



The Application of Visionary Leadership and Its Impact on Organizational Performance: An Analytical Study at the BPJS Employment Office of Makassar City

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Article Info

Article history:

Received 26-10-2025

Revised 20-11-2025

Accepted 17-12-2025

Keyword:

Visionary Leadership;
Leadership Implementation;
BPJS Employment Office;
Makassar City

ABSTRACT

Implementation of Visionary Leadership at the Makassar City BPJS Ketenagakerjaan Office. Supervised by Harbani Pasolong and Aisyah. This study aims to determine how visionary leadership is implemented and the obstacles encountered in implementing it at the Makassar City BPJS Ketenagakerjaan Office. The research method used was descriptive research using a saturated envelope sampling technique, where the entire population, 29 people, were sampled. Data collection methods included observation, interviews, and questionnaires. Data analysis used quantitative analysis supported by qualitative analysis and data processing using frequency distribution tables. The findings reveal that visionary leadership is implemented at a low level, with an overall score of only 42.7%, indicating a "poor" category based on the organizational performance scale used. Quantitatively, only 8 out of 29 respondents (27.6%) agreed that leaders communicated clear long-term goals, while 21 respondents (72.4%) perceived the leadership vision as unclear or inconsistently delivered. The results of this study indicate that the implementation of visionary leadership at the Makassar City BPJS Ketenagakerjaan Office can be categorized as "poor." Furthermore, three obstacles faced in implementing visionary leadership at the Makassar City BPJS Ketenagakerjaan Office include one-way communication, lack of coordination and communication between employees, and inadequate use of technology to support work processes.



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INTRODUCTION

Essentially, leadership is a branch of administrative sciences, particularly public administration (Pasolong, 2022:1). According to Mulyasa (2004:107), "Leadership is defined as the activity of influencing people toward the achievement of organizational goals (Mukhlis, Suradi, et al., 2023; Mukhlis, 2025b)." Meanwhile, Irham Fahmi (2017:15) explains that "Leadership is a field of study that comprehensively examines how to direct, influence, and supervise others to perform tasks in accordance with planned instructions." Good leadership can enhance organizational performance and improve internal relations. One type of leadership that can be applied is visionary leadership.

According to Kahan (2019:28), "Visionary leadership involves the capability, competence, and extraordinary skill to offer success and prosperity in the future." Furthermore, (Bidayati et al., 2023) states that...

"Visionary leadership refers to a leadership model aimed at giving meaning to the work and collective efforts of organizational members by providing direction and significance to their actions based on a clear vision. Thus, a visionary leader possesses the ability to communicate

that vision clearly to others. Visionary leadership is characterized by distinctive traits that serve as the foundation for understanding the attitudes and behaviors of leaders who are oriented toward achieving their vision.”

Visionary leadership is characterized, among other things, by a leader’s ability to develop clear planning so that the organization’s vision reflects the specific goals to be achieved in the institution’s development (Sá & Serpa, 2020; Yirga & Beshir, 2025). According to Fahmi Alaydroes, as cited in (Pälli & Lehtinen, 2025), a visionary leader should possess at least eight characteristics: (1) having a forward-looking perspective, (2) demonstrating courage in making policies, (3) being able to organize subordinates to achieve objectives, (4) having a clear vision, (5) having a mission to be implemented, (6) adhering firmly to spiritual values, (7) building effective relationships, and (8) being innovative. These characteristics form an essential foundation for a leader in performing their role.

Leaders in an organization play a crucial role in directing and influencing subordinates so that collective goals can be achieved. (“Urban and Rural Teacher Perspectives on Indonesian Educational Reform: Challenges and Policy Implications,” 2025) states, “The importance of leadership in achieving an organization’s goals is such that the success or failure experienced by an organization is largely determined by the quality of leadership of those entrusted with leading within that organization (Baranyanan et al., 2024; Purnomo et al., 2025).” Therefore, leadership plays a very significant role in determining an organization’s success.

In the context of BPJS Ketenagakerjaan, leadership becomes a vital aspect because this organization bears great responsibility for providing social security to workers in Indonesia (Mukhlis, Arifin, Ridwan, & Zulbaidah, 2025; Mukhlis, Arifin, Ridwan, Zulbaidah, et al., 2025). As a public institution, BPJS is recognized as an organization that requires and implements an effective leadership style (Klarić et al., 2024). Leaders at BPJS Ketenagakerjaan must not only direct employees to work in alignment with the organization’s vision but also motivate them to remain innovative and committed in facing both operational and social challenges. (Senadjki et al., 2024) further explains that a leader must possess intelligence, accountability, good health, and traits such as maturity, social adaptability, self-motivation, achievement drive, and a humanistic attitude toward work relationships.

Based on research findings, it was revealed that at the BPJS Ketenagakerjaan Office in Makassar City, communication typically flows only from superiors to subordinates, without two-way discussions (Abahuje et al., 2021). This often leads to misunderstandings among departments due to a lack of coordination and the absence of regular communication between employees (Khurniawan et al., 2021; Kusumawati & Umam, 2025). Consequently, work does not proceed smoothly, and delays frequently occur in task completion. In addition, many processes are still performed manually and have not utilized technology that could make work faster and easier (Dasrimin et al., 2023; Wolff & Ehrström, 2020). From these observations, it appears that the BPJS Ketenagakerjaan Office in Makassar City still lacks in applying visionary leadership.

Leader and Leadership

A leader is known as someone who has the ability to lead an organization. (Wippold et al., 2025) defines a leader as “an individual who possesses certain superior qualities, thereby having the authority and power to motivate others to engage in collective efforts to achieve specific goals.”

(Jones et al., 2020) states that leadership is “the process of directing and influencing the work-related activities of group members.”

Leadership Style

Basically, leadership style has a significant influence on a leader’s success in shaping the behavior of their followers (Pasolong, 2022: 47).

The Concept of Visionary Leadership

According to (Bendermacher et al., 2020), “Visionary leadership is the ability of a leader to formulate an idea or vision, and through critical dialogue with other leaders (Mukhlis et al., 2024;

Mukhlis, Maryam, et al., 2023), to design the desired future of the organization to be achieved through the commitment of all its members, as well as through the process of socialization, transformation, and implementation of the leader’s ideal ideas.”

Meanwhile, (Alsayed, 2024) explains that “Visionary leadership involves the extraordinary ability and skill to inspire success and prosperity in the future.”

RESEARCH METHODS

Research Location and Time

This research was conducted at the BPJS Employment Office (BPJS Ketenagakerjaan) in Makassar City (Lutz & Knox, 2014; McNabb, 2015), located at Jl. Urip Sumoharjo Km 4.5, Pampang, Makassar District, Makassar City, South Sulawesi. The study was carried out over a period of one month, from July 14 to August 14, 2025.

Type of Research

The type of research employed in this study is descriptive research.

Population

The population in this study consists of all employees directly under the BPJS Employment Office of Makassar City (Hillman & Radel, 2018; Migdal, 2018), totaling 29 employees.

Sample

The sample in this study includes all employees directly under the BPJS Employment Office of Makassar City, totaling 29 employees.

Data Collection Techniques

The data collection techniques used in this research are as follows:

Observation

The observation technique in this study involved the researcher directly observing and analyzing existing problems within the office by examining the work activities of several employees at the BPJS Employment Office of Makassar City.

Interview

Interviews were conducted in a semi-structured manner, where the researcher prepared a list of core questions but allowed flexibility for further exploration and development of questions based on the respondents’ answers.

Questionnaire

Questionnaires were completed by all employees under the BPJS Employment Office of Makassar City, totaling 29 respondents (Carreiras & Castro, 2012; Iosifides, 2016). The questionnaire was addressed to these employees to obtain relevant data for the study.

Data Analysis

This research employs quantitative data analysis techniques (Daly, 2007; Longhofer et al., 2012). The respondents’ answers are analyzed using a frequency distribution table.

Table 1. Likert Scale Categories

No	Category	Score
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1	Very Good (VG)	5
2	Good (G)	4
3	Neutral (N)	3
4	Poor (P)	2
5	Very Poor (VP)	1

Operational Definition

The operational definitions of the indicators used to measure the implementation of visionary leadership in this study are as follows (Fife, 2020; Kawamura, 2020):

1. Having a forward-looking perspective.
2. Demonstrating courage in policymaking.
3. Ability to organize subordinates to achieve goals.
4. Possessing a clear vision.
5. Having a defined mission to be implemented.
6. Upholding spiritual values that are personally believed.
7. Building effective relationships.
8. Being innovative.

RESULTS AND DISCUSSION

Based on the data analysis results, the majority of respondents expressed disagreement that the leadership of the BPJS Ketenagakerjaan office had demonstrated a solution-oriented attitude toward problems occurring in the workplace (Mukhlis, Janwari, et al., 2023; Mukhlis & Abdullah, 2025). To identify the indicators of charismatic leadership at the BPJS Ketenagakerjaan Office in Makassar City, we can refer to the following table, which summarizes the overall conclusions discussed for each indicator.

Table 2. Average Response per Indicator Toward Charismatic Leadership at the Head of Bontonmpo Community Health Center, Gowa Regency

No	Indicator	Response				
		5	4	3	2	1
		SB	B	N	TB	STB
1	Has a Vision for the Future	5	8	12	22	12
2	Shows Courage in Making Policies	4	7	12	22	14
3	Is Able to Organize Subordinates to Achieve Goals	4	8	12	22	12
4	Has a Clear	5	5	20	17	11

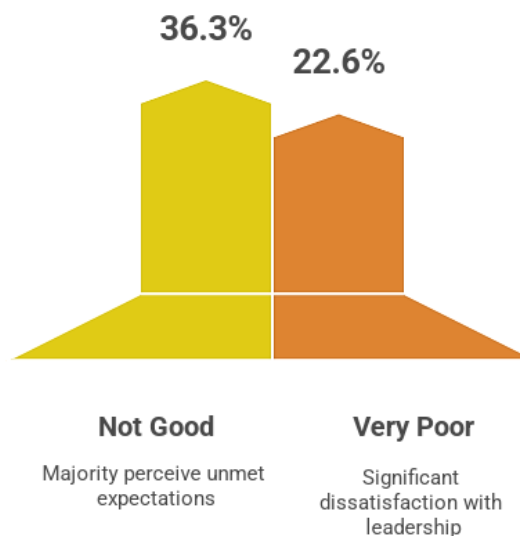
	Vision					
5	Possesses a Mission to be Implemented	4	10	8	22	14
6	Upholds Believed Spiritual Values	5	7	12	21	13
7	Builds Effective Relationships	2	7	10	22	17
8	Is Innovative	2	8	12	21	14
Total		31	60	98	169	107
Percentage (%)		6.7	12.9	21.1	36.3	22.6

Based on the recapitulation table of responses to the characteristics of visionary leadership at the BPJS Ketenagakerjaan Office in Makassar City, it can be observed that respondents' opinions vary (Mukhlis, 2025a; Mukhlis & Saidah, 2025). A total of 6.7% of respondents rated the leader's visionary leadership as very good, and 12.9% rated it as good (Ferdiansyah et al., 2022). These percentages are relatively low, indicating that positive appreciation for visionary leadership remains limited.

Meanwhile, 21.1% of respondents selected neutral, suggesting that a considerable number of employees have not yet perceived tangible impacts of visionary leadership or are still uncertain in providing their assessments.

However, the majority of respondents gave negative feedback: 36.3% stated that it was not good, and 22.6% stated that it was very poor (Al-Zubi & Alsheikh, 2024). This condition serves as an important signal that most employees perceive that visionary leadership has not yet met their expectations.

Employee Feedback on Visionary Leadership



CONCLUSION

The application of visionary leadership at the BPJS Employment Office in Makassar City falls into the “Poor” category. Among the five Likert scale levels, the highest percentage—36.3%—was in the “Poor” category. This indicates that most employees perceive that visionary leadership has not been implemented as expected. Furthermore, 22.6% of respondents even rated it as “Very Poor,” suggesting that the application of visionary leadership still requires improvement and enhancement in various aspects. These findings highlight a critical gap between the organization’s strategic vision and employees’ experience of leadership practices, reinforcing theoretical expectations that weak visionary leadership diminishes communication quality, coordination effectiveness, and organizational innovation. From a practical standpoint, the results emphasize the urgent need for leadership capacity building, particularly in developing two-way communication, fostering collaborative work processes, and strengthening digital-based work mechanisms. The institution should also consider implementing structured leadership development programs and adopting performance indicators that explicitly measure visionary leadership behaviors. Theoretically, this study contributes by demonstrating how the absence of visionary leadership within a public service institution directly correlates with suboptimal organizational outcomes, supporting existing models that link leadership vision to organizational performance. Future research is recommended to examine (1) comparative analyses across multiple BPJS offices to identify contextual leadership challenges, (2) longitudinal studies to track improvements after leadership interventions, and (3) mixed-method approaches that integrate statistical modeling with deeper qualitative exploration to provide a more comprehensive understanding of visionary leadership in public sector organizations.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

REFERENCES

- Abahuje, E., Bartuska, A., Koch, R., Youngson, G., Ntakiyiruta, G., Williams, W., Dias, R. D., Rosu, C., Yule, S., & Riviello, R. (2021). Understanding Barriers and Facilitators to Behavior Change After Implementation of an Interdisciplinary Surgical Non-Technical Skills Training Program in Rwanda. *Journal of Surgical Education*, 78(5), 1618–1628. Scopus. <https://doi.org/10.1016/j.jsurg.2021.01.011>
- Alsayed, H. (2024). The Mechanism of Non-Financial Firms’ Performance and Corporate Governance Leadership. *Business Ethics and Leadership*, 8(4), 210–214. Scopus. [https://doi.org/10.61093/bel.8\(4\).201-214.2024](https://doi.org/10.61093/bel.8(4).201-214.2024)
- Al-Zubi, H. A., & Alsheikh, G. A. A. (2024). The Impact of Resonant Leadership on Strategic Adaptation in Jordanian Islamic Banks. *Journal of Logistics, Informatics and Service Science*, 11(4), 104–115. Scopus. <https://doi.org/10.33168/JLISS.2024.0406>
- Baranyanan, S. D., Firmandayu, N., & Danendra, R. (2024). The Compliance of Regional Autonomy with State Administrative Court Decisions. *Journal of Sustainable Development and Regulatory Issues*, 2(1), 35–52. Scopus. <https://doi.org/10.53955/jsderi.v2i1.25>
- Bendermacher, G. W. G., De Grave, W. S., Wolfhagen, I. H. A. P., Dolmans, D. H. J. M., & Egbrink, M. G. A. O. (2020). Shaping a Culture for Continuous Quality Improvement in Undergraduate Medical Education. *Academic Medicine*, 95(12), 1913–1920. Scopus. <https://doi.org/10.1097/ACM.0000000000003406>
- Bidayati, U., Thoyib, A., Aisjah, S., & Rahayu, M. (2023). The Impact of Muhammadiyah’ Leadership Style and Total Quality Management on Competitive Advantage in Universities – Case on Universities in Yogyakarta, Indonesia. *Revista de Cercetare Si Interventie Sociala*, 81, 62–84. Scopus. <https://doi.org/10.33788/rcis.81.4>

- Carreiras, H., & Castro, C. (2012). *Qualitative methods in military studies: Research experiences and challenges* (p. 194). Taylor and Francis; Scopus. <https://doi.org/10.4324/9780203099223>
- Daly, K. J. (2007). *Qualitative methods for family studies & human development* (p. 293). SAGE Publications Inc.; Scopus. <https://doi.org/10.4135/9781452224800>
- Dasrimin, H., Bafadal, I., Arifin, I., Maisyaroh, n., & Dami, Z. A. (2023). Spirituality leader qualities in Catholic schools in Malang, Indonesia: Teacher and student character strengthened. *Issues in Educational Research*, 33(4), 1342–1361. Scopus. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85179652691&partnerID=40&md5=937b2a8850667377dac23c0ec1e1cb66>
- Ferdiansyah, S., Winarno, A., & Ardhita, Z. (2022). Service learning in Indonesia: Developing undergraduate students' leadership during COVID-19 pandemic. *Higher Education, Skills and Work-Based Learning*, 12(5), 884–899. Scopus. <https://doi.org/10.1108/HESWBL-06-2021-0123>
- Fife, W. (2020). *Counting as a Qualitative Method: Grappling with the Reliability Issue in Ethnographic Research* (p. 140). Springer International Publishing; Scopus. <https://doi.org/10.1007/978-3-030-34803-8>
- Hillman, W., & Radel, K. (2018). *Qualitative methods in tourism research: Theory and practice* (p. 294). Channel View Publications; Scopus. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85050434848&partnerID=40&md5=7ea1e3f0b2027993b53f6a795804ee51>
- Iosifides, T. (2016). *Qualitative Methods in Migration Studies: A Critical Realist Perspective* (p. 266). Taylor and Francis; Scopus. <https://doi.org/10.4324/9781315603124>
- Jones, B., Currin-Mcculloch, J., Petruzzi, L., Phillips, F., Kaushik, S., & Smith, B. (2020). Transformative teams in health care: Enhancing social work student identity, voice, and leadership in a longitudinal interprofessional education (ipe) course. *Advances in Social Work*, 20(2), 424–439. Scopus. <https://doi.org/10.18060/23658>
- Kawamura, Y. (2020). *DOING RESEARCH IN FASHION AND DRESS: An Introduction to Qualitative Methods, 2nd edition* (p. 166). Bloomsbury Publishing Plc.; Scopus. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85188589040&partnerID=40&md5=b3db406659cd1ea5b20e05664bec39a3>
- Khurniawan, A. W., Sailah, I., Muljono, P., Indriyanto, B., & Maarif, M. S. (2021). Strategy for improving the effectiveness of management vocational school-based enterprise in Indonesia. *International Journal of Education and Practice*, 9(1), 37–48. Scopus. <https://doi.org/10.18488/journal.61.2021.91.37.48>
- Klarić, K., Barčić, A. P., Greger, K., Vukman, K., Perić, I., & Klarić, M. (2024). Striving for Excellence: Deconstruction of Total Quality Management Measuring Model for Croatian Furniture Industry. *Sustainability (Switzerland)*, 16(24). Scopus. <https://doi.org/10.3390/su162411236>
- Kusumawati, E., & Umam, K. (2025). Strengthening teacher competence for leading and sustaining the implementation of the Merdeka Curriculum. *Cogent Education*, 12(1). Scopus. <https://doi.org/10.1080/2331186X.2025.2501458>
- Longhofer, J., Floersch, J., & Hoy, J. (2012). *Qualitative Methods for Practice Research* (p. 224). Oxford University Press; Scopus. <https://doi.org/10.1093/acprof:oso/9780195398472.001.0001>
- Lutz, W., & Knox, S. (2014). *Quantitative and qualitative methods in psychotherapy research* (p. 448). Taylor and Francis; Scopus. <https://doi.org/10.4324/9780203386071>
- McNabb, D. E. (2015). *Research methods for political science: Quantitative and qualitative methods: Second edition* (p. 426). Taylor and Francis; Scopus. <https://doi.org/10.4324/9781315701141>

- Migdal, A. B. (2018). *Qualitative Methods in Quantum Theory* (p. 460). CRC Press; Scopus. <https://doi.org/10.1201/9780429497940>
- Mukhlis, L. (2025a). A Phenomenological Study of Personal Spiritual Experiences in Navigating Religious Pluralism within Interfaith Communities. *Irfana: Journal of Religious Studies*, 1(6), 212–220.
- Mukhlis, L. (2025b). Spiritual Grounds for Economic Growth: A Qualitative Exploration of Rural Indonesian Women's Transformative Journeys Through Mosque-Led Empowerment Programs. *Servina: Jurnal Pengabdian Kepada Masyarakat*, 1(8), 289–298.
- Mukhlis, L., & Abdullah, M. N. (2025). *Hukum Keluarga Islam di Indonesia* (1st ed.). Mukhlisina Revolution Center.
- Mukhlis, L., Arifin, T., Ridwan, A. H., & Zulbaidah. (2024). Integrating Artificial Intelligence and Maqāṣid al-Syarī'ah: Revolutionizing Indonesia's Sharia Online Trading System. *Computer Fraud and Security*, 2024(11), 301–309. <https://doi.org/10.52710/cfs.238>
- Mukhlis, L., Arifin, T., Ridwan, A. H., & Zulbaidah. (2025). Reorientation of Sharia Stock Regulations: Integrating Taṣarrufāt al-Rasūl and Maqāṣid al-Sharī'ah for Justice and Sustainability. *Journal of Information Systems Engineering and Management*, 10(10s), 58–66. <https://doi.org/10.52783/jisem.v10i10s.1341>
- Mukhlis, L., Arifin, T., Ridwan, A. H., Zulbaidah, Rosadi, A., & Solehudin, E. (2025). Reformulation of Islamic Stock Law: The Application of Taṣarrufāt al-Rasūl and Maqāṣid al-Syarī'ah to Develop a Dynamic and Sustainable Islamic Capital Market in Indonesia. *Journal of Posthumanism*, 5(3), 1–13. <https://doi.org/10.63332/joph.v5i3.913>
- Mukhlis, L., Janwari, Y., & Syafe'i, R. (2023). INDONESIA STOCK EXCHANGE: THEORETICAL AND PHILOSOPHICAL ANALYSIS OF MUDHARABAH AND MUSYARAKAH CONTRACTS. *Yurisprudencia: Jurnal Hukum Ekonomi*, 9(2), 243–264. <https://doi.org/10.24952/yurisprudencia.v9i2.8466>
- Mukhlis, L., Maryam, S., & Sormin, S. A. (2023). Model Pembelajaran Living History Berbasis PjBL Untuk Meningkatkan Keterampilan Histografi Mahasiswa. *Jurnal Educatio FKIP UNMA*, 9(4), 1800–1809. <https://doi.org/10.31949/educatio.v9i4.5595>
- Mukhlis, L., & Saidah, Y. (2025). Dynamics of Nature-Based learning in Developing Children's Motoric Skills: Teacher and Parent Perspectives. *HUMANISMA: Journal of Gender Studies*, 9(1), 64–79. <http://dx.doi.org/10.30983/humanisme.v4i2.9366>
- Mukhlis, L., Suradi, Janwari, Y., & Syafe'i, R. (2023). Sosialisasi Saham Syariah sebagai Instrumen Pengembangan Ekonomi Masyarakat di Badan Kontak Majelis Taklim (BKMT) Kabupaten Mandailing Natal. *Jurnal Pengabdian Multidisiplin*, 3(2), 2–9. <https://doi.org/10.51214/japamul.v3i2.604>
- Pälli, P., & Lehtinen, E. (2025). When the discourse of strategy meets the discourse of spirituality: A study of the recontextualization of strategy discourse in a Church organization. *Pragmatics and Society*, 16(5), 701–725. Scopus. <https://doi.org/10.1075/ps.20038.pal>
- Purnomo, E., Firdaus, O., Jermaina, N., Gumilar, A., Amsal, M. F., Gemaini, A., Akbar, A., Muspita, R., & Abidin, N. E. Z. (2025). Teacher Involvement in Integrating Universal Values in Schools. *Annals of Applied Sport Science*, 13(Special-Issue), 317–320. Scopus. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-105004294533&partnerID=40&md5=a8dbaedf84eba541f646ece09c51efd>
- Sá, M. J., & Serpa, S. (2020). The covid-19 pandemic as an opportunity to foster the sustainable development of teaching in higher education. *Sustainability (Switzerland)*, 12(20), 1–16. Scopus. <https://doi.org/10.3390/su12208525>
- Senadjki, A., Au Yong, H. N., Ganapathy, T., & Ogbeibu, S. (2024). Unlocking the potential: The impact of digital leadership on firms' performance through digital transformation.

- Journal of Business and Socio-Economic Development*, 4(2), 161–177. Scopus. <https://doi.org/10.1108/JBSED-06-2023-0050>
- Urban and rural teacher perspectives on Indonesian educational reform: Challenges and policy implications. (2025). *Cogent Education*, 12(1). Scopus. <https://doi.org/10.1080/2331186X.2025.2497142>
- Wippold, G. M., Jowers, T., Garcia, K. A., Frary, S. G., Murphy, H., Brown, S., Carr, B., Jeter, O., Johnson, K., & Williams, T. L. (2025). Understanding and Promoting Preventive Health Service Use Among Black Men: Community-Driven and Informed Insights. *Journal of Racial and Ethnic Health Disparities*, 12(1), 201–211. Scopus. <https://doi.org/10.1007/s40615-023-01864-3>
- Wolff, L.-A., & Ehrström, P. (2020). Social sustainability and transformation in higher educational settings: A utopia or possibility? *Sustainability (Switzerland)*, 12(10). Scopus. <https://doi.org/10.3390/su12104176>
- Yirga, S. A., & Beshir, M. A. (2025). The effect of total quality management practices on innovation: Evidence from selected agricultural technical and vocational education training colleges in Ethiopia. *Journal of Innovation and Entrepreneurship*, 14(1). Scopus. <https://doi.org/10.1186/s13731-024-00460-x>