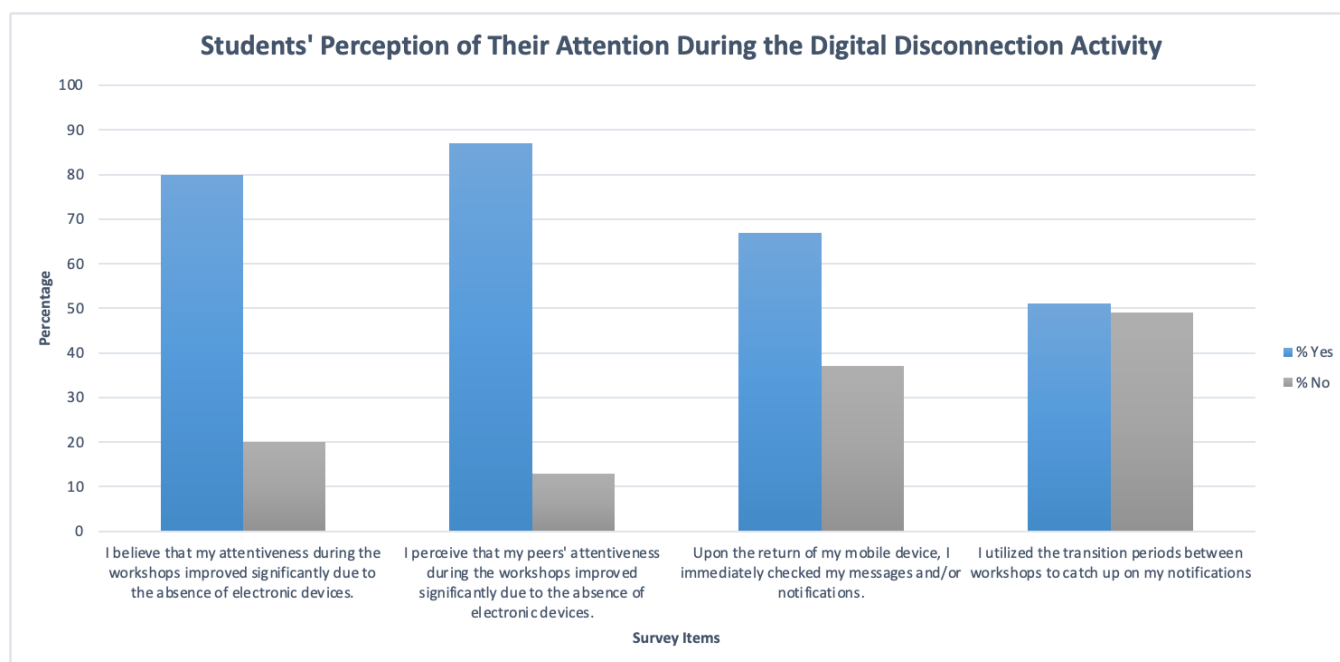
As mentioned earlier, studies highlight how both groups have different perceptions due to their roles; therefore, clear differences emerge between students and teachers (Alobiedat, 2012). Students do not accept that they are hooked to their devices and may not do what they are supposed to do. The student survey explicitly shows how they consider that the phone is not a distracting factor and that it is not an emotional danger to them and their close community. Meanwhile, teachers in their survey show deep concern regarding the students' attention and academic growth.

Figure 1



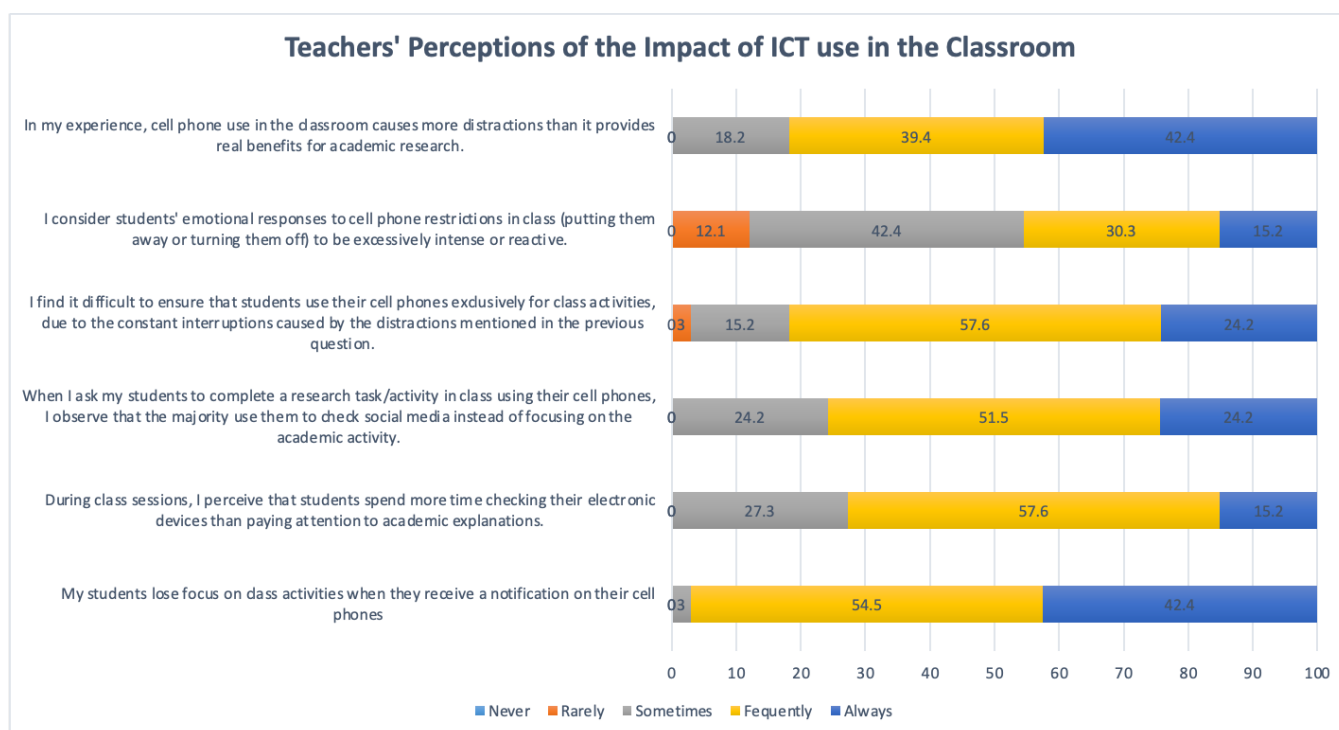
Source: author's own development

Figure 2



Source: author's own development

Figure 3



Source: author's own development

Conclusions

This study concludes that the use of mobile devices in the classroom generates a significant perceptual and behavioral challenge. The results demonstrate that students experience a dissonance between their general perception and their practical reality. Although they underestimate the consequences of technology on their performance, their specific behavioral responses confirm disproportionate use and a strong dependence on it.

This divergence is evident when comparing the applied instruments. As illustrated in Figure 1, a high proportion of students report concurrent use of their mobile devices while engaging in other daily activities (such as watching television, using the restroom, studying, eating, and sleeping). Paradoxically, these same students assert that this habit does not impact their emotional state or the effectiveness of their academic tasks.

Nevertheless, the data from the second survey (Figure 2) exposes a revealing contradiction. After participating in an intentional digital disconnection activity, students acknowledged that their quality of attention improved considerably, admitting that the mere presence of the device would have diminished their concentration. Additionally, the reported behavior of immediately checking the device upon regaining access suggests a clear indicator of technological dependence.

Finally, this lack of self-perception among students contrasts starkly with the teachers' perspective. Teachers can accurately identify how these specific behaviors act as distractors, significantly altering attention levels and engagement during academic sessions; however, much like the students, the majority of teachers fail to perceive a concerning impact within the emotional sphere.

In closing, this comparative analysis between the stances of students and teachers highlights that there is still considerable work to be done within the educational environment. Although attentional impairments can be identified at a behavioral level, the problem has deeper roots. As mentioned in the Research Results, literature shows that prolonged exposure to these devices alters brain connectivity, causing reduced excitability in the right prefrontal cortex, which directly affects decision-making, emotional regulation, and executive functioning (Sosa Ferrera, 2018-2019). Consequently, the very cognitive faculties that students require to regulate their attention and resist distractions in the classroom are being neurobiologically compromised by their digital habits. Given this reality, it is imperative to design strategies that guide the student community to recognize and bring visibility to the profound emotional and cognitive impact of the inappropriate use of these devices—a critical aspect that, up to now, they continue to minimize.

References

Aburto Rodríguez, A. L., & Durón Parajón, K. M. (2024). *Uso de redes sociales y sus efectos en las funciones cognitivas de atención y memoria en estudiantes de secundaria de un colegio público de la ciudad de León, Nicaragua, en el año 2023* (Doctoral dissertation).

- Alobiedat, A. (2012). Faculty and Student Perception Towards the Appropriate and Inappropriate Use of Mobile Phones in the Classroom at The University of Granada. *International Journal of Instructional Media*, 39(1), 7-16.
- De León Rivas, J. M. (2022). Dispositivos móviles uso y consecuencias a nivel neurofisiológico, emocional y conductual. *Revista Académica Sociedad del Conocimiento Cunzac*, 2(2), 259-266.
- Luján, J. M. B., Sánchez, J. D. J. R., & Camacho, M. A. G. (2025). Consecuencia del uso del celular y de las redes sociales en el rendimiento académico de los estudiantes de una Institución de Educación Superior en Fresnillo, Zac. *Filha*, 20(33), 32-32.
- Maldonado, A. A. C., Cuñas, G. D. P. T., Muñoz, A. M. C., & Alava, J. J. C. (2025). Impacto del uso del Celular en la Atención y Concentración de Estudiantes Rurales de Educación Básica Superior. *Ciencia Latina: Revista Multidisciplinar*, 9(5), 54.
- Matienzo López, R. (2020). Percepciones de docentes sobre el aprendizaje móvil en Educación Superior. *Educación Superior*, 7(2), 37-48.
- Muñoz Iturrieta, P. (2023). Apaga el celular y enciende tu cerebro: Manipulación, control y destrucción del ser humano. *HarperEnfoque*.
- Roig-Vila, R., López-Padrón, A., & Urrea-Solano, M. (2023). Dependencia y adicción al smartphone entre el alumnado universitario: ¿Mito o realidad?. *Alteridad*, 18(1), 34-47
- Salazar Alvarado, E. (2024). De la pantalla al cerebro: Implicaciones psico-neurofisiológicas del uso de redes sociales en adolescentes.
- Sosa Ferrera, L. (2019). Abuso del móvil y consecuencias asociadas a nivel cerebro

Exploring Value Co-creation Behavior in Higher Education: A Qualitative Study of University Students in Vietnam

Du Thi Chung^{1*}, Nguyen Thi Duy Quyen²

¹⁻² University of
Finance – Marketing,
No. 778 Nguyen Kiem
St., Duc Nhuan
District, Ho Chi Minh
City, Vietnam

***Corresponding author:**
duchung@ufm.edu.vn



This work is licensed under CC
BY-NC-ND 4.0. To view a copy of
this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: This study explores how undergraduate students perceive and experience value co-creation behavior within the university service ecosystem through a qualitative research approach. Data were collected through two focus group discussions involving 16 undergraduate students from one public university and one private university in Vietnam and analyzed using reflexive thematic analysis. The findings reveal that students perceive value co-creation as a continuous and collaborative process that extends across the entire university experience rather than being confined to classroom learning. Participants described themselves as active contributors who co-create value through interactions with multiple stakeholders, including lecturers, peers, administrative staff, student organizations, alumni, employers, and community partners. Six interrelated themes emerged from the analysis. First, students perceive value co-creation as active participation in academic, social, and institutional activities throughout their university journey. Second, value is created through reciprocal interactions and resource integration among multiple actors within the university ecosystem. Third, collaboration, mutual trust, and shared responsibility are considered essential conditions for successful value co-creation. Fourth, students perceive that value co-creation generates diverse outcomes, including personal development, meaningful learning experiences, stronger relationships, and enhanced institutional value. Fifth, organizational culture, institutional support, and opportunities for participation shape students' willingness and ability to engage in value co-creation. Finally, differences between public and private universities indicate that institutional context influences how students experience and enact value co-creation. By adopting a service ecosystem perspective, this study extends current understanding of student value co-creation beyond classroom engagement. It highlights the central role of collaborative interactions in creating sustainable educational value within higher education.

KEYWORDS: Student value co-creation; Service ecosystem; Higher education; Qualitative research; Focus group discussions; Vietnam.

How to cite: Thi Chung, D., & Thi Duy Quyen, N. (2026). Exploring Value Co-creation Behavior in Higher Education: A Qualitative Study of University Students in Vietnam. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21721621>

Introduction

Higher education is increasingly transitioning from a traditional knowledge transmission model toward a collaborative service ecosystem in which students are recognized as active contributors to educational value rather than passive recipients of knowledge. This transformation reflects the evolution of Service-Dominant Logic (SDL), which conceptualizes value as being co-created through resource integration and reciprocal interactions among multiple actors rather than produced solely by service providers (Vargo & Lusch, 2004, 2016). Within this perspective, universities are no longer viewed simply as providers of education but as facilitators of a service ecosystem that enables students, lecturers, administrative staff, alumni, employers, and community partners to jointly create meaningful educational experiences.

In higher education, value co-creation extends beyond students' participation in classroom learning. Students actively contribute to educational value through a wide range of academic, social, professional, and institutional activities, including seeking and sharing information, collaborating with lecturers and peers, participating in student organizations, engaging in research and community projects, providing constructive feedback, supporting university initiatives, and interacting with external stakeholders. Through these activities, students integrate their knowledge, skills, experiences, and social relationships with the resources provided by universities, thereby contributing to value creation for themselves, other students, the institution, and society.

Growing recognition of students as active partners has stimulated increasing scholarly interest in student value co-creation. Previous studies have demonstrated that students who actively participate in educational processes are more likely to experience greater educational value, stronger engagement, higher satisfaction, and stronger intentions to support their universities through voluntary behaviors. Nevertheless, most existing research has approached student value co-creation from a quantitative perspective, operationalizing the concept through predefined behavioral dimensions and examining its relationships with various educational outcomes. While these studies have substantially advanced empirical understanding, they provide limited insight into how students themselves perceive, interpret, and experience value co-creation within the broader context of university life.

Moreover, existing conceptualizations of student value co-creation remain largely grounded in service encounter perspectives, emphasizing interactions between students and lecturers or specific learning activities. Comparatively less attention has been given to understanding value co-creation as a process embedded within the broader university service ecosystem, where educational value emerges through interactions among multiple stakeholders operating across academic, administrative, professional, and community settings. Consequently, there remains limited qualitative evidence explaining how students understand their own role in co-creating value throughout their entire university journey.

This gap is particularly evident in emerging higher education systems such as Vietnam. Over the past decade, Vietnamese universities have experienced substantial transformation through institutional autonomy, digital transformation, international collaboration, stronger university-industry partnerships, and increasing emphasis on student-centered education. These developments have expanded opportunities for students to participate in decision-making, extracurricular activities, community engagement, entrepreneurship, internships, and research. At the same time, significant differences continue to exist between public and private universities regarding organizational structures, institutional culture, student support mechanisms, and stakeholder

engagement practices. Such differences provide an important context for exploring how students perceive and enact value co-creation within different university ecosystems.

From a service ecosystem perspective, these institutional contexts are likely to influence not only students' opportunities for participation but also how they integrate resources, collaborate with different actors, and construct educational value. However, little is currently known about how Vietnamese students experience these processes or how they understand their own contributions within the broader university ecosystem. Addressing this knowledge gap requires an exploratory approach that captures students' lived experiences rather than relying solely on predefined measurement scales. More recently, Nejari (2026) conceptualized student value creation as a multi-stage and multi-stakeholder process by integrating the perspectives of students, faculty members, and higher education managers. The study demonstrated that student value creation contributes significantly to both the financial and market performance of private higher education institutions, highlighting the strategic importance of collaborative value creation beyond individual learning outcomes. While this multi-actor perspective represents an important advancement, the study relied on a quantitative design and predefined constructs to examine relationships among stakeholders. Consequently, limited attention has been paid to how students themselves understand and experience value co-creation within the broader university service ecosystem. Addressing this gap requires qualitative inquiry capable of capturing students' lived experiences and the meanings they attach to collaborative value creation.

Accordingly, this study adopts a qualitative research design using focus group discussions to explore how undergraduate students from public and private universities in Vietnam perceive and experience value co-creation within the university service ecosystem. Rather than focusing exclusively on classroom participation, the study investigates how students describe value co-creation across multiple academic, social, organizational, and community contexts, and how interactions with diverse stakeholders contribute to educational value creation.

Specifically, the study addresses the following research questions:

- RQ1. How do undergraduate students perceive and define value co-creation within the university service ecosystem?
- RQ2. Through what activities and interactions do students perceive that value is co-created during their university experience?
- RQ3. Which stakeholders and institutional conditions facilitate or constrain student value co-creation?
- RQ4. How do students perceive the outcomes of value co-creation for themselves, the university, and other stakeholders?
- RQ5. How do students from public and private universities differ in their experiences and perceptions of value co-creation?

This study contributes to the higher education and service management literature in several important ways. First, it enriches the conceptual understanding of student value co-creation by moving beyond a behavioral perspective toward a service ecosystem perspective, where value is viewed as an emergent outcome of continuous resource integration among multiple stakeholders. Second, it provides qualitative evidence from an emerging higher education context, complementing the predominantly quantitative literature and offering richer insights into how students construct meaning around value co-creation in their everyday university experiences. Third, by comparing public and private universities, the study demonstrates how institutional contexts shape

opportunities for collaboration and resource integration within university ecosystems. Finally, the findings offer practical guidance for university leaders and policymakers seeking to design collaborative educational environments that strengthen stakeholder engagement, enhance institutional value creation, and support the long-term sustainability of higher education institutions.

Literature Review and Research Methodology

Student Value Co-creation in Higher Education

The concept of value co-creation originates from Service-Dominant Logic (SDL), which argues that value is not created solely by organizations but emerges through interactions among multiple actors (Vargo & Lusch, 2004, 2008). Within higher education, this perspective redefines students from passive recipients of educational services to active participants who collaborate with lecturers, peers, and universities in creating meaningful learning experiences.

Student value co-creation encompasses a wide range of voluntary behaviors through which students contribute to both their own learning and institutional development. These behaviors include active classroom participation, collaborative learning, providing constructive feedback, engaging in extracurricular activities, and supporting university initiatives. Rather than being viewed as consumers of education, students are increasingly recognized as partners who play a central role in shaping educational value.

Previous studies have consistently shown that value co-creation contributes to positive educational outcomes, including enhanced learning experiences, stronger engagement, improved academic performance, and greater institutional attachment. However, most existing studies conceptualize value co-creation through predefined measurement scales and examine its effects using quantitative approaches. Consequently, relatively little is known about how students themselves interpret these behaviors and how they experience value co-creation in different educational contexts.

Student Value Co-creation and Student Outcomes

Within the Service-Dominant Logic (SDL), value is not embedded in educational services. However, it is co-created through interactions among multiple actors who integrate resources within a service ecosystem (Vargo & Lusch, 2016). Accordingly, students are not passive recipients of educational services; rather, they actively shape their learning experiences by collaborating with lecturers, peers, university staff, and other stakeholders. Through these interactions, student value co-creation generates various educational outcomes that extend beyond academic achievement, including perceived value, student satisfaction, and student citizenship behavior.

Perceived value represents students' overall assessment of the benefits obtained from higher education relative to the resources they invest, such as time, effort, and financial costs (Zeithaml, 1988). In higher education, this evaluation encompasses not only academic knowledge but also personal development, professional competencies, social relationships, emotional well-being, and career preparedness (Ledden et al., 2007; Brown & Mazzarol, 2009). From the perspective of value co-creation, these benefits are not delivered solely through teaching activities but emerge from students' active engagement in collaborative learning processes and continuous interactions within the university ecosystem (Dollinger et al., 2018; Vargo & Lusch, 2016). Consequently, students who participate more actively in co-creating their educational experiences are expected to perceive greater value from their university education.

Student satisfaction constitutes another important outcome of student value co-creation. Traditionally, satisfaction has been conceptualized as students' overall evaluation of whether their educational experiences meet or exceed prior expectations (Elliott & Healy, 2001). However, contemporary higher education increasingly recognizes satisfaction as a cumulative evaluation developed through diverse experiences, including academic interactions, administrative services, extracurricular activities, campus facilities, and relationships with members of the university community (Alves & Raposo, 2007; Brown & Mazzarol, 2009; Helgesen & Nasset, 2007). Because value co-creation enhances students' engagement, autonomy, collaboration, and sense of belonging, it contributes to more meaningful educational experiences that ultimately strengthen student satisfaction (Dollinger et al., 2018; Tomlinson, 2017). Thus, satisfaction should be viewed as an emergent outcome of collaborative educational experiences rather than merely an assessment of teaching quality.

Beyond shaping students' personal evaluations, value co-creation also encourages voluntary behaviors that benefit the wider university community. These discretionary actions are conceptualized as student citizenship behavior, which refers to voluntary contributions that are not formally required but support the effectiveness, reputation, and sustainability of the institution (Groth, 2005). Drawing on the literature on customer citizenship behavior (Groth, 2005; Yi & Gong, 2013), student citizenship behavior includes helping fellow students, recommending the university to prospective students, participating in institutional activities, providing constructive feedback, and promoting the university's positive image. Such behaviors strengthen collaborative learning environments, reinforce social connections, and contribute to institutional development. As universities increasingly adopt partnership-oriented educational models, student citizenship behavior represents an important manifestation of students' commitment to the university community and their willingness to contribute beyond formal academic requirements.

Research Methodology

Research Design

This study adopted a qualitative research design to explore how undergraduate students perceive and experience value co-creation within the university service ecosystem. A qualitative approach is particularly appropriate when the aim is to understand participants' subjective meanings, lived experiences, and socially constructed realities rather than to test causal relationships among predefined variables (Creswell & Poth, 2018; Denzin & Lincoln, 2018). Because value co-creation is embedded in students' everyday interactions with multiple stakeholders, qualitative inquiry enables researchers to capture the complexity, context, and meanings underlying these experiences.

Specifically, focus group discussions (FGDs) were employed as the primary data collection method. Focus groups facilitate interaction among participants, allowing them to reflect on shared experiences, challenge one another's perspectives, and collectively construct meanings that may not emerge through individual interviews (Krueger & Casey, 2015; Morgan, 1997). This interactive format is particularly suitable for exploring socially embedded phenomena such as student value co-creation, where experiences are shaped through collaborative interactions within the university ecosystem.

Participants and Data Collection

Participants were recruited using purposive sampling, a widely adopted strategy in qualitative research that enables researchers to select information-rich participants capable of providing meaningful insights into the phenomenon under investigation (Patton, 2015).

Two focus group discussions were conducted between undergraduate students from one public university and one private university in Vietnam. Each focus group comprised eight participants, yielding a total sample of sixteen students. Including students from different institutional contexts was intended to capture variations in educational environments and enrich understanding of value co-creation across university settings.

To ensure participants possessed sufficient experience to reflect on university life, the study included only undergraduate students who had completed at least three semesters of study and had participated in both academic and extracurricular activities. Participants represented diverse academic disciplines and years of study, allowing a broad range of perspectives to emerge during the discussions.

Each focus group lasted approximately 120 minutes and was facilitated by the researchers using a semi-structured interview guide. All discussions were conducted in Vietnamese, audio-recorded with participants' informed consent, and supplemented by detailed field notes documenting group dynamics, non-verbal interactions, and contextual observations. Data collection continued until the discussions generated sufficiently rich information to address the research questions, consistent with the principle of information power proposed by Malterud et al. (2016).

Interview Protocol

The semi-structured interview guide was developed based on the literature on Service-Dominant Logic (Vargo & Lusch, 2004, 2016), student value co-creation (Yi & Gong, 2013; Dollinger et al., 2018), and higher education service research. The interview questions were designed to encourage participants to describe their experiences openly while allowing flexibility to pursue emerging topics relevant to value co-creation (Kallio et al., 2016).

The discussions focused on the following broad topics:

- students' understanding of value co-creation within the university ecosystem;
- experiences of interacting with lecturers, peers, administrative staff, and other university stakeholders;
- participation in academic, extracurricular, community engagement, and university activities;
- experiences of seeking, sharing, and integrating knowledge and resources;
- perceptions of educational value derived from collaborative participation;
- experiences of contributing voluntarily to the university community; and
- recommendations for strengthening value co-creation within higher education.

Throughout each discussion, the moderator employed probing questions and follow-up prompts to encourage participants to elaborate on their experiences, clarify meanings, and provide concrete examples, thereby enhancing the depth and richness of the data (Krueger & Casey, 2015).

Data Analysis

The data were analyzed using reflexive thematic analysis, following the six-phase framework developed by Braun and Clarke (2006, 2021). Reflexive thematic analysis is particularly appropriate for exploring participants' subjective experiences because it acknowledges the active interpretive role of researchers in generating themes while maintaining close engagement with the data.

All audio recordings were transcribed verbatim immediately after each focus group discussion. The transcripts were repeatedly reviewed alongside field notes to achieve familiarity with the data and to preserve contextual meanings throughout the analytical process.

The analysis followed six iterative stages (Braun & Clarke, 2006, 2021):

1. Familiarization with the data;
2. Generating initial codes;
3. Constructing preliminary themes;
4. Reviewing and refining themes;
5. Defining and naming themes; and
6. Producing the final analytical narrative.

Coding was conducted manually to maintain close engagement with participants' narratives and to facilitate continuous comparison across participants and between the two focus groups. Rather than treating coding as a purely mechanical process, the researchers engaged in continuous reflection throughout the analysis to interpret meanings within the broader university service ecosystem.

To enhance the trustworthiness of the findings, the research team held regular discussions during coding and theme development to compare interpretations and refine emerging themes. Credibility was strengthened through prolonged engagement with the data, iterative coding, and the use of verbatim quotations to illustrate participants' perspectives.

Results and Discussion

The thematic analysis revealed that students perceive value co-creation as a holistic and dynamic process embedded within the university ecosystem rather than as isolated classroom activities. Participants consistently described value co-creation as emerging through continuous interactions with lecturers, peers, university administrators, student organizations, industry partners, alumni, and the broader community. Rather than viewing themselves as passive recipients of educational services, students regarded themselves as active contributors who jointly shape educational experiences and institutional value.

Across the two focus groups, six overarching themes emerged, illustrating how value is co-created throughout students' university journeys.

Theme 1: Value co-creation begins with students' active roles within the university ecosystem

Students consistently rejected the traditional notion that universities are solely responsible for delivering educational value. Instead, they emphasized that value is jointly created when students actively engage in various aspects of university life.

Participants explained that being a university student involves much more than attending lectures. It includes participating in academic activities, extracurricular programs, student clubs, research projects, competitions, volunteering, internships, and institutional events.

One participant commented:

"University gives us opportunities, but whether those opportunities become valuable depends on how actively we participate." (Public University, Participant 4)

Another student explained:

"Learning is only one part of university life. We also create value through clubs, volunteering, competitions and supporting university activities." (Private University, Participant 7)

These findings indicate that students conceptualize value co-creation as a university-wide process extending beyond formal teaching and learning.

Theme 2: Value is co-created through interactions with multiple stakeholders

Participants described value co-creation as a network of interactions involving numerous stakeholders rather than a simple student-lecturer relationship.

Students identified lecturers, classmates, administrative staff, academic advisors, student affairs offices, alumni, employers, and community organizations as important actors contributing to their educational experiences.

One participant noted:

"Every interaction matters. Sometimes administrative staff or alumni help us solve problems that lecturers cannot." (Public University, Participant 2)

Another student stated:

"Internships and company projects help us understand what employers expect, so they are also part of creating educational value." (Private University, Participant 5)

The findings demonstrate that students perceive universities as interconnected service ecosystems where educational value emerges through collaborative relationships among multiple actors.

Theme 3: Reciprocal collaboration is the foundation of value co-creation

Participants repeatedly emphasized that value co-creation depends on reciprocal participation rather than one-sided efforts.

Students believed universities should provide supportive environments, while students themselves must demonstrate initiative, responsibility, and willingness to contribute.

One participant explained:

"The university cannot create value alone. Students also need to participate and take responsibility for their own development." (Private University, Participant 1)

Similarly,

"If lecturers encourage discussion but students remain silent, then no real value is created." (Public University, Participant 6)

This reciprocal perspective closely reflects Service-Dominant Logic, where value is generated through resource integration among interacting actors.

Theme 4: Value co-creation generates value for multiple stakeholders

Participants emphasized that value co-creation benefits not only individual students but also lecturers, universities, employers, and society.

Students described multiple forms of value generated through participation, including knowledge acquisition, professional skills, confidence, social relationships, employability, institutional reputation, and community development.

One participant remarked:

"When students actively participate, everyone benefits—not only ourselves but also lecturers and future students." (Private University, Participant 3)

Another student added:

"Helping junior students today creates a better learning environment for everyone tomorrow." (Public University, Participant 8)

Students therefore viewed value creation as collective rather than individual.

Theme 5: Institutional conditions enable or constrain value co-creation

Although students from both public and private universities expressed similar motivations to contribute, they perceived different institutional conditions affecting their opportunities.

Public university students frequently mentioned larger class sizes, administrative complexity, and limited access to lecturers.

Conversely, students from private universities highlighted personalized support, smaller classes, flexible communication, and greater encouragement to participate.

As one participant explained:

"Our university encourages students to propose ideas and organize activities, so we feel our opinions really matter." (Private University, Participant 6)

Meanwhile,

"Sometimes we want to contribute, but the procedures are too complicated or nobody follows up." (Public University, Participant 1)

These findings suggest that organizational environments significantly influence students' opportunities to participate in value co-creation.

Theme 6: Value co-creation fosters a sense of belonging and long-term commitment

Students described value co-creation as strengthening their emotional attachment to the university.

Many participants indicated that active participation made them feel respected, connected, and proud of being members of their university community.

Consequently, they became more willing to recommend the university, support institutional events, mentor junior students, and maintain relationships after graduation.

One participant stated:

"When the university values our contributions, we naturally want to contribute even more." (Private University, Participant 2)

Another reflected:

"Being involved makes me feel this university is partly mine, so I want it to become better." (Public University, Participant 5)

This finding suggests that value co-creation encourages long-term commitment and voluntary contributions extending beyond graduation.

Discussion

The findings provide new insights into how students conceptualize value co-creation within higher education and contribute to a broader understanding of student participation from a service ecosystem perspective. Rather than perceiving value co-creation as a collection of discrete behaviors, participants described it as a continuous process of interaction, collaboration, and resource integration that unfolds throughout their university journey. This perspective is consistent with the fundamental premise of Service-Dominant Logic (SDL), which argues that value is co-created through reciprocal exchanges among multiple actors rather than produced unilaterally by service providers (Vargo & Lusch, 2004, 2016). More importantly, the findings illustrate that the university functions as a service ecosystem in which students actively integrate resources through their relationships with lecturers, peers, administrative staff, student organizations, employers, alumni, and community partners.

These findings both support and extend previous conceptualizations of student value co-creation. Existing research has generally adapted customer value co-creation behavior to the higher education context by emphasizing behaviors such as information seeking, information sharing, responsible behavior, and personal interaction (Yi & Gong, 2012; Dollinger et al., 2018). These dimensions conceptualize value co-creation primarily as a set of individual participatory behaviors occurring during service encounters. Participants in the present study recognized the importance of these behaviors; however, they also described value co-creation as involving broader forms of engagement that extend beyond direct interactions with lecturers or classroom activities.

Students associated value co-creation with participation in student organizations, community engagement, research projects, internships, mentoring, university governance, and collaboration with external stakeholders. These findings suggest that the existing behavioral dimensions represent important mechanisms of value co-creation but do not fully capture the complexity of students' experiences within contemporary higher education.

The study therefore expands the conceptual boundaries of student value co-creation by shifting attention from individual service encounters to the broader university service ecosystem. From students' perspectives, value is not created through isolated interactions but through the continuous integration of knowledge, skills, relationships, institutional resources, and social networks across multiple educational settings. This broader interpretation resonates with the service ecosystem perspective, which emphasizes that value emerges through interconnected networks of actors operating within shared institutional arrangements rather than through dyadic provider-customer relationships alone (Vargo & Lusch, 2016). Consequently, student value co-creation should be understood not merely as students' participation in learning activities but as their active contribution to the development of the university community as a whole.

Another important finding concerns the reciprocal nature of value co-creation. Students consistently emphasized that meaningful value creation requires active contributions from both universities and students. Universities provide educational resources, learning opportunities, institutional support, and collaborative environments, whereas students contribute through participation, communication, knowledge sharing, responsibility, leadership, and social engagement. This reciprocal understanding differs from traditional higher education models in which universities are viewed as primary producers of educational value and students as passive recipients. Instead, the findings reinforce recent arguments that universities should be regarded as facilitators of resource integration, enabling multiple stakeholders to co-create educational value.

The comparison between public and private universities further highlights the importance of institutional context in shaping value co-creation. While students across both institutional types demonstrated similar motivations to contribute, differences emerged regarding opportunities for participation, organizational responsiveness, communication practices, and institutional support. Students from private universities generally perceived greater accessibility to lecturers, stronger institutional encouragement, and more flexible participation opportunities. In contrast, students from public universities more frequently described structural constraints such as larger class sizes and administrative complexity. These findings suggest that value co-creation is influenced not only by students' willingness to participate but also by the institutional conditions that either enable or constrain collaborative interactions. This observation extends previous quantitative studies by illustrating that contextual factors should be viewed as integral components of the value co-creation process rather than merely antecedents or moderators.

Finally, the findings contribute to the higher education literature by demonstrating that student value co-creation generates value beyond individual learning outcomes. Participants associated value co-creation with personal growth, stronger interpersonal relationships, professional development, institutional improvement, and contributions to the wider university community. This broader understanding aligns with contemporary perspectives that educational value is multidimensional and co-created among interconnected stakeholders. It also suggests that universities should evaluate value co-creation not only in terms of academic performance or

student satisfaction but also through its contribution to institutional development, social connectedness, and long-term sustainability within the university service ecosystem.

Conclusion and Managerial Implications

Conclusion

This study explored how students perceive and experience value co-creation within the university service ecosystem through focus group discussions with undergraduate students from one public university and one private university in Vietnam. Adopting a qualitative approach enabled the study to move beyond predefined conceptualizations of student value co-creation and capture students' own interpretations of how educational value is jointly created throughout their university journey.

The findings demonstrate that students do not perceive value co-creation as limited to classroom participation or interactions with lecturers. Instead, they view it as a continuous process of collaboration involving multiple stakeholders across the university ecosystem, including peers, lecturers, administrative staff, student organizations, alumni, employers, and community partners. Through these interactions, students actively integrate their knowledge, skills, experiences, and social relationships to create value not only for themselves but also for the wider university community.

The study also reveals that value co-creation is inherently reciprocal. Universities provide resources, learning opportunities, and institutional support, while students contribute through active participation, knowledge sharing, collaboration, feedback, leadership, and community engagement. Educational value therefore emerges from ongoing interactions rather than being delivered unilaterally by the institution.

Furthermore, institutional context plays an important role in shaping opportunities for value co-creation. Although students from both public and private universities expressed similar motivations to contribute, differences in organizational culture, communication practices, institutional support, and learning environments influenced how students engaged with the university ecosystem.

Overall, the findings contribute to the growing literature on student value co-creation by presenting a broader ecosystem perspective in which educational value is continuously negotiated and co-created through collaborative relationships among multiple actors. This perspective extends existing understandings of student participation beyond classroom engagement and highlights the collective nature of value creation in higher education.

Theoretical Contributions

This study offers several theoretical contributions to the literature on higher education and service management.

First, it extends Service-Dominant Logic by demonstrating that student value co-creation is embedded within a university service ecosystem rather than confined to individual learning activities. Educational value is generated through the integration of resources contributed by multiple stakeholders, supporting the ecosystem perspective proposed in contemporary service research.

Second, the study broadens the conceptualization of student value co-creation by revealing that students associate value co-creation with a wide range of academic, social, professional, and community-oriented

activities. These findings suggest that student value co-creation should be understood as an ongoing process of participation across the entire university experience instead of a collection of isolated classroom behaviors.

Third, by comparing students from public and private universities, the study highlights the importance of institutional context in enabling or constraining value co-creation. This finding enriches existing research by illustrating that organizational conditions shape not only students' opportunities to participate but also the meanings they attach to collaborative educational experiences.

Managerial Implications

The findings provide several implications for university leaders, academic staff, and policymakers seeking to strengthen student engagement through value co-creation.

First, universities should move beyond viewing students as recipients of educational services and instead recognize them as strategic partners in creating educational value. Institutional policies should encourage students to participate in curriculum feedback, academic governance, quality assurance, student-led initiatives, and strategic development activities. Such involvement enhances students' sense of ownership and strengthens their commitment to the university community.

Second, universities should cultivate an ecosystem that facilitates interactions among multiple stakeholders. In addition to strengthening lecturer-student relationships, institutions should create opportunities for collaboration with administrative staff, alumni, employers, professional associations, and community organizations. Experiential learning, internships, service-learning projects, mentoring programs, and interdisciplinary collaborations can provide meaningful platforms for value co-creation beyond traditional classroom settings.

Third, institutional support systems should lower barriers to student participation by promoting open communication, responsive administrative services, transparent feedback mechanisms, and inclusive decision-making processes. Students in the focus groups emphasized that they were more willing to contribute when they perceived that their ideas were acknowledged and could lead to tangible improvements. Universities should therefore establish formal mechanisms through which student contributions are systematically collected, evaluated, and incorporated into institutional practices.

Fourth, universities should foster a culture of collaboration rather than one of passive service delivery. Student organizations, peer mentoring schemes, leadership development programs, volunteer initiatives, innovation competitions, and community engagement activities can encourage students to contribute not only to their own learning but also to the development of their peers and the institution as a whole. Such initiatives reinforce reciprocal relationships that are central to value co-creation within the university ecosystem.

Finally, while both public and private universities can benefit from adopting ecosystem-oriented approaches, institutional strategies should reflect their specific organizational contexts. Public universities may focus on reducing structural barriers that limit student participation, such as large class sizes and complex administrative procedures. Private universities, meanwhile, can build upon their strengths in personalized support and flexible learning environments by further integrating students into institutional innovation and decision-making processes.

Collectively, these managerial implications suggest that sustainable educational quality depends not only on improving teaching and learning but also on creating collaborative ecosystems in which students and other stakeholders jointly participate in the continuous creation of educational value.

Limitations of this study

This study has several limitations that should be considered when interpreting its findings. First, the research adopted a qualitative design based on two focus group discussions involving undergraduate students from one public university and one private university in Vietnam. While this approach generated rich and context-specific insights into students' experiences of value co-creation, the findings are not intended to be statistically generalizable to the broader higher education population. Future studies could employ quantitative methods with larger and more diverse samples to validate and extend the themes identified in this research.

Second, although the study intentionally compared students from public and private universities, it did not include participants from other institutional contexts, such as international universities, vocational institutions, or community colleges. Educational policies, institutional cultures, and learning environments vary considerably across different types of higher education institutions and may influence how students perceive and engage in value co-creation. Comparative studies across a wider range of institutional settings would provide a more comprehensive understanding of the university service ecosystem.

Third, the study focused primarily on students' perspectives. Consistent with the principles of Service-Dominant Logic and Service Ecosystem Theory (Vargo & Lusch, 2012), value co-creation is a collaborative process involving multiple actors, including lecturers, university administrators, professional staff, alumni, employers, and community partners. Future qualitative research could adopt a multi-stakeholder perspective to explore how these actors jointly contribute to value creation and how their interactions shape students' educational experiences.

Finally, this study explored students' perceptions and lived experiences at a particular point in time. Because value co-creation is a dynamic and evolving process, students' experiences may change throughout their academic journey and in response to institutional reforms, digital transformation, or changing societal expectations. Longitudinal qualitative studies or mixed-methods research could provide deeper insights into how student value co-creation develops over time and how universities can continuously strengthen collaborative relationships within the higher education ecosystem.

References

- Alves, H., & Raposo, M. (2007). Conceptual model of student satisfaction in higher education. *Total Quality Management*, 18(5), 571-588.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Braun, V., & Clarke, V. (2021). *Thematic analysis: A practical guide*. SAGE Publications.
- Brown, R. M., & Mazzarol, T. W. (2009). The Importance of Institutional Image to Student Satisfaction and Loyalty within Higher Education. *Higher Education*, 58, 81-95. <https://doi.org/10.1007/s10734-008-9183-8>

- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE Publications.
- Denzin, N. K., & Lincoln, Y. S. (Eds.). (2018). *The SAGE handbook of qualitative research* (5th ed.). SAGE Publications.
- Dollinger, M., Lodge, J., & Coates, H. (2018). Co-creation in higher education: Towards a conceptual model. *Journal of Marketing for Higher Education*, 28(2), 210-231. <https://doi.org/10.1080/08841241.2018.1466756>
- Elliott, K.M. and Healy, M. A. (2001). Key Factors Influencing Student Satisfaction Related to Recruitment and Retention. *Journal of Marketing for Higher Education*, 10, 1-11. https://doi.org/10.1300/J050v10n04_01
- Groth, M. (2005). Customers as good soldiers: Examining citizenship behaviors in internet service deliveries. *Journal of Management*, 31(1), 7-27.
- Helgesen, O., & Nasset, E. (2007). What Accounts for Students' Loyalty? Some Field Study Evidence. *International Journal of Educational Management*, 21, 126-143. <https://doi.org/10.1108/09513540710729926>
- Kallio, H., Pietilä, A. M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: Developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing*, 72(12), 2954-2965. <https://doi.org/10.1111/jan.13031>
- Krueger, R. A., & Casey, M. A. (2015). *Focus groups: A practical guide for applied research* (5th ed.). SAGE Publications.
- Ledden, L., Kalafatis, S. P., & Samouel, P. (2007). The relationship between personal values and perceived value of education. *Journal of Business Research*, 60(9), 965-974.
- Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies: Guided by information power. *Qualitative Health Research*, 26(13), 1753-1760. <https://doi.org/10.1177/1049732315617444>
- Morgan, D. L. (1997). *Focus groups as qualitative research* (2nd ed.). SAGE Publications.
- Nejjari, R. (2026). Exploring value co-creation in private higher education institutions in Morocco: implications for financial and market performance. *Journal of Applied Research in Higher Education*, 18(4), 1148-1159.
- Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.). SAGE Publications.
- Tomlinson, M. (2008). 'The degree is not enough': students' perceptions of the role of higher education credentials for graduate work and employability. *British journal of sociology of Tomlinson education*, 29(1), 49-61.
- Vargo, S. L. and Lusch, R. F. (2016). Institutions and Axioms: An Extension and Update of Service-Dominant Logic. *Journal of the Academy of Marketing Science*, 44, 5-23. <https://doi.org/10.1007/s11747-015-0456-3>

- Vargo, S. L., & Akaka, M. A. (2012). Value cocreation and service systems (re) formation: A service ecosystems view. *Service Science*, 4(3), 207-217.
- Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68(1), 1-17.
- Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: Continuing the evolution. *Journal of the Academy of Marketing Science*, 36(1), 1-10. <https://doi.org/10.1007/s11747-007-0069-6>
- Vargo, S. L., & Lusch, R. F. (2016). Institutions and axioms: An extension and update of service-dominant logic. *Journal of the Academy of Marketing Science*, 44(1), 5-23. <https://doi.org/10.1007/s11747-015-0456-3>
- Yi, Y., & Gong, T. (2012). Customer value co-creation behavior: Scale development and validation. *Journal of Business Research*, 66(9), 1279-1284. <https://doi.org/10.1016/j.jbusres.2012.02.026>
- Yi, Y., & Gong, T. (2013). Customer value co-creation behavior: Scale development and validation. *Journal of Business Research*, 66(9), 1279-1284.
- Zeithaml, V.A. (1988). Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence. *Journal of Marketing*, 52, 2-22. <http://dx.doi.org/10.2307/1251446>

SECTION

Philological sciences



Futurity Research Publishing

The Socio-Pragmatics of Emotional Expression in Digital Slang

Luu Dat Phi

¹Independent researcher,
Ho Chi Minh City, Vietnam

✉ ***Corresponding author:**

datphi19030@gmail.com



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Modern digital landscapes have evolved from temporary pandemic-era fixes into permanent infrastructures that fundamentally recalibrate human interaction. This study investigates how Generation Z employs digital slang as a high-efficiency mechanism for affective pragmatics and social gatekeeping. The research utilized a combination of qualitative content analysis and interpretive phenomenological analysis to collect data from high-context ecosystems, including Threads, TikTok, and Discord (2024-2026). The results demonstrate that minimalistic signifiers function as semantic anchors, enabling people to communicate their complex emotional states through shared cultural knowledge while they achieve faster communication and lower digital fatigue. Critically, digital slang functions as a sociolinguistic filter that automatically excludes out-groups through its temporary nature and specific contextual requirements. The research develops a new meaning model enabling real-time intent reconstruction through continuous meaning flows beyond traditional lexical inventories. Ultimately, digital minimalism does not simplify language but re-engineers it to protect subcultural intimacy through linguistic friction.

KEYWORDS: Digital slang, affective pragmatics, Gen Z, social gatekeeping, minimalistic signs, post-pandemic communication.

How to cite: Luu. D. P. (2026). The Socio-Pragmatics of Emotional Expression in Digital Slang. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21259479>

Introduction

In the post-pandemic era, digital environments have transitioned from temporary tools into a primary, agentic infrastructure for social interaction (Gu et al., 2026; Leal Filho et al., 2024). This shift has fundamentally altered interpersonal dynamics, forcing Generation Z to recalibrate essential communicative habits like empathy and active listening within increasingly mediated frameworks (Kizbaz, 2024). As physical cues, such as body language and direct tonality, diminished, users were compelled to restructure how they express and negotiate emotions (Abdelmonem & Karawia, 2024). Within this landscape, digital slang has evolved into a high-efficiency mechanism for affective pragmatics, distilling complex emotional states into concise, context-sensitive signifiers (Luu et al., 2025).

Existing literature has long established slang as a socio-linguistic filter that categorizes speakers into in-group or out-group identities (Bailey, 1985; Damirjian, 2025). Previous studies have extensively analyzed the morphological processes of slang, such as acronyms and semantic shifts, viewing them as markers of cultural competency or studied carelessness (Danesi, 2010; Melville, 1912). Furthermore, artifacts like memes and internet slang have been documented as outlets for shared social intensities that challenge traditional models of identity (Rahma & Moetia, 2024; Szablewicz, 2020). However, most of these studies remain descriptive, focusing primarily on lexical inventories (what the words mean) or identity construction (who uses them).

The novelty of this study lies in its shift from static vocabulary analysis to the dynamic negotiation of meaning in hyper-speed environments. While previous research implies a research gap, this study explicitly addresses the lack of focus on how minimalistic signs function as semantic anchors. These signs do not merely simplify language; they optimize affective synchronization by outsourcing meaning to a shared cultural reservoir. Unlike traditional models that view slang as a way to fill linguistic gaps, this research argues that post-pandemic slang represents a move toward a flowing meaning model where intent is collaboratively reconstructed in real-time.

Research aim and research questions

By focusing on the specific platform architectures of Threads, TikTok, and Discord, this paper seeks to decode the strategic use of brevity to recreate intimacy in fractured virtual spaces. To investigate these dynamics, the study addresses the following research questions:

1. How do online users employ digital slang to recreate intimacy and affective pragmatics in fragmented virtual environments?
2. In what ways do minimalistic signs in digital slang facilitate the negotiation of meaning between speakers and listeners?

Theoretical framework

The theory of affective pragmatics (TAP) defines emotional expressions as speech act analogs. These expressions are not just reactions; they are social tools that perform four specific moves, such as expressives (manifesting internal states), imperatives (demanding behavioral changes), declaratives (appraising reality), and commissives (signaling future actions) (Scarantino, 2017). While traditional TAP focuses on bodily displays, this study applies it to digital signifiers. For example, a minimalistic W functions as a declarative, representing a shared appraisal of success, and an expressive, manifesting the speaker's alignment with the group. This framework allows the research to move beyond literal meaning to the action-oriented nature of slang (Fischer & Sauter, 2017).

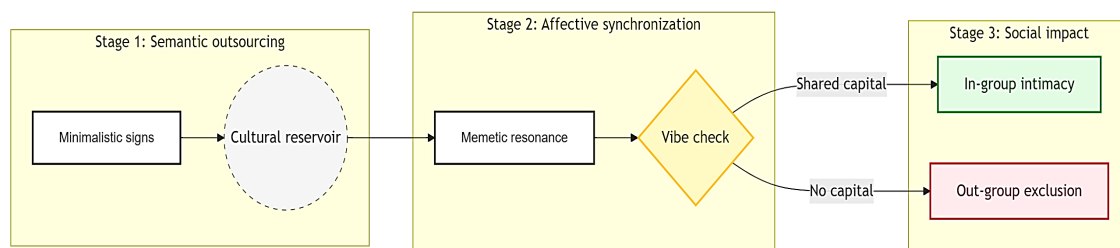
To decode the force behind digital slang, this study employs speech act theory. Communication is not a sequence of linguistic forms, but a series of moves where illocutionary force is reduced to their functional and sequential properties (Moeschler, 2002). Every digital utterance follows a bipartite structure $F(p)$, where the illocutionary force indicating device (F) combines with a propositional act (p) to accomplish a communicative goal (Sadock, 2006). In post-pandemic spaces, Gen Z utilizes slang as a formal device to signal intention, such as using Sus to perform a preparatory act of communal doubt. This theory provides the structural rules to explain how brevity can still carry a complete communicative weight.

Relevance theory provides the cognitive lens to explain how listeners decode extreme brevity. Humans employ a fast and frugal heuristic to identify a speaker's intended meaning by balancing cognitive effects against processing effort (Wilson & Sperber, 2004). Every ostensive stimulus, as an attempt to take up the hearer's attention, conveys a guarantee of its own optimal relevance (Allott, 2013). Within a mutual cognitive environment, Gen Z users use minimalistic signs to trigger a biologically rooted search for relevance (Yus, 2009). This process inferentially enriches underdetermined texts. By minimizing the processing effort for the in-group while maximizing it for the out-group, digital slang effectively automates social exclusion.

The following meaning model, shown in Figure 1, defines digital slang as a social interaction system that evolves instead of being treated as a language decline. In stage 1 (semantic outsourcing), users employ basic symbols to transmit messages that require less mental effort because they tap into shared cultural understanding for quick communication. The process advances to stage 2 (affective synchronization) because the vibe check functions as an essential pragmatic filter, which enables meaning to be reconstructed through memetic resonance instead of direct decoding. The third stage (social impact) demonstrates how linguistic friction produces its effects, which enable users with shared cultural capital to develop in-group bonds while others face social rejection. The model demonstrates digital brevity in three stages because it shows how online spaces after the pandemic use digital brevity as a method to control social access.

Figure 1

The following meaning model



Methodology

Research design

This study uses Qualitative Content Analysis (QCA) together with Interpretive Phenomenological Analysis (IPA) to examine how digital slang functions in social and pragmatic contexts. The Researcher selected a dual-layered design because it enables them to connect visible linguistic patterns with the hidden emotional meanings that exist beyond those patterns.

The adoption of QCA enables researcher to systematically categorize slang usage across different digital platforms while discovering common patterns that show how particular signifiers function as emotional anchors (Schreier, 2012). However, the QCA method does not meet the requirements because post-pandemic digital communication needs to understand both atmosphere and hidden information. The design uses IPA as a tool to explore how digital users experience their lives through their use of minimalistic shorthand to build their social understanding.

The research needs this combined method because it helps researcher study online conversations, which lack conventional non-verbal communication methods. The study uses an interpretive lens to examine how people establish meaning through their emotional connections and their use of simplified language. The research follows post-positivist tradition (Creswell & Poth, 2016) because digital meaning exists as a changing, co-created reality that emerges within particular cultural groups. The research design enables the researcher to examine digital slang as an evolving social-linguistic instrument because they treat it as more than basic language use.

Data collection and source

The data for this study were systematically harvested from three primary high-context digital ecosystems, such as Threads, Discord, and TikTok. The researcher selected these platforms because they serve as the digital frontier that post-pandemic communication requires for studying modern language evolution (Zappavigna, 2012). These spaces differ from standard social media platforms because they enable users to conduct their discussions through asynchronous threaded conversations, which allows members to demonstrate their membership through specific behaviors.

The researcher used purposive sampling methods to create a dataset with specific social and linguistic features. The researcher selected conversation threads that had more than 50 interactions because they wanted to analyze the specific conversation threads that included the target words W, L, No Cap, Sus, and Era. The selected data preserves both the specific slang usage and the process through which speakers reach shared understanding. The researcher will collect data between 2024 and early 2026 to study how digital-first communication became the main social connection method after the pandemic.

Table 1

Distribution of data sources and linguistic affordances

Platform	Nature of discourse	Primary linguistic affordance	Data volume (N)
Threads	Reflective and dialogic	High-context narrative building, ideal for Era branding	150 threads
Discord	In-group and hyper-local	Private socio-pragmatic filtering, high density of Sus + Ratio	200 interactions
TikTok	Memetic and performative	Rapid affective synchronization, origin of W/L and Ate	300 comments

To maintain temporal relevance, the scraping process utilized a snowballing digital tracking method, identifying a core set of viral slang and following its trajectory across different platform architectures. This multi-platform approach acknowledges that digital slang is not monolithic; its pragmatic function is often dictated by the

affordances of the hardware and the algorithm of the specific site (Gibson, 2014; Hutchby, 2001). The study establishes complete linguistic documentary evidence through the three separate data sources, which it combines. This shows that its results have not been affected by one particular application because they demonstrate a general change in emotional digital communication practices between different age groups.

Data analysis procedure

The analysis followed a multi-staged QCA framework, moving from inductive categorization to deductive pragmatic mapping. This procedure ensures that the findings are grounded in the actual discourse while being interpreted through established socio-pragmatic theories (Mayring, 2014). The process was operationalized through a three-step coding trajectory:

Step 1: Open coding and functional categorization

The initial phase involved a recursive reading of the harvested datasets to identify recurring linguistic units. Through the open coding process, the researcher established two types of digital slang terms and defined their purposes of communication (Strauss & Corbin, 1990). This resulted in four main functional categories which include epistemic/affirmation (no cap), exclusionary/gatekeeping (sus ratio), aesthetic/performance (ate, slay) and existential/branding (era) as their major components.

Step 2: Pragmatic mapping and affective calibration

Following the initial categorization, the data underwent pragmatic mapping. This step aligned the identified slang with speech act theory to determine their illocutionary force, which is what the speaker is doing by saying the word (Searle, 1969). For instance, the use of W was mapped as an act of collective validation. Furthermore, the researcher used an affective scale to assess the emotional intensity of their acts, which they performed to evaluate their capacity to show different types of emotional expression.

Table 6

Analytical framework for pragmatic mapping

Coding stage	Analytical lens	Targeted outcome
Open coding	Inductive labeling	Functional taxonomy
Pragmatic mapping	Speech act theory	Illocutionary force identification
Contextual triangulation	Comparative analysis	Cross-platform variance

Step 3: Contextual triangulation and in-group/out-group dynamics

The final stage employed contextual triangulation to validate the findings across different platform architectures and social hierarchies. The analysis scrutinized how the pragmatic value of a signifier (e.g., sigma) shifts when deployed on Threads (high-context narrative) versus TikTok (hyper-speed memetic resonance). Critically, the main goal of this process required the assessment of how in-group members and out-group tourists established their shared understanding through their linguistic interactions. The process determines which digital meanings exist as temporary digital signs instead of permanent digital signs.

Ethical considerations

The ethical framework of this study is grounded in the principles of digital anonymity and the public domain doctrine. The researcher collected the data from social media platforms which required following the ethical guidelines established by the Association of Internet Researcher because the research used online discussions as a source for research data (Markham & Buchanan, 2012). The researcher recognized that Discord data collection presents an ethical challenge because users there anticipate greater privacy protection than they would in public areas of TikTok.

The study started by establishing an authentication process. All personally identifiable information (PII), which included usernames and profile pictures and specific location tags, was removed during the data extraction process. The researcher examined direct quotes to determine which required paraphrasing because a verbatim quote would enable search engine users to identify a specific private individual (Townsend & Wallace, 2016). The strategy becomes essential because users in public digital spaces experience a sense of private subcultural identity which makes them believe their spoken words will not be collected for research purposes.

The method recognizes that people believe they have privacy rights in their online subcultural communities, although digital environments exist as public spaces. In addition, the data collection process followed both public domain regulations and the particular service requirements established by Threads and Discord and TikTok. Only comments and threads from publicly accessible profiles were included. Data from private groups or invite-only Discord servers were strictly excluded to avoid a breach of contextual integrity (Nissenbaum, 2004).

Results

Digital slang as a sociolinguistic gatekeeping mechanism

Digital slang functions not merely as a lexicon of convenience but as a formidable sociopolitical filter used to police in-group boundaries. Participants demonstrated that membership is not a static state but a continuous performance of authenticity. This signaling is verified through two critical factors: temporal relevance (adopting terms before they are colonized by the mainstream) and contextual precision. Failure to meet these criteria does not just result in a misunderstanding. It triggers a social demotion, effectively indexing the individual as a tourist or a cultural outsider. For instance, a Discord exchange following a gaming session revealed this friction: when an older user attempted to bridge the social gap by typing *"That play was so skibidi, no cap,"* a younger participant replied, *"Who let the boomer cook? The aura is in the negatives."* This interaction illustrates that using the correct marker with the wrong timing or vibe results in immediate social penalty rather than inclusion.

A key mechanism for enforcing these social borders is the use of reactive affirmation markers (e.g., No Cap, Facts, Bet). In a post-pandemic digital landscape saturated with clout-chasing, the strategic use of No Cap functions as an ethical litmus test. The Gen Z users who use these markers demonstrate their complete rejection of artificial social behavior. Data from TikTok comment sections show that when a creator posts an overly polished, clearly sponsored video, the top-liked comments are often a single word like NPC or Ratio. The creators in this situation lose their social status because the weaponized shortness of this content deems their work as unoriginal and automatic. This establishes a moral hierarchy where individuals who master unfiltered truth markers wield greater social influence and symbolic power than those perceived as trying too hard.

Table 1

Strategic signaling as a tool for social stratification

Signaling strategy	Linguistic markers	Critical sociolinguistic function
Epistemic alignmer	No Cap, Facts, Bet	Enforces a social contract of reliability, purges perceived inauthenticity from the inner circle.
Archetypal labeling	NPC, Sigma, Simp	Weaponizes social categorization to punish robotic or predictable behaviors and reward perceived autonomy
Aesthetic validation	Slay, Drip, Ate	Regulates the group's visual economy, establishes who possesses the right to belong.
Digital literacy gatekeeper	Touch Grass, Rati Skibidi	Penalizes cultural stagnation, uses hyper-fast meme cycles to automate the exclusion of normies

In addition, signaling membership requires affective synchronization, the ability to mirror the group's emotional frequency to solidify social alliances. This goes beyond simple communication; it is a phatic performance that signals, *"I belong to this emotional tribe."* Critically, terms like vibe check or calling someone Sus function as regulatory surveillance tools. In one analyzed Discord thread, a member was vibe checked after sharing a controversial take; the community's response, a flood of Sus emojis, effectively silenced the individual without needing a formal argument. When a user fails a vibe check, slang shifts from a welcoming gesture to a weapon of exclusion. This binary dynamic suggests that slang is a weaponized social instrument used to protect the purity of the subculture against those who lack the cultural capital to keep up.

Perhaps the most sophisticated signaling found is the commodification of identity through narrative branding (e.g., Slay era, Villain era). By framing personal experiences as an era, Gen Z users align themselves with a global narrative power structure. This is evident in *"Get ready with me"* videos, where users announce, *"I'm officially entering my IDGAF era"* to justify a change in social behavior. This allows the individual to curate the self as a digital product, signaling that they possess the hyper-reflexivity required to survive in a competitive, attention-based economy.

Table 2

Tactical nuance and the risks of social exclusion

Contextual variable	High fluency in-group usage	Low-fluency out-group error	Consequence of failure
Tone	Irony or satire (Sigma)	Literal interpretation	Loss of status, identified as intellectually out of sync
Timing	Early adoption	Late or mainstream adoption	Social death, the term becomes cringe, and the user is shunned
Platform	Platform-specific (Ratio)	Misplaced usage	Indexing as a boomer, total loss of digital credibility

Ultimately, the specific digital slang that Gen Z members use functions as their digital identity test, which automatically divides people into different social groups. The results show that people now use communication methods that verify their identity instead of transmitting their actual meanings. Belonging is no longer about shared language, but about the flawless execution of social unwritten rules. In the post-pandemic era, where physical

touchpoints have diminished, this exclusionary intimacy has become the primary infrastructure for power-brokering within the generation. As observed in the data, the linguistic friction created by misused slang acts as a self-correcting algorithm for the group. Those who misuse the slang are not merely incorrect. They are socially invisible, effectively purged from the digital tribe through linguistic friction.

Minimalistic signs as high-context semantic anchors

While the previous result outlines how slang acts as a social barrier to enforce group hierarchy, the following section examines the internal cognitive mechanics and linguistic compression that allow this barrier to function so efficiently through minimalistic signs.

The data suggests that Gen Z's reliance on minimalistic signs (e.g., W, L, Fr, Ate, Real) is not an evolutionary laziness but a calculated optimization of linguistic economy. The signs work as semantic anchors that transfer cognitive meaning processing from their textual content to a common cultural knowledge base. For instance, the TikTok comment section about a creator's comeback shows that the letter W attracts thousands of likes from users who comment on the video. The single character functions as a complete replacement for a paragraph that provides moral support and validation through its speed of evaluation. By stripping away syntactic complexity, the speaker triggers a rapid cognitive synchronization, where the listener must bypass literal decoding to achieve an immediate, intuitive understanding of the vibe.

Minimalistic signs facilitate a high-velocity information exchange that is essential in the post-pandemic digital environment. In this context, the deployment of markers like Fr or Sus acts as a linguistic trust contract. This negotiation is not based on factual accuracy but on inter-subjective sincerity. As seen in Discord community chats, when a user shares a personal struggle, the response Real acts as a profound empathetic anchor. It signals that the listener has not only read the message but has relocated themselves into the speaker's emotional state, bypassing the need for performative sympathy. By reducing a complex emotional state to a single signifier, the speaker initiates an immediate calibration of resonance. This linguistic compression is a technical necessity for maintaining a real-time connection in a space defined by infinite scrolling and rapid content turnover.

Table 3

Cognitive mechanics and semantic reduction of minimalistic signs

Minimalistic sign	Semantic reduction	Negotiated context	value	Socio-pragmatic function
W / L	Binary polarity	Collective moral or judgment	success	Optimizes evaluative speed by bypassing descriptive adjectives
Fr / Real	Epistemic focus	Verification of performative intent	no	Automates the validation of sincerity in low-trust digital spaces
Sus	Heuristic skepticism	A prompt for communal doubt		Streamlines collective vigilance without requiring explicit evidence
Ate	Aesthetic peak	Recognition of a perfect performance		Condenses high-level praise into a single, high-impact syllable
POV	Relational immersion	Subjective, shared empathy		Outsources situational context, forcing the listener to co-create the narrative.

Furthermore, the minimalism of these signs creates a strategic ambiguity that rewards high-speed cognitive processing. This process transforms language into a dynamic, flowing meaning model. Unlike traditional dictionaries, where meanings are fixed, the value of signs like Skibidi or Rizz is negotiated through memetic resonance. The data shows that the term POV (Point of View) has migrated from its technical cinematographic origin to a general marker of shared empathy. On Threads, a post starting with "POV: it's 3 AM, and you're..." forces the reader to co-author the narrative instantly, using the sign as a bridge between individual and collective experience. Meaning is liquid; it evolves at the speed of an algorithm, requiring the listener to constantly scan an internal database of viral subtexts.

Besides, the process of transitioning to flowing meaning creates a major linguistic shift that results in a generation divide that both conventional translation systems and AI systems cannot overcome because people understand meaning through temporary expressions instead of permanent language. This situation exists because outsiders interpret emoji sequences and single-letter answers as meaningless, while in-group members understand them as complex multi-dimensional communication.

Table 4

Negotiation outcomes and processing efficiency

Dimension negotiation	High-fluency (in-group)	Low-fluency group)	Cognitive and systemic impact
Interpretive labor	Low, meaning is intuitive & rhythmic	High, requires external decoding	Prioritizes cognitive ease for those with shared subcultural data
Semantic precision	Negotiated via vibes and subtext	Literal and misinterpreted	Shifts communication from informative to purely relational
Response velocity	Near-instantaneous	Delayed by clarifying questions	Syncs communication speeds with platform-specific logic and hardware
Communication resilience	High, meaning survives syntactic sparsity	Low breaks down without syntax	Future-proofs subcultural talk against mainstream co-option

In general, minimalistic signs do not simplify digital communication; they re-engineer it for maximum efficiency. By minimizing the form, Gen Z maximizes the requirement for a collaborative reconstruction of intent. This strategy ensures that meaning is no longer just a transfer of information, but a mutual recognition of shared reality. The linguistic friction lies in the unspoken. The requirement for cognitive synchronization, which establishes membership, has already been broken by your need to inquire about the meaning of W in its particular use. The process of linguistic minimalism, which people use to communicate, shows that in a digital world, unspoken communication represents the most effective way to transmit messages, which only those who understand the special meaning of one letter can comprehend.

Discussions and implications

The findings of this study confirm that digital slang in the post-pandemic era has transcended its role as a mere linguistic shortcut. While previous literature by Barseghyan (2013) and Verheijen (2017) emphasized keystroke-saving economy, a more profound shift toward socio-pragmatic weaponization has occurred. Slang is no longer just

about speed; it is about calculated exclusion. Unlike the principle of economy described by Al-Sa'Di and Hamdan (2005), the brevity found in markers does not aim to make communication easier for everyone. Instead, the system creates extra work to interpret its content for people who are not part of its main group. This demonstrates that people use slang to create barriers that prevent them from understanding each other in global communication (Daoudi, 2011) because they want to protect their subcultural identity through secret language.

Furthermore, the model that uses flowing meanings marks a complete shift from the fixed word lists that Danesi (2010) and Melville (1912) studied. Earlier studies viewed slang through morphological processes like acronymization or clipping. However, the signifier (the word) is now secondary to the vibe (the transient context). For instance, the term Sigma or Skibidi does not hold a fixed definition; its value is negotiated through memetic resonance in real-time. This supports Walther's (1992) SIP Theory regarding the adaptation of textual cues, but adds a new layer. In 2026, the sufficient time required for relational bonding has been replaced by near-instantaneous affective synchronization. In a world of digital fatigue (Gregersen et al., 2023), Gen Z has optimized communication not by adding more information, but by outsourcing meaning to a shared cultural reservoir.

In addition, the use of Eras (e.g., Villain era) as a narrative branding tool suggests that identity is now being commodified for the attention economy. While Rahma and Moetia (2024) saw memes as outlets for shared social intensities, these artifacts have become regulatory surveillance tools. A vibe check is not just a social gesture; it is an automated mechanism for social stratification. This moves beyond Bailey's (1985) concept of the shibboleth by showing that modern gatekeeping is not about mastering a stable dialect, but about possessing the hyper-reflexivity to navigate shifting algorithmic logic. Belonging, therefore, is no longer a status but a high-stakes, continuous performance.

This research extends the TAP by demonstrating that minimalistic signs function as high-context Speech Act Analogs. While Scarantino (2017) focused on physical bodily displays, the researcher argues that a single letter can perform complex declarative and expressive moves simultaneously. This suggests that in mediated environments, linguistic compression does not result in semantic loss but in pragmatic intensification. Future linguistic frameworks must move away from word-based decoding toward contextual-inferential models that account for the liquid nature of meaning in algorithmic spaces.

The emergence of linguistic friction as a defense mechanism against mainstream co-option has profound implications for intergenerational communication. Slang development occurs at a pace that exceeds the ability of traditional dictionaries and AI models to monitor its progress. The generational gap now extends beyond vocabulary differences because slang has developed into a new way of thinking which people use to communicate. Specifically, educators and social practitioners need to go beyond slang translation because they require an understanding of slang. Instead, there must be an emphasis on understanding the affective trust contracts that Gen Z uses to verify sincerity in a low-trust post-pandemic digital landscape.

The finding that platform architectures dictate the velocity of shared meaning suggests that digital infrastructure is never neutral. The automation of social exclusion through Ratioing or Vibe checks indicates that online spaces are currently designed for confrontational gatekeeping rather than inclusive dialogue. Developers and moderators should recognize that linguistic bullying often hides behind minimalistic shorthand. Therefore, digital literacy programs must evolve to address socio-pragmatic policing, helping users navigate environments where social invisibility is the ultimate penalty for linguistic non-fluency.

Conclusion

The present digital slang used after the pandemic has developed into a critical social communication system that people need for their everyday social interactions. The digital shibboleth functions as a linguistic marker that establishes social divisions while it maintains the authentic language of specific subcultures. By re-engineering communication through minimalistic markers, users prioritize affective synchronization and inter-subjective sincerity over factual clarity, intentionally increasing the interpretive labor for out-group members. This research is limited by its reliance on public data and the inherent volatility of an English-centric lexicon. In particular, the underlying flowing meaning model remains a persistent mechanism of digital intimacy. Consequently, while specific terms like Skibidi or Rizz may face rapid obsolescence, the strategic use of brevity to gatekeep digital spaces persists. Future inquiries should therefore shift from static definitions to mathematically modeling the decay rate of these signifiers through interdisciplinary, AI-driven sentiment analysis. The existing educational system requires practical literacy programs that teach digital access control ethics. This helps educators and policy-makers reduce social exclusion risks and digital alienation problems that arise in today's divided online spaces.

References

- Abdelmonem, M., & Karawia, S. (2024). Classroom communications post pandemic: a case study. *Humanities and Social Sciences Communications*, 11(1), 1-11. <https://doi.org/10.1057/s41599-024-03171-6>
- Allott, N. (2013). Relevance theory. In A. Capone, F. Lo Piparo, & M. Carapezza (Eds.), *Perspectives on linguistic pragmatics* (Vol. 2, pp. 57-98). Springer. https://doi.org/10.1007/978-3-319-01014-4_3
- Al-Sa'Di, R. A., & Hamdan, J. M. (2005). "Synchronous online chat" English: Computer-mediated communication. *World Englishes*, 24(4), 409-424. <https://doi.org/10.1111/j.0883-2919.2005.00423.x>
- Bailey, R. (1985). South African English slang: Form, function and origins. *South African Journal of Linguistics*, 3(1), 1-42. <https://doi.org/10.1080/10118063.1985.9724192>
- Barseghyan, L. (2013). On some aspects of Internet slang. *Graduate School of Foreign Languages N*, 14, 19-31. <https://artsakhlib.am/wp-content/uploads/2019/12/Liana-Barseghyan-On-Some-Aspects-of-Internet-Slang.pdf>
- Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. SAGE Publications.
- Damirjian, A. (2025). The social significance of slang. *Mind & Language*, 40(2), 138-156. <https://doi.org/10.1111/mila.12530>
- Danesi, M. (2010). The forms and functions of slang. *Semiotica*, 2010(182), 507-517. <https://doi.org/10.1515/semi.2010.069>
- Daoudi, A. (2011). Globalization, computer-mediated communications and the rise of e-Arabic. *Middle East Journal of Culture and Communication*, 4(2), 146-163. <https://doi.org/10.1163/187398611x571328>
- Fischer, A. H., & Sauter, D. A. (2017). What the Theory of Affective Pragmatics Does and Doesn't Do. *Psychological Inquiry*, 28(2-3), 190-193. <https://doi.org/10.1080/1047840x.2017.1338100>
- Gibson, J. J. (2014). *The Ecological Approach to Visual Perception: Classic Edition* (1st ed.). Psychology Press.

<https://doi.org/10.4324/9781315740218>

- Gregersen, E. M., Astrupgaard, S. L., Jespersen, M. H., Gårdhus, T. P., & Albris, K. (2023). Digital dependence: Online fatigue and coping strategies during the COVID-19 lockdown. *Media, Culture & Society*, 45(5), 967-984. <https://doi.org/10.1177/01634437231154781>
- Gu, M. M., Huang, C. F., & Lin, A. M. Y. (2026). Multilingual and multimodal digital communication in the post-pandemic era. *Journal of Multilingual and Multicultural Development*, 47(1), 1-7. <https://doi.org/10.1080/01434632.2024.2446614>
- Hutchby, I. (2001). *Conversation and technology: From the telephone to the internet*. John Wiley & Sons.
- Kizbaz, A. (2024). Rethinking the shift in communication dynamics post pandemic. In H. Gürkan & A. Serttaş (Eds.), *Transformed communication codes in the mediated world: A contemporary perspective* (pp. 338-352). IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3693-0896-7.ch019>
- Leal Filho, W., Lange Salvia, A., Beynaghi, A., Fritzen, B., Ulisses, A., Avila, L. V., ... & Nikolaou, I. (2024). Digital transformation and sustainable development in higher education in a post-pandemic world. *International Journal of Sustainable Development & World Ecology*, 31(1), 108-123. <https://doi.org/10.1080/13504509.2023.2237933>
- Luu, D. P., Anh, N. H. M., Truc, N. D. T., Dung, L. N., Vi, L. T. T., & Thu, D. T. X. (2025). The socio-pragmatics of digital slang in post-pandemic online communities. *Acta Globalis Humanitatis et Linguarum*, 2(5), 28-39. <https://doi.org/10.69760/aghel.0250050003>
- Markham, A., & Buchanan, E. (2012). *Ethical decision-making and internet research: Recommendations from the AoIR Ethics Working Committee (version 2.0)*. Association of Internet Researchers. <https://aoir.org/reports/ethics2.pdf>
- Mayring, P. (2014). *Qualitative content analysis: Theoretical foundation, basic procedures and software solution*. Klagenfurt. https://www.ssoar.info/ssoar/bitstream/handle/document/39517/ssoar-2014-mayring-Qualitative_content_analysis_theoretical_foundation.pdf
- Melville, A. H. (1912). An investigation of the function and use of slang. *The Pedagogical Seminary*, 19(1), 94-100. <https://doi.org/10.1080/08919402.1912.10532807>
- Moeschler, J. (2002). Speech act theory and the analysis of conversation. *Essays in Speech Act Theory*, 77, 239-262. <https://doi.org/10.1075/pbns.77.15moe>
- Nissenbaum, H. (2004). Privacy as contextual integrity. *Washington Law Review*, 79, 119-158. <https://digitalcommons.law.uw.edu/cgi/viewcontent.cgi?article=4450&context=wlr>
- Rahma, N., & Moetia, M. (2024). An analysis of using slang word in social media X. *Syntax Idea*, 6(8), 3562-3570. <https://doi.org/10.46799/syntax-idea.v6i8.4307>
- Sadock, J. (2006). *Speech acts*. In K. Brown (Ed.), *Encyclopedia of language and linguistics* (pp. 53-73). Wiley-Blackwell. <https://doi.org/10.1002/9780470756959.ch3>
- Scarantino, A. (2017). How to do things with emotional expressions: The theory of affective pragmatics. *Psychological Inquiry*, 28(2-3), 165-185. <https://doi.org/10.1080/1047840x.2017.1328951>

- Schreier, M. (2012). *Qualitative content analysis in practice*. SAGE Publications.
- Searle, J. R. (1969). *Speech acts: An essay in the philosophy of language*. Cambridge University Press.
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research* (Vol. 15, pp. 61-110). SAGE Publications.
- Szablewicz, M. (2020). "Losers" "acting gay": Internet slang, memes, and affective intensities. In *Mapping digital game culture in China* (pp. 143-169). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-36111-2_6
- Townsend, L., & Wallace, C. (2016). Social media research: A guide to ethics. *University of Aberdeen*, 1(16), 1-16. <https://www.scu.edu.au/media/scu-dep/research/documents/hrec/Social-media-research-ethics---University-of-Aberdeen.pdf>
- Verheijen, L. (2017). WhatsApp with social media slang? Youth language use in Dutch written computer-mediated communication. *Investigating computer-mediated communication: Corpus-based approaches to language in the digital world*, 72-101. <https://repository.ubn.ru.nl/bitstream/handle/2066/235915/235915.pdf?sequence=1>
- Walther, J. B. (1992). Interpersonal effects in computer-mediated interaction: A relational perspective. *Communication Research*, 19(1), 52-90. <https://doi.org/10.1177/009365092019001003>
- Wilson, D., & Sperber, D. (2006). *Relevance theory*. In K. Brown (Ed.), *Encyclopedia of language and linguistics* (pp. 606-632). Wiley-Blackwell. <https://doi.org/10.1002/9780470756959.ch27>
- Yus, F. (2009). Relevance theory. In B. Heine & H. Narrog (Eds.), *The Oxford handbook of linguistic analysis* (pp. 679-701). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199544004.013.0027>
- Zappavigna, M. (2012). *Discourse of Twitter and social media*. Bloomsbury Publishing. <https://www.torrossa.com/it/resources/an/5203763>

Corpus Linguistics in Modern Linguistic Research: A Theoretical Review of Evolution, Methodologies, and Future Horizons

Cong Khanh Ly  ¹

¹ M.Ed. in TESOL, English lecturer, Faculty of Foreign Languages, Ho Chi Minh City University of Industry and Trade (HUIT), Vietnam

✉ Corresponding author:
khanhlc@huit.edu.vn



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: This research paper provides a systematic theoretical review of corpus linguistics within modern linguistic research. The primary objective is to clarify the shifting conceptual definitions of a corpus, trace its historical development from manual text collections to the digital era, and evaluate its core methodological frameworks. Using a qualitative desk-research design, this study filters and analyzes core academic texts and foundational literature published since the 1960s. The results show that the definition of a corpus has evolved from a loose text collection into a highly structured, digital dataset designed for specific research questions. Furthermore, historical data highlights major technological milestones, such as the creation of early computer corpora and the rise of mega-corpora, which shifted linguistics into an empirical science. The analysis also reveals that while the field remains theoretically divided between corpus-based and corpus-driven methods, modern applied linguistics increasingly blends both approaches to solve practical problems. The significance of these findings lies in their application to language education and artificial intelligence. Understanding corpus design helps practitioners build accurate language teaching materials while providing the baseline data needed to train natural language processing tools, ensuring that future digital innovation remains anchored in natural human communication.

KEYWORDS: corpus, corpus-based, corpus-driven, corpus linguistics, applied linguistics, digital data.

How to cite: Ly, C. K. (2026). Corpus Linguistics in Modern Linguistic Research: A Theoretical Review of Evolution, Methodologies, and Future Horizons. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21261626>

Introduction

For a long time, linguistic research relied heavily on the personal intuition and theoretical reflection of scholars. Researchers often create their own examples to analyze language structures. However, the rise of computing technology in the late twentieth century shifted the discipline toward empirical, evidence-based approaches. At the center of this change is corpus linguistics, which investigates language through large, digital collections of real-world texts known as corpora. Today, corpus linguistics is recognized as a powerful methodological framework rather than an isolated theory. It allows linguists to discover what is actually frequent and natural in daily communication (McEnery & Brezina, 2022). Despite its widespread use, the field currently faces several challenges. First, as digital technology advances, the precise definition and boundaries of a corpus are becoming less clear (Gauthier, 2025). Many researchers struggle to collect data that truly reflects real language use. Second, scholars continue to debate whether a corpus should only be used to validate existing theories, or if the data itself should drive the creation of new linguistic descriptions (Tognini-Bonelli, 2001). Finally, there is a gap between rapid technological developments and basic research practices. Many language practitioners use advanced software and digital vocabulary materials, but they often lack a clear understanding of how the underlying corpus data was designed (Crosthwaite, 2024). This challenge is further intensified in the era of artificial intelligence, where language teachers increasingly rely on automated platforms and Large Language Models (LLMs) to generate and evaluate ELT coursebooks without grounding these data-driven analyses in established linguistic theories (Ly, 2026a).

This lack of methodological clarity can lead to errors in data analysis. To address these issues, researchers need a systematic overview of the field. This research paper provides a concise review of corpus linguistics by examining its historical development, clarifying its core methodologies, and outlining its future directions in modern applied linguistics.

Research Aim and Research Questions

The primary objective of this research paper is to provide a systematic and critical review of corpus linguistics within modern linguistic research. Specifically, this study aims to clarify the shifting definitions of a corpus, trace its historical development from early text collections to the digital era, and evaluate its core methodological frameworks. By doing so, the paper seeks to address current challenges in data interpretation and outline the future directions of corpus applications in an increasingly technology-driven academic landscape.

To achieve this main goal, the study synthesizes the evolving conceptual boundaries of a corpus in existing literature, identifies the key technological shifts that drove the historical evolution of the discipline, and analyzes the practical contributions and methodological divisions in modern corpus applications.

To guide the investigation, this study addresses the following three research questions:

1. **RQ1:** How is the concept of a corpus defined, characterized, and classified in foundational and current linguistic literature?
2. **RQ2:** What are the key historical milestones and technological changes that have shaped the evolution of corpus linguistics?

3. **RQ3:** What are the core methodological approaches in corpus studies, and how do they inform the future directions of modern applied linguistics?

Literature Review

1. Definitions and Classifications of a Corpus

To understand the scientific value of corpus linguistics, researchers must first establish what a corpus actually is. Early studies defined it simply as any collection of texts chosen for language analysis (Francis & Kučera, 1982). As computer tools advanced, Sinclair (2004b) emphasized that a true corpus must consist of naturally occurring texts, collected according to strict rules. Modern scholars state that a corpus must be digital, organized, representative, and limited in size (McEnery & Hardie, 2012).

Previous literature divides corpora into specific types based on research goals. General corpora, like the British National Corpus, represent a language as a whole (Biber et al., 2021). In contrast, specialized corpora focus on narrow areas, such as academic (Chang, 2014) or medical language (Florescu & Ohniwa, 2025). While these divisions are well-known, the rapid rise of internet communication challenges these traditional categories, creating a clear need to review how these definitions adapt to new digital formats. Moreover, from a pedagogical perspective, the structural representative of specialized corpora serves as a baseline for evaluating materials, ensuring that selected resources achieve an appropriate skills-systems balance and align with learners' needs (Ly, 2025).

2. Historical Development and Technological Shifts

The history of corpus linguistics is closely tied to computer progress. Before the 1960s, empirical language study relied on manual data collection, in which researchers used paper index cards to count word frequencies (Kennedy, 1998). This early era required a lot of hard work, which greatly limited the size and scope of datasets. The field experienced a major change with the creation of the Brown Corpus in the 1960s, which contained one million words of written American English (Meyer, 2002). This project proved that computers could successfully store and analyze large amounts of language data.

During the 1990s, the discipline grew quickly with the development of large corpora containing hundreds of millions of words (Brezina, 2018). Scholars like Biber (1993) showed that these big datasets allowed for accurate statistical analyses of grammatical patterns and text variations. Understanding this history is important because it shows how current computer limits directly affect data reliability.

3. Methodological Divisions: Corpus-Based versus Corpus-Driven

A major point of discussion in previous research is the methodological division between corpus-based and corpus-driven approaches. Tognini-Bonelli (2001) clearly explained this distinction, which remains central to modern debates. A corpus-based approach uses corpus data mainly to check, test, or change existing linguistic theories (Xiao, 2008). In this model, the theory remains the main driver, and the corpus serves as a tool to validate it.

On the other hand, a corpus-driven approach claims that the data itself should be the only source of linguistic description (Biber, 2015). Researchers allow the patterns within the corpus to create new theoretical ideas without pre-existing assumptions. Recent reviews show that while this distinction is

clear in theory, practical applications often mix the two approaches (McEnery & Hardie, 2012). Many modern studies combine elements of both methods without a clear reason. This lack of clarity can weaken the validity of the research findings, which is why a clear review of these core methods is essential. Recent conceptual investigations reiterate this concern, arguing that advanced computational and AI-supported tools must function purely as analytical supports rather than autonomous evaluators to maintain theoretical integrity (Ly, 2026b).

Research Methodology

This study uses a qualitative desk research design to conduct a systematic review of the corpus linguistics literature. As a theoretical review, the methodology focuses on a clear process of selecting, filtering, and analyzing published academic texts to ensure reliability (Snyder, 2019).

The research process followed three main steps. First, an initial search was conducted across major databases, including Scopus, Google Scholar, Web of Science, and ResearchGate. The search terms included "*corpus linguistics definition*", "*history of corpus linguistics*", and "*corpus-based versus corpus-driven*". The search was limited to books, book chapters, and peer-reviewed journal articles.

Second, strict selection rules filtered the texts. To be included, publications had to focus directly on the theoretical development or methodology of corpus linguistics and be published by recognized academic sources. General opinion pieces, brief abstracts, and non-academic web sources were excluded, leaving a final selection of core texts from the 1980s to recent papers.

Finally, the selected literature was analyzed using thematic analysis based on three categories: conceptual definitions, historical milestones, and methodological frameworks. Comparing these categories allows this study to identify the main theoretical shifts in the discipline.

Research Results and Discussion

The analysis of the selected literature provides clear answers to the three research questions regarding the definitions, history, and methods of corpus linguistics.

1. Conceptual Definitions and Classifications

Regarding RQ1, the results show that the definition of a corpus has evolved from a loose collection of texts into a highly structured dataset. Foundational literature initially viewed a corpus as a general collection of texts used for language analysis (Francis & Kučera, 1982; Sinclair, 2004a). In contrast, current literature establishes strict criteria: modern corpora must be digital, systematically organized, and representative of a specific language variety (McEnery & Hardie, 2012; Wynne, 2005). To achieve representativeness, researchers now balance their data selection across different text genres rather than just gathering a large volume of words. They must account for variables like spoken versus written modes, formal versus informal registers, and demographic factors (Ne'matova & Hakima, 2025; Szmrecsanyi & Engel, 2023).

Furthermore, classifications have expanded. While early research relied mostly on general corpora to study whole languages, current studies frequently utilize specialized, parallel, and learner corpora (Hakima & Iroda, 2025). These specialized tools allow researchers to target the specific linguistic features of distinct professional domains. This shift indicates that a corpus is no longer just a

passive storage of words, but an active tool designed for specific research questions (Egbert et al., 2022)s.

2. Historical Milestones and Technological Shifts

For RQ2, the historical data highlights two major technological milestones. The first milestone was the transition from manual counting to computer storage in the 1960s, marked by the creation of the Brown Corpus (Francis & Kučera, 1982; Kholkovskaia, 2017). This shift allowed researchers to move past paper index cards and analyze one million words efficiently.

The second milestone occurred in the 1990s with the rise of mega-corpora like the British National Corpus, which expanded data sizes to hundreds of millions of words (Biber, 1993; Friginal et al., 2014). These technological changes did not just make data collection faster; they changed linguistic theory by proving that rare grammatical patterns can only be detected through massive datasets. Instead of relying on personal opinions, linguists can now use real frequency numbers to describe how people actually use language. This empirical shift forced researchers to re-examine traditional grammar rules, as corpus data often revealed that actual language use differs significantly from textbook examples (Li, 2024).

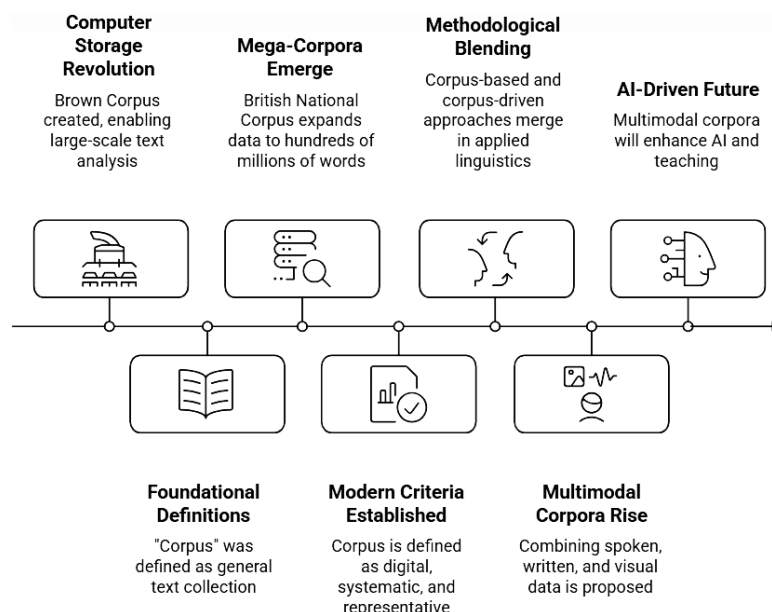
3. Methodological Approaches and Future Horizons

For RQ3, the results confirm that the field remains theoretically divided between corpus-based and corpus-driven methodologies (Lu et al., 2021; Tognini-Bonelli, 2001). The corpus-based approach uses data to test pre-existing theories, while the corpus-driven approach allows data to form new theories from scratch (Meyer, 2014). However, this strict division is becoming less useful in practice. Modern researchers usually combine both methods to analyze actual texts more effectively. A study might begin with an existing theoretical framework but remain open to new patterns that emerge from the software analysis.

These methodologies directly inform the future of the discipline. As language research enters the era of artificial intelligence, the focus is moving toward multimodal corpora that combine spoken, written, and visual data (Zhao & Nazir, 2022). Future studies will focus on how these integrated datasets can improve language teaching materials and natural language processing tools, ensuring that corpus linguistics remains central to digital innovation (Ali et al., 2026). In local contexts, such as higher education in Vietnam, integrating these technology-enhanced corpus tools can effectively foster learner autonomy and bridge the gap between theoretical insights and digital classroom applications (Tran & Ly, 2025).

Figure 1

Key milestones in corpus linguistics (Source: author's own development)



Conclusions

This theoretical review has synthesized the development of corpus linguistics across its definitions, history, and methods. The recapitulation shows that a corpus has evolved from a simple text collection into a structured, digital tool. Major technological milestones, including early computer storage and the rise of mega-corpora, have transformed linguistics into an empirical science, making traditional methodological divisions more flexible in modern practice.

These findings carry important implications for language education and digital research. For practitioners, corpus insights help design accurate teaching materials based on real-world usage rather than intuition. For the broader scientific community, corpus methodologies provide the baseline data needed to train modern artificial intelligence and natural language processing tools, ensuring machine learning reflects natural human communication.

However, this study has certain limitations, as it focuses primarily on written text corpora and relies heavily on Western linguistic frameworks. For further research in the future, it is highly recommended that scholars investigate multimodal corpora, combining visual and spoken data to better capture digital communication. Future studies should also explore how novice researchers in diverse geographic contexts adapt corpus design rules to local language teaching needs, ensuring continuous innovation in the discipline.

References

- Ali, M., Ali, N., & Khuram, M. (2026). Corpus Studies, Current Trends and Future Directions. *Contemporary Journal of Social Science Review*, 4(1), 122-136. <https://doi.org/10.63878/cjssr.v4i1.1876>
- Biber, D. (1993). Representativeness in Corpus Design. *Literary and Linguistic Computing*, 8(4), 243-257. <https://doi.org/10.1093/llc/8.4.243>

- Biber, D. (2015). Corpus-Based and Corpus-Driven Analyses of Language Variation and Use. In B. Heine, & H. Narrog (Eds.), *The Oxford Handbook of Linguistic Analysis* (2nd ed., pp. 193-224). Oxford Academic. <https://doi.org/10.1093/oxfordhb/9780199677078.013.0008>
- Biber, D., Johansson, S., Leech, G. N., Conrad, S., & Finegan, E. (2021). *Grammar of Spoken and Written English*. John Benjamins Publishing Company. <https://doi.org/10.1075/z.232>
- Brezina, V. (2018). *Statistics in Corpus Linguistics: A Practical Guide*. Cambridge University Press. <https://doi.org/10.1017/9781316410899>
- Chang, J.-Y. (2014). The use of general and specialized corpora as reference sources for academic English writing: A case study. *ReCALL*, 26(2), 243-259. <https://doi.org/10.1017/S0958344014000056>
- Crosthwaite, P. (Ed.). (2024). *Corpora for Language Learning: Bridging the Research-Practice Divide* (1st ed.). Routledge. <https://doi.org/10.4324/9781003413301>
- Egbert, J., Biber, D., & Gray, B. (2022). Corpus Design and Representativeness in Practice – With Daniel Keller. In J. Egbert, D. Biber, & B. Gray (Eds.), *Designing and Evaluating Language Corpora: A Practical Framework for Corpus Representativeness* (pp. 177-219). Cambridge University Press. <https://doi.org/10.1017/9781316584880.007>
- Florescu, C. M., & Ohniwa, R. L. (2025). On the replicability of corpus-derived medical word lists. *Applied Corpus Linguistics*, 5(2), 100130. <https://doi.org/10.1016/j.acorp.2025.100130>
- Francis, W. N., & Kučera, H. (1982). *Frequency Analysis of English Usage: Lexicon and Grammar*. Houghton Mifflin.
- Friginal, E., Walker, M., & Randall, J. B. (2014). Exploring mega-corpora: Google Ngram Viewer and the Corpus of Historical American English. *EuroAmerican Journal of Applied Linguistics and Languages*, 1(1), 48-68. <https://doi.org/10.21283/2376905X.1.4>
- Gauthier, L. (2025). Digital Humanities and the Notion of Corpus in Ancient History. *Digital Studies/Le champ numérique*, 15(1), 1-28. <https://doi.org/10.16995/dscn.18169>
- Hakima, A., & Iroda, A. (2025). Types of Corpora: General, Specialized, and Parallel. *THEORY OF SCIENTIFIC RESEARCHES OF WHOLE WORLD*, 2(5), 36-39. Retrieved June 11, 2026, from <https://esiconf.org/index.php/TOSROF/article/view/6038/6026>
- Kennedy, G. (1998). *An Introduction to Corpus Linguistics*. Routledge.
- Kholkovskaia, O. (2017). Role of the Brown Corpus in the History of Corpus Linguistics. *Poster 2017 Proceedings*. Prague: Sciencesconf. Retrieved June 11, 2026, from https://poster.fel.cvut.cz/poster2017/proceedings/Poster_2017/Section_HS/HS_018_Kholkovskaia.pdf
- Li, L. X. (2024). Developing Strategies to Improve Textbook Design Using Synergy of Native and Learner Corpora. *Journal of Psycholinguistic Research*, 53, 76. <https://doi.org/10.1007/s10936-024-10116-2>
- Lu, R., Ali, A. M., & Ghani, C. A. (2021). A Comparative Study of Corpus-based and Corpus-driven Approaches. *Linguistics International Journal*, 15(2), 119-132. Retrieved June 11, 2026, from https://www.researchgate.net/publication/358125006_A_Comparative_Study_of_Corpus-based_and_Corpus-driven_Approaches
- Ly, C. K. (2025). Language Teaching Materials Evaluation: Principles from Theoretical Perspectives. *World Conference on Emerging Science, Innovation and Policy 2025*. 3. Poland: Futurity Research Publishing. <https://doi.org/10.5281/zenodo.15961001>

- Ly, C. K. (2026a). Artificial Intelligence in Language Teaching Materials: A Review of Current Trends and Future Directions. *Conference Proceedings The First SVAIL International Conference: Language Research and Teaching with AI*. Ho Chi Minh City, Vietnam: Social Sciences Publishing House. Retrieved from <https://drive.google.com/file/d/1YWCYr4UtPKeBTy5c8w0dT7YLMJVMWEm-/view>
- Ly, C. K. (2026b). Revisiting Linguistic Evaluation of ELT Coursebooks in the Era of AI. *International Multidisciplinary Conference on Innovation, Technology and Sustainability*. Poland: Futurity Research Publishing . <https://doi.org/10.5281/zenodo.18835734>
- McEnery, T., & Brezina, V. (2022). Everyday Linguistics: Form and Function. In T. McEnery, & V. Brezina, *Fundamental Principles of Corpus Linguistics* (pp. 154-183). Cambridge University Press. <https://doi.org/10.1017/9781107110625.007>
- McEnery, T., & Hardie, A. (2012). *Corpus Linguistics: Method, Theory and Practice*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511981395>
- Meyer, C. F. (2002). Corpus analysis and linguistic theory. In C. F. Meyer, *English Corpus Linguistics: An Introduction* (pp. 1-29). Cambridge University Press. <https://doi.org/10.1017/CBO9780511606311.002>
- Meyer, C. F. (2014). Corpus-based and corpus-driven approaches to linguistic analysis: one and the same? In I. Taavitsainen, M. Kytö, C. Claridge, & J. Smith (Eds.), *Developments in English: Expanding Electronic Evidence* (pp. 14-28). Cambridge University Press. <https://doi.org/10.1017/CBO9781139833882.004>
- Ne'matova, D., & Hakima, A. (2025). Differences between Written and Spoken Corpora. *Models and Methods in Modern Science*, 4(16), 93-95. <https://doi.org/10.5281/zenodo.17974462>
- Sinclair, J. (2004). Corpus and Text – Basic Principles. In M. Wynne (Ed.), *Developing Linguistic Corpora: A Guide to Good Practice*. Oxbow Books. Retrieved June 11, 2026, from <https://users.ox.ac.uk/~martinw/dlc/chapter1.htm>
- Sinclair, J. (2004). *Trust the Text: Language, Corpus, and Discourse*. Routledge.
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333-339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Szmrecsanyi, B., & Engel, A. (2023). A variationist perspective on the comparative complexity of four registers at the intersection of mode and formality. *Corpus Linguistics and Linguistic Theory*, 19(1), 79-113. <https://doi.org/10.1515/cllt-2022-0031>
- Tognini-Bonelli, E. (2001). *Corpus Linguistics at Work*. John Benjamins Publishing Company. <https://doi.org/10.1075/scl.6>
- Tran, T. N., & Ly, C. K. (2025). *Integrating Information Technology in Foreign Language Education: Theoretical Foundations and Pedagogical Applications*. Nhà xuất bản Đại học Sư Phạm TP Hồ Chí Minh.
- Wynne, M. (2005). *Developing Linguistic Corpora: a Guide to Good Practice*. Oxbow Books. Retrieved June 11, 2026, from <https://users.ox.ac.uk/~martinw/dlc/index.htm>
- Xiao, R. Z. (2008). Theory-driven corpus research : using corpora to inform aspect theory. In A. Lüdeling, & M. Kytö (Eds.), *Corpus Linguistics: An International Handbook* (Vol. 1). Mouton de Gruyter.
- Zhao, Q., & Nazir, S. (2022). English Multimode Production and Usage by Artificial Intelligence and Online Reading for Sustaining Effectiveness. *Mobile Information Systems*, 2022, 6780502. <https://doi.org/10.1155/2022/6780502>

SECTION

Law Sciences



Futurity Research Publishing

Intellectual Property Law in the Context of International Economic Integration

Dang Hai Long^{1*}, Nguyen Thi Quynh Anh²

¹ Mien Dong Innovative
Technology University,
Vietnam

² Tan Tao University,
Vietnam

✉ ***Corresponding author:**
danghailonghp@gmail.com



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: In the context of deepening international economic integration, intellectual property (IP) law plays a crucial role in safeguarding the rights of creators and enhancing national competitiveness. This article investigates the evolution of Vietnam's intellectual property (IP) legal framework in alignment with international commitments, while critically evaluating persistent discrepancies in practical enforcement. Using a qualitative methodology, the study conducts a systematic analysis of domestic regulations against the standards prescribed by the TRIPS Agreement, CPTPP, and EVFTA. The research primarily relies on secondary data, including domestic legal documents, international treaties, reports from international organizations, and selected case studies of representative disputes from 2015 to 2024. The findings indicate that Vietnam has made significant progress in internalizing international intellectual property commitments, thereby strengthening its legal framework to better align with global standards. However, a substantial gap persists between legal provisions and their practical application. This gap is reflected in the limited effectiveness of enforcement mechanisms, constraints on institutional and judicial capacity, and insufficient compliance awareness and underdeveloped "intellectual ethics" in business practices. Based on these findings, the article concludes that enhancing the effectiveness of IP law enforcement requires a comprehensive approach that combines further legal refinement, strengthening institutional capacity, and fostering a culture of compliance amid ongoing international integration.

KEYWORDS: intellectual property, economic integration, law enforcement, international commitments, legal harmonization" và "enforcement efficiency, Vietnam

How to cite: Hai Long, D., & Thi Quynh Anh, N. (2026). Intellectual Property Law in the Context of International Economic Integration. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing.
<https://doi.org/10.5281/zenodo.20841462>

Introduction

In the context of deepening globalization and international economic integration, intellectual property (IP) has emerged as a fundamental pillar of the knowledge-based economy, contributing to innovation, enhancing national competitiveness and maintaining a fair and efficient business environment. For Vietnam, accession to the World Trade Organization (WTO), together with participation in new-generation free trade agreements such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the EU-Vietnam Free Trade Agreement (EVFTA), has created an urgent need to further develop its intellectual property legal framework in line with international standards.

In recent years, Vietnam has made considerable efforts to amend and refine its IP legislation, progressively internalizing international commitments and aligning domestic law with global practices. Notwithstanding these advancements, practical enforcement of intellectual property rights remains limited, resulting in a significant gap between legal provisions and their implementation in practice.

The issue of intellectual property law in the context of international integration has been extensively examined in the global literature from multiple perspectives. At the institutional level, the TRIPS Agreement is widely regarded as the foundational framework that establishes minimum standards for the protection and enforcement of intellectual property rights and guides the process of legal harmonization among member states. From a theoretical standpoint, the level of IP protection is closely associated with a country's stage of economic development and degree of integration, with seminal studies demonstrating that stronger protection not only safeguards creators' interests but also supports strategies for attracting foreign investment and facilitating technology transfer.

From an empirical perspective, a substantial body of research has analyzed the impact of strengthened IP protection on economic growth, innovation, and foreign direct investment flows. The findings generally suggest that aligning legal frameworks with international standards can generate positive outcomes; however, such effects are contingent upon institutional capacity and the effectiveness of enforcement mechanisms within individual countries. Notably, recent studies have shifted their focus from assessing the "level of protection on paper" to examining the "effectiveness of enforcement in practice," thereby highlighting the persistent gap between legal rules and their real-world application—particularly in developing economies. Despite significant theoretical and empirical contributions, existing studies still exhibit certain limitations, especially the lack of systematic analyses addressing the interplay between international integration requirements, legislative techniques, and enforcement capacity at the national level. Against this backdrop, this article seeks to examine the evolution of Vietnam's intellectual property legal framework in response to international commitments, while critically assessing its enforcement challenges. In doing so, the study aims to elucidate the gap between

legal norms and practical application and to propose directions for further legal and institutional improvement in the context of ongoing international integration.

Methodologies and Data

This article adopts a qualitative research approach as the primary methodology, combined with a descriptive framework, to systematically analyze Vietnam's intellectual property (IP) legal provisions in the context of international economic integration. This approach enables a comprehensive examination of the legal nature of existing regulations and identifies gaps and deficiencies in their practical implementation.

With regard to specific methods, the study first employs analytical and synthetic techniques to systematize Vietnam's IP legal framework, with particular emphasis on provisions relating to the protection and enforcement of intellectual property rights in light of international commitments such as the TRIPS Agreement, the CPTPP, and the EVFTA. Building on this foundation, a comparative method is utilized to examine the extent to which Vietnam's legal system aligns with international standards, thereby assessing the degree of legal harmonization and the process of internalizing international obligations. In addition, case-based analysis and descriptive examination of practice are applied to illustrate issues arising in the enforcement of intellectual property rights in Vietnam. These include common forms of infringement such as copyright violations in the digital environment, as well as the production and distribution of counterfeit and trademark-infringing goods. Through the analysis of these practical manifestations, the study seeks to clarify the gap between legal provisions and their effectiveness in real-world application. In terms of data, the research primarily relies on secondary sources, including: (i) Vietnam's legal documents on intellectual property, particularly the Law on Intellectual Property and its implementing regulations; (ii) relevant international treaties to which Vietnam is a party; (iii) reports and publications from international organizations such as the WTO and WIPO; and (iv) academic literature from both domestic and international scholars. In addition, selected empirical data are drawn from reports issued by competent state authorities and publicly available sources to support the analysis and provide practical illustrations. The qualitative and descriptive approach adopted in this study does not aim to quantify the economic impacts of intellectual property law; rather, it focuses on elucidating core legal issues, thereby providing a scientific basis for proposing solutions to improve the legal framework and enhance the effectiveness of enforcement in the context of ongoing international economic integration.

Results and Discussion

The Gap Between Legal Provisions and Practical Enforcement (Gap Analysis)

The analysis indicates that Vietnam has achieved a relatively high level of alignment between its intellectual property (IP) legal framework and international commitments, particularly under the TRIPS Agreement, the CPTPP, and the EVFTA. Provisions concerning the scope and duration of protection, as

well as enforcement mechanisms, have been progressively amended and refined to approximate international standards, most notably through the 2022 amendments to the Law on Intellectual Property.

However, a significant gap persists between “law on the books” and “law in practice.” In reality, infringements of intellectual property rights remain widespread, particularly in areas such as digital copyright, trademarks, and industrial designs. These violations have become increasingly sophisticated, often occurring in digital and cross-border environments, while existing enforcement mechanisms have not kept pace in terms of both legal instruments and regulatory capacity. A comparison with the obligations set out in the CPTPP and the EVFTA reveals that, although Vietnam has internalized many commitments related to the protection and enforcement of intellectual property rights, the implementation of key mechanisms -such as border control measures against infringing goods, enforcement in digital platforms, and protection of rights in online environments-remains limited. This disparity highlights that the formal completeness of legal provisions does not necessarily translate into effective enforcement.

Challenges in Public Governance and Judicial Capacity

One of the primary causes underlying the aforementioned gap lies in the limitations of public governance and the judicial system. First, coordination mechanisms among IP enforcement authorities-including inspectorates, market surveillance agencies, customs authorities, and judicial bodies-remain fragmented and insufficiently integrated, leading to overlaps and inefficiencies in addressing infringements. Moreover, the professional capacity of enforcement officials and judicial personnel has yet to fully meet the demands of increasingly complex intellectual property disputes, particularly those involving high technology and digital environments. The absence of specialized intellectual property courts, coupled with difficulties in assessing damages and gathering evidence, has further undermined the effectiveness of judicial protection mechanisms. Judicial practice demonstrates that many IP infringement cases, especially those involving trademarks and copyright, are often subject to prolonged resolution periods, while compensation levels remain insufficient to serve as an effective deterrent. These shortcomings not only adversely affect the legitimate interests of rights holders but also weaken public confidence in the effectiveness of the legal system as a whole.

The Impact of International Integration on Business Behavior and “Intellectual Ethics”

International economic integration has significantly changed the behavior of business actors while simultaneously imposing new requirements for the development and consolidation of “intellectual ethics” in the business environment. On the one hand, the strengthening of intellectual property (IP) protection under international commitments has encouraged enterprises to place greater emphasis on the registration, protection, and commercialization of intellectual assets as a source of competitive advantage. In the context of deeper participation in new-generation free trade agreements, intellectual

property rights are no longer merely legal instruments for safeguarding creative outputs; rather, they have evolved into strategic assets closely associated with brand value, innovation capacity, and firms' positioning in international markets. On the other hand, empirical evidence indicates that a considerable proportion of enterprises and individuals still fail to fully comply with intellectual property regulations. Practices such as software piracy, unauthorized use of digital content, and the production and distribution of trademark-infringing goods remain widespread, reflecting limitations in legal awareness and compliance culture. Notably, in the digital and e-commerce environment, infringement activities have become increasingly sophisticated, difficult to detect, and inherently cross-border in nature, thereby intensifying challenges for enforcement mechanisms.

In the context of international integration, the divergence between international legal standards and domestic business practices further underscores the issue of "intellectual ethics." This concept extends beyond mere legal compliance to encompass norms of conduct and corporate social responsibility. "Intellectual ethics" may be understood as respect for the intellectual property rights of others, manifested through the avoidance of unauthorized exploitation, reproduction, or use of protected intellectual products. However, in a transitional economy, where consumption patterns and business practices have not yet fully adapted to international standards, the development of a robust foundation in intellectual ethics remains a gradual and complex process. Practical experience from representative disputes clearly illustrates this pressure. Cases involving trademark infringement in consumer goods markets, copyright violations on digital platforms, and industrial design disputes demonstrate an increasing trend in both frequency and complexity. As Vietnamese enterprises integrate more deeply into global value chains, non-compliance with intellectual property standards may give rise to significant legal risks, including international disputes, reputational damage, and restricted market access.

From a comparative perspective, commitments under the CPTPP and the EVFTA impose higher standards for the protection and enforcement of intellectual property rights, particularly in relation to the digital environment and the application of civil and administrative remedies. While Vietnam has made notable adjustments to its legal framework, the effective implementation of these standards remains limited. The gap between legal provisions and enforcement outcomes not only reflects constraints in institutional capacity but also indicates deficiencies in legal culture and business ethics. Accordingly, the impact of international integration extends beyond the refinement of the legal framework, necessitating a restructuring of business behavior toward greater transparency, compliance, and respect for intellectual property rights. The development of "intellectual ethics" should therefore be regarded as a critical component of sustainable development, requiring coordinated efforts among the state, enterprises, and society. Only by narrowing the gap between legal norms and actual practices can the intellectual property system effectively fulfill its role in the context of deepening international economic integration. From the foregoing analysis, it can be concluded that although

Vietnam has made significant progress in improving its intellectual property legal framework to meet the demands of international integration, limitations in enforcement, governance capacity, and societal awareness remain substantial barriers. The gap between legal provisions and their practical application is not merely a technical legal issue but reflects broader systemic challenges inherent in the process of integration and development.

Ultimately, while technical and institutional reforms are foundational, they are not sufficient on their own. The persistent challenges in IP enforcement highlight a deeper, normative issue: the lack of a mature ethical framework. The term 'intellectual ethics' transcends mere legal adherence; it encompasses a broader paradigm of corporate social responsibility and a profound respect for intellectual contributions, which remains in a nascent stage within Vietnam's transitional economy. Addressing this ethical dimension is therefore imperative for the long-term sustainability of intellectual property protection in Vietnam.

Conclusion

Based on a systematic analysis of theoretical, legal, and practical dimensions, this study demonstrates that Vietnam has made significant progress in refining its intellectual property (IP) legal framework to meet international commitments in the context of global economic integration. The process of internalizing international standards—particularly those embodied in the TRIPS Agreement, the CPTPP, and the EVFTA—has contributed to the development of an increasingly comprehensive legal system, closely aligned with international practices and providing a stronger foundation for the protection of intellectual property rights.

However, the findings also reveal that the gap between legal provisions and their practical application remains a central issue, reflecting limitations in enforcement capacity, public governance, and societal awareness. The analysis of enforcement gaps, judicial capacity, and business behavior indicates that, while legal reform is necessary, it is not sufficient to ensure effective protection of intellectual property rights in practice. This challenge is further exacerbated in the context of the digital economy and deepening international integration, where emerging issues—such as cross-border infringement, e-commerce-related violations, and the underdevelopment of "intellectual ethics"—have become increasingly complex and difficult to address. From a scientific perspective, this study contributes to the literature by advancing an analytical framework that links international integration requirements with the effectiveness of domestic legal enforcement. It highlights that formal legal alignment with international standards does not automatically translate into practical effectiveness. The primary contribution of this research lies in emphasizing the systemic nature of intellectual property governance, where enforcement outcomes depend not only on legal design but also on institutional capacity, enforcement mechanisms, and the broader legal culture within society.

From a practical and policy-oriented perspective, the findings suggest that improving the effectiveness of IP law enforcement requires a comprehensive and coordinated approach. In addition to further refining the legal framework, priority should be given to strengthening the capacity of enforcement authorities, enhancing inter-agency coordination, improving judicial mechanisms, and, importantly, raising awareness and compliance among businesses and the public. At the same time, the development and consolidation of “intellectual ethics” should be regarded as a key pillar of sustainable economic development in the context of international integration. This study is subject to certain limitations. Because it relies on qualitative methods and secondary data, it does not quantify the impact of legal factors on the effectiveness of intellectual property enforcement. Moreover, the analysis focuses on the general legal framework and overall practice, without examining specific sectors such as digital copyright, patents, or trademarks in particular industries. Future research may address these limitations by incorporating quantitative methods to measure the impact of IP law on economic growth, innovation, and business behavior. Further studies could also adopt sector-specific approaches or conduct comparative analyses between Vietnam and other countries in the region to better identify the determinants of effective enforcement. In addition, examining the implications of emerging technologies-such as digital platforms, artificial intelligence, and new business models-for the intellectual property system represents a promising direction for future inquiry in the context of ongoing international economic integration. Overall, this study affirms that the most pressing challenge today lies not in the creation of additional legal provisions but in ensuring their feasibility and effective implementation in practice. This constitutes a fundamental prerequisite for intellectual property law to function as a meaningful instrument for economic development and sustainable integration.

References

- Amentae, T. K., Song, W., & Wang, J. (2024). Intellectual property rights in the agri-food chains: A systematic review and bibliometric analysis. *World Patent Information*, 76, 102279. <https://doi.org/10.1016/j.wpi.2024.102279>
- Biancini, S., & Bombarda, P. (2021). Intellectual property rights, multinational firms and technology transfers. *Journal of Economic Behavior & Organization*, 185, 191-210. <https://doi.org/10.1016/j.jebo.2021.02.009>
- Chen, Y., & Puttitanun, T. (2005). Intellectual property rights and innovation in developing countries. *Journal of Development Economics*, 78(2), 474-493. <https://doi.org/10.1016/j.jdeveco.2004.11.005>
- Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). (2018). *Chapter 18: Intellectual property*. <https://vntr.moit.gov.vn/storage/agreement/cptpp/1-chapters/vietnamese/18-chuong-so-huu-tri-tue-vie.pdf>

- Darshan, P., et al. (2025). *Intellectual property rights and entrepreneurship in the NFT ecosystem* (arXiv:2507.00172). <https://arxiv.org/abs/2507.00172>
- European Commission. (2020). *EU-Vietnam Free Trade Agreement (EVFTA): Chapter 12 - Intellectual property*. https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/viet-nam/eu-viet-nam-agreements/texts-agreements_en
- Nguyễn, T. Q. A. (2024). *Hoàn thiện pháp luật sở hữu trí tuệ Việt Nam trong bối cảnh tham gia các hiệp định thương mại tự do thế hệ mới*. Nhà xuất bản Chính trị quốc gia Sự thật.
- Nguyễn, V. H. (2024). Quyền sở hữu trí tuệ trong kỷ nguyên AI: Thực trạng và giải pháp tại Việt Nam. *Tạp chí Nghiên cứu lập pháp*, (19), 25-35.
- Quốc hội nước Cộng hòa xã hội chủ nghĩa Việt Nam. (2005, sửa đổi 2009, 2019, 2022). *Luật Sở hữu trí tuệ*. <https://thuvienphapluat.vn/van-ban/So-huu-tri-tue/Luat-So-huu-tri-tue-2005-50-2005-QH11-7022.aspx>
- Qian, Y. (2007). Do national patent laws stimulate domestic innovation in a global patenting environment? *Review of Economics and Statistics*, 89(3), 436-453. <https://doi.org/10.1162/rest.89.3.436>
- Thủ tướng Chính phủ. (2023). *Nghị định số 13/2023/NĐ-CP ngày 17/4/2023 về bảo vệ dữ liệu cá nhân*.
- Trần, T. B. Á. (2025). Hoàn thiện khung pháp lý cho các doanh nghiệp khoa học công nghệ khởi nguồn từ các viện nghiên cứu, trường đại học. In *Kỷ yếu Hội thảo khoa học, Trường Đại học Luật Hà Nội*.
- World Intellectual Property Organization (WIPO). (2024). *Global innovation index 2024: Unlocking the promise of social entrepreneurship*. <https://www.wipo.int/edocs/en/wipo-pub-2000-2004-en-gu-2024.pdf>
- World Intellectual Property Organization (WIPO). (2025). *World intellectual property indicators 2025*. <https://www.wipo.int/publications/en/details.jsp?id=4822>

SECTION

Philosophical sciences



Futurity Research Publishing

Socratic Intellectualism and the Identity of Knowledge and Virtue: Foundations of Rational Ethics

Zauresh Otengenkizi¹, Aigul Niyazbayeva², Elena Stavrova^{3*}

¹PhD, Associate Professor
NJSC "K. Zhubanov Aktobe
Regional University",
Kazakhstan

²NJSC "K. Zhubanov Aktobe
Regional University",
Kazakhstan

³PhD, Associate Professor
SWU "N. Rilski", Blagoevgrad,
Bulgaria

Corresponding author: stavrova@swu.bg



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: This study examines the philosophical foundations of Socratic ethics and explores their relevance for contemporary discussions in business ethics and ethical leadership. The research focuses on the central principle of Socratic intellectualism - the identification of virtue with knowledge - and analyzes its implications for rational models of ethical decision-making. Through historical-philosophical and conceptual analysis of classical sources and modern interpretations, the study investigates the epistemological relationship between knowledge, moral reasoning, and ethical behavior.

The article further examines the role of dialectical inquiry as a methodological instrument for critical reflection and ethical deliberation. By interpreting Socratic philosophy as an early cognitive framework of moral reasoning, the study highlights the significance of self-knowledge, rational inquiry, and moral autonomy in the formation of ethical judgment.

In addition to its philosophical analysis, the paper discusses the relevance of Socratic ethics for contemporary organizational contexts, emphasizing its implications for ethical leadership, responsible decision-making, and the development of moral competence within modern institutions. The findings suggest that Socratic intellectualism offers a valuable conceptual foundation for understanding the cognitive dimensions of ethical leadership and the role of knowledge in shaping responsible organizational behavior.

KEYWORDS: Socratic ethics, virtue as knowledge, moral epistemology, ethical leadership, business ethics, dialectic method, moral autonomy.

How to cite: Otengenkizi, Z., Niyazbayeva, A., & Stavrova, E. (2026). Socratic Intellectualism and the Identity of Knowledge and Virtue: Foundations of Rational Ethics. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21721193>

Introduction

Ethics, as a philosophical inquiry into the nature of right and wrong, represents one of the oldest and most fundamental fields of human intellectual reflection. Since antiquity, philosophers have long sought to determine the principles that govern moral behavior and the conditions under which individuals can achieve a virtuous and meaningful life. Within this intellectual tradition, the ethical philosophy of Socrates (470–399 BCE) occupies a central and transformative position in the development of Western moral thought.

The historical and philosophical significance of Socrates lies not only in the content of his ethical teachings but also in the methodological shift he introduced in moral inquiry. In contrast to earlier moral traditions that relied primarily on cultural norms, religious authority, or social conventions, Socrates proposed a rational approach to ethics grounded in critical reflection and philosophical dialogue. Through dialectical inquiry, he sought to uncover universal moral truths and to demonstrate that ethical knowledge could be attained through reasoned examination of human beliefs and values.

Although Socrates left no written works, his ideas have been preserved through the dialogues of his students, most notably Plato and Xenophon. These texts portray Socrates as a philosopher who redefined ethics as a rational and intellectual discipline centered on the pursuit of knowledge and self-understanding. His famous claim that “virtue is knowledge” constitutes the core of what later scholars have described as Socratic intellectualism—the idea that moral excellence arises from correct understanding of the good. At the same time, immoral behavior results from ignorance rather than deliberate malice.

The philosophical importance of Socratic intellectualism extends far beyond the historical context of classical Athens. The Socratic view that ethical action is inseparable from knowledge has profoundly shaped subsequent philosophical traditions, including the ethical systems of Plato and Aristotle, the moral doctrines of Stoicism, and later developments in Christian and Enlightenment philosophy. Moreover, contemporary debates in moral epistemology, moral psychology, and cognitive ethics increasingly revisit the Socratic insight that moral behavior may be fundamentally connected to cognitive understanding. This intellectualist perspective has also influenced contemporary discussions in applied ethics, including business ethics, where ethical decision-making is often analyzed in relation to moral knowledge, responsibility, and rational judgment (Crane & Matten, 2016; Treviño & Nelson, 2021).

Despite the extensive scholarly literature devoted to Socratic ethics, significant questions remain regarding the epistemological status of virtue and the cognitive mechanisms underlying moral action. Much of the existing research interprets Socratic intellectualism primarily as a historical doctrine within ancient Greek philosophy. However, fewer studies explore its potential relevance as a theoretical framework for understanding the relationship between knowledge, moral reasoning, and ethical decision-making in contemporary philosophical discourse.

Against this background, the present study aims to reinterpret Socratic intellectualism as an epistemological and cognitive foundation of moral philosophy. Rather than treating Socrates merely as a moral teacher of antiquity, the study examines his ethical theory as an early rational model of moral cognition in which knowledge constitutes both the necessary and sufficient condition for virtuous action. From this perspective, Socratic ethics may be understood as a proto-theoretical framework that anticipates modern discussions concerning the role of cognition, rationality, and self-knowledge in moral behavior.

The central hypothesis of the study is that Socratic intellectualism represents a universal cognitive model of ethical action according to which moral conduct arises from rational understanding and self-knowledge. If virtue is indeed identical with knowledge - as Socrates claims - then moral failure should be interpreted not as a weakness of will or emotional deficiency but as a form of cognitive ignorance regarding the nature of the good.

The main objective of the research is therefore *to analyze the philosophical foundations of Socratic ethics and to clarify the relationship between knowledge, virtue, and moral autonomy*. In doing so, the study seeks to demonstrate that Socratic ethics provides a timeless conceptual framework for understanding the rational foundations of moral behavior and its relevance for contemporary philosophical discussions in moral epistemology and ethical theory.

Methodology

The present study employs a theoretical and historical-philosophical research methodology to analyze the conceptual foundations of Socratic ethics and clarify the relationship between knowledge, virtue, and moral action. Given the philosophical nature of the research topic, the study relies primarily on qualitative philosophical analysis of conceptual interpretation and critical analysis of classical philosophical texts.

The research design integrates several complementary methodological approaches.

First, the study applies historical-philosophical analysis in order to situate Socratic ethics within the broader intellectual context of classical Greek philosophy. This approach involves examining primary philosophical sources that preserve the ethical views attributed to Socrates, particularly the dialogues of Plato and the writings of Xenophon. These texts are analyzed in order to reconstruct the central concepts of Socratic intellectualism, including the identification of virtue with knowledge, the role of dialectical inquiry, and the ethical significance of self-knowledge.

Second, the research employs conceptual analysis as a methodological tool for clarifying the philosophical meaning of key ethical categories such as virtue, knowledge, moral autonomy, and eudaimonia. Through this analytical approach, the study examines the internal logical structure of Socratic ethics and explores the epistemological assumptions underlying the Socratic claim that moral wrongdoing results from ignorance.

Third, the study uses comparative philosophical analysis to examine how Socratic intellectualism relates to later developments in Western ethical theory. In particular, the research compares Socratic ethics with the virtue ethics of Aristotle, the rational moral framework of Stoicism, and selected contemporary theories in moral epistemology and moral psychology. This comparative perspective allows the study to evaluate the enduring relevance of Socratic thought within the broader history of ethical philosophy.

In addition, the research incorporates elements of interpretative textual analysis, which are commonly employed in philosophical scholarship when examining classical sources. This method allows for the careful interpretation of philosophical arguments presented in ancient texts and facilitates the identification of underlying conceptual structures within Socratic moral theory.

Through the integration of these methodological approaches—historical-philosophical analysis, conceptual analysis, comparative interpretation, and textual examination—the study seeks to provide a comprehensive understanding of Socratic intellectualism as both a historical philosophical doctrine and a theoretical model of

moral cognition.

This methodological framework enables the research to investigate the epistemological foundations of virtue in Socratic philosophy and to evaluate the continuing relevance of Socratic ethics for contemporary discussions in moral epistemology, moral psychology, and ethical theory.

Literature Review

The ethical philosophy of Socrates has long occupied a central place in the history of Western moral thought. As one of the earliest systematic attempts to ground morality in rational inquiry, Socratic ethics introduced a conceptual framework in which ethical knowledge and rational reflection play a decisive role in moral behavior. The interpretation of this philosophical position - commonly referred to as Socratic intellectualism - has generated extensive scholarly debate in both classical and contemporary philosophy.

Early interpretations of Socratic ethics emerged primarily through the works of Plato (L. Campbell, 1980). and Xenophon, whose dialogues provide the principal sources for reconstructing Socrates' philosophical views (Plato, 2006; Xenophon, 2019). These texts present Socrates as a thinker who rejected traditional moral explanations based on social conventions, mythological authority, or political norms. Instead, he proposed that ethical truth could be discovered through rational inquiry and dialectical dialogue.

One of the most influential modern interpretations of Socratic ethics is offered by Gregory Vlastos, who emphasizes the paradoxical nature of Socratic intellectualism. According to Vlastos (1991), Socrates' claim that no one willingly does wrong reflects a radical form of moral intellectualism in which moral knowledge is both necessary and sufficient for virtuous action. Vlastos argues that these so-called "Socratic paradoxes" were deliberately formulated to challenge conventional assumptions about moral responsibility and to stimulate philosophical reflection.

Similarly, Terence Irwin (2006) interprets Socratic ethics as a foundational stage in the development of rational moral philosophy. Irwin argues that Socrates transformed ethical inquiry by shifting the focus from traditional moral customs (*nomos*) toward rational justification of moral beliefs. In this sense, Socratic ethics introduced a form of moral epistemology, in which ethical judgments require rational justification and conceptual clarity.

Another important line of interpretation concerns the epistemological dimension of Socratic intellectualism. Scholars such as Brickhouse and Smith (2010) and Brickhouse, T., & Smith, N. (2000) emphasize that Socrates understood moral knowledge not merely as theoretical understanding but as a form of practical wisdom that guides human action. According to their interpretation, the Socratic method of dialectical questioning functions as a philosophical tool designed to reveal contradictions in commonly held beliefs and to refine moral concepts through critical inquiry.

Julia Annas (1993) further develops this perspective by situating Socratic ethics within the broader tradition of ancient virtue ethics. She argues that Socrates initiated a philosophical shift from external moral norms toward internal moral reasoning, thereby establishing the intellectual foundations of later ethical theories developed by Plato and Aristotle. In Annas' interpretation, the Socratic emphasis on self-knowledge and rational reflection laid the groundwork for the subsequent development of virtue ethics as a philosophical tradition.

Martha Nussbaum (1986) offers another influential interpretation by examining the ethical significance of rational inquiry in classical Greek philosophy. Nussbaum argues that Socratic philosophy introduced a model of ethical reflection in which the cultivation of reason becomes essential for achieving human flourishing (*eudaimonia*). In this framework, ethical development requires not only intellectual knowledge but also the capacity for critical self-examination and philosophical dialogue.

Scholars have also examined the relationship between Socratic intellectualism and later developments in moral psychology. For example, Cooper (1999) argues that Socrates' claim that wrongdoing results from ignorance anticipates modern theories that emphasize the cognitive foundations of moral judgment. Similarly, Annas (2011) suggests that Socratic ethics represents an early form of cognitive ethics in which moral behavior emerges from understanding rather than emotional impulse or social conditioning.

Another important aspect of Socratic philosophy concerns the methodological role of dialectic. According to H.H. Benson (2013), Benson (2011) the Socratic method of elenchus functions as a systematic procedure for testing the coherence of moral beliefs. By exposing contradictions within accepted opinions, dialectical questioning encourages individuals to revise their moral assumptions and to pursue a more rational understanding of ethical concepts.

In addition to its methodological innovations, Socratic ethics has also been interpreted as the foundation of the broader philosophical tradition of moral rationalism. Scholars such as A. A. Long (2006) and T. Irwin (2003) emphasize that Socrates' insistence on rational justification of moral beliefs profoundly influenced later philosophical traditions, including Stoicism and Enlightenment moral theory.

Recent philosophical research has also explored the contemporary relevance of Socratic intellectualism. Studies in moral epistemology and cognitive ethics increasingly examine the role of knowledge, reasoning, and conceptual understanding in shaping moral behavior (Audi, 2015; Zagzebski, 2017; Thomas C. Brickhouse). Within these discussions, Socrates is often regarded as one of the earliest thinkers to propose a cognitive model of moral action in which ethical behavior is grounded in rational understanding.

Despite the extensive literature on Socratic ethics, several interpretative challenges remain unresolved. In particular, scholars continue to debate whether Socratic intellectualism should be understood as a strict claim about the impossibility of moral weakness (*akrasia*) or as a methodological strategy designed to emphasize the importance of moral knowledge (Brickhouse, Smith, 2010; Benson, 2013). Furthermore, the relationship between Socratic intellectualism and later virtue-ethical theories remains an important subject of philosophical investigation.

Within this broader scholarly context, the present study contributes to the ongoing discussion by interpreting Socratic intellectualism as an early cognitive model of moral reasoning. By examining the epistemological structure of Socratic ethics and its connection to rational inquiry and self-knowledge, the research aims to demonstrate that Socratic philosophy provides a foundational framework for understanding the relationship between knowledge, virtue, and moral action.

Virtue as Knowledge: The Principle of Socratic Intellectualism

A central and defining principle of Socratic ethics is the claim that virtue is identical with knowledge. This thesis, often referred to as Socratic intellectualism, constitutes one of the most influential and controversial ideas

in the history of moral philosophy. According to Socrates, genuine moral action arises necessarily from knowledge of the good, while immoral behavior results from ignorance rather than deliberate wrongdoing.

The foundations of this view can be traced primarily through the Platonic dialogues, where Socrates repeatedly argues that ethical knowledge determines human conduct. In Plato's *Meno*, Socrates explores whether virtue can be taught and suggests that moral excellence is inseparable from an understanding of what is truly beneficial (Plato, 2014). If virtue is a form of knowledge, then ethical development becomes fundamentally an intellectual process rather than merely a matter of habit, socialization, or emotional disposition.

This position represents a significant departure from earlier Greek ethical traditions, which often understood virtue primarily in terms of social roles, heroic conduct, or cultural norms. Socrates shifts the focus from external behavior to the cognitive foundations of moral action, emphasizing that individuals must first understand the nature of the good in order to act virtuously. In this sense, Socratic ethics introduces a rational model of moral agency grounded in knowledge, reflection, and philosophical inquiry.

One of the most distinctive implications of Socratic intellectualism is the claim that no one willingly does wrong. This proposition, articulated in dialogues such as *Protagoras*, suggests that moral failure is not the result of malicious intent but of a mistaken understanding of what is truly good (Plato, 2006). According to this view, individuals who engage in harmful or unjust actions do so because they incorrectly believe such actions will lead to personal benefit or happiness.

Modern scholars have extensively debated the philosophical implications of this claim. Gr. Vlastos (1991) famously characterized these statements as the "Socratic paradoxes," noting that they challenge common assumptions about moral responsibility and human motivation. For Vlastos, Socratic intellectualism does not deny the complexity of human psychology but instead emphasizes the fundamental role of rational understanding in guiding ethical behavior.

Similarly, T. Irwin (2007) interprets Socratic intellectualism as an early form of moral rationalism. From this perspective, the Socratic identification of virtue with knowledge establishes a framework in which ethical inquiry becomes analogous to other forms of rational investigation. Moral concepts such as justice, courage, and moderation are therefore not merely social conventions but subjects of philosophical examination that require conceptual clarity and logical justification.

This cognitive orientation also has important implications for the study of moral psychology. If knowledge of the good necessarily motivates virtuous action, then moral education must focus primarily on intellectual development and critical reflection. Socrates' famous injunction to "know thyself" reflects this epistemological approach to ethics, emphasizing that self-knowledge is an essential condition for moral autonomy and responsible action.

However, the Socratic identification of virtue with knowledge was later reconsidered by Aristotle, who argued that moral excellence involves not only rational understanding but also the cultivation of character and emotional discipline (Aristotle, 2014). In the *Nicomachean Ethics*, Aristotle introduces the concept of *phronesis* (practical wisdom), suggesting that ethical behavior requires a synthesis of intellectual insight, habituation, and emotional moderation. Despite this critique, Aristotle's theory still preserves the Socratic insight that rational reflection plays a central role in ethical life.

In contemporary philosophical discourse, Socratic intellectualism is increasingly interpreted as an early precursor to modern cognitive approaches to moral reasoning. Scholars in moral epistemology and moral psychology have emphasized that ethical judgment often depends on the ability to correctly interpret moral situations, evaluate competing values, and understand the consequences of human action (Annas, 2011; Audi, 2015). From this perspective, the Socratic thesis that ignorance lies at the root of moral failure can be understood as a profound insight into the cognitive dimensions of ethical decision-making.

Thus, the principle that virtue is knowledge represents not merely a historical doctrine within ancient Greek philosophy but a foundational concept in the development of rational ethics. By linking moral behavior to intellectual understanding, Socrates established a philosophical framework in which ethical inquiry becomes inseparable from the pursuit of knowledge, self-reflection, and rational autonomy. This intellectualist conception of morality continues to influence contemporary debates concerning the nature of ethical knowledge and the cognitive foundations of human moral agency.

Dialectic as a Method of Moral Inquiry

A central element of Socratic philosophy is the use of dialectical inquiry as a method for examining moral concepts and uncovering ethical truth. Unlike traditional forms of instruction that rely on the transmission of established doctrines, the Socratic method represents one of the earliest attempts to establish philosophy as a rational discipline grounded in argumentation and logical consistency. Through this dialogical approach, Socrates transformed philosophy into a dynamic process of critical reflection and rational examination.

The methodological core of Socratic dialectic is commonly described as *elenchus*, a form of argumentative cross-examination through which interlocutors are encouraged to reconsider their assumptions about fundamental ethical notions such as justice, courage, and virtue. Rather than presenting ready-made answers, Socrates guides his interlocutors through a sequence of questions that gradually expose inconsistencies in their views. This process often leads to a state of *aporia*, or intellectual perplexity, which serves as the starting point for deeper philosophical investigation.

In Plato's dialogues - particularly *Euthyphro*, *Protagoras*, and *Theaetetus* - Socratic dialectic appears as a methodological tool designed to test the coherence of moral beliefs (Plato, 2006). By subjecting commonly accepted opinions to critical scrutiny, Socrates seeks to demonstrate that many moral judgments are based on unexamined assumptions rather than genuine knowledge. In this sense, the Socratic method represents one of the earliest philosophical attempts to establish philosophy as a rational discipline grounded in argumentation and logical consistency.

Modern scholars have emphasized the epistemological significance of the Socratic method. According to Benson (2013), dialectical questioning functions as a systematic procedure for identifying conceptual contradictions and refining ethical definitions. Through the *elenchus*, Socrates exposes the limitations of superficial moral opinions (*doxa*) and encourages the pursuit of genuine knowledge (*epistēmē*). This methodological emphasis on conceptual clarification reflects Socrates' broader conviction that ethical knowledge must be grounded in rational understanding rather than social convention.

The dialectical method also plays a crucial role in the ethical transformation of the individual. By confronting interlocutors with the inadequacy of their moral beliefs, Socrates encourages a process of intellectual self-

examination. This process aligns with the famous Delphic maxim “know thyself,” which Socrates interpreted as a call for philosophical reflection on the nature of the human soul and the principles that guide moral action. In this way, dialectic functions not only as a logical method but also as a form of ethical education, aimed at cultivating intellectual humility and moral awareness.

Furthermore, the Socratic method introduced a new model of philosophical inquiry that would profoundly influence later intellectual traditions. Plato adopted the dialogical structure of Socratic argumentation as the primary literary form of his philosophical works. At the same time, Aristotle later systematized logical reasoning and argument analysis within the framework of formal logic (Aristotle, 2014). In this sense, the Socratic method can be seen as an early precursor to the methodological foundations of both philosophical reasoning and scientific inquiry.

Contemporary scholars have also highlighted the enduring relevance of Socratic dialectic for modern intellectual practices. The method continues to play an important role in fields such as legal education, pedagogy, and psychotherapy, where structured questioning is used to encourage critical thinking and reflective understanding. In these contexts, the Socratic method serves as a pedagogical tool that promotes intellectual autonomy and analytical reasoning.

From a philosophical perspective, the significance of Socratic dialectic lies in its ability to link methodological inquiry with ethical development. By demonstrating that moral knowledge requires careful conceptual analysis and rational dialogue, Socrates established a model of ethical investigation that integrates epistemology, logic, and moral philosophy. This methodological innovation remains one of the most enduring contributions of Socratic thought to the history of Western philosophy.

Ultimately, the dialectical method illustrates Socrates’ broader conviction that philosophy is not merely a theoretical discipline but an active process of intellectual and moral self-transformation. Through dialogue, questioning, and critical reflection, individuals are encouraged to move beyond unexamined beliefs toward a more rational understanding of ethical truth. In this sense, dialectic represents both a methodological instrument of philosophical inquiry and a practical path toward moral wisdom.

Eudaimonia and the Rational Structure of the Good Life

A central objective of Socratic ethics is the pursuit of *eudaimonia*, a concept commonly translated as human flourishing, well-being, or true happiness. In Socratic philosophy, ethical inquiry is ultimately directed toward understanding how individuals can live a good and meaningful life. Unlike moral systems grounded in social conventions or external authority, Socratic ethics presents the good life as the result of rational self-understanding and moral knowledge.

The concept of *eudaimonia* in Socratic thought reflects a teleological structure of ethics, in which human actions are oriented toward an end or ultimate good. For Socrates, this ultimate goal cannot be achieved through wealth, power, or social status, but only through the cultivation of virtue and wisdom. Ethical excellence therefore becomes inseparable from intellectual development, reinforcing the broader Socratic thesis that knowledge and virtue are fundamentally interconnected.

This philosophical position is evident in Plato’s dialogues, where Socrates repeatedly argues that genuine happiness depends on the condition of the soul rather than on external circumstances. In the *Apology*, Socrates

maintains that the unexamined life is not worth living, emphasizing that self-examination and philosophical reflection are essential for achieving a meaningful existence (Plato, 2006). Similarly, in the *Republic*, Socrates presents justice and moral harmony as conditions necessary for the flourishing of both the individual soul and the political community.

From this perspective, the pursuit of *eudaimonia* requires the cultivation of rational understanding and moral insight. Socratic ethics therefore links happiness not to pleasure or material success but to the development of intellectual and moral virtue. This view contrasts with hedonistic interpretations of happiness and instead emphasizes the importance of wisdom, moderation, and ethical reflection as the foundations of human flourishing.

The connection between virtue and happiness became a defining feature of the broader tradition of ancient Greek ethics. Later philosophers, particularly Aristotle, further developed this idea by presenting *eudaimonia* as the highest human good and the ultimate aim of ethical life (Aristotle, 2014). Although Aristotle criticized certain aspects of Socratic intellectualism—especially the claim that knowledge alone guarantees virtuous action—he retained the fundamental insight that rational activity plays a central role in achieving human flourishing.

Modern interpretations of Socratic ethics have also emphasized the cognitive dimension of *eudaimonia*. Scholars such as Annas (1993) and M. Nussbaum (2001) argue that Socratic philosophy presents happiness as the outcome of rational self-development and moral understanding. In this interpretation, ethical life is not defined by external rewards but by the cultivation of an intellectually reflective and morally coherent character.

This perspective has important implications for contemporary discussions in moral philosophy and moral psychology. By linking happiness to knowledge and ethical understanding, Socrates proposes a model of human flourishing grounded in cognitive and rational capacities. Moral development, in this framework, becomes inseparable from intellectual growth and philosophical reflection.

Furthermore, the Socratic emphasis on self-knowledge reinforces the idea that individuals must actively examine their beliefs and values in order to achieve a truly fulfilling life. The Delphic maxim “know thyself,” which Socrates adopted as a guiding philosophical principle, highlights the importance of introspection and critical inquiry in ethical development. Through this process of self-examination, individuals can align their actions with a rational understanding of the good.

Ultimately, the Socratic conception of *eudaimonia* presents the good life as a rational and ethical project grounded in knowledge, virtue, and philosophical inquiry. By identifying happiness with the cultivation of wisdom and moral insight, Socrates established a teleological framework that continues to influence both classical and contemporary theories of virtue ethics.

Moral Autonomy and Ethical Integrity in Socratic Philosophy

A defining feature of Socratic ethics is its emphasis on moral autonomy and the integrity of the rational moral agent. In contrast to ethical systems that derive moral authority from social customs, political power, or religious tradition, Socratic philosophy locates the source of moral obligation within the rational capacities of the individual. Ethical action, in this framework, arises from reflective understanding and personal commitment to truth rather than from external coercion or conformity to prevailing norms. Similar ideas appear in modern theories of business ethics, where moral autonomy and responsible decision-making are considered essential

elements of ethical leadership and corporate responsibility (Ferrell, Fraedrich & Ferrell, 2019).

The Socratic conception of moral autonomy is closely connected with the principle of intellectualism discussed earlier. If virtue is identical with knowledge, then ethical responsibility depends on the individual's capacity for rational inquiry and self-examination. Moral agents must therefore actively evaluate their beliefs and actions in light of a rational understanding of the good. This perspective transforms ethics from a system of externally imposed rules into a process of internal moral deliberation grounded in reason.

One of the most striking illustrations of Socratic moral autonomy appears in Plato's *Crito*. In this dialogue, Socrates is allowed to escape from prison and avoid the death sentence imposed by the Athenian court. Despite the apparent injustice of the verdict, he refuses to flee, arguing that violating the laws of the city would contradict the ethical principles he has defended throughout his life (Plato, 2006). His decision reflects a profound commitment to moral consistency and rational integrity.

From the Socratic perspective, ethical integrity requires that individuals remain faithful to their rationally justified principles even when doing so leads to personal sacrifice. Socrates' acceptance of his death sentence demonstrates that the value of moral truth outweighs considerations of personal safety or social approval. This episode illustrates the depth of Socratic commitment to the idea that moral principles must be grounded in reason rather than convenience or expediency.

Modern scholars often interpret this aspect of Socratic philosophy as an early expression of moral autonomy. This concept later became central to Enlightenment moral theory, particularly in the works of Immanuel Kant. While Socrates did not formulate a formal theory of moral law, his insistence that individuals must act according to their rational understanding of justice anticipates later philosophical arguments concerning the autonomy of the moral will.

At the same time, Socratic ethics emphasizes the social significance of philosophical inquiry. Socrates regarded the philosopher as a critical participant in public life whose task was to challenge unexamined assumptions and stimulate ethical reflection within the community. In Plato's *Apology*, Socrates describes himself as a "gadfly" whose mission is to provoke the citizens of Athens to question their beliefs and examine the moral foundations of their actions (Plato, 2006). Through this metaphor, Socrates presents philosophy not merely as a theoretical activity but as a form of civic responsibility.

This understanding of the philosopher's role underscores the broader ethical vision of Socratic thought. Moral autonomy does not imply isolation from society; rather, it requires active engagement in rational dialogue aimed at improving both individual character and collective moral understanding. By encouraging citizens to critically examine their values, Socrates sought to cultivate a more reflective and ethically responsible community.

Furthermore, Socratic philosophy highlights the inseparable connection between self-knowledge and moral responsibility. The Delphic maxim "know thyself," which Socrates frequently invoked, emphasizes that ethical life begins with recognizing one's own ignorance and the willingness to pursue philosophical inquiry. Through this process of self-examination, individuals develop the intellectual humility and rational clarity necessary for ethical judgment.

Ultimately, the Socratic conception of moral autonomy presents ethics as a lifelong pursuit of wisdom guided by reason, dialogue, and critical reflection. By grounding moral responsibility in rational self-examination

and intellectual integrity, Socrates established a philosophical model of ethical agency that continues to influence modern discussions of moral responsibility, civic virtue, and the role of philosophical critique in democratic societies.

Socratic Ethics and Ethical Leadership in Contemporary Organizations

The philosophical principles of Socratic ethics offer important insights for contemporary discussions in business ethics and ethical leadership. Although Socrates developed his ideas within the context of ancient Greek philosophy, the intellectual foundations of his ethical theory remain highly relevant for modern organizational environments characterized by complex decision-making, moral uncertainty, and increasing societal expectations for responsible corporate behavior.

A central element of Socratic intellectualism is the claim that virtue is inseparable from knowledge. In the context of modern organizations, this principle suggests that ethical decision-making depends fundamentally on leaders' and managers' cognitive capacity to understand the moral implications of their actions. Ethical leadership therefore requires not only compliance with formal rules or regulatory frameworks but also the development of moral knowledge and reflective judgment.

From a managerial perspective, the Socratic emphasis on rational inquiry and self-knowledge provides an important foundation for responsible leadership. Leaders who engage in critical self-reflection are better able to recognize ethical dilemmas, evaluate competing values, and make decisions that align with long-term organizational integrity. In this sense, the Socratic maxim "know thyself" can be interpreted as a principle of ethical self-awareness that enables leaders to understand the motivations, biases, and consequences associated with their decisions.

The methodological significance of the Socratic dialectic is also highly relevant for contemporary organizational practice. The Socratic method of questioning encourages open dialogue, critical thinking, and the examination of underlying assumptions. Within modern organizations, such dialogical processes can foster ethical deliberation and improve decision-making by challenging unexamined beliefs and encouraging diverse perspectives.

In the field of business ethics, structured dialogue and critical questioning are increasingly recognized as important mechanisms for preventing ethical failures and promoting transparency within organizations. By encouraging employees and managers to question established practices and evaluate the ethical consequences of corporate strategies, organizations can cultivate a culture of moral responsibility and intellectual openness.

Furthermore, Socratic intellectualism provides a valuable perspective on the relationship between knowledge and ethical responsibility in leadership. If moral wrongdoing is often the result of ignorance or misunderstanding—as Socrates suggests—then ethical leadership requires continuous learning and the development of moral competence. Modern organizations therefore benefit from investing in ethical education, leadership development programs, and training initiatives that enhance managers' ability to recognize and address ethical challenges.

The concept of virtue as knowledge also has implications for corporate governance. Effective governance structures depend not only on regulatory compliance but also on the ethical competence of decision-makers. Boards of directors and executive leaders must possess the intellectual capacity to evaluate complex ethical

situations and to balance economic objectives with broader social responsibilities.

In this regard, Socratic ethics offers a normative framework for understanding ethical leadership as a rational and reflective practice. Leaders are not merely administrators of organizational processes but moral agents responsible for shaping the ethical culture of their institutions. Through rational inquiry, dialogue, and commitment to truth, leaders can cultivate organizational environments that promote integrity, trust, and responsible decision-making.

Finally, the Socratic conception of moral autonomy highlights the importance of individual responsibility within organizational structures. Ethical leadership requires the courage to act according to rationally justified principles even when such actions involve personal or professional risk. In contemporary corporate contexts, this principle is reflected in practices such as whistleblowing, ethical dissent, and responsible decision-making that prioritizes long-term ethical integrity over short-term gains.

Taken together, these considerations demonstrate that Socratic ethics provides a valuable philosophical foundation for contemporary discussions of business ethics and leadership. By emphasizing the role of knowledge, rational reflection, and moral autonomy, the Socratic tradition contributes to the development of ethical leadership models capable of addressing the moral challenges of modern organizational life.

Conclusion

The present study examined the philosophical foundations of Socratic ethics, focusing on the relationship between intellectualism, virtue, and moral knowledge as central elements of classical Greek moral philosophy. Through a historical-philosophical and conceptual analysis of Socratic thought, the research explored the theoretical significance of the claim that virtue is identical with knowledge and that moral wrongdoing arises from ignorance rather than deliberate intention.

The analysis demonstrates that Socratic intellectualism represents one of the earliest rational models of ethical inquiry in Western philosophy. By linking moral action to knowledge and rational understanding, Socrates introduced a cognitive framework in which ethical behavior emerges from intellectual reflection and philosophical self-examination. This perspective shifted the foundations of ethics from external authority and social convention toward rational justification and individual moral responsibility.

The study further emphasized the methodological importance of the Socratic dialectic as a form of philosophical investigation. Through dialectical questioning, Socrates developed a systematic method for testing moral beliefs and refining ethical concepts. This methodological innovation transformed philosophy into an active process of critical inquiry aimed at uncovering universal moral principles.

In addition, the research examined the teleological dimension of Socratic ethics through the concept of *eudaimonia*. Socrates' interpretation of the good life highlights the connection between virtue, rational understanding, and human flourishing. In this framework, happiness is not defined by external success or material well-being but by the cultivation of wisdom and moral integrity.

Finally, the study analyzed the principle of moral autonomy in Socratic philosophy, demonstrating that ethical responsibility arises from rational self-examination and commitment to truth. Socrates' life and philosophical practice illustrate the idea that moral principles must be grounded in reason and consistently

upheld even in the face of social pressure or personal risk.

Taken together, these findings suggest that Socratic ethics provides a foundational model of moral philosophy in which knowledge, virtue, and rational inquiry are inseparably connected. The Socratic identification of ethical action with intellectual understanding continues to influence contemporary discussions in moral epistemology, virtue ethics, and moral psychology.

These findings also demonstrate the relevance of Socratic intellectualism for contemporary discussions in business ethics and ethical leadership, where rational reflection and moral knowledge remain essential for responsible decision-making.

By reinterpreting Socratic intellectualism as a cognitive framework of moral reasoning, this study contributes to the ongoing philosophical dialogue concerning the relationship between knowledge and ethical behavior. In doing so, it highlights the enduring relevance of Socratic thought for modern debates about moral agency, ethical education, and the rational foundations of the good life.

Moreover, the Socratic emphasis on moral knowledge and rational responsibility also resonates with contemporary discussions in business ethics, where ethical decision-making within organizations is frequently analyzed in terms of moral reasoning, leadership integrity, and responsible judgment (A.Crane, D. Matten, 2016; Treviño, Nelson, 2021). The Socratic emphasis on knowledge, rational judgment, and moral responsibility also offers a valuable philosophical perspective for contemporary debates on emerging ethical challenges, including the development of responsible artificial intelligence and the role of ethical reasoning in technologically mediated decision-making.

References

- Annas, J. (1993). *The morality of happiness*. Oxford University Press.
- Annas, J. (2011). *Intelligent virtue*. Oxford University Press.
<https://doi.org/10.1093/acprof:oso/9780199228782.001.0001>
- Annas, J. (2015). Virtue and practical reason. *Philosophy*, 90(2), 205–224.
<https://doi.org/10.1017/S0031819115000042>
- Aristotle. (2014). *Nicomachean ethics* (R. Crisp, Ed. & Trans.). Cambridge University Press.
<https://doi.org/10.1017/CBO9781139600514>
- Audi, R. (2004). *The good in the right: A theory of intuition and intrinsic value*. Princeton University Press.
- Audi, R. (2015). *Moral perception*. Princeton University Press. <https://doi.org/10.1515/9781400846320>
- Benson, H. H. (2011). Socratic wisdom. *Oxford Studies in Ancient Philosophy*, 41, 1–45.
- Benson, H. H. (2013). Socratic method. In H. H. Benson (Ed.), *A companion to Socrates*. Wiley-Blackwell.
<https://doi.org/10.1017/CCOL9780521833424.008>
- Brickhouse, T., & Smith, N. (2000). *The philosophy of Socrates*. Westview Press.
- Brickhouse, T., & Smith, N. (2010). *Socratic moral psychology*. Cambridge University Press.
<https://doi.org/10.1017/CBO9780511776946>

- Campbell, L. (1980). *Plato's Republic: The Greek text with notes*. Oxford University Press.
<https://doi.org/10.4324/9780429058677>
- Cooper, J. (1999). *Reason and emotion: Essays on ancient moral psychology and ethical theory*. Princeton University Press.
- Crane, A., & Matten, D. (2016). *Business ethics: Managing corporate citizenship and sustainability in the age of globalization*. Oxford University Press.
- Irwin, T. (2003). *Plato's ethics*. Oxford University Press.
- Irwin, T. (2007). *The development of ethics: A historical and critical study*. Oxford University Press.
- Nussbaum, M. (1986). *The fragility of goodness*. Cambridge University Press.
<https://doi.org/10.1017/CBO9780511817915>
- Nussbaum, M. (2001). *The therapy of desire: Theory and practice in Hellenistic ethics*. Princeton University Press.
- Plato. (2006a). *Apology* (G. M. A. Grube, Trans.). Hackett Publishing.
- Plato. (2006b). *Complete works* (J. Cooper, Ed.). Hackett Publishing.
- Plato. (2006c). *Protagoras* (S. Lombardo & K. Bell, Trans.). Hackett Publishing.
- Plato. (2006d). *Republic* (G. M. A. Grube & C. D. C. Reeve, Trans.). Hackett Publishing.
- Plato. (2014). *Meno* (B. Jowett, Trans.). CreateSpace Independent Publishing Platform.
- Rowe, C. (2007). *Plato and the art of philosophical writing*. Cambridge University Press.
<https://doi.org/10.1017/CBO9780511482625>
- Scott, D. (2006). *Plato's Meno*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511482632>
- Taylor, C. C. W. (1998). *Plato: Protagoras*. Oxford University Press.
- Treviño, L. K., & Nelson, K. A. (2021). *Managing business ethics: Straight talk about how to do it right*. Wiley.
- Vlastos, G. (1991). *Socrates: Ironist and moral philosopher*. Cambridge University Press.
- Vlastos, G. (1994). *Socratic studies*. Cambridge University Press.
- Williams, B. (1985). *Ethics and the limits of philosophy*. Harvard University Press.
- Xenophon. (2019). *Memorabilia* (A. L. Bonnette, Trans.). Oxford University Press.
- Zagzebski, L. (2017). *Exemplarist moral theory*. Oxford University Press.
<https://doi.org/10.1093/oso/9780190655846.001.0001>

SECTION

Management



Futurity Research Publishing

The Role of Artificial Intelligence in Enterprise Resource Planning Systems within Organizations

Galena Chavkoska^{1*}, Irena Ashtalkoska², Marina Kantardjieva³

¹ B.Sc. in Business and Management, American University of Europe-FON, Skopje, North Macedonia; functional consultant at AXM365 Skopje, North Macedonia

²PhD, Full Professor, American University of Europe-FON, Skopje, North Macedonia

³PhD, Associate Professor, American University of Europe-FON, Skopje, North Macedonia

✉ ***Corresponding author:**
galenachavkoska2@gmail.com



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Artificial intelligence (AI) is no longer a future concept in business-it is already embedded in the daily operations of organizations worldwide. This paper examines what happens when AI becomes part of Enterprise Resource Planning (ERP) systems and, more specifically, how this changes the way managers make decisions. The study combines a review of relevant management theory, a detailed case analysis of Microsoft Dynamics 365 Business Central and its AI assistant, Copilot and a survey conducted among 10 professionals who use the system in their everyday work and perform at least one of the basic Management roles and responsibilities. The results are clear: AI-integrated ERP systems have significant working time, reduce errors in routine processes, and give managers access to better, faster information. Survey respondents reported an average saving of around eleven hours per week. At the same time, the research highlights that technology alone is not enough - data quality and user readiness are equally important. The paper argues that the real value of AI in ERP lies not in replacing human judgment but in giving managers more room to use it.

KEYWORDS: artificial intelligence, enterprise resource planning, management, decision-making, Microsoft Dynamics 365, Copilot, automation, predictive analytics.

How to cite: Chavkoska, G., Ashtalkoska, I., & Kantardjieva, M. (2026). The Role of Artificial Intelligence in Enterprise Resource Planning Systems within Organizations. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21296631>

Introduction

Every manager, regardless of the industry or organization size, faces the same challenge: making good decisions with imperfect information, under time pressure, while juggling multiple priorities at once. This is not a new problem – but the tools available to address it are changing rapidly. ERP systems have been part of organizational life for decades. The concept was introduced by Gartner in 1990 to describe integrated business software that could connect finance, procurement, sales, inventory and human resources in a single platform (GeniusERP, 2024). The promise was straightforward: instead of every department keeping its own records in its own system, everyone would work from the same data. In practice, this delivered real value – but it also had a clear ceiling. Traditional ERP systems are good at recording what happened. They are less helpful when you need to know what is likely to happen next or what you should do about it. That ceiling is now being pushed. According to McKinsey & Company (2024), 65% of organizations are now regularly using generative AI in their operations – up from 33% just a year earlier. This is not a gradual trend; it is a shift that is happening faster than most organizations anticipated. And one of the places where this shift is most visible is within ERP systems, where AI is moving these platforms from passive record-keeping tools toward something closer to an active decision-support partner.

This paper explores that shift. It draws on management theory and decision-making, a practical case study of Microsoft Dynamics 365 Business Central with embedded Copilot AI, and firsthand survey data from 10 professionals who use the system daily. The author works as a functional consultant for Business Central and has presented “AI-driven decision-making at the BizVision365 International conference in Amsterdam, which means this is not purely an academic exercise.

Research Aim and Research Questions

This paper aims to examine how AI integration within ERP systems affects managerial decision-making – both in terms of operational efficiency and decision quality.

Three questions guide the research:

- How does AI change what ERP systems can offer to managers?
- What do the numbers actually show regarding time savings and error reduction?
- What makes AI adoption work in practice – and what gets in the way?

Research Results

Management theory identifies planning, organizing, leading, and controlling as the core functions of a manager. Running through all of them is decision-making – the moment where analysis turns into action (Ashtalkoska, 2023). And the quality of that moment depends heavily on the information available at the time. This is where ERP systems have always played a role. By bringing together data from across the organization, they give managers a more complete picture than any single department

could provide on its own. In addition, the effective use of organizational knowledge and information contributes to higher levels of customer satisfaction and overall organizational performance (Kantardjieva et al., 2022).

Furthermore, organizational performance is influenced not only by technological capabilities but also by the continuous development of employee competencies and skills (Ashtalkoska et al., 2020). The global ERP market reflects how deeply embedded these systems have become – it was valued at 66 billion USD in 2024, with annual growth of 11.3% (Gartner, 2024). The move toward cloud-based ERP has made these systems accessible to smaller organizations that previously could not afford traditional implementations. But there is a well-known limitation. As Agrawal et al. (2018) point out, the value of information in decision-making depends not just on having it, but on being able to act on it quickly and accurately. Traditional ERP systems provide the data, but the work of analyzing it, identifying patterns, and generating forecasts has largely remained with the human on the other side of the screen. AI changes this by, as Agrawal et al. (2018) put it, reducing the “cost of prediction” near to zero. When forecasting becomes cheap and fast, a whole category of decisions that once required significant human effort can be handled differently. Gartner (2025) frames this as a transition from “systems of record” to “systems of intelligence” – and projects that by 2030, more than half of routine ERP tasks will be handled autonomously by AI.

Table 1

Frequency of AI use by position

Frequency	Consultants	Key Users	Project Managers	Total
Daily	2	1	2	5
Several times/week	1	1	1	3
Rarely	1	1	-	2
Never	-	-	-	-

Source: author’s own development.

Five of ten respondents use AI functionalities every day, while three use them several times per week. Two respondents reported using AI rarely, which, in both cases, reflected limited exposure to specific functionalities rather than a deliberate choice to avoid it. No respondent reported never using AI, which in itself says something about how embedded these tools have become in the work of people working closely with the system.

Table 2

Weekly time savings by Position

Position	Estimated weekly saving	Main users
-----------------	--------------------------------	-------------------

Functional consultants	~15 hours	Documentation, problem analysis, data summarization
Key users	~12 hours	Bank reconciliation, error analysis, supplier/product analysis, email summarization.
Project managers	~20 hours	E-mail drafting, budget analysis, project planning.

Source: author's own development.

The highest time savings were reported by project managers, who estimated saving approximately 20 hours per week – primarily through AI-assisted email drafting, time-tracking analysis, budget tracking and project plan preparation. Functional consultants reported the second-highest savings at around fifteen hours per week, mainly through automated documentation and problem analysis. Key users reported more moderate but still meaningful savings. Averaged across all respondents, the estimate comes to approximately 11 hours per person per week. On accuracy, the responses revealed a more nuanced picture than a simple scale could capture. Five out of ten respondents stated that accuracy depends heavily on the type of task: for organization, summarization and for analytical tasks, AI responses are generally reliable; for step-by-step process guidance on specific solutions, errors appear more frequently. Two respondents said they encounter inaccuracies “sometimes, but not often”, two said “often”, and one said “rarely”. This distribution suggests that the practical reliability of AI is closely tied to the nature of the task being performed. Regarding how respondents actually use AI recommendations, key users reported accepting Copilot’s suggestions directly in over 80% of cases for routine transactions. For larger or more consequential decisions, everyone reported doing additional checks. Three of the four respondents in these roles said they feel noticeably more confident in their decisions when Copilot has provided input, not because they follow it blindly, but because having a structured analysis available changes how they approach the decision. Project managers noted that AI-supported onboarding had shortened project timelines by roughly 10-15%, mainly by supporting documentation, testing scenarios and user adaptation during the transition period. One finding that cuts across all respondent groups is worth naming explicitly: nobody described AI as a threat to their job. The consistent framing was the opposite – AI handles the repetitive parts, freeing up time for strategic decision-making and work that requires judgment. This aligns with what Iansiti and Lakhani (2020) argue: the organizational value of AI lies not in replacing human decision-making but in giving people greater capacity to do it well.

Conclusions

The question this paper started with was whether AI integration in ERP systems actually changes how managers make decisions – and the answer, based on the evidence gathered, is yes, in ways that

are both measurable and meaningful. At the operation level, the effects are concrete. Routine processes that once took hours are completed in minutes. Errors resulting from manual data entry have been significantly reduced. Information that previously required an IT request or a waiting period is available on demand when a decision needs to be made. At a deeper level, something more interesting is happening. Managers in this study are not just faster – they report feeling better informed and more confident. The shift from reactive to proactive decision-making that AI enables is not just about efficiency; it changes the nature of what managers spend their time on. Two conditions consistently determine whether AI delivers on this potential. First, data quality: AI does not compensate for bad data or poor management; it amplifies it. Organizations that invest in AI without investigating in data governance are likely to be disappointed. Second, user readiness: knowing when to trust an AI recommendation, when to question it, and when to disregard it is a skill that needs to be developed – it does not come automatically with system access. The key takeaway is that AI cannot turn a bad manager into a good one, but it can ensure good managers have the right tools and insights to do their work even better when used carefully and effectively.

References

- Agrawal, A., Gans, J., & Goldfarb, A. (2018). *Prediction machines: The simple economics of artificial intelligence*. Harvard Business Review Press
- Ashtalkoska, I. (2023). Managing results. AUE-FON University, Skopje.
- Ashtalkoska, I., Ashtalkoski, S., & Kantardjieva, M. (2020). *Process of employee training and its impact on organizational performance*. *KNOWLEDGE - International Journal*, 40(1), 195-200. <https://ikm.mk/ojs/index.php/kij/article/view/945>
- Forrester Consulting. (2025). *The total economic impact™ of Microsoft 365 Copilot*. <https://tei.forrester.com/go/microsoft/M365Copilot>
- Gartner. (2024). *Market share: Enterprise resource planning, worldwide, 2024*. <https://www.gartner.com/en/documents/6524002>
- Gartner. (2025). *Predicts 2026: The future of ERP*. <https://www.rambase.com/resources/blog/gartner-predicts-2026-the-future-of-erp>.
- GeniusERP. (2024). *A brief history of ERPs*. <https://www.geniuserp.com/resources/blog/a-brief-history-of-erps/>
- Iansiti, M., & Lakhani, K. R. (2020). *Competing in the age of AI: Strategy and leadership when algorithms and networks run the world*. Harvard Business Review Press.
- Kantardjieva, M., Golubovski, G., & Ashtalkoska, I. (2022). TQM and marketing: Two-prong contribution towards customer satisfaction. *KNOWLEDGE - International Journal*, 51(1), 133-137. <https://ikm.mk/ojs/index.php/kij/article/view/5049>

- McKinsey & Company. (2024). *The state of AI in early 2024: Gen AI adoption spikes and starts to generate value*. <https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-2024>
- Microsoft. (2025). *Dynamics 365 Business Central*. <https://www.microsoft.com/en-us/dynamics-365/products/business-central>
- Microsoft Learn. (2024). *Copilot and AI capabilities – Dynamics 365 Business Central 2024 release wave 2*. <https://learn.microsoft.com/en-us/dynamics365/release-plan/2024wave2/smb/dynamics365-business-central/copilot-agents>
- Microsoft Learn. (2025). *Overview of Dynamics 365 Business Central 2025 release wave 1*. <https://learn.microsoft.com/en-us/dynamics365/release-plan/2025wave1/smb/dynamics365-business-central/>

Managerial Innovation and Digitalization: Drivers of Well-being at Work in Schools in Morocco

Hasna Imakor¹, Sahar Sader¹, Loubna Chabba¹, Lalla Sara Yousfi²

¹ PhD student at the
Faculty of Economic
and Social Sciences
Souissi, Mohammed V
University, Rabat,
Morocco

² Professor of
economics and
management at the
Higher School of
Technology of Salé,
Mohammed V
University, Rabat,
Morocco

***Corresponding author:**
sahar_sader@um5.ac.ma



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Managerial innovation and digitalization are key drivers of well-being at work in schools in Morocco. This study explores how innovative management practices, in a context of increasing digitalization, influence teachers' well-being. Using an exploratory qualitative approach based on 32 semi-structured interviews, we analyze teachers' perceptions of management practices and their connection to well-being. The results show that digitalization acts as a booster for managerial practices but can create tensions if not supported by proper management. Supportive communication (38%), active listening (74%), and recognition of work (60%) are the strongest drivers of well-being, while lack of recognition (26%) and absence of feedback (21%) remain the main obstacles.

KEYWORDS: Managerial innovation, digitalization, well-being at work.

How to cite: Imakor, H., Sader, S., Chabba, L., & Yousfi, L. S. (2026). Managerial Innovation and Digitalization: Drivers of Well-being at Work in Schools in Morocco. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21622368>

Introduction

In Morocco, the public education sector is going through an unprecedented modernization phase, driven by strategic initiatives like the National Digitization Plan, the widespread adoption of digital equipment, and the rollout of distance learning platforms in schools (Ministry of National Education, 2022). This digital transition aims to improve learning quality, boost administrative efficiency, and prepare young generations for the challenges of the digital economy.

However, digitalization is not just about rolling out technology. It involves a deep transformation of management practices, communication styles, and hierarchical relationships within organizations. In this context, school leaders are expected to play a key role in supporting this transition by adopting innovative management practices that put teachers at the heart of the transformation process (Panczuk & Point, 2008).

The issue of teacher well-being at work is particularly pressing in Morocco. Education jobs face major structural challenges: teacher shortages, overcrowded classrooms, lack of material resources, and profound changes due to digitalization and successive educational reforms. As Chainane & Boudi (2024) point out, work well-being in the Moroccan context is closely tied to management practices and recognition. These two areas are still underdeveloped in the public education sector.

Previous research has extensively documented the positive effects of management practices on workplace well-being in private organizations (Bakker & Demerouti, 2007; Grawitch et al., 2015). In the education sector, studies have shown that the quality of supervisory relationships, recognition, and active listening is a major factor in teachers' engagement and satisfaction (Hakanen et al., 2006).

Moreover, digitalization is deeply changing these managerial relationships. It can make communication and feedback easier through digital platforms, but it can also create significant tensions: increased cognitive load, depersonalization of interactions, digital gap between generations, or feelings of being monitored (Chen, 2025; Ehmann et al., 2025). These ambivalent effects of digitalization on employee well-being, well-documented in the Anglo-Saxon literature, remain largely unknown in the specific context of Moroccan schools. Yet, understanding these mechanisms is essential to shed light on the conditions for successful digitalization, that is, generating well-being rather than tension.

The existing literature thus shows a double gap: on the one hand, it has paid little attention to the link between managerial innovation and digitalization in the educational public sector; on the other hand, it has not yet explored in depth how these practices can ease or worsen the effects of digitalization on teachers' well-being in Morocco. This double gap is at the heart of the issue in this research.

Given this situation, the central question guiding this study is the following: how do innovative management practices, in a context of increasing digitalization, influence the work well-being of

teachers in Moroccan schools? This question is scientifically significant in several ways. For example, it helps identify the conditions for digitalization that respect employees' well-being and addresses a pressing operational concern for Moroccan public policymakers, who are keen to modernize the education system while maintaining teachers' mental health and engagement.

To answer this question, we adopt an exploratory qualitative approach, based on semi-structured interviews conducted with school teachers. This methodology provides access to the perceptions and lived experiences of actors in the field, and to identify the explanatory mechanisms linking managerial practices, digitalization and well-being at work. The following section breaks down this general objective into specific research questions.

Research goal and research questions

The main goal of this study is to explore how innovative management practices, in the context of increasing digitalization, affect the well-being of teachers at work in Moroccan schools. To address this goal, we formulate the following three research questions:

Q1: What innovative management practices are seen by teachers as supportive of their well-being at work?

Q2: How does the digitalization of schools affect the perception and implementation of these innovative management practices?

Q3: What are the barriers and obstacles that harm teachers' well-being, and how does digitalization amplify or lessen them?

Search results

Theoretical Framework

Managerial innovation is defined as the introduction and implementation of practices, processes, structures, or management techniques that are perceived as new by the organization and aim to improve its performance and adaptability (Birkinshaw, Hamel & Mol, 2008; Hamel, 2006). According to Birkinshaw et al. (2008), it is "the invention and implementation of a practice, process, structure, or management technique that is new compared to the state of the art and intended to help achieve organizational goals." In the education sector, managerial innovation comes through adopting new ways of organizing work, new ways of running schools, and new approaches to the relationships between leadership teams and teaching staff (Hallinger & Heck, 2010; Fullan, 2007). It helps transform management practices and improve how schools operate, responding to today's challenges of performance and well-being at work (Day et al., 2011; Spillane, 2006).

Well-being at work is understood as a multidimensional state arising from an individual's subjective evaluation of their work experience (Grawitch et al., 2015). The job demands-resources model (Bakker & Demerouti, 2007) provides a useful framework: well-being comes from balancing job

demands with available resources. In the education sector, digitalization can be looked at through this lens: it's both a resource (making communication easier, automating tasks, providing personalized feedback) and an extra demand (information overload, cognitive load, feeling monitored). Recent studies confirm this mixed effect of digitalization on employee well-being (Chen, 2025; Ehmann et al., 2025).

Methodology

The study takes an exploratory qualitative approach, favored for understanding the complexity of social phenomena through the discourse of the actors (Creswell, 2014; Denzin & Lincoln, 2018). It falls within an interpretivist paradigm, which assumes that individuals construct social reality through their interactions and interpretations (Schwandt, 1994; Guba & Lincoln, 1994).

The target population consists of teachers working in pioneering schools in the Moroccan public sector. In total, 32 teachers (21 women, 11 men) participated in the interviews, which amounts to a 75% acceptance rate. Among them, 53% have more than 10 years of experience, and 60% have worked at least once at another school, which enhances their ability to compare management practices.

Empirical Results

The results show that teachers see innovative management practices through several angles: their relationship with the administration, communication and feedback, active listening, recognition and appreciation, as well as the role of digitalization.

Regarding the relationship with management, it is generally positive, built on mutual respect and trust. However, the quality of this relationship still depends on the personality of the head of the institution, as some comments show: 'It depends on their personality' (R7).

When it comes to communication and feedback, perceptions are mixed. While most teachers enjoy clear and accessible communication, a significant number complain that communication is mostly one-way, without any room for back-and-forth (R31). Active listening is widely mentioned as a factor for well-being by 74% of respondents. Teachers feel heard when they raise issues, even though some report vague or delayed responses.

Recognition at work comes across as a major motivation boost (60%). It mostly happens in informal ways, like thanks and encouragement, since formal recognition is almost nonexistent in the public sector. On the flip side, 26% of teachers report feeling unrecognized, which can come across as devaluing.

Finally, digitalization plays a mixed role. It's seen as helpful when it improves access to information and transparency, but it also creates stress with cognitive load, monitoring, and the digital gap between generations.

Managerial practices that are favorable and unfavorable to well-being are shown in [Table 1].

Favorable practice	%	Verbatims	Unfavorable practice	%	Verbatims
Caring/supportive communication	38%	<i>"Communication is clear, regular, and accessible."</i>	Lack of recognition	28%	<i>"Recognition is often absent."</i>
Active listening	74%	<i>"The active listening and availability of the principal."</i>	Lack of feedback	9%	<i>"I receive no feedback."</i>
Recognition	60%	<i>"Recognition of work and appreciation."</i>	Top-down communication	9%	<i>"Communication is top-down."</i>
Organizational justice	13%	<i>"Equality and fairness among teachers."</i>	Favoritism/injustice	14%	<i>"Unfair distribution and favoritism."</i>
Skills development	11%	<i>"Continuous training and coaching."</i>	Lack of resources	22%	<i>"The lack of infrastructure is demeaning."</i>

Source: personal development

The results confirm that digitalization acts as an amplifier of managerial practices (Bondarouk & Ruël, 2009). When paired with supportive communication, it boosts transparency and efficiency. On the other hand, without good managerial practices, it heightens tensions (Chen, 2025). This finding aligns with recent studies on the mixed effects of digitalization on employee well-being.

Structural barriers persist: lack of recognition, no feedback, favoritism, and lack of material resources. These barriers limit the impact of management practices. What's specific about the Moroccan context is the importance of non-financial levers. In a public sector setting where financial levers are almost non-existent, informal recognition becomes a strategic issue (Chainane & Boudi, 2024).

Conclusion

This exploratory study aimed to understand how innovative management practices, in a context of increasing digitalization, affect teachers' well-being at work in Moroccan schools. The analysis of interview data from 32 teachers reveals several significant insights. First, digitalization is neither a resource nor a requirement in itself; it acts as an amplifier of management practices. When paired with caring management and transparent communication, it boosts organizational efficiency and teacher satisfaction. On the other hand, in the absence of quality management practices, it magnifies tensions and creates harmful effects like cognitive overload or feelings of being monitored. This finding suggests moving beyond tech-centered approaches and seeing digitalization as a tool whose effects closely depend on how it is implemented.

Secondly, persistent structural barriers limit the impact of management practices: lack of recognition (26%), absence of feedback (21%), favoritism (9%), and insufficient resources (11%). These obstacles, inherent to the Moroccan public sector, can be exacerbated by poorly supported

digitalization. They call for a reflection on the institutional conditions needed for truly innovative management to emerge.

Thirdly, the Moroccan context is characterized by the importance of non-financial levers. In an environment where formal recognition mechanisms (bonuses, promotions) are almost non-existent, informal recognition such as thanks, verbal praise, and personalized attention becomes a strategic issue for teachers' well-being and, ultimately, for the quality of the education system.

In light of these results, several practical recommendations can be made for the actors in the Moroccan education system.

The institutionalization of recognition and feedback practices is also necessary. Rather than relying solely on directors' individual initiative, these practices should be integrated into institutional management procedures to ensure their sustainability and fairness.

We believe that supporting digitalization should be seen as an overall process, including a continuous training plan to prevent the digital divide between generations of teachers and to avoid the feeling of being monitored.

Finally, improving material working conditions is an essential prerequisite. Managerial practices, no matter how innovative, cannot make up for the lack of basic infrastructure and proper resources.

References

- Bakker, A. B., & Demerouti, E. (2007). The job demands-resources model: State of the art. *Journal of Managerial Psychology*, 22(3), 309-328. <https://doi.org/10.1108/02683940710733115>
- Bardin, L. (2013). *L'analyse de contenu* (2e éd.). Presses Universitaires de France.
- Berry, L. L. (1981). The employee as customer. *Journal of Retail Banking*, 3(1), 25-28.
- Biétry, F., & Creusier, J. (2015). Le bien-être au travail : Les apports d'une étude par profils. *Relations Industrielles / Industrial Relations*, 70(1), 11-35. <https://doi.org/10.7202/1032399ar>
- Birkinshaw, J., Hamel, G., & Mol, M. J. (2008). Management innovation. *Academy of Management Review*, 33(4), 825-845. <https://doi.org/10.5465/amr.2008.34421969>
- Bondarouk, T. V., & Ruël, H. J. (2009). Electronic human resource management: Challenges in the digital era. *The International Journal of Human Resource Management*, 20(3), 505-514. <https://doi.org/10.1080/09585190802707235>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Brun, J. P., & Dugas, N. (2005). *La reconnaissance au travail : Analyse d'un concept prometteur*. Université Laval.

- Chainane, Y., & Boudi, Y. (2024). Le bien-être au travail et ses implications managériales : une revue de littérature exhaustive. *International Journal of Accounting, Finance, Auditing, Management and Economics*, 5(7), 61–80. <https://doi.org/10.5281/zenodo.12745678>
- Chen, X. (2025). How does internal corporate social responsibility influence employee turnover intention in the era of digital transformation?
- Colquitt, J. A. (2001). On the dimensionality of organizational justice: A construct validation of a measure. *Journal of Applied Psychology*, 86(3), 386–400. <https://doi.org/10.1037/0021-9010.86.3.386>
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE.
- Day, C., Sammons, P., Leithwood, K., Hopkins, D., Gu, Q., & Brown, E. (2011). *School leadership and student outcomes: Building and sustaining success*. Springer. <https://doi.org/10.1007/978-94-007-1574-3>
- Denzin, N. K., & Lincoln, Y. S. (Eds.). (2018). *The SAGE handbook of qualitative research* (5th ed.). SAGE.
- Ehmann, S., Kampkötter, P., Wenzel, J., & Wolter, S. (2025). Management practices and perceived job quality. *Journal of Economic Behavior & Organization*, 221, 1–18. <https://doi.org/10.1016/j.jebo.2024.01.015>
- Fullan, M. (2007). *The new meaning of educational change* (4th ed.). Teachers College Press.
- Given, L. M. (Ed.). (2008). *The SAGE encyclopedia of qualitative research methods*. SAGE. <https://doi.org/10.4135/9781412963909>
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Aldine Publishing Company.
- Grawitch, M. J., Ballard, D. W., & Erb, K. R. (2015). To be or not to be (stressed): The critical role of a psychologically healthy workplace in effective stress management. *Stress and Health*, 31(4), 264–273. <https://doi.org/10.1002/smi.2523>
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105–117). SAGE.
- Hallinger, P., & Heck, R. H. (2010). Collaborative leadership and school improvement: Understanding the impact on school capacity and student learning. *School Leadership & Management*, 30(2), 95–110. <https://doi.org/10.1080/13632431003663214>
- Hamel, G. (2006). The why, what, and how of management innovation. *Harvard Business Review*, 84(2), 72–84.

- Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge. <https://doi.org/10.4324/9780203887332>
- Le Boterf, G. (2011). *Ingénierie et évaluation des compétences*. Eyrolles.
- Liger, P. (2004). *Le marketing des ressources humaines*. Dunod.
- Maslach, C., & Leiter, M. P. (1997). *The truth about burnout: How organizations cause personal stress and what to do about it*. Jossey-Bass.
- Ministère de l'Éducation Nationale du Maroc. (2022). *Stratégie nationale de la digitalisation du secteur éducatif* [National strategy for the digitalization of the education sector].
- Orabi, M., & Bentaleb, C. (2019). *Le bien-être au travail au Maroc : Essai de contextualisation*.

SECTION

Public administration



Futurity Research Publishing

With Reference to Traditional Public Administration - New Public Management

Florina Popa

SR III, PhD., Institute of
National Economy,
Romanian Academy,
Bucharest, Romania

Corresponding author:

florinapopa289@gmail.com

JEL Classification: H11; H41



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Studies conducted on the methods and techniques of public sector administration have highlighted two basic concepts, with effects on the public administrations of the countries. In recent decades, traditional public administration, designed for a stable environment, has undergone global changes, requiring reforms in the public sector to which it had to adapt. The objective was a governance characterized by efficiency, responsibility, ethics and transparency. To meet these objectives, a solution was adopted, by some countries, of the New Public Management, implementation methods being different. (1) **The objective** of the present study is to provide a review of the transformations that the public administration had to face, to highlight the characteristic elements of each of the two forms of administration, Traditional Public Administration, New Public Management and the essential aspects that differentiate them. (2) **The methodology** of the research was the documentation, selection of ideas from the scientific specialty literature and their processing in the author's own interpretation. in order to achieve the coherence of the study. (3) **Results:** Some similarities and distinctions between the two forms of public administrative system organization based on the relevant ideas and principles of the foundation of the two models are highlighted. (4) **The significance** of the results lies in the presentation of: the context of the appearance of the two models of organization of the public administrative system, tracing the elements characteristic to them, the approach of the transformations of traditional public administration, getting through in order to move to the New Public Management, and the presentation of the aspects that differentiate them.

KEYWORDS: Public Traditional Administration, New Public Management, characteristics, comparative elements.

How to cite: Popa, F. (2026). With Reference to Traditional Public Administration - New Public Management. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21452743>

Introduction

Public administration has been around since the earliest times of human civilization, being a field in continuous development. It puts into practice policies formulated in order to achieve the needs of society, and the degree to which it manages to meet these requirements constitutes an element of success of governments (Zia Yorid Ahsan and Khan M. Zeb, 2014).

A definition formulated by Gerald E. Caiden (1982) shows that "Public administration refers to the implementation of decisions made by public authorities, the organization of coercive mechanisms to ensure the conformity of society and the relations between the community and public authorities, called collective interests [...].It encompasses the organization of public affairs, social objectives and collective decision-making, the management of public institutions, public functions and public property and public administration by officials, covering attitudes and behaviors as well as actions" (Nazmul Ahsan Kalimullah, Kabir M. Ashraf Alam M. M. Ashaduzzaman Nour,2012 p.4, quotes Gerald E. Caiden,1982);.

Studies conducted on the methods and techniques of public sector administration have highlighted two basic concepts, with effects on the public administrations of the countries.

One of the theories - expression of the traditional system of public governance - refers to the bureaucratic system (Weberian), based on hierarchical structure, centralization, policies and rules.

The other - the current of thought represented by the New Public Management - targets aspects such as decentralization, a flexible structure, emphasis on results and citizen participation. Against the background of this theory, in some countries, changes are manifested in the roles and responsibilities of government institutions. (Zia Yorid Ahsan and Khan M. Zeb, 2014).

Research Aim

The study aims to present some ideas and principles of the foundation of the two forms of organization of the public administrative system, respectively, traditional administration and New Public Management. Some similarities and distinctions relevant to outlining a comparative picture and observing the approach and implementation of public actions are highlighted, in relation to the challenges addressed to the economic and social life of the current stage.

Research Results

Traditional Public Administration - Characteristic Elements

Based on the principles of hierarchy and meritocracy, the traditional model of public administration emerged at the end of the 19th century as a result of bureaucratic reforms in the United Kingdom and Prussia, aimed at overcoming administrative systems in which government decisions and appointments to public positions were subject to favoritism. (Robinson M., 2015)

Its origin lies in the theoretical foundations of Woodrow Wilson and Fr. Taylor - United States of

America, the Northcote – Trevelyan report - Great Britain and M. Weber, in Germany. It is considered the best way to organize work in the public sector, being used in a wide range of countries (Katsamunska, P., 2012). Other scientists have also contributed to the shaping of the concept, among them, Luther Gulick, Herbert Simon, Buchanan, Williamson, etc. (Zia Yorid Ahsan and Khan M. Zeb, 2014).

In expressing the principles of bureaucracy, the theory developed by Max Weber focused on hierarchical "top-bottom" control, through which policies were formed at the higher level and were executed by a series of organizations, through the hierarchical subordination of each manager or employee to his superior (Pfiffner J, P., 2004, quoting Weber M., 1946, p.95).

The model was used, for the most part, in Western countries in the 19th and early 20th centuries. An essential element is that "in modern government systems, professional bureaucrats perform the tasks of public administration and, at the same time, are separated from political mechanisms, as well as from the private sphere" (Polya Katsamunska, 2012) quotes Hoos, J., G. Jenei and L.Vass., "Public Administration and Public Management: Approaches and Reforms", In: [Public Policy in Central and Eastern Europe: Theories, Methods, Practices], (eds.) M. Potucek, L.T. (Leloup, G. Jenei, L. Varadi, NISPAcee, 2003, p. 123).

Referring to the defining elements, some authors consider it as "an administration under the formal control of political leadership, based on a strictly model of hierarchical bureaucracy, employed by permanent, neutral and anonymous officials, motivated only by the public interest, which serves and governs citizens equally and does not contribute to politics, but only administers those policies decided by politicians" Polya Katsamunska (2012) quotes Hughes, Owen E., "Public Management and Administration: An Introduction", 3rd ed., Palgrave Macmillan, 2003, p. 17.

The bureaucratic system is characterized by a set of rules and regulations that originate in public law (Pfiffner J. P., 2004), perceived as a "specific set of structural arrangements" (Emile Kolthoff, p 9, quoting Lammers 1983; Shafritz și Hyde 1997, 5).

Robinson Mark (2015, p.5) shows that the essential aspects of this model were formulated by McCourt (2013), who was inspired by the opinions of Minogue (2001):

- ✓ The character of continuity, predictability and governance by rules of public administration;
- ✓ Qualification and professional training are basic elements in the appointment of administrators;
- ✓ There is a hierarchy of tasks and individuals and a division of labor;
- ✓ Resources belong to the organization and not to the individuals within it;
- ✓ Public servants serve the public interest.

The theoretical foundation of the traditional administration model is Weber's theory of

bureaucracy, considered the determined form in a society and particular aspects such as the rationalization of the organization and the bureaucratic coordination of human activities, a specific element of modern organizations (Katsamunska, 2012; Kolthoff, 2007).

In studies on organizations, Weber (1946) shows the elements that characterize an ideal bureaucracy (Kolthoff E., 2007):

- the existence of administrative laws or regulations;
- The principle of hierarchical subordination - a system of subordination of lower offices to those at a higher level; in the management of the modern office, original, written documents are used;
- The management of specialized functions requires specialized training (responsibility lies with the executive and employees);
- Job management is based on general, more or less stable rules.

The above elements show that authorities make decisions based on an established legal framework by applying existing rules. (Kolthoff E., 2007)

Also, the occupation of positions in the bureaucratic organization is based on certain criteria (Polya Katsamunska, 2012, quoting Fry, Brian R., 1989, p. 31):

- ✓ Civil servants are not elected, but appointed on a contract basis. In Weber's opinion, their election would change the conditions of hierarchical subordination;
- ✓ The appointment of civil servants is based on the level of professional qualification;
- ✓ Civil servants are remunerated with a fixed salary and have guaranteed pension rights;
- ✓ Career promotion is based on merit, and seniority may also be taken into account;
- ✓ A unitary system of control and discipline of civil servants is manifested, including concrete instruments of constraint.

An important moment in the formation of administration, as a science, is represented by Woodrow Wilson's work, called "The Study of Administration" (Zia Yorid Ahsan and Khan M. Zeb, p. 428, quoting Woodrow Wilson, "The Study of Public Administration", Political Science Quarterly, Volume 2, Number 2, 1887).

He brought into discussion the politics-administration dichotomy, considering that there must be a clear separation between administration and politics. (Katsamunska, P. 2012).

In the traditional form of public administration, aspects related to hierarchy, independence and integrity, organizational structure and efficiency, based on command and control, predominate, and there is a distinction between civil servants, politicians and citizens.

Considered, in part, inefficient, the bureaucratic model attracted the initiation of reforms targeting the public service. These, however, joined to the area of the Weberian model of the public

service, with the objective of making traditional public administration more efficient and not adopting a new model entirely. (Robinson M., 2015)

The emergence of modern bureaucratic models is related to the industrial revolution and the development of modern economies. Parallel to the system identified by Max Weber, in Germany, in other industrially developed countries, a bureaucratic system developed that made an important contribution to the broad development of private or public enterprises (Pfiffner J. P. 2004).

Unlike European countries, in America, the introduction of management methods from private sector organizations into public ones was practiced in order to make the activity more efficient. In 1911, Frederick W. Taylor published the fundamental work "The Principles of Scientific Management", an important objective for that era, being the finding of management techniques from the private sector that would contribute to making the activity of the government more efficient. Thus, scientific management became an important theory, supported by officials, in search of the best means of increasing efficiency in the public sector. The elements introduced by Taylor in public administration - "standardization of work, systematic control and hierarchical organization" - underline the contribution brought to the public sector, until the 1940s, by the theory of scientific management. (Katsamunskaja, P. 2012)

Fry shows that "these three components - time and motion studies, wage incentive systems and functional organization - constitute the core of Taylor's Scientific Management" (Polya Katsamunskaja, 2012, p 77, quoting Fry, Brian R., Mastering Public Administration: From Max Weber to Dwight Waldo, Chatham House Publishers, Inc., Chatham, New Jersey, 1989, p. 60).

Traditional public administration, designed for a stable environment, has been subject to changes in recent decades, at a global level, which have called for reforms in the public sector and to which it has had to adapt. The objective was a governance characterized by efficiency, responsibility, ethics and transparency (Katsamunskaja, P., 2012).

The emergence of the New Public Management, at the end of the last century, brought changes, with reform initiatives being oriented towards the development of the activity of governments in countries with industrialized economies and, less so, for developing countries (Pfiffner J. P., 2004).

Although a multitude of transformations have taken place, there has been no unanimous opinion that the change in administration has been completed, ensuring an ideal formula for the functioning of the public sector (Peter, B. Guy, 2001). (Polya Katsamunskaja, 2012, quotes Peter, B. Guy, 2001, p. 78).

New Public Management - characteristics

The New Public Administration, from the period of the years 1960s - 1970s, emerged as a challenge to the old form of administration (criticized for the absence of a clear ideology) and had as its basic arguments participation, decentralization, and representative bureaucracy. (Katsamunskaja, P.,

2012).

Participation, in its two forms - political and organizational - signified a process of dispersing power and involving citizens in governance and, respectively, dispersing power in the organization.

Decentralization supported the involvement of citizens in governmental and organizational actions.

Representative bureaucracy signified an administration with a focus on the client and representing the client's interests.

Esveltdt (1997) (Emile Kolthoff, 2007), p 15, quotes (Esveltdt, 1997); signals the presence of the modern model of bureaucracy (Likert, 1961) (Emile Kolthoff, 2007, p.15, quotes Likert, 1961); distinct from the classic Weberian model, the difference between the two variants refers to the personality of the individual.

Thus, the modern model emphasizes respect for the individuality of the organization's members, based on appropriate management, according to which they participate in decision-making, responsibility being divided.

In contrast, the classic model of bureaucracy rejects the individual action of members of a group within the organization. (Kolthoff E., 2007)

The New Public Management, initiated in the last decades of the last century, as a new approach to public sector administration, was focused on issues of efficiency and effectiveness in the field of organizations, government procedures, and the high quality of services delivered.

The process of reforming governance, through the New Public Management, which began in the 1980s - 1990s, was taken up differently. Some countries implemented the new model, others (Western European countries) adopted modernization through which the traditions regarding the strong role of the state in society and the high status of civil servants were confirmed in a new form (Katsamunsk, P., 2012).

Modern reforms of the central administration involve the modernization of the Weberian tradition, by adding new elements to the existing ones, in the context of the market economy, as announced by Geert Bouckaert and Christopher Pollitt (Polya Katsamunsk, 2012), p. 80, quotes (Bouckaert, G., Pollitt, C., 2004, p. 99-100):

- ⇒ the transition from internal bureaucratic rules to satisfying the needs and desires of citizens, demonstrating professionalism to increase the quality and improve services;
- ⇒ increasing the role of representative democracy, through consultation procedures with reference to the expression of citizens' opinions;
- ⇒ In the process of resource management, it is important to give special interest to obtaining results, more than following the observance of procedures;

⇒ improving the public service, with an orientation towards satisfying the requirements of its users.

This reform process, which includes traditional (Weberian) and neo-elements, adopted by the countries of Continental Europe, expresses confidence in the role of the state, in the future, as well as a new approach to reforming public services; at the same time, it is a relevant aspect regarding the range of different approaches to change, which the New Public Management implies (Katsamunskia P., 2012).

The initiation of this new governance formula – the New Public Management – as shown by Yorid Ahsan Zia and M. Zeb Khan (2014), took place in the context of criticisms brought to the bureaucratic principle of organizing public administration, considered inflexible, due to the hierarchical pyramidal system of rules and decision-making, distanced from the expectations of citizens (Yorid Ahsan Zia și M. Zeb Khan, 2014, quotes Richard Parry, in C. Duncan,(ed.), 1992, p. 433).

Characteristic of the New Public Management guidelines is the emphasis on verifying results, disaggregating large organizations and decentralizing managerial authority, taking over market mechanisms that include stimulating competition, directing services to the client, as summarized by Christopher Hood (Yorid Ahsan Zia și M. Zeb Khan, 2014, quote Christopher Hood, p. 433):

- emphasis on the freedom to lead, at the level of organizations;
- performance standards and procedures, on objectives and indicators;
- The transition from practicing input controls to the form of output controls, by measuring based on performance indicators;
- the movement from large, unified management systems to disaggregating/decentralizing the units of the public system;
- practicing competition, in the public sector, with effects on reducing costs;
- taking over some management practices from the private sector (for example, short-term employment contracts);
- concern for reducing costs, efficiency in the use of resources.

(Yorid Ahsan Zia and M. Zeb Khan, 2014)

The aim is to use business practices in the public sector, so that stimulating competition in the public services sector and applying other levers of market mechanisms lead to reducing government costs.

According to some authors (Kolthoff E., 2007), there are two basic principles of the New Public Management, distinct from each other: managerialism and market orientation.

The first principle – managerialism – supports the maintenance of bureaucracy based on its reform and improvement.

The second principle – market orientation – is based on coordination through market mechanisms, the motivation being the possibility of increasing responsibility and efficiency, by increasing quality, emphasis on delegation of authority, and performance measurement (Walsh, 1995) (Emile Kolthoff, 2007, p. 14, quoting Walsh, 1995).

The assessments are that approaching business practices at the governmental level, by using procedures of the private system, implies not the elimination of bureaucracy, but its maintenance, based on the removal of deficient, unproductive elements of the public administrative system. At the same time, the remark is made, in principle, regarding the maintenance of the bureaucratic organizational system in the private sector, primarily in large companies.

The potential positive effects expected as a result of the implementation of public management reform, reported by Pollitt and Bouckaert (2004), refer to the achievement of savings in public spending, increasing the quality of public services, the efficiency of government actions and the effectiveness of policies. (Kolthoff E., 2007, p. 24)

The consequences of the New Public Management initiatives were significant changes in public sector approaches by introducing new management practices, contracting the main services through private companies and non-profit organizations, and creating executive agencies for implementation (Robinson M., 2015).

A comment on the distinctive elements between the two forms of administration approach – New Public Management and Traditional Public Administration can also be made from the perspective of other characteristic principles that show the different orientations of the two concepts and their consequences.

New Public Management emphasizes the achievement of goals and the development of a strategy, since implementation is done by setting objectives and organizing the operations necessary to achieve them. (Schilder A., 2000).

In the Traditional Public Administration paradigm, the interest given to goals and strategy is limited, usually considered absent (Osborne & Gaebler, 1992) (Ard Schilder, 2000, quoting Osborne and Gaebler, 1992); traditionally, special attention has been directed towards internal balance. Strategy development could be beneficial to the traditional model of public sector administration, contributing to the shaping of a coherent purpose of the organization.

In the context of New Public Management, the emphasis is on results and performance measurement, based on the achievement of the objectives of the chosen strategy. The model assumes personal responsibility for obtaining results. Organizational objectives, as well as those of the personnel, being concrete, create the possibility of measuring achievements through performance indicators; the information thus provided, on the achievement of goals, can be useful to the government for monitoring the implementation of policies. (Schilder A., 2000)

In contrast, traditional public administration emphasizes processes and procedures, and responsibility is related to compliance with instructions, in order to prevent errors. Tasks, being established on the basis of specific rules, there is a risk that they will not become procedures for obtaining results. In the public sector, performance evaluation is carried out haphazardly and, as Dixit (1996) (Ard Schilder, 2000 quotes Dixit, 1996) shows, its measurement shows difficulties and involves risks.

Reporting compliance with instructions is gradual; the trajectory follows the direction, from employees to managers, these to the board, and the last, to stakeholders.

The insufficient attention paid to obtaining results, in the public sector, is explained by Vickers and Yarrow, 1988:27, by (Ard Schilder, 2000 quotes Vickers and Yarrow, 1988:27):

- ✓ lack of concern of managers for maximizing profit;
- ✓ absence of valuation on the stock market (lack of trading of shares);
- ✓ non-existence of bankruptcy constraints, generated by financial problems.

Thus, through the New Public Management, the mechanisms of the private sector are established as a model, being accessible to the public sector (emphasis on results, market mechanisms, performance).

Considering the two forms of governance, synthetic, we can speak of the balance that exists between responsibility and efficiency.

- *Responsibility* means hierarchical controls, measuring achievements through the precision with which procedures are followed;
- *efficiency*: the hierarchy is dispersed, the freedom of decision is delegated, the operations of the central level (government) are executed by those outside the hierarchy; it is important to measure results and not to supervise the application of procedures. (Pfiffner J. P., 2004, Schilder A 2000.)

Through the New Public Management, the transition from traditional public administration to new managerial practices is aimed at, constituting itself as a set of techniques and methods adapted to the public sector (Lane) (Marius Petrescu, Delia Popescu, Ionuț Barbu, Roxana Dinescu, 2010, p. 411, quoting Lane). As Hood (1991) states, it is perceived as a current of thought, based on the adoption of techniques and tools from the private sector in the public sector. (Ferlie, Pettigrew, Ashburner and Fitzgerald, 1996) (Marius Petrescu, Delia Popescu, Ionuț Barbu, Roxana Dinescu, 2010, p. 411 quote Ferlie, Pettigrew, Ashburner și Fitzgerald, 1996). Its emergence signified a response to a series of problems encountered by governments around the world in the last two decades of the last century, challenges that traditional administration did not face, such as pressures to reduce spending and increase efficiency in the public sector; the development of advanced technologies; increasing competition, in the context of globalization; society's demands for increasing the quality of services.

(Nazmul Ahsan Kalimullah, Kabir M. Ashraf Alam M. M. Ashaduzzaman Nour, 2012).

Conclusions

Public administration in the 21st century is facing a series of challenges both in advanced economies and in many developing countries. Globally, the world's states must face increasingly complex problems (political, economic and social). The requirement is to find new ways to respond to new challenges.

The emergence of the New Public Management, after the 1980s, meant a new form of approach to public administration and management, an attempt to change and move away from bureaucratic traditions, hierarchical organization towards cultivating new management practices, adapted to the requirements of the market economy, with an emphasis on competition, delegation and performance.

An alternative to bureaucracy, the New Public Management favors the relaxation of the procedures of the traditional system, through actions such as:

- ✓ *fragmentation* of large bureaucratic units into smaller units, more efficient in achieving objectives;
- ✓ *delegation* of decision-making freedom to lower levels of management, to allow initiative and creativity;
- ✓ *contracting* of goods and services and stimulating competition that can lead to improved performance.

The purpose of the changes is for the methods and techniques adopted to generate the reformation of public sector organizations, increasing their competitiveness and efficiency in the use of resources and the provision of services.

The distinction between the two forms of governance is given by the balance between responsibility and efficiency.

Responsibility means hierarchical controls, measuring achievements, through the precision with which procedures are followed, and responsibility for the implementation of public policy.

Efficiency - it is important, especially the measurement of results, rather than the supervision of the application of procedures; the hierarchy is dispersed, the freedom of decision is delegated, and the operations of the central level (government) are executed by those outside the government hierarchy.

At the same time, it is worth noting that both models present elements that highlight the common interest of finding an efficient formula for managing public activities, according to their own principles.

Both branches have as an important element public policies and ways of implementing them, so as to lead to the improvement of the living conditions of society, having professional qualifications

(knowledge of public finances, leadership skills, strategic thinking, etc.).

In practical terms, the two fields, public administration and public management, form a partnership, and the efficiency of putting into practice the skills they possess determines the success in developing public policies. The assessments are that approaching business practices at the government level, by using procedures of the private system, does not imply the elimination of bureaucracy, but its maintenance, based on the removal of deficient, unproductive elements of the public administrative system. (Promberger Kurt, Rauskala Iris 2003. ; Pfiffner, 2004, Klaus Konig, A. Benz, H. Siedentopf, and K.P. Sommermann, eds., Duncker & Humbolt, 2004, Pfiffner, 2000, in J. P. Pfiffner and D. A. Brook, eds, Van Helden and Jansen 2004, 5 quted by Kolthoff Emile, Arkupal Acharya, Schilder, Ard, 2000 , NMP & Traditional Public Administration, Agarwal, Rohit, Smriti Chand, Araujo, 2001 citat de Nazmul Ahsan Kalimullah, Kabir M. Ashraf Alam, M. M. Ashaduzzaman Nour, 2012, p.5; Public Administration vs. Public Management: What's the Difference?, 2019, 2020; Sclar E. D 2000). Polya Katsamunska, 2012.

Although a multitude of transformations have taken place, a unanimous opinion has not been reached, according to which the change of administration has been completed, ensuring an ideal formula for the functioning of the public sector (Peter, B.Guy, 2001) (Polya Katsamunska, 2012, quotes Peter, B.Guy, 2001).

In view of the new challenges of society and the increased demands of citizens, addressed to the New Public Management, it is necessary to find out its best techniques, as well as to adopt methods and tools in relation to the situations that have arisen, which will lead to the achievement of the proposed objectives.

References

- Agarwal, R. (n.d.). *Advantages and disadvantages of decentralization*. Your Article Library. <http://www.yourarticlelibrary.com/accounting/responsibility-accounting/advantages-and-disadvantages-of-decentralisation/52903/>
- Araujo, J. F. F. E. de. (2001). Improving public service delivery: The crossroads between NPM and traditional bureaucracy. *Public Administration*, 79(4), 915-932.
- Borins, S. (1995). The New Public Management is here to stay. *Canadian Public Administration*, 38(1), 122-132.
- Burnheim, J. (1988). *Is democracy possible? The alternative to democratic politics*. Polity Press.
- Caiden, G. E. (1982). *Public administration*. Palisades Publishers.
- Chand, S. (n.d.). *Decentralisation: Meaning, advantages and disadvantages of decentralisation*. Your Article Library. <http://www.yourarticlelibrary.com/organization/decentralisation-meaning-advantages-and-disadvantages-of-decentralisation/25703/>

- Clarke, J., & Newman, J. (1997). *The managerial state: Power, politics and ideology in the remaking of social welfare*. SAGE.
- Dixit, A. (1996). *The making of economic policy: A transaction-cost politics perspective*. MIT Press.
- Dunleavy, P., & Hood, C. C. (1994). From old public administration to new public management. *Public Money and Management*, 14(3), 9-16.
- Dunn, W. N. (1994). *Public policy analysis*. Prentice-Hall.
- Esveltdt, K. (1997). *Bureaucratie bij de overheid en in de particuliere sector* [Bureaucracy in government and in the private sector] [Master's thesis]. VU University Amsterdam.
- Ferlie, E., Lynn, L., & Pollitt, C. (2007). *The Oxford handbook of public management*. Oxford University Press.
- Fitzgerald, L., Ferlie, E., Ashburner, L., & Pettigrew, A. M. (1996). *The new public management in action*. Oxford University Press.
- Fry, B. R. (1989). *Mastering public administration: From Max Weber to Dwight Waldo*. Chatham House.
- Goodsell, C. T. (1994). *The case for bureaucracy: A public administration polemic* (3rd ed.). Chatham House.
- Guy Peters, B. (2001). *The future of governing* (2nd ed.). University Press of Kansas.
- Hodgkinson, C. (1978). *Towards a philosophy of administration*. Basil Blackwell.
- Hood, C. (1991). A public management for all seasons? *Public Administration*, 69(1), 3-19.
- Hoos, J., Jenei, G., & Vass, L. (2003). Public administration and public management: Approaches and reforms. In M. Potucek, L. T. Leloup, G. Jenei, & L. Varadi (Eds.), *Public policy in Central and Eastern Europe: Theories, methods, practices* (p. 123). NISPAcee.
- Hughes, O. E. (1994). *Public management and administration: An introduction*. Macmillan Press.
- Hughes, O. E. (2003). *Public management and administration: An introduction* (3rd ed.). Palgrave Macmillan.
- Hume, L. J. (1981). *Bentham and bureaucracy*. Cambridge University Press.
- Kalimullah, N. A., Alam, K. M. A., & Ashaduzzaman, N. M. (2012). New public management: Emergence and principles. *BUP Journal*, 1(1), 1-22.
- Katsamunsk, P. (2012). Classical and modern approaches to public administration. *Economic Alternatives*, (1), 74-81.
- Kolthoff, E. (2007). *Ethics and new public management: Empirical research into the effects of businesslike government on ethics and integrity*. BJU Legal Publishers.

- Lammers, C. J. (1983). *Organisaties vergelijkenderwijs: Ontwikkeling en relevantie van het sociologisch denken over organisaties* [Organizations compared: Development and relevance in sociological thinking about organizations]. Het Spectrum.
- Lane, J. E. (1994). Will public management drive out public administration? *Asian Journal of Public Administration*, 16(2), 139-151.
- Likert, R. (1961). *New patterns of management*. McGraw-Hill.
- McCourt, W. (2013). *Models of public service reform: A problem-solving approach* (Policy Research Working Paper No. 6428). The World Bank.
- McSwite, O. C. (2002). *Invitation to public administration*. M. E. Sharpe.
- Merton, R. K. (1940). Bureaucratic structure and personality. *Social Forces*, 18(4), 560-568.
- Metcalf, L., & Richards, S. (1990). *Improving public management* (2nd ed.). SAGE.
- Minogue, M. (2001). The internationalization of new public management. In W. McCourt & M. Minogue (Eds.), *The internationalization of public management: Reinventing the Third World state* (pp. 1-19). Edward Elgar.
- Minogue, M., Polidano, C., & Hulme, D. (Eds.). (1998). *Beyond the new public management*. Edward Elgar.
- Nunberg, B., & Nellis, J. (1995). *Civil service reform and the World Bank* (World Bank Discussion Paper No. 161). The World Bank.
- Osborne, D., & Gaebler, T. (1992). *Reinventing government: How the entrepreneurial spirit is transforming the public sector*. Addison-Wesley.
- Parry, R. (1992). Concepts and assumptions of public management. In C. Duncan (Ed.), *The evolution of public management: Concepts and techniques for the 1990s*. Macmillan.
- Parsons, T. (1971). *The system of modern societies*. Prentice-Hall.
- Peirce, W. (1981). *Bureaucratic failure and public expenditure*. Academic Press.
- Petrescu, M., Popescu, D., Barbu, I., & Dinescu, R. (2010). Public management: Between the traditional and new model. *Review of International Comparative Management*, 11(3), 408-415.
- Pfiffner, J. P. (2000). Government legitimacy and the role of the civil service. In J. P. Pfiffner & D. A. Brook (Eds.), *The future of merit: Twenty years after the Civil Service Reform Act*. Woodrow Wilson Center Press.
- Pfiffner, J. P. (2004). Traditional public administration versus the new public management: Accountability versus efficiency. In A. Benz, H. Siedentopf, & K. P. Sommermann (Eds.), *Institutionenbildung in Regierung und Verwaltung: Festschrift für Klaus König* (pp. 443-454). Duncker & Humblot.

- Pollitt, C., & Bouckaert, G. (2004). *Public management reform: A comparative analysis* (2nd ed.). Oxford University Press.
- Pollitt, C., & Summa, H. (1997). Trajectories of reform: Public management change in four countries. *Public Money and Management*, 17(1), 7-18.
- Promberger, K., & Rauskala, I. (2003). *New public management: An introduction from the UK perspective* (Working Paper No. 6/2003). <http://www.verwaltungsmanagement.at/687/uploads/10657009510.pdf>
- Robinson, M. (2015). *From old public administration to the new public service: Implications for public sector reform in developing countries*. UNDP Global Centre for Public Service Excellence.
- Sarker, A. E., & Pathak, R. D. (2000). New public management: An analytical review. *Productivity*, 41(1).
- Schilder, A. (2000). *Government failures and institutions in public policy evaluation: The case of Dutch technology policy*. Van Gorcum.
- Sclar, E. D. (2000). *You don't always get what you pay for: The economics of privatization*. Cornell University Press.
- Shafritz, J. M., & Hyde, A. C. (1997). *Classics of public administration*. Harcourt Brace.
- Stewart, J., & Walsh, K. (1992). Change in the management of public services. *Public Administration*, 70(4), 499-518.
- Taylor, F. (1911). *The principles of scientific management*. Harper & Brothers.
- Turner, M., & Hulme, D. (1997). *Governance, administration and development: Making the state work*. Macmillan.
- Van Helden, G. J., & Jansen, E. P. (2003). New public management in Dutch local government. *Local Government Studies*, 29(2), 68-88.
- Vickers, J. (1988). *Privatization: An economic analysis*. MIT Press.
- Walsh, K. (1995). *Public services and market mechanisms: Competition, contracting and the new public management*. Macmillan Press.
- Weber, M. (1946). Politics as a vocation. In H. H. Gerth & C. W. Mills (Eds.), *From Max Weber*. Oxford University Press.
- Weiss, C. H., & Barton, A. H. (1980). *Making bureaucracies work*. SAGE.
- Wilson, W. (1887). The study of public administration. *Political Science Quarterly*, 2(2), 197-222.
- Zia, Y. A., & Khan, M. Z. (2014). A comparative review of traditional and new public administration and critique of new public management. *Dialogue*, 9(4), 428-442.

SECTION

Engineering



Futurity Research Publishing

Determination of Initial Gas in Place and Active Water Drive in Single-Phase Gas Reservoirs Using the Material Balance Method

Redian Ismailaj^{1*}, Lusjen Ismaili²

¹ State Technical and Industrial
Inspectorate, Tirana, Albania

² Ministry of Infrastructure and
Energy, Tirana, Albania

Corresponding author:
redianismailaj0@gmail.com



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Oil and natural gas remain the world's primary energy resources and continue to play a fundamental role in the global economy. Consequently, the effective management and optimal exploitation of subsurface hydrocarbon reservoirs to maximize hydrocarbon recovery represent major challenges in petroleum engineering and related scientific disciplines. One of the fundamental objectives of reservoir engineering is the estimation of hydrocarbon reserves throughout both the early production stage and the depletion phase of a reservoir, as well as the identification of the natural reservoir drive mechanisms responsible for fluid flow from the reservoir formation to the production wells. These evaluations are essential for the proper characterization, management, and efficient development of oil and gas reservoirs. The present study demonstrates the application of the Material Balance Method to single-phase gas reservoirs for the determination of the Initial Gas in Place and the identification of the presence of an active water-drive mechanism. The proposed methodology integrates historical production data with the physical properties of reservoir gas over a specified production period. The obtained results illustrate the effectiveness of material balance analysis as a practical and reliable reservoir engineering tool for reservoir characterization, reserve estimation, and the evaluation of reservoir drive mechanisms, thereby providing valuable support for reservoir management and future field development planning.

KEYWORDS: cumulative production, reservoir, gas, volume factor, equation, water drive.

How to cite: Ismailaj, R., & Ismaili, L. (2026). Determination of Initial Gas in Place and Active Water Drive in Single-Phase Gas Reservoirs Using the Material Balance Method. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21619534>

Introduction

The existence and producibility of an oil or gas field are primarily governed by two fundamental conditions: the geological condition and the thermodynamic condition. While reservoir characterization commonly involves determining petrophysical properties such as permeability, porosity, fluid saturation, and other reservoir parameters, one of the most critical aspects of reservoir evaluation is the thermodynamic characterization of reservoir fluids through Pressure-Volume-Temperature (PVT) laboratory analysis. Reservoir fluid samples collected at the bottom of production wells are subjected to different pressure and temperature conditions in the PVT laboratory, allowing the investigation of fluid behavior through the phase transformations that occur under reservoir and laboratory conditions (Ahmed, *Reservoir engineering handbook Second Edition*, 2000) (Ahmed, *Reservoir Engineering Handbook*, 2019). The results of these thermodynamic investigations enable the construction of the pressure-temperature (P-T) phase diagram, which represents the fundamental basis for identifying the reservoir fluid type and understanding its phase behavior throughout reservoir depletion (Ahmed & McKinney, *Advanced Reservoir Engineering*, 2005). Accurate characterization of reservoir fluids is therefore essential for predicting reservoir performance, estimating hydrocarbon reserves, and selecting appropriate field development and production strategies.

Furthermore, continuous monitoring of production performance and reservoir pressure throughout the exploitation period, combined with periodic PVT analyses of reservoir fluid samples and the determination of their physicochemical properties as functions of pressure, provides the necessary information for the application of the Material Balance Method (Ahmed & McKinney, *Advanced Reservoir Engineering*, 2005) (Dake, Last Accessed Date November 06, 2024). Material balance analysis constitutes one of the fundamental techniques of reservoir engineering for estimating hydrocarbon reserves and identifying the dominant reservoir drive mechanism (Fuentes-Cruz & Vásquez-Cruz, 2022). Unlike purely volumetric approaches, the Material Balance Method evaluates the actual energy available within the reservoir to displace hydrocarbons from the porous formation toward the production wells, thereby providing a more realistic representation of reservoir performance and depletion behavior (Fuentes-Cruz & Vásquez-Cruz, 2022). The present study considers a single-phase gas reservoir under the assumption of volumetric reservoir behavior. Using historical production data, reservoir pressure measurements, cumulative gas production, and the gas formation volume factor over a specified production period, the Initial Gas in Place (IGIP) is determined through material balance analysis (Ahmed & McKinney, *Advanced Reservoir Engineering*, 2005) (James G. Speight PhD, 2016). Subsequently, the calculated IGIP values at different reservoir pressures are plotted to assess the presence of an active water-drive mechanism. The proposed methodology provides an effective reservoir engineering approach for simultaneous reserve estimation and identification of reservoir drive mechanisms, thereby supporting more reliable reservoir management and field development decisions.

Methodology

Based on the reservoir pressure measurements, cumulative gas production, and gas formation volume factor values presented in Table 1, the Initial Gas in Place (IGIP) was estimated for three representative reservoir pressure levels: 2925 psia, 2525 psia, and 2125 psia. The calculations were performed using the general Material Balance Equation (MBE), followed by its simplification for a single-phase gas reservoir (Ronald E. Terry, 2014). The simplification of the material balance equation was based on the assumptions that the reservoir initially contained no oil, that the effects of rock compressibility and water compressibility were negligible, and that the reservoir exhibited volumetric behavior (Ronald E. Terry, 2014). Under these assumptions, the general material balance equation reduces to a simple linear relationship involving cumulative gas production, the gas formation volume factor, and reservoir pressure. This linear formulation provides a practical and reliable approach for estimating the Initial Gas in Place (IGIP) from production and pressure data (Ronald E. Terry, 2014).

The calculated IGIP values corresponding to the three reservoir pressure levels were subsequently compared through graphical analysis. The consistency of these values was used to verify the applicability of the volumetric reservoir assumption. In contrast, any systematic variation of the calculated IGIP with declining pressure was interpreted as an indication of the presence of an active water-drive mechanism.

Table 1

Data During the Exploitation History

Pressure (psia)	Gas Cumulative Production (MMSCF)	Gas Volume Factor (ft ³ /SCF)
3200	0	0.0052622
2925	79	0.0057004
2525	221	0.0065311
2125	452	0.0077360

Furthermore, based on the selected reservoir pressure, gas formation volume factor, and reservoir temperature values, and by applying the formula $\beta_g = 0.02829 * \frac{Z*T}{p}$, the gas compressibility factor (Z-factor) was determined. Subsequently, the corresponding P/Z ratios were calculated, as summarized in Table 2.

Table 2

Calculation of z-factor and P/Z.

P	T	Z	P/Z
3200	680	0.8753	3656
2925	680	0.8667	3375
2525	680	0.8572	2946
2125	680	0.8545	2487

Using the data presented in Table 2, a P/Z versus cumulative gas production plot was constructed. This graphical analysis was employed not only to estimate the Initial Gas in Place (IGIP) but also to evaluate the existence of an active water-drive mechanism. Under volumetric reservoir conditions, the P/Z plot is expected to exhibit a linear trend, whereas systematic deviations from linearity provide evidence of water influx into the reservoir. The complete methodology including the formulation of the Material Balance Equation (MBE), its simplification for the single-phase gas reservoir considered in this study, the estimation of OGIP at three different reservoir pressure levels, and the construction and interpretation of the P/Z versus cumulative gas production plot is presented in the following section (Ronald E. Terry, 2014) (McKinney, 2005).

Results and Discussion

Based on the general Material Balance Equation, presented in Equation (1), and its subsequent simplification for the specific reservoir conditions considered in this study, as expressed in Equation (2), the Initial Gas in Place (IGIP) was calculated for the three selected reservoir pressure levels.

$$N * (B_t - B_{ti}) + \frac{N * m * B_{ti}}{B_{gi}} * (B_g - B_{gi}) + (1 + m) * N * B_{ti} * \left[\frac{C_w * S_{wi} + C_f}{1 - S_{wi}} \right] * \Delta \bar{P} + W_e =$$

$$= N_p * [B_t + (R_p - R_{soi}) * B_g] + B_w * W_p \quad (1)$$

$$G * (B_g - B_{gi}) + G * B_{gi} * \left[\frac{C_w * S_{wi} + C_f}{1 - S_{wi}} \right] * \Delta \bar{P} + W_e = G_p * B_g + B_w * W_p$$

$$G * (B_g - B_{gi}) + W_e = G_p * B_g + B_w * W_p$$

$$G * (B_g - B_{gi}) = G_p * B_g \rightarrow G = \frac{G_p * B_g}{B_g - B_{gi}} \quad (2)$$

For P=2925 psia

$$G = \frac{79 * 10^6 * 0.0057004}{0.0057004 - 0.0052622} = 1028 \text{ MMSCF}$$

For P=2525 psia

$$G = \frac{221 * 10^6 * 0.0065311}{0.0065311 - 0.0052622} = 1138 \text{ MMSCF}$$

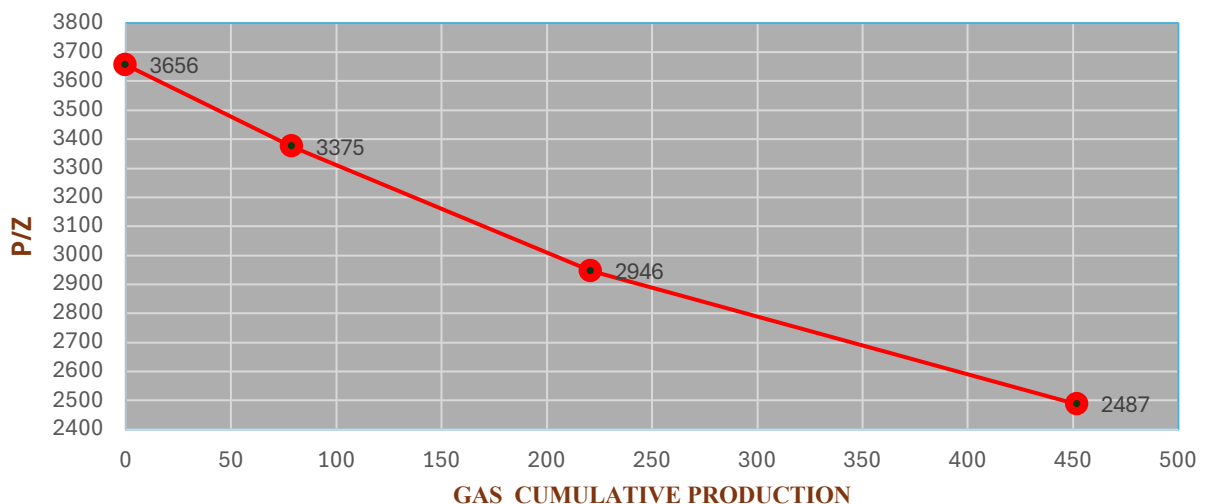
For P=2125 psia

$$G = \frac{452 * 10^6 * 0.0077360}{0.0077360 - 0.0052622} = 1414 \text{ MMSCF}$$

The calculated IGIP values indicate the presence of an active water-drive mechanism. This conclusion is supported by the observation that the estimated original gas reserves obtained at successive stages of reservoir pressure depletion, under the assumption of no water influx, exhibit progressively increasing values. Since the Initial Gas in Place is a fixed reservoir property and should remain constant throughout reservoir depletion, this apparent increase demonstrates that water influx contributes additional reservoir energy, thereby violating the assumptions of a purely volumetric gas reservoir. Consequently, the observed trend provides clear evidence of an active water-drive mechanism. Conversely, if the calculated IGIP values had remained essentially constant over the entire pressure depletion range, the reservoir would have been classified as a volumetric gas reservoir, indicating negligible or no water influx and depletion driven exclusively by gas expansion. Furthermore, based on the calculated values presented in Table 2, the P/Z versus cumulative gas production plot shown in Figure 1 was constructed. At the initial stage of reservoir depletion, the plot exhibits an approximately linear trend, characteristic of a volumetric gas reservoir and initially suggesting depletion driven solely by gas expansion.

Figure 1

Variation of P/Z with Gas Cumulative Production



However, as reservoir pressure declines and the P/Z ratio decreases to approximately 2946, then to 2487, the plotted data progressively deviate from linearity. If reservoir depletion continues, this deviation becomes increasingly pronounced. Such behavior is widely recognized as a characteristic response of reservoirs influenced by an active water-drive mechanism, where water influx provides additional reservoir energy and alters the pressure-depletion relationship predicted for a purely volumetric gas reservoir. Therefore, the observed departure of the P/Z plot from a straight-line trend confirms the existence of active water influx and demonstrates that reservoir performance is governed not only by gas expansion but also by the contribution of the surrounding aquifer.

Conclusion

The application of the Material Balance Equation (MBE), based on historical production and reservoir pressure data acquired throughout the exploitation period of an oil and gas reservoir, together with the reservoir fluid properties determined from Pressure-Volume-Temperature (PVT) analyses of bottom-hole fluid samples, provides a reliable and practical approach for reservoir evaluation.

The methodology enables not only the estimation of hydrocarbon reserves, including the Original Gas in Place (OGIP), but also the identification of the prevailing reservoir drive mechanism and the assessment of the reservoir depletion stage. Consequently, material balance analysis represents an essential reservoir engineering tool for reservoir characterization and performance evaluation. Furthermore, the results of this analysis provide a sound technical basis for reservoir management, production optimization, and strategic decision-making for the planning, development, and long-term exploitation of oil and gas fields.

References

- Ahmed, T. (2000). *Reservoir engineering handbook Second Edition*. Houston, Texas: Gulf Professional Publishing.
- Ahmed, T. (2019). *Reservoir Engineering Handbook*. Gulf Professional Publishing.
- Ahmed, T., & McKinney, P. (2005). *Advanced Reservoir Engineering*. Gulf Professional Publishing. doi:<https://doi.org/10.1016/B978-0-7506-7733-2.X5000-X>
- Dake, L. P. (Last Accessed Date November 06, 2024). *fundamentals of reservoir engineering Developments in Petroleum Science*, 8. Amsterdam Holand.
- Fuentes-Cruz, G., & Vásquez-Cruz, M. (2022). Reservoir performance analysis through the material balance equation: An integrated review based on field examples. *Journal of Petroleum Science and Engineering*, Volume 208, Part A, January 2022, 109377. doi:<https://doi.org/10.1016/j.petrol.2021.109377>

- Islam, M. R. (2021). *Reservoir Development*. Gulf Professional Publishing.
doi:<https://doi.org/10.1016/C2019-0-00936-3>
- James G. Speight PhD, D. (2016). Chapter 4 - Reservoir Fluids. In *Introduction to Enhanced Recovery Methods for Heavy Oil and Tar Sands (Second Edition)*. doi:<https://doi.org/10.1016/B978-0-12-849906-1.00004-7>
- McKinney, T. A. (2005). *Advanced Reservoir Engineering*. Gulf Professional Publishing.
doi:<https://doi.org/10.1016/B978-0-7506-7733-2.X5000-X>
- Ronald E. Terry, J. B. (2014). *Applied Petroleum Reservoir Engineering Third Edition*. Westford.

SECTION

Computer science, computing and automation



Futurity Research Publishing

AskYourDocs: A Retrieval-Augmented Generation (RAG) Powered Document Assistant for Intelligent Information Retrieval

Dr. V. Neelima¹, Panuganti Varshini², Shaik Zohaib Ur Rahman², Purella Sravya², Mohammed Ansaar Ahmed²

¹Professor and Head of
Department, Department of
CSE (AI&ML), Jyothishmathi
Institute of Technology and
Science, Karimnagar,
Telangana, India

²UG Students, Department of
CSE (AI&ML), Jyothishmathi
Institute of Technology and
Science, Karimnagar,
Telangana, India

✉ **Corresponding author:** Dr. V. Neelima,
Department of CSE (AI&ML), Jyothishmathi
Institute of Technology and Science,
Karimnagar, Telangana, India



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: The rapid growth of electronic documents in academic, research, legal and enterprise environments has made effective information retrieval progressively more difficult. Conventional keyword-based search approaches are unable to understand the semantic meaning and the contextual intent of the user query, leading to incomplete or irrelevant results. In this paper, we introduce AskYourDocs, a RAG-based intelligent document assistant that enables users to query documents in natural language. The system accepts multiple document formats such as PDF, DOCX, and TXT. It processes the documents by cleaning the text and splitting it into smaller chunks. These chunks are transformed into semantic embeddings using Sentence-Transformer models and stored in a vector database, FAISS. When a user query comes in, the system performs a vector similarity search to retrieve the most relevant document segments and uses them as grounding context for the Google Gemini Large Language Model (LLM) to generate accurate, document-grounded responses. Voice input and text-to-speech output are also integrated into the system for better accessibility. The system is implemented through an interactive interface built with Streamlit. AskYourDocs combines semantic retrieval and generative AI to reduce hallucinated responses and improve the reliability of document-based question answering, providing a practical solution for education, research, legal, healthcare and enterprise use cases.

KEYWORDS: Retrieval-Augmented Generation, Semantic Search, Vector Database, FAISS, Sentence Transformers, Large Language Model, Natural Language Processing, Document Assistant, Google Gemini, Streamlit.

How to cite: Neelima, V., Varshini, P., Rahman, S. Z. U., Sravya, P., & Ahmed, M. A. (2026). AskYourDocs: A Retrieval-Augmented Generation (RAG) Powered Document Assistant for Intelligent Information Retrieval. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21672590>

Introduction

The rapid digital transformation of academic, professional and organizational content has resulted in large volumes of unstructured documents such as reports, manuals and research papers. The process of extracting specific information from these documents is a time-consuming manual process and traditional keyword-based search systems often do not understand the underlying context and semantic meaning of a user's query resulting in inaccurate or incomplete retrieval results.

To address these issues, in this work, we propose AskYourDocs, an AI-powered document assistant based on the Retrieval-Augmented Generation (RAG) paradigm. RAG is a hybrid of semantic retrieval and generative language modelling, which enables a system to ground its responses in the real content of the uploaded documents, rather than the parametric knowledge of the underlying language model. This grounding mechanism removes the possibility of hallucinated or fabricated answers, a known limitation of stand-alone large language models.

AskYourDocs allows users to upload documents in PDF, DOCX, or TXT format and have a chat with them. The system extracts and sanitizes the textual content, splits it into manageable chunks, converts these chunks into semantic vector embeddings, and stores these embeddings in a vector database for efficient similarity-based retrieval. When the system receives a natural language query, it retrieves the most contextually relevant chunks and sends them to a large language model to generate a coherent, context-aware answer. The platform also includes voice interaction with speech-to-text input and text-to-speech output, making it more accessible to a wider range of users.

The main motivations for this work are (i) reducing the manual effort needed to search large document collections, (ii) improving the contextual accuracy of retrieved information beyond simple keyword matching, (iii) enabling querying across documents from a single interface, and (iv) providing an accessible, voice-enabled interaction model suitable for educational, research, legal, healthcare and enterprise environments.

A. Contributions of This Work

The following list summarises the main contributions of this paper, which are a direct consequence of the design and implementation of the AskYourDocs system:

- A modular Retrieval-Augmented Generation pipeline that combines multi-format document ingestion, Sentence-Transformer embeddings, FAISS-based vector retrieval, and Google Gemini LLM generation to produce document-grounded answers.
- A semantic retrieval mechanism that reduces dependence on exact keyword matching by identifying document segments based on contextual similarity rather than literal word overlap.
- Ability to query multiple documents at once through a single conversation interface without having to cross-reference information manually across multiple files.
- Add support for optional voice input and text to speech output and add support for multiple languages (English, Hindi, Telugu) to improve accessibility.
- A lightweight Streamlit based user interface needing no deep technical expertise, plus auxiliary utilities like jumbled-text correction, symbol/character table generation and chat export.

Literature Review

The combination of Large Language Models (LLMs) and Retrieval-Augmented Generation has had a significant impact on recent research into intelligent document question-answering systems. In this section, we review related work that inspired the design of AskYourDocs.

Singh et al. (2025) propose an agentic RAG framework with autonomous reasoning agents in the retrieval pipeline for dynamic retrieval and reasoning steps to address hallucination and improve factual consistency of LLM outputs. This notion of retrieval augmented with controlled reasoning inspired AskYourDocs' design of restricting LLM responses to the context of the retrieved documents.

Shan (2024) proposed OpenRAG, a modular open-source RAG architecture for customized learning applications, which is scalable and integrates with vector databases flexibly. The layered architecture used for AskYourDocs reflects the modular design philosophy of separating document processing, embedding generation, retrieval, and generation into separate components.

Heydari et al. (2024) proposed a Context Awareness Gate (CAG) to filter out irrelevant retrieved content before sending it to the language model for reduced hallucination and improved factual reliability. This principle of controlled, filtered retrieval is consistent with the context selection used in AskYourDocs, which is based on similarity search.

Mengmeng et al. (2024) presented a multi-stage semantic filtering mechanism to refine search results prior to generation, which enhanced the retrieval precision. This underscores the significance of an optimized vector similarity search stage, which constitutes a core part of the AskYourDocs pipeline.

Gijre et al. (2024) examined the joint use of knowledge graphs and retrieval-augmented generation to enhance interpretability and contextual matching in domain-specific question answering. Although AskYourDocs applies vector retrieval instead of knowledge graphs, this research creates avenues for enhancement.

The research conducted by Putri et al. (2024) assessed strategies for streamlining the generation of embedded data in RAG-based systems in order to lower computational burden whilst maintaining the efficacy level, as indicated by the implementation of a slim Sentence-Transformer embedding engine in AskYourDocs, making it usable even in real-time interactions.

Tural et al. (2024) wrote on various design approaches for ensuring integration of various retrieval components with LLMs. These include embedding matching, query rewriting, and document re-ranking. They are seen in AskYourDocs, where query-embedding, vector-similarity-search, and context-based generation techniques are used.

Other key contributions in this field include Lewis et al. (2020), who first described a combination of a neural retriever and a sequence-to-sequence generator in the retrieval-augmented generation framework; Reimers and Gurevych (2019), whose Sentence-BERT architecture is the basis of applied models for obtaining sentence embeddings, including for the all-MiniLM-L6-v2 model from AskYourDocs; as well as Johnson et al. (2021), whose work on a method for efficient similarity search laid the computational foundation for the FAISS library applied in the system for vector storage and retrieval.

To sum up the articles analyzed so far, RAG technology plays a positive role in enhancing the accuracy of

information provided by documents when answering user queries. Nevertheless, the majority of implementations of this technology are limited to one specific area of application, do not support different document formats, and do not even prioritize the ease of use of their service. AskYourDocs builds on these contributions by combining semantic embedding generation, vector database retrieval, and LLM-based generation within a multi-format, voice-enabled, user-accessible system.

Existing System and Problem Statement

A. Existing System

Conventional document management and retrieval systems rely predominantly on manual reading or keyword-based search. Standard PDF readers and basic search tools match exact words rather than the semantic intent behind a query, and cannot generate conversational, context-aware responses. When multiple documents must be searched, users are required to manually cross-reference content, which increases workload and reduces productivity. Furthermore, standalone LLMs used without a retrieval mechanism may generate responses not grounded in actual document content, resulting in hallucinated or misleading outputs.

B. Limitations of Existing Systems

- Time-consuming manual document analysis.
- Keyword-based search lacks semantic understanding.
- Difficulty retrieving information across multiple documents simultaneously.
- Absence of context-aware or conversational response generation.
- Increased likelihood of hallucinated answers in standalone AI systems without document grounding.
- Inefficient handling of large volumes of unstructured data.

C. Problem Statement

There is a need to design and implement an intelligent document assistant using Retrieval-Augmented Generation that allows users to query documents in natural language, retrieves relevant sections through semantic similarity search, generates accurate and document-grounded responses, supports multiple document formats, and provides scalable, user-friendly interaction suitable for academic and professional use.

Proposed System and System Architecture

A. Proposed System

AskYourDocs addresses the above limitations through a RAG-based pipeline that integrates document preprocessing, semantic embedding, vector-based retrieval, and LLM-based response generation. Uploaded documents (PDF, DOCX, TXT) are parsed to extract raw text, which is cleaned and divided into overlapping chunks using a recursive character-based text-splitting strategy. Each chunk is transformed into a semantic vector embedding using a Sentence-Transformer model (all-MiniLM-L6-v2) and stored in a FAISS vector database.

When a user submits a natural language query, the same embedding model converts the query into a vector representation. The system performs a similarity search against the stored embeddings to retrieve the top-k most relevant chunks. These retrieved chunks, together with the original query, are passed as contextual input

to the Google Gemini LLM, which generates a response grounded in the retrieved document content. The final response is displayed through a Streamlit-based chat interface and can optionally be converted to speech using a text-to-speech module.

B. System Architecture

The system architecture consists of the following functional modules:

- Document Upload Module - Accepts PDF, DOCX, and TXT files through the Streamlit interface.
- Text Extraction and Preprocessing Module - Extracts and cleans raw text using format-specific loaders (e.g., PyPDFLoader for PDF, docx2txt for DOCX).
- Text Chunking Module - This module divides the extracted text into overlaps by using a recursive character text splitter that allows for contextual continuity in the text chunks.
- Embedding Generation Module - This module turns text chunks into high-dimensional semantic vectors with a Sentence-Transformer embedding model.
- Vector Database Module - This module saves and organizes the embeddings in such a way that makes it easy to find the similarities between them with FAISS.
- Module of Query Processing and Retrieval - Converts user queries into an embedding before carrying out a similarity search to find relevant portions.
- Response Generation Module - Provides the Google Gemini LLM with collected information along with the user query so it can produce a context-aware, document-grounded answer.
- Voice Interaction Module - Facilitates speech query input and text-to-speech output for the generated answers.

Fig. 1.

Architecture of AskYourDocs system.

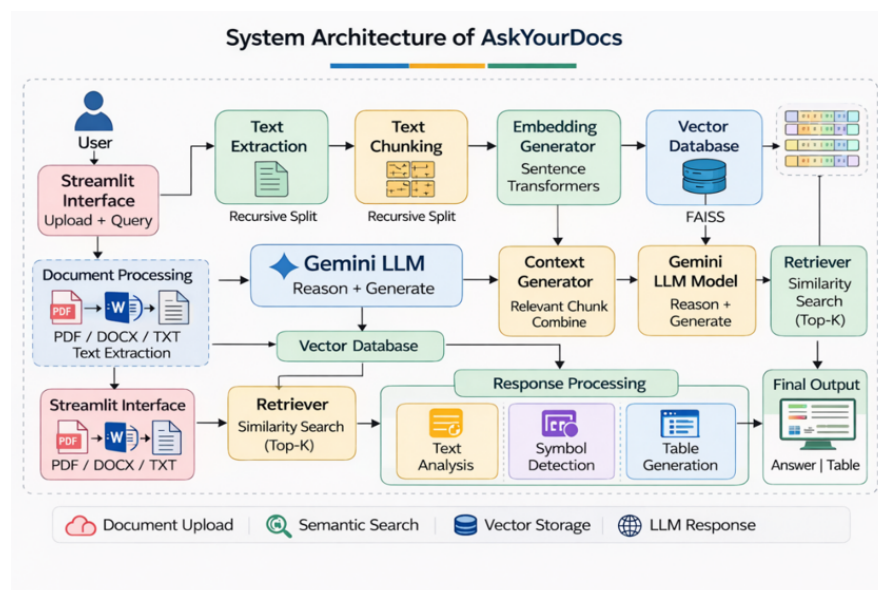
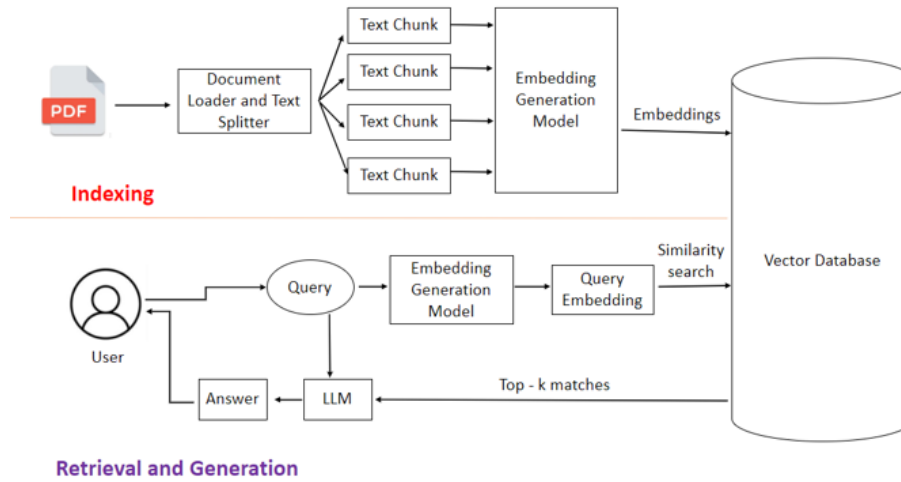


Fig. 2.

Data flow diagram for indexing and generation retrieval phases.



The modular design allows for the decoupling of the retrieval and generation functions, thereby allowing the system to anchor the results of the large language model in reality based on the verifiability of the documents.

C. Mathematical Formulation

AskYourDocs' retrieval-augmented generation (RAG) algorithm can be described in the following manner. Let there be a document split into chunks $c_1, c_2, \dots, c_N$. Every chunk undergoes the transformation from a sentence to a d -dimensional embedding vector using the Sentence-Transformer embedding function f :

$$e_i = f(c_i), \quad i = 1, 2, \dots, N \quad (1)$$

Likewise, the user query q is mapped to the same space of embeddings:

$$e_q = f(q) \quad (2)$$

The relevance between the query embedding and each chunk embedding is measured using cosine similarity, which quantifies the angular closeness between two vectors irrespective of their magnitude:

$$\text{sim}(e_q, e_i) = (e_q \cdot e_i) / (\|e_q\| \|e_i\|) \quad (3)$$

where $e_q \cdot e_i$ denotes the dot product of the query and chunk embeddings, and $\|\cdot\|$ denotes the Euclidean norm. A similarity value closer to 1 indicates greater semantic closeness between the query and the chunk.

The FAISS vector database ranks all indexed chunks by similarity and returns the top- k most relevant segments:

$$C_{\text{top-k}} = \arg \text{top-k} \{ \text{sim}(e_q, e_i) \mid i = 1, \dots, N \} \quad (4)$$

The last step involves concatenation of the obtained top- k chunks, $C_{\text{top-k}}$, together with the query, q , to be used as the grounding context for the Gemini language model to obtain the answer, A .

$$A = \text{LLM}(q, C_{\text{top-k}}) \quad (5)$$

By limiting the generation process to be conditioned on Ctop-k instead of conditioning on parametric knowledge only, Equation (5) formulates the grounding process, which avoids hallucinations, according to the principle of retrieval-augmented generation mentioned in the Literature Review section.

System Implementation

A. Hardware and Software Environment

The system has been developed and tested using a standard laptop/desktop computing environment that requires at least 8 GB of RAM (16 GB recommended), a microphone as an input device, loudspeakers or headphones as the output device, and an Internet connection to connect with the cloud-based Gemini API. The software stack includes the following: Python (version 3.8 and above), Streamlit as a web interface, LangChain for RAG process orchestration, FAISS for vector storage, Sentence-Transformers for generating embeddings, Google Generative AI SDK for large language models, and additional libraries like PyPDF, docx2txt, python-dotenv, gTTS, and SpeechRecognition.

B. Pipeline Algorithm

Algorithm 1 summarizes the complete AskYourDocs pipeline. It covers document ingestion and response generation, as shown in the RAGEngine module.

Algorithm 1

Pseudocode of the AskYourDocs retrieval-augmented generation pipeline.

Algorithm 1: AskYourDocs RAG Pipeline

Input: Document set $D = \{d_1, \dots, d_m\}$; user query q

Output: Generated answer A

```

1: for each document  $d$  in  $D$  do
2:    $text \leftarrow \text{ExtractText}(d)$  // PyPDFLoader / docx2txt / plain read
3:    $chunks \leftarrow \text{RecursiveCharacterTextSplitter}(text, size=1000, overlap=200)$ 
4:   for each chunk  $c$  in  $chunks$  do
5:      $ec \leftarrow \text{SentenceTransformerEmbed}(c)$ 
6:      $\text{FAISS\_Index.add}(ec, c)$ 
7:   end for
8: end for
9:  $eq \leftarrow \text{SentenceTransformerEmbed}(q)$ 
10:  $\text{Ctop-k} \leftarrow \text{FAISS\_Index.similaritySearch}(eq, k)$ 
11:  $context \leftarrow \text{Concatenate}(\text{Ctop-k})$ 
12:  $A \leftarrow \text{GeminiLLM.generate}(q, context)$  // RetrievalQA chain
13: Display( $A$ ) on Streamlit chat interface
14: if voice_output enabled then
15:    $\text{SpeakText}(A)$  // gTTS text-to-speech
16: end if
17: return  $A$ 

```

C. Implementation Workflow

The implementation is done following a systematic workflow that involves:

1. Environment Setup: Setup of Python along with the required libraries and configuration of the code editor.
2. API Configuration: Creation of an API key for Google Gemini using Google AI Studio and saving it through environment variables (.env file) that avoids the exposure of credentials in the source code. The langchain-google-genai library makes use of the connection between the RAG pipeline and the Gemini model.
3. Project Structuring: The structure of the project is based on modularity, where the application file (app.py) is separated from the files for loading the documents, generating embeddings, retrieving the results and working with the voice.
4. Documents Upload and Text Extraction: Documents are uploaded by users in the Streamlit interface and loaders specific to their formats get the text part of the document for further operations.
5. Text Chunking: The RecursiveCharacterTextSplitter splits the extracted text into equal overlapping chunks to maintain the context.
6. Embeddings Creation: The Sentence-Transformer model processes each chunk to create its vector representation.
7. Embeddings Storage: Created embeddings are saved in the FAISS vector store.
8. Query Input: The users ask questions via text or voice input and if there is voice input, it is converted to text by the SpeechRecognition library.
9. Similarity Search: Cosine similarity is used for finding k-nearest chunks based on the similarity of embedding.
10. Response Generation: The found chunks together with the query of the user are used as the context by the Gemini LLM to generate the answer.
11. Answer Presentation and Voice Output: The answer is shown in the chat interface and if it is needed, it can be converted to voice by gTTS.

Fig. 3.

Streamlit-based document upload and chatting interface.

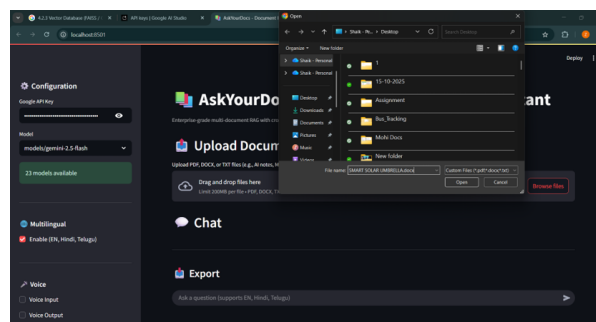


Fig. 4.

Use-case diagram of AskYourDocs.

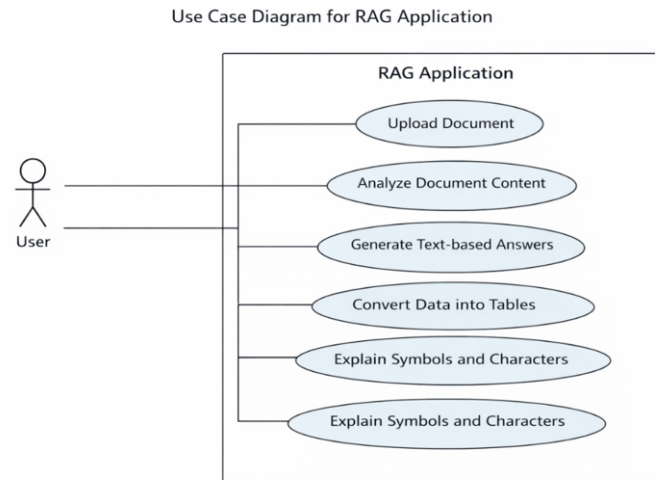
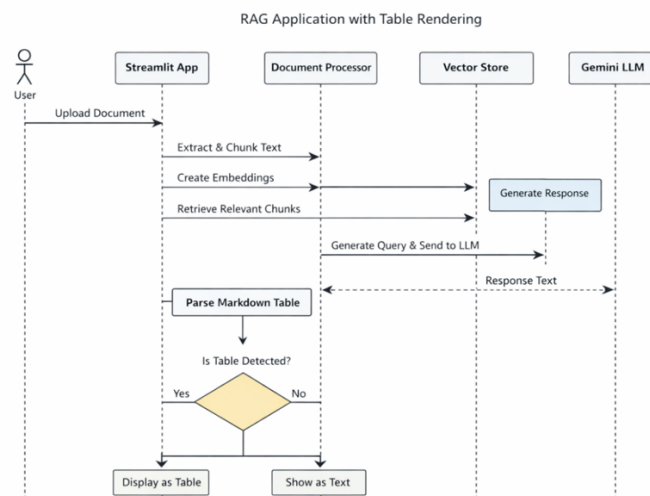


Fig. 5.

Query process and response generation sequence diagram.



D. Core Modules

The architecture of the system consists of distinct modules, which include:

- (1) RAGEngine – is a class responsible for document chunking, embeddings generation, vector stores generation, and executing queries via a RetrievalQA pipeline;
- (2) document_loader – is a module that extracts text in different formats;
- (3) embeddings – is a module that holds HuggingFace Sentence-Transformer model; and

(4) voice_module - is a module responsible for playing audio with texts converted to speech via gTTS.

Furthermore, there are additional modules, such as correction of disordered/corrupted text, generation of symbol/character table based on the raw data, multilingual detection, and exporting the chat log.

Research Results and Discussion

The implemented AskYourDocs solution was evaluated based on observed performance rather than using benchmarking with metrics such as accuracy, precision, recall, and latency, since there were no measurements performed during the development process of this tool. Thus, the following analysis will be focused only on qualitative evaluation of the system's performance and usability.

A. Streamlit Interface

The interface offered an efficient and unified environment where one could set up their Google API key, choose from the Gemini model, upload files, and communicate through the chat box. Multilingual capabilities of the interface were shown by allowing languages like English, Hindi, and Telugu, along with the option to use voice inputs/outputs, without requiring any changes in the backend pipeline itself.

B. Document Upload and Processing

This system was right in accepting PDF, DOCX, and TXT files since they were analyzed through text extraction and chunking and embedding was done without the need for any human effort. This clearly shows that the multi-format ingestion process worked well as expected.

C. Semantic Search and Retrieval Quality

Since both the query and document fragments are mapped to the same vector space, the retrieval can be done based on semantic similarity as opposed to lexical match. This is the main benefit of the RAG framework when compared to keyword search since the system is able to find relevant fragments regardless of whether the wording used by the user is different from the one used in the document.

D. Response Relevance and Hallucination Reduction

With the inclusion of only the extracted and ranked similar documents as the context for the Gemini model, the output was grounded on the source texts instead of being produced using the model's parametric knowledge alone. The approach is consistent with the aims of reducing hallucinations identified in the referenced literature (Singh et al., 2025; Heydari et al., 2024). This is also seen from the ability of the system to provide responses that could be linked back to the documents uploaded.

E. Voice Interaction and Accessibility

Voice inputs and speech outputs served as an accessibility improvement, allowing the users to make their queries vocally and get answers in speech form. This addition improved the usability of the system for those users who prefer to work with auditory feedback.

F. Additional Functional Observations

Apart from these functions, there are some additional auxiliary abilities possessed by this system, such as the ability to fix scrambled or distorted texts, create tables for symbols, numbers, and letters out of disorganized

data, and exporting chat conversations.

Fig. 6

Sample of context-based text response generated using the uploaded document.

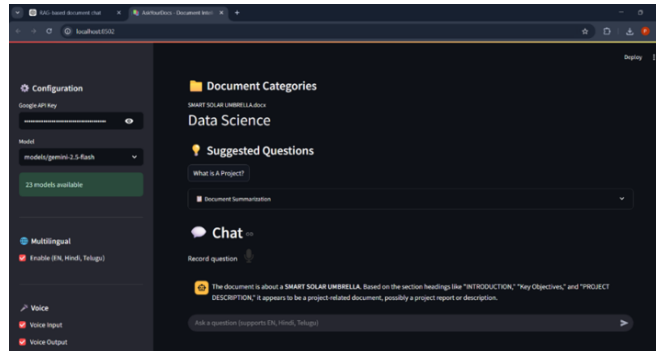
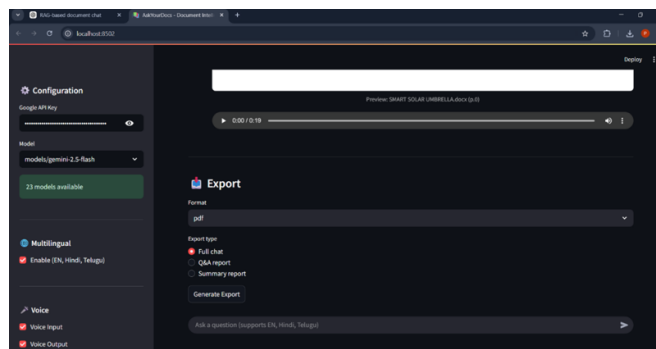


Fig. 7

Sample text-to-speech playback interface for the response generated.



G. Limitations

- No quantitative evaluation (accuracy, precision, recall, F1-score, or latency) was performed; all observations reported are qualitative and based on functional testing during development.
- The mechanism requires a consistent internet connection and the availability of an external Google Gemini API to generate responses, hence making it incompatible for off-line usage.
- The process of dividing information into chunks using overlap can sometimes divide contextually-related data into different chunks, thus reducing the effectiveness of the retrieval.
- The responses generated depend entirely on the language processing and understanding ability of the Google Gemini LLM, which is not under the control of the retrieval framework.
- The current version of the retrieval mechanism uses similarity search based solely on vector space and does not incorporate structured knowledge representation such as knowledge graphs which could further improve contextual precision.
- On the whole, it can be concluded that the RAG-driven approach to AskYourDocs design is an actual improvement of keyword-based search by providing for semantic interpretation of the user requests,

minimizing dependency on non-grounded knowledge of the LLM, and accommodating accessible multi-modal interaction. Mentioned limitations appear to be truly restricting and determine the path for further research.

H. Qualitative Comparison of Retrieval Approaches

The following table highlights a comparative study that is consistent with the above-mentioned observations regarding AskYourDocs, keyword search approach, and a single large language model without using any retrieval system. Note that the table indicates only descriptive characteristics.

Table 1

Comparison of document information retrieval approaches.

Capability	Traditional Keyword Search	Standalone LLM (No Retrieval)	AskYourDocs (RAG-Based)
Understands query semantics/context	No – exact word matching only	Yes, but based only on parametric knowledge	Yes – semantic embedding similarity
Responses grounded in actual uploaded document content	Partial – limited to literal matches	No – not grounded in any external document	Yes – restricted to retrieved chunks
Risk of hallucinated/fabricated answers	Low (no generation occurs)	High	Reduced, via retrieval grounding
Cross-document querying from one interface	Manual cross-referencing required	Not applicable	Yes – single conversational interface
Multi-format ingestion (PDF / DOCX / TXT)	Format-specific tools needed separately	Not applicable	Yes – unified pipeline
Voice input/text-to-speech accessibility	No	No (typically)	Yes – optional voice module
Requires manual effort to locate information	Yes – time-consuming manual reading	N/A	Reduced – automated retrieval

Source: author(s) own development.

Conclusion

The current paper outlines the implementation of a novel document assistant named AskYourDocs, which is a Retrieval-Augmented Generation (RAG) based tool aimed at improving information extraction efficiency and accuracy. In this regard, a combination of multiple steps, including multi-document format ingestion, generating semantic embeddings with the help of Sentence-Transformers, conducting vector similarity search using FAISS, as well as generating the response with the help of Google Gemini LLMs, can be found in the Streamlit framework. The use of RAG as a basis for the grounding procedure reduces the likelihood of getting hallucinated answers since the generation process is confined to contextually relevant documents retrieved. Also, the adoption of voice commands and speech-to-text functionality improves the accessibility of the model.

Some of the future possibilities that could be considered with regards to such a system would be the use of more advanced language models to improve the reasoning abilities of the software; the ability to handle more

file types, such as scanned documents and spreadsheets using OCR methods; better multilingual processing and translation; advanced speech recognition so that the system can accept voice commands; real-time collaboration among users for document analysis; and distributed vector storage for handling massive document corpora. With advances in artificial intelligence technology in knowledge management, there is definite scope for such systems to make knowledge bases from documents an interactive reality.

References

- Gijre, S., Agrawal, R., Laddha, P., & Keswani, G. (2024). Enhancing question answering with knowledge graph retrieval and generation using LLMs. In *Proceedings of the 2024 International Conference on Artificial Intelligence and Quantum Computation-Based Sensor Application (ICAQSA)* (pp. 1-6). IEEE. <https://doi.org/10.1109/ICAQSA64000.2024.10882212>
- Heydari, M. H., Hemmat, A., Naman, E., & Fatemi, A. (2024). Context awareness gate for retrieval-augmented generation. In *Proceedings of the 2024 15th International Conference on Information and Knowledge Technology (IKT)* (pp. 260-264). IEEE. <https://doi.org/10.1109/IKT65497.2024.10892659>
- Johnson, J., Douze, M., & Jégou, H. (2021). Billion-scale similarity search with GPUs. *IEEE Transactions on Big Data*, 7(3), 535-547. <https://doi.org/10.1109/TBDATA.2019.2921572>
- Lewis, P., Perez, E., Piktus, A., Petroni, F., Karpukhin, V., Goyal, N., Küttler, H., Lewis, M., Yih, W., Rocktäschel, T., Riedel, S., & Kiela, D. (2020). Retrieval-augmented generation for knowledge-intensive NLP tasks. In *Advances in Neural Information Processing Systems 33 (NeurIPS 2020)* (pp. 9459-9474). Curran Associates.
- Mengmeng, S., Zhibin, L., Qingwei, W., Man, H., & Feiyang, X. (2024). An effective retrieval method to improve RAG performance. In *Proceedings of the 2024 7th International Conference on Data Science and Information Technology (DSIT)* (pp. 1-5). IEEE. <https://doi.org/10.1109/DSIT61374.2024.10881380>
- Putri, M. R., [+ additional authors]. (2024). *Simplification of embedding process in RAG for optimizing QA chatbot*.
- Reimers, N., & Gurevych, I. (2019). Sentence-BERT: Sentence embeddings using Siamese BERT-networks. In *Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing and the 9th International Joint Conference on Natural Language Processing (EMNLP-IJCNLP)* (pp. 3982-3992). Association for Computational Linguistics. <https://doi.org/10.18653/v1/D19-1410>
- Shan, R. (2024). OpenRAG: Open-source retrieval-augmented generation architecture for personalized learning. In *Proceedings of the 2024 4th International Conference on Artificial Intelligence, Robotics, and Communication (ICAIRC)* (pp. 212-216). IEEE. <https://doi.org/10.1109/ICAIRC64177.2024.10900069>
- Singh, A., Gupta, R., & Kumar, P. (2025). *Agentic retrieval-augmented generation: Enabling autonomous reasoning in RAG systems*. arXiv. <https://doi.org/10.48550/arXiv.2501.09136>
- Tural, B., [+ additional authors]. (2024). *Retrieval-augmented generation (RAG) and LLM integration*.

SECTION

Environmental sciences



Futurity Research Publishing

Renewable Energy Governance and Community Benefit-Sharing in Nepal: Policy Gaps and Local Development Challenges

Hari Prasad Ghimire 

¹ PhD Scholar, Faculty of Environmental Management, Prince of Songkla University, Hat Yai, Songkhla, Thailand

✉ Corresponding author:

harighimire2@gmail.com



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Renewable energy is a core element of energy security, low-carbon transition, and rural development in Nepal, and in particular hydropower and decentralized clean energy systems. However, project benefits do not necessarily translate into local development outcomes. This paper critically summarizes the governance and public benefit sharing of the renewable energy sector in Nepal based on secondary sources of policy documents, institutional reports, and academic literature. The results indicate that royalties, local shares, compensation, employment benefits, community support, and subsidies are present, but they are neither very advanced nor well monitored. The paper suggests a governance framework based upon participation, benefit allocation, local outcomes and accountability, that is oriented towards the community. It provides a summary policy contribution, without using unpublished thesis data.

KEYWORDS: Renewable energy governance; benefit-sharing; hydropower; energy justice; local development; Nepal.

How to cite: Ghimire, H. P. (2026). Renewable Energy Governance and Community Benefit-Sharing in Nepal: Policy Gaps and Local Development Challenges. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21260946>

Introduction

There is a growing recognition of the importance of renewable energy in Nepal, as it can contribute to addressing energy access challenges, energy security, low-carbon development, and rural economic transformation. The electricity pathway in Nepal is heavily dependent on hydropower, and for remote and rural areas, decentralized renewable technologies like micro-hydro, solar, biogas, and improved cooking systems are important. There are also recent national documents linking energy transition to climate ambition. There is a long-term trajectory for achieving net zero carbon dioxide emissions by 2045 in the NDC 3.0, and the energy sector is a pivotal instrument in national development planning in the Energy Sector Synopsis Report 2024 (Government of Nepal, 2025; WECS, 2024).

Even with the policy momentum, development of renewables presents a governance challenge. Projects can help to provide electricity for the country, but communities affected by them are not asking for "just compensation". They want reasonable engagement, employment locally, access to electricity, infrastructure development, earning opportunities, environmental protection, and transparency of revenue. In the case of hydropower, these expectations are reinforced, as communities provide land, water access, local labor, social acceptance and ecological space. The issue of benefits sharing is thus not just a matter of project finance. It is about who is involved, who must pay, who is going to get something out of it, and who will keep an eye on the promises once they are approved for the project.

There are several formal and informal benefit-sharing instruments in Nepal. This encompasses compensation, employment and renewable energy subsidies, community development activities, local share offers, and royalty distribution. According to IFC (2018), the local shares mechanism in Nepal is an innovative approach to reserve up to 10% of shares within hydropower projects for project-affected communities. Later, World Bank case studies confirmed that 32 hydropower projects had issued local shares as of September 2019 (World Bank, 2021). These mechanisms demonstrate that benefit-sharing is currently in practice in Nepal with renewable energy, but is not balanced and project-specific.

The main issue is that the governance of renewable energy tends to be more focused on installed capacity, generation, investments, and growth of the grid, with less monitoring of local development outcomes. This paper attempts to fill that void by examining policy and institutional challenges of renewable energy governance and community benefits sharing in Nepal. It shall be an original conference paper using inclusive data, and not include unpublished thesis survey, interview, or field data.

Research Aim and Research Questions

This paper aims to examine policy gaps and local development challenges in renewable energy governance and community benefit-sharing in Nepal. The paper addresses three research questions:

1. How is community benefit-sharing reflected in Nepal's renewable energy governance?
2. What policy and institutional gaps affect local development outcomes?

3. How can renewable energy governance become more community-centered and accountable?

Materials and Methods

This research is qualitative research with a policy analysis approach using a review methodology. It is based on secondary sources such as energy laws, renewable energy policies, government reports, energy justice and benefit-sharing studies, and academic papers. Some key sources are the Electricity Act, 1992, National Energy Strategy of Nepal, Nepal's Long-term Strategy for Net-zero Emissions, NDC 3.0, AEPC progress reports, NEA annual reports, WECS energy sector reports, IFC's local shares study, ICIMOD's benefit-sharing report, and World Bank hydropower benefit-sharing case studies (AEPC, 2024; Government of Nepal, 1992, 2013, 2021, 2025; IFC, 2018; ICIMOD, 2016; NEA, 2024; WECS, 2024; World Bank, 2021).

Thematic content analysis was used for the analysis. The sources were analyzed by the six themes of governance structure, participation, benefit-sharing instruments, local development outcomes, monitoring, and policy gaps. The method can be used for a short conference paper, as in this case, the thesis data is not duplicated or directly based on primary human participant research.

Research Results

There are five key findings of the review. First, the governance of renewable energy has broadened in Nepal, while decision-making is still heavily centralized, influenced by government laws, regulators, project developers and national energy policies. The Electricity Act 1992 offers a royalty mechanism for electricity projects, and more recent strategies and programs focus on the development of renewable energy, private investment and decentralized energy supply (Government of Nepal, 1992, 2013). This facilitates sectoral growth but may result in a reduced ability of local governments and affected communities to influence project design and benefit distribution and post-construction monitoring.

Second, there are several instruments to implement community benefit-sharing, but the instruments are not fully integrated. The main mechanisms are summarized in Table 1. Royalty distribution can help the local public finance; local shares can provide equity participation; compensation can help to cover direct losses; and community programs can enhance the infrastructure or services. These devices, however, do tend to function independently. Weak livelihood restoration and compensation to the community. Another one might be granted access to local shares but not have the financial knowledge to comprehend investment risk. This brings a gap between policy and implementation of benefits and local development outcomes.

Table 1

Main community benefit-sharing instruments in Nepal's renewable energy sector

Instrument	Main purpose	Local value	development	Key gap
Royalty sharing	Public revenue from hydropower generation	Can finance local infrastructure and services		Weak public tracking of actual community outcomes
Local shares	Equity participation by affected communities	Creates ownership and possible financial return		Risk of unequal access and low financial literacy
Compensation	Payment for land and project-related losses	Reduces direct household loss		May not restore long-term livelihoods
Community support	Roads, electrification, schools, health or local programs	Visible project-area benefits		Often project-specific and weakly standardized
Renewable energy subsidy	Access to clean energy technologies	Supports remote and underserved groups		Requires stronger targeting and sustainability

Source: Author's synthesis based on AEPC (2024), IFC (2018), ICIMOD (2016), WECS (2024), and World Bank (2021).

Third, and most importantly, local shares are a unique mechanism in Nepal for sharing benefits but must be better protected. IFC (2018) commented that local shares can foster local ownership and support for hydropower. The local shares can also capture parts of the value of hydropower for project-affected people, as the World Bank (2021) also revealed. But equity does not necessarily translate to equitable benefit-sharing. Lower-income families may not be able to invest as much. Some investors may lack understanding of the volatility of share price, lock-in period, or the risk of the market. Such a system of benefits sharing, therefore, can benefit those households who have more cash, have better financial knowledge, and have better networks.

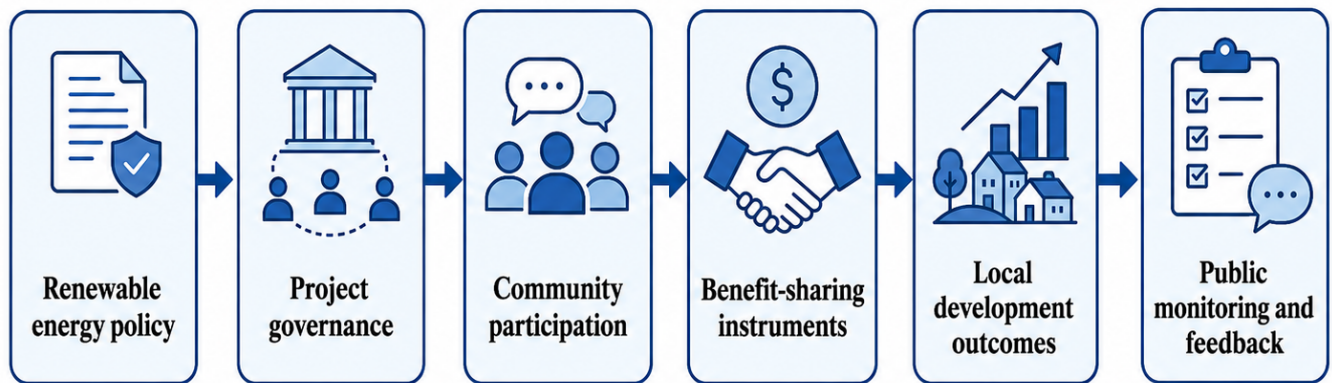
Fourth, the issue of participation continues to be a key governance challenge. Distribution justice, procedural justice, and recognition justice are identified as key aspects of energy systems in the energy justice literature (Jenkins et al., 2016; McCauley et al., 2013; Sovacool & Dworkin, 2015). In terms of governing renewables in Nepal, these are three practical questions. Who benefits and who suffers the costs? What stakeholders are involved in decisions before and after project approval? Who is included in the planning for needs, risk, and identity? Public consultation is not effective in ensuring meaningful community influence if it is restricted to procedural meetings.

Fifth, there should be more effective monitoring of local development results. Energy access, renewable energy growth, and climate-aligned development (AEPC) are highlighted in various national reports, including those from the WECS, NEA, Government of Nepal (2021, 2025), and NEP (2024).

While these goals are important, communities affected by the issue need to see tangible local results. They include livelihood restoration, the use of royalty funds, local infrastructure maintenance, grievance resolution, and inclusion of women, indigenous people, and low-income households, among others. Public reporting can transform benefit sharing from a project promise, not a development mechanism that can be held accountable for.

Figure 1

Community-centered framework for renewable energy benefit-sharing



Source: Author's own development.

The framework in Figure 1 proposes a practical sequence. Renewable energy policy should not end at generation targets. It should move through project governance, meaningful participation, defined benefit-sharing instruments, measurable local development outcomes, and public feedback. This framework can help Nepal connect national renewable energy goals with local legitimacy.

Policy Implications

After the review, there are four policy implications. Nepal should develop more transparent rules and procedures for the sharing of benefits from renewable energy projects, including the minimum requirements for participation, compensation, local shares, local jobs, public reporting, and problem resolution. Second, the local government should be more involved in monitoring the benefits promised, rather than in facilitating the project. Third, there is a need for financial literacy and risk disclosure and inclusion measures in conjunction with local shares to ensure that the poorest households are not being left out. Fourth, local development outcomes from renewable energy projects, such as who gained from the project, what was provided, and whether benefits were maintained or sustained, should be reported.

Conclusions

The paper analyzed renewable energy governance and community benefit-sharing in Nepal by

using a policy analysis approach based on a review. The key conclusion is that while some benefit-sharing mechanisms have been established in Nepal, they are not comprehensive or well monitored. Local shares are innovative and visible but are not a substitute for governance at the community level. Royalty sharing, compensation, employment, community support, and renewable energy subsidies can only be used to promote local development if they are tied to participation, transparency, and public accountability.

The paper provides a short framework to link renewable energy policy to project governance, community engagement, benefit sharing mechanisms, local development outcomes, and feedback. The policy change that needs to happen for Nepal is from generation to a community-centered approach for renewable energy governance. The present framework should be further tested through comparative case studies of hydropower, solar, and decentralized renewable energy in various ecological regions of Nepal in the future.

Declarations

Funding: This research received no external funding.

Conflict of interest: The author declares no conflict of interest.

Ethics statement: This paper is based only on secondary data, policy documents, reports, and published literature. No human participants, surveys, interviews, or personal data were used.

Data availability: All sources used in this paper are publicly available and cited in the reference list.

References

- Alternative Energy Promotion Centre. (2024). *Progress at a glance: Year in review FY 2080/81 (2023/24)*. Government of Nepal. <https://www.aepc.gov.np/doc/progress-at-a-glance-year-in-review-fy-208081-202324>
- Electricity Act, 2049 (1992). Government of Nepal. <https://admin.theiguide.org/Media/Documents/ElectricityAct1992.pdf>
- Government of Nepal. (2013). *National energy strategy of Nepal*. <https://policy.asiapacificenergy.org/sites/default/files/National%20Energy%20Strategy%20of%20Nepal%202013%20%28EN%29.pdf>
- International Centre for Integrated Mountain Development. (2016). *Benefit sharing and sustainable hydropower: Lessons from Nepal*. <https://lib.icimod.org/records/ynfg5-j8b20/files/icimodHydropower.pdf>
- International Finance Corporation. (2018). *Local shares: An in-depth examination of the opportunities and risks for local communities seeking to invest in Nepal's hydropower projects*.

<https://ifcsia.org/publications/local-shares-an-in-depth-examination-of-the-opportunities-and-risks-for-local-communities-seeking-to-invest-in-nepals-hydropower-projects/>

Jenkins, K., McCauley, D., Heffron, R., Stephan, H., & Rehner, R. (2016). Energy justice: A conceptual review. *Energy Research & Social Science*, 11, 174–182. <https://doi.org/10.1016/j.erss.2015.10.004>

McCauley, D., Heffron, R., Stephan, H., & Jenkins, K. (2013). Advancing energy justice: The triumvirate of tenets. *International Energy Law Review*, 32(3), 107–110.

Ministry of Forests and Environment. (2021). *Nepal's long-term strategy for net-zero emissions*. Government of Nepal. https://giwmscdnone.gov.np/media/pdf_upload/Nepal%27s%20Long-Term%20Strategy%20for%20Net-Zero%20Emission%20%28Approved%20by%20the%20Cabinet%202078-07-09%29_5radiof.pdf

Ministry of Forests and Environment. (2025). *Nepal nationally determined contribution 3.0*. Government of Nepal. <https://unfccc.int/sites/default/files/2025-05/Nepal%20NDC3.pdf>

Nepal Electricity Authority. (2024). *A year in review: Fiscal year 2023/2024*. <https://nea.org.np/en/category/annual-reports>

Sovacool, B. K., & Dworkin, M. H. (2015). Energy justice: Conceptual insights and practical applications. *Applied Energy*, 142, 435–444. <https://doi.org/10.1016/j.apenergy.2015.03.108>

Water and Energy Commission Secretariat. (2024). *Energy sector synopsis report 2024 (FY 2079/80)*. Government of Nepal. <https://wecs.gov.np/content/56/energy-sector-synopsis-report-2024--fy-2079-80-/>

World Bank. (2021). *Case studies on local benefit sharing in hydropower projects*. <https://documents1.worldbank.org/curated/en/757781627388178782/pdf/Case-Studies-on-Local-Benefit-Sharing-in-Hydropower-Projects.pdf>

SECTION

Chemical Sciences



Futurity Research Publishing

Design and Synthesis of 4-amino-1H-indole-6-carboxamide derivatives as targeting molecules of Cholinesterase Enzymes

Kundavaram Raju^{1*}, Dr. L. Siva Sanker Reddy²

¹⁻² Research Scholar,
Department of Pharmaceutical
Sciences, Jawaharlal Nehru
Technological University,
Anantapur, Ananthapuramu,
Andhra Pradesh-515002, India

✉ ***Corresponding author:**
me@kingraju.live



This work is licensed under CC BY-NC-ND 4.0.
To view a copy of this license, visit
<https://creativecommons.org/licenses/by-nc-nd/4.0>

ABSTRACT: Alzheimer's disease, being a neurodegenerative disorder that progresses over time, is one of such diseases that needs immediate and serious attention. As inhibitors of acetylcholinesterase and butyrylcholinesterase for the treatment of Alzheimer's disease, a new series of 4-amino-1H-indole-6-carboxamides has been designed, and 15 such molecules have been synthesized from 3,5-dinitrobenzoic acid via a multicomponent reaction. These synthesized compounds were characterized by spectral data and evaluated for inhibitory activity against acetylcholinesterase and butyrylcholinesterase. Among the series compound 9o with indole carboxamide fused with trimethoxy benzaldehyde with methylene-2-(thiazol-4-yl) aceto hydrazide linker showed potent inhibitory activity with IC₅₀ of 0.94±0.10 and 1.10 ±0.05 µM compared to standard drug rivastigmine 0.47 ±0.2 & 0.65 ±0.02 µM against AChE and BuChE, respectively. 9o was further studied for brain cholinesterase inhibitory activity and exhibited potent activity with IC₅₀ values of 25.32±0.25 and 28.24±0.18µM, respectively. Docking studies revealed that the designed molecules interacted with the nicotinic receptor through at least two hydrogen-bond interactions, except for a few compounds.

KEYWORDS: Tacrine, Alzheimer's disease, cholinesterase inhibitors, Hydrazine.

How to cite: Raju, K., & Sanker Reddy, L. S. (2026). Design and Synthesis of 4-amino-1H-indole-6-carboxamide derivatives as targeting molecules of Cholinesterase Enzymes. *World Conference on Science, Innovation and Human Progress*. Futurity Research Publishing. <https://doi.org/10.5281/zenodo.21236265>

Introduction

The most prevalent type of dementia in the elderly population is caused by Alzheimer's disease (AD), a gradual and deadly degenerative illness of the central nervous system. [1]. According to the 2015 Alzheimer's Disease International Association Report, dementia affects over 46 million individuals worldwide. This figure is predicted to rise sharply in the future due to the spread of the AD epidemic, reaching 131.5 million cases by 2050 [2]. The amyloid beta cascade hypothesis is the most widely recognized idea about the cause of AD. When hyperphosphorylated Tau builds up in AD, it separates from microtubules, causing instability, a disruption in neuronal transport, and brain atrophy [4]. According to the cholinergic theory of AD, cognitive and memory impairments result from a decrease in acetylcholine (ACh) levels, and medications that raise ACh levels have been shown to improve the disease's behavioral, functional, and cognitive symptoms. Therefore, maintaining or regaining cholinergic function is thought to be clinically advantageous [5]. It has been discovered that oxidative stress is present in the brain tissue of AD patients. Therefore, treatments for AD that disrupt the vicious cycles of oxidative stress and neurodegeneration present new possibilities [6].

Research Aim and Research Questions

Currently, there is no cure for Alzheimer's disease, and therapeutic therapies only provide palliative care. The primary method of treating Alzheimer's disease has been to increase ACh levels in the brain using acetyl cholinesterase inhibitors (AChEIs) such as tacrine, donepezil, galantamine, or rivastigmine, as well as the NMDA receptor antagonist memantine [7, 8]. The hybrid-based approach has been growing and has become a central point in the field of medicinal chemistry. So, in the design of multitarget-directed novel 4-amino-1H-indole-6-carboxamides derivatives, the indole group could be modified by binding other functional fragments, which is still of great interest [9]. With respect to designing hybrid structures, some multi-target compounds were designed by connecting 4-amino-1H-indole-6-carboxamides with another fragment through a proper linker in order to develop potent ChEIs with additional activities [10]. After that, several molecules with similar structures were synthesized by other groups that showed anti-A β activities [11-13].

Research Results

Baswaraju Macha et al. (2022) [14] reported A new series of acetylcholinesterase and butyrylcholinesterase inhibitors designed based on the structure. Bingul et al. (2020 [15] reported that the Methyl 7-[(E)-(2-benzoylhydrazinylidene)-methyl]-4,6-dimethoxy-1H-indole-2-carboxylates were evaluated for anti-cholinesterase activity, with the highest inhibition determined with the values of 83.31% and 73.55 % for AChE and BChE, respectively. Baswaraju Macha et al., 2020 [16] reported a series of new phenyl-containing benzo chromo pyridine compounds were designed, synthesized, characterized by spectral data and evaluated for cholinesterase inhibitory activity to be useful in Alzheimer's disease. Shoaib Khan et al. (2025 [17] reported synthesizing and evaluating a series of

thiazole-derived thiadiazole-based Schiff base derivatives for their potential anti-Alzheimer and antioxidant activities, with a focus on identifying promising drug-like candidates.

The designed compounds were synthesized as outlined [scheme-1]. The physical data of the synthesized compounds, results of biochemical evaluation (in vitro AChE and BuChE inhibitory activity and in vitro brain AChE and BuChE inhibitory activity of the compounds), and docking results have been tabulated below after scheme 1 in [Table-1], [Table-2] and [Table-3], respectively.

Scheme 1:

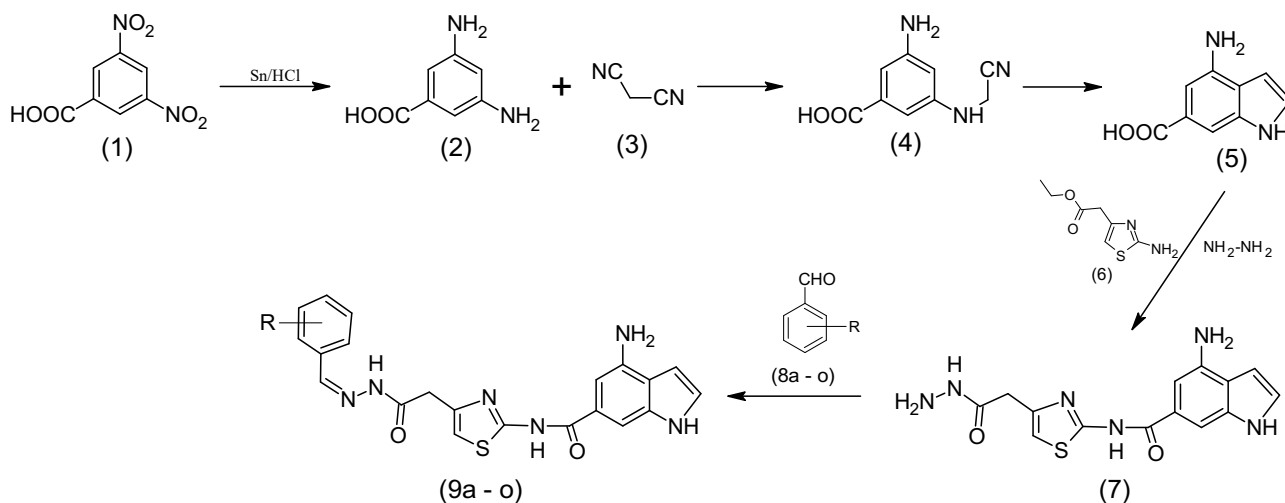


Table 1

Physical data of the 4-amino-N-(4-(2-(Substituted-2-benzylidenehydrazineyl)-2-oxoethyl)thiazol-2-yl)-1H-indole-6-carboxamide (9a-o).

Com	R	M. Form	M.Wt	M.P	Rf*	% Yield
9a	H	C ₂₁ H ₁₈ N ₆ O ₂ S	418	160-162	0.9	27
9b	4-Cl	C ₂₂ H ₁₉ ClN ₆ O ₃ S	482	175-177	0.5	30
9c	4-Br	C ₂₂ H ₁₉ BrN ₆ O ₃ S	527	160-162	0.6	54
9d	4-F	C ₁₅ H ₁₂ FN ₃ O	466	212-214	0.8	68
9e	4-NO ₂	C ₂₂ H ₁₉ N ₇ O ₅ S	493	178-180	0.7	72
9f	4-CH ₃	C ₂₃ H ₂₂ N ₆ O ₃ S	462	158-160	0.8	45
9g	3-Cl	C ₂₂ H ₁₉ ClN ₆ O ₃ S	482	180-182	0.5	70
9h	2,4 Di chloro	C ₂₂ H ₁₈ Cl ₂ N ₆ O ₃ S	517	158-160	0.8	47
9i	3,4,5 tri chloro	C ₁₅ H ₁₀ Cl ₃ N ₃ O	355	160-162	0.9	45
9j	2,4 Di bromo	C ₂₂ H ₁₈ Br ₂ N ₆ O ₃ S	603	174-176	0.8	68
9k	2,4 Di flouro	C ₂₂ H ₁₈ F ₂ N ₆ O ₃ S	484	199-201	0.7	55
9l	2,4 Di nitro	C ₂₂ H ₁₈ N ₈ O ₇ S	538	169-171	0.8	50

9m	2,4 Di methyl	C ₂₄ H ₂₄ N ₆ O ₃ S	476	180-182	0.6	65
9n	2,4 dihydroxy	C ₂₂ H ₂₀ N ₆ O ₅ S	480	190-192	0.4	81
9o	3,4,5 tri methoxy	C ₂₅ H ₂₆ N ₆ O ₆ S	538	194-196	0.5	70

Table 2

In vitro AChE/BuChE inhibitory activity and *in vitro* Brain AChE/BuChE inhibitory activity

In vitro AChE/BuChE inhibitory activity				In vitro Brain AChE/BuChE inhibitory activity		
Comp.	AChE ^a	BuChE ^a	SI ^b	Comp.	AChE ^a	BuChE ^a
9a	2.82±0.25	3.08±0.03	1.09	9b	32.27±0.20	35.36±0.28
9b	1.82±0.12	2.35±0.07	2.0	9h	29.24±0.20	31.45±0.23
9c	2.43±0.21	3.86±0.05	2.69	9i	26.34±0.18	30.43±0.26
9d	3.05±0.03	4.08±0.03	1.33	9j	29.65±0.15	33.56±0.32
9e	4.35±0.02	3.89±0.02	1.52	9k	28.24±0.41	31.35±0.34
9f	3.79±0.04	4.28±0.12	2.94	9n	34.31±0.24	30.23±0.26
9g	2.30±0.02	3.65±0.15	1.06	9o	25.32±0.25	28.24±0.18
9h	1.03±0.02	1.35±0.07	1.20	Rivastigmine	23.48±0.20	29.25±0.28
9i	0.98±0.18	1.21±0.14	1.61	Control	38.25±0.52	55.20±0.22
9j	1.25±0.02	2.64±0.12	2.18			
9k	1.38±0.15	2.02±0.10	2.20			
9l	2.65±0.27	5.04±0.08	1.90			
9m	3.08±0.14	4.24±0.06	3.0			
9n	1.94±0.10	2.10±0.05	1.17			
9o	0.94±0.10	1.10±0.05	1.40			
Standard	0.47±0.2	0.65±0.02	1.38			

^a data are expressed in IC₅₀(μM) as (mean ± SD, n=3).

^b Selectivity index = IC₅₀ (BuChE) / IC₅₀ (AChE)

Table 3

Results of Docking Studies

Comp	B.E* (1HBJ)	Hydrogen bonding (1acj)	B.E* (7Q1P)	Hydrogen bonding (6ep4)
9a	-10.07(6)	Tyr121, Ser122(2), Ser200,	-7.57(1)	Asp221
9b	-9.22(3)	Tyr121, Ser122,	-6.61(1)	Gly128
9c	-8.66(4)	Tyr70, Ser122, Ser200, Se122	-6.38(2)	Asp56(2)w

9d	-9.51 (4)	Ser122, His440, Ser122	-7.33(3)	Asp33, Glu125, Gly128
9e	-10.73(5)	Trp84, Tyr121, Ser122, Ser200, Ser122	-6.84(2)	Asp133, Gly128
9f	-10.90 (4)	Ser200, Ser81, Trp84	-7.52(4)	Tsr54, Asp56, Lys54, Asn49
9g	-11.05(4)	Ser122, Ser200, Ser122, His440	-7.46(2)	Gly128, Glu125
9h	-10.73(4)	Tyr121, Ser122, Ser122	-8.56(0)	----
9i	-11.01(5)	Ser122, Tyr121, Glu199(3)	-8.55(2)	Glu125(2)
9j	-10.97(2)	Ser200, Glu199	-7.44(2)	Gly128, Asp56
9k	-10.71(4)	Tyr121, Ser122, Tyr130, Ser122	-8.13(1)	Phe55
9l	-10.62 (4)	Trp84, Tyr121, Tyr130, Gly80	-8.51(2)	Glu96(2)
9m	-10.50(3)	Tyr130, Tyr121, Ser122	-7.59 (1)	Glu125
9n	-10.79(0)	--	-6.15(3)	Gly128
9o	-11.38(4)	Asp72, Ser200(2), Trp84	-9.16 (1)	Gly128

Conclusions

In conclusion, new compounds based on novel 4-amino-1h-indole-6-carboxamides have been designed and fifteen such molecules have been synthesized from 3, 5-dinitrobenzoic acid in multicomponent reaction. Most active compound among the series was found to be 9o with indole carboxamide fused with Trimethoxy benzaldehyde with methylene-2-(thiazol-4-yl)aceto hydrazide linker showed potent inhibitory activity with IC₅₀ of 0.94±0.10 and 1.10 ±0.05 µM compared to standard drug rivastigmine 0.47 ±0.2 & 0.65 ±0.02 µM against AChE and BuChE respectively. 9o was further studied for brain cholinesterase inhibitory activity and exhibited potent activity with IC₅₀ of value of 25.32±0.25 and 28.24±0.18µM respectively. Docking studies revealed that the designed molecules interacted with in nicotinic receptor with at list two hydrogen bond interactions barring few compounds.

References

1. Cohen SI, Arosio P, Presto J, Kurudenkandy FR, Biverstål H, Dolfe L, et al. A molecular chaperone breaks the catalytic cycle that generates toxic Aβ oligomers. *Nat Struct Mol Biol.* 2015;22(3):207–213. doi:10.1038/nsmb.2971
2. Kuca K, Soukup O, Maresova P, Korabecny J, Nepovimova E, Klimova B, et al. Current approaches against Alzheimer's disease in clinical trials. *J Braz Chem Soc.* 2016;27(4):641–649. doi:10.5935/0103-5053.20160048
3. Boutajangout A, Wisniewski T. Tau-based therapeutic approaches for Alzheimer's disease—a mini-review. *Gerontology.* 2014;60(5):381–385. doi:10.1159/000358875

4. Amemori T, Jendelova P, Ruzicka J, Machova Urdzikova L, Sykova E. Alzheimer's disease: mechanism and approach to cell therapy. *Int J Mol Sci.* 2015;16(11):26417-26451. doi:10.3390/ijms161125961
5. Scarpini E, Cogiamanian F. Alzheimer's disease: from molecular pathogenesis to innovative therapies. *Expert Rev Neurother.* 2003;3(5):619-630. doi:10.1586/14737175.3.5.619
6. Gella A, Durany N. Oxidative stress in Alzheimer disease. *Cell Adh Migr.* 2009;3(1):88-93. doi:10.4161/cam.3.1.7402
7. Romero A, Cacabelos R, Oset-Gasque MJ, Samadi A, Marco-Contelles J. Novel tacrine-related drugs as potential candidates for the treatment of Alzheimer's disease. *Bioorg Med Chem Lett.* 2013;23(7):1916-1922. doi:10.1016/j.bmcl.2013.02.017
8. Meng Q, Ru J, Zhang G, Shen C, Schmitmeier S, Bader A. Re-evaluation of tacrine hepatotoxicity using gel entrapped hepatocytes. *Toxicol Lett.* 2007;168(2):140-147. doi:10.1016/j.toxlet.2006.11.009
9. Singh M, Kaur M, Chadha N, Silakari O. Hybrids: a new paradigm to treat Alzheimer's disease. *Mol Divers.* 2016;20(1):271-297. doi:10.1007/s11030-015-9628-9
10. Spilovska K, Korabecny J, Nepovimova E, Dolezal R, Mezeiova E, Soukup O, et al. Multitarget tacrine hybrids with neuroprotective properties to confront Alzheimer's disease. *Curr Top Med Chem.* 2017;17(9):1006-1026. doi:10.2174/1568026605666160927153015
11. Kakkar R. Isatin and its derivatives: a survey of recent syntheses, reactions, and applications. *MedChemComm.* 2019;10(3):351-368. doi:10.1039/c8md00585k
12. Nath R, Pathania S, Grover G, Akhtar MJ. Isatin containing heterocycles for different biological activities: analysis of structure activity relationship. *J Mol Struct.* 2020;1222:128900. doi:10.1016/j.molstruc.2020.128900
13. Mok NY, Chadwick J, Kellett KA, Hooper NM, Johnson AP, Fishwick CW. Discovery of novel non-peptide inhibitors of BACE-1 using virtual high-throughput screening. *Bioorg Med Chem Lett.* 2009;19(23):6770-6774. doi:10.1016/j.bmcl.2009.09.10
14. Macha B, Kulkarni R, Garige AK, Palabindala R, Akkinapally R, Garlapati A. Design, synthesis and biological evaluation of new cycloalkyl fused quinolines tethered to isatin Schiff bases as cholinesterase inhibitors. *Comb Chem High Throughput Screen.* 2022;25(1):167-186. doi:10.2174/1386207323666201211095614
15. Bingul M, Ercan S, Boga M. The design of novel 4,6-dimethoxyindole based hydrazide-hydrazones: molecular modeling, synthesis and anticholinesterase activity. *J Mol Struct.* 2020;1213:128202. doi:10.1016/j.molstruc.2020.128202
16. Macha B, Kulkarni R, Bagul C, Garige AK, Akkinapally R, Garlapati A. Molecular hybridization-based design and synthesis of new benzo[5,6]chromeno[2,3-b]-quinolin-13(14H)-one analogs as cholinesterase inhibitors. *Med Chem Res.* 2021;30(3):685-701. doi:10.1007/s00044-020-02685-3

17. Khan S, Iqbal T, Hussain R, Fiaz Z, Abdellattif MH, Kashtoh H. Novel thiazole-thiadiazole as a potential anti-Alzheimer agent: synthesis and molecular interactions via an in-silico study. *Future Med Chem.* 2025;17(13):1-13. doi:10.1080/17568919.2025.2523361
18. Zhang H, Wang X, Wan Y, Liu L, Zhou J, Li P, et al. Discovery of N-arylsulfonyl-indole-2-carboxamide derivatives as Galectin-3 and Galectin-8 C-terminal domain inhibitors. *ACS Med Chem Lett.* 2023;14(9):1257-1265. doi:10.1021/acsmchemlett.3c00234

CONTENTS

ECONOMIC SCIENCES

6

Resilience and Recovery of Ukraine's Economy and Environment under Wartime Challenges: An Interdisciplinary Synthesis..... 7

Iryna Zabroda

Macroeconomic Growth in Indonesia under the Fourth Industrial Revolution: Insights from VAR and VD 13

Jan Horas Veryady Purba

Road Infrastructure Investment and Internal Migration in Albania: A District-Level Analysis of Spatial Heterogeneity (2014–2024)..... 19

Vilma Bilaj, Elida Liko

Changes in the Tourism of Vlora Region: A Statistical Data Analysis for the Period 2015–2025 26

Deana Delaj, Entela Kostista, Mithat Mema

Current Aspects of Financial Mechanisms of Technopark Residents in the Context of Sustainable Development..... 34

Leyli Afras Melikova

Financial Performance Indicators: A Tool for Assessing Organizational Performance 41

Emmanuel Dele Omopariola

Performance-Based Delivery and Administrative Burden: Preparing Albania for EU Cohesion Policy 54

Sonil Bilaj, Valeria Valeri

Current Problems of Entrepreneurship Development in the Karabakh Economic Region in the Context of Sustainable Development 62

Shafa Aliyev

Evolution of the Trade Balance in Response to Exchange Rate Policy: State of the Art..... 70

Walid Khiyat, Mohamed Elkandili

EDUCATIONAL SCIENCES

72

From AI Adoption to Pedagogical Intelligence: Modeling Teacher Agency, Ethics and Innovation in Malaysia..... 73

Zaheril Zainudin, Numuma Kamarina Jamil, Roselan Baki, Mohd Sofian Omar Fauzee

YouTube Spoken Corpora in Pronunciation Instruction for Fostering Intercultural Willingness to Communicate 81

Phi Dat Luu

Reducing Foreign Language Anxiety Through AI-Mediated Speaking Practice in the USA ... 90

Volha Hurskaya

The 4E Teacher in Nootechnological Ecologies: Agency, Empowerment, and Professional Reflexivity 96

Mariella Tripaldi

Cell Phones as Classroom Impact on Behavior, Attention, and Distractors: A Comparative Study of Students' Perceptions and Teachers' Observations..... **112**

Marco Antonio Santos Ayala Acuña, Rosa María Carrillo Guerrero

Exploring Value Co-creation Behavior in Higher Education: A Qualitative Study of University Students in Vietnam..... **122**

Du Thi Chung, Nguyen Thi Duy Quyen

PHILOLOGICAL SCIENCES **138**

The Socio-Pragmatics of Emotional Expression in Digital Slang **139**

Dat Phi Luu

Corpus Linguistics in Modern Linguistic Research: A Theoretical Review of Evolution, Methodologies, and Future Horizons **152**

Cong Khanh Ly

LAW SCIENCES **160**

Intellectual Property Law in the Context of International Economic Integration **161**

Dang Hai Long, Nguyen Thi Quynh Anh

PHILOSOPHICAL SCIENCES **169**

Socratic Intellectualism and the Identity of Knowledge and Virtue: Foundations of Rational Ethics **170**

Zauresh Otengenkizi, Aigul Niyazbayeva, Elena Stavrova

MANAGEMENT **184**

The Role of Artificial Intelligence in Enterprise Resource Planning Systems within Organizations **185**

Galena Chavkoska, Irena Ashtalkoska, Marina Kantardjieva

Managerial Innovation and Digitalization: Drivers of Well-being at Work in Schools in Morocco **191**

Hasna Imakor, Sahar Sader, Loubna Chabba, Lalla Sara Yousfi

PUBLIC ADMINISTRATION **199**

With Reference to Traditional Public Administration - New Public Management **200**

Florina Popa

ENGINEERING **214**

Determination of Initial Gas in Place and Active Water Drive in Single-Phase Gas Reservoirs Using the Material Balance Method **215**

Redian Ismailaj, Lusjen Ismaili

COMPUTER SCIENCE, COMPUTING AND AUTOMATION **222**

AskYourDocs: A Retrieval-Augmented Generation (RAG) Powered Document Assistant for Intelligent Information Retrieval..... **223**

ENVIRONMENTAL SCIENCES

236

Renewable Energy Governance and Community Benefit-Sharing in Nepal: Policy Gaps and Local Development Challenges 237

Hari Prasad Ghimire

CHEMICAL SCIENCES

244

Design and Synthesis of 4-amino-1H-indole-6-carboxamide Derivatives as Targeting Molecules of Cholinesterase Enzymes 245

Kundavaram Raju, L. Siva Sanker Reddy



**FUTURITY
PUBLISHING**

**World Conference on Science,
Innovation and Human Progress 2026:
collection of scientific papers,
Futurity Proceedings,
July 26-28, 2026. Poland.
Organizer Futurity Research Publishing**



ISBN

978-83-969744-2-5



**Indexing in Google Scholar,
Crossref, and OpenAIRE**

