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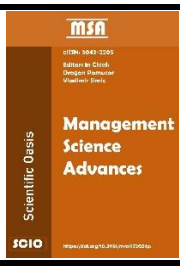

Addressing Human Capital Development Challenges in Developing Countries Using an Interval-spherical Fuzzy Environment

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ABSTRACT

This study evaluates and ranks the challenges of human capital development in developing countries based on their severity. Human capital development is crucial for economic growth, as acquiring knowledge, skills, and abilities plays a vital role in advancing these countries. However, various challenges impede the ability of developing countries to invest in human capital. Six key challenges were identified through a review of existing literature and expert insights. To analyse these challenges, the Stepwise Weight Assessment Ratio Analysis (SWARA) method within an interval-valued spherical fuzzy (IVSF) framework was utilized. The findings reveal that high unemployment, low literacy and education levels, and inadequate investment in skills development are the most significant challenges. Based on these results, the study offers actionable recommendations for governments seeking to enhance human capital development in these countries.

1. Introduction

Africa faces persistent challenges in human capital development (HCD), reflected in the mismatch between economic growth and key health and education metrics. Life expectancy in the region averages 64 years as of 2024, well below the global average of 73 years, highlighting systemic issues in healthcare access and quality. The shortage of healthcare professionals is severe, with Africa falling significantly short of the World Health Organization-recommended ratio of healthcare workers per 1,000 people [1]. In education, low school enrollment rates further hinder workforce development, as noted by Schultz [2], who emphasizes Africa's lagging performance in health and education relative to other regions. These deficits underscore the urgent need for integrated policies and empirical research to address the underlying causes and improve HCD outcomes.

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Human capital development in developing countries is hindered by a range of interconnected challenges, with low literacy and education levels at the forefront [3]. These issues stem from inadequate infrastructure, a shortage of qualified teachers [4, 5], and socioeconomic disparities that restrict educational access for vulnerable groups [6]. Compounding these barriers are healthcare workforce shortages, which weaken service delivery and adversely affect human capital quality [7], and high unemployment rates driven by a skills mismatch between the labor force and job market demands [8]. Additionally, brain drain, as noted by Docquier and Marfouk [9], exacerbates these challenges by depleting skilled professionals, leaving critical sectors underserved. Gender inequality further limits human capital development, as restricted access to education and employment for women stifles their economic contributions [10]. These issues are intensified by insufficient public investment in education and skills development, which perpetuates gaps in workforce readiness and economic growth potential [11]. Addressing these interrelated obstacles is vital for advancing sustainable development.

Unlike previous studies, such as Oketch [12], Ouedraogo *et al.,* [13], Masuku and Nkala [14], and Bekele *et al.,* [15], which overlooked the use of multi-criteria decision-making (MCDM) methodologies in examining human capital development, this study adopts an approach to address this gap. The research is guided by two main objectives: (1) to identify and assess the prevalent challenges to human capital development across Africa, and (2) to prioritize these challenges based on their critical severity. This study offers two significant contributions. First, it employs interval-valued spherical fuzzy sets (IVSFs) within an MCDM framework to rank the common challenges to human capital development in Africa systematically. Second, it provides practical, evidence-based recommendations to effectively address these challenges and support sustainable human capital development.

Fuzzy sets (FSs) have emerged as essential tools in research, with advancements such as spherical fuzzy sets (SFSs) and interval-valued fuzzy sets (IVFSs) offering improved solutions for managing ambiguity [16, 17]. Interval-valued spherical fuzzy sets (IVSFSs) build on these advancements by providing a more effective approach for addressing uncertainty, surpassing the capabilities of traditional FSs [18, 19]. These sets are particularly useful for handling complex uncertainty and facilitating the integration of multiple evaluation techniques. The SWARA method, introduced by Keršuliene *et al.,* [20], has proven to be a practical and efficient tool for determining the weights of criteria, especially within the IVSF framework. The remainder of the paper is organized into five sections.

2. Literature Review

Human capital development is essential for driving economic growth in developing countries, but it is often impeded by significant challenges. These issues restrict their integration into the global economy and limit sustainable progress, spurring considerable academic interest in understanding and addressing the root causes. For instance, Ubaka *et al.,* [21] used an ex-post facto research design to analyze how human capital development affected Nigeria's economic growth from 1986 to 2019. The study found a long-term equilibrium among the variables, with life expectancy and health expenditure positively impacting GDP, while education expenditure and primary school enrollment showed a negative effect. Abubakar *et al.,* [22] explored factors influencing sustainable human capital development in Saudi Arabia under Vision 2030. Training, community engagement, institutional support, and technology were found essential, while education, learning, and resource access showed no significant impact. Hakooma and Seshamani [23] studied Zambia's economic growth (1970–2013) and found a long-term link between GDPs per capita and human capital,

measured by health and education spending and secondary school enrollment. Md and Noor [24] analyzed the impact of human capital on Bangladesh's economic growth, using GDP and education and health indicators. They found that human capital significantly boosts growth, urging stakeholders to adopt practical development strategies. Abel *et al.,* [25] found that from 1980 to 2015, health spending significantly enhanced Zimbabwe's economic growth, both short- and long-term, by improving workforce productivity.

In the human capital development studies, the MCDM approach has been applied. For instance, Brodny and Tutak [26] studied the impact of human capital on economic growth, innovation, and sustainable development across the EU. They found notable differences, with the Netherlands, Denmark, and Sweden leading, while Greece, Romania, and Bulgaria lagged. Cyprus, Malta, and Portugal showed the most improvement. Valmohammadi and Shahrashoob [27] used a hybrid fuzzy decision-making approach to identify and prioritize indicators and strategies for human capital development programs. Aggarwal [28] adopted a methodology to rank human capital indicators based on various factors. The study highlighted that in Indian organizations, the most critical indicators include employee satisfaction with growth prospects, internal relationships, skill levels, effective use of knowledge, and access to training and development opportunities. Bozbura *et al.* [29] identified five attributes and 20 indicators to prioritize human capital measurement. Key indicators in Turkey included knowledge application, employee skills, knowledge sharing, and training program success.

3. Methodology

The methodology involves two steps: collecting data from experts and previous studies, followed by evaluating six challenges to human capital development in Africa using the SWARA method within an IVSF framework. Figure 1 shows the study's flowchart.

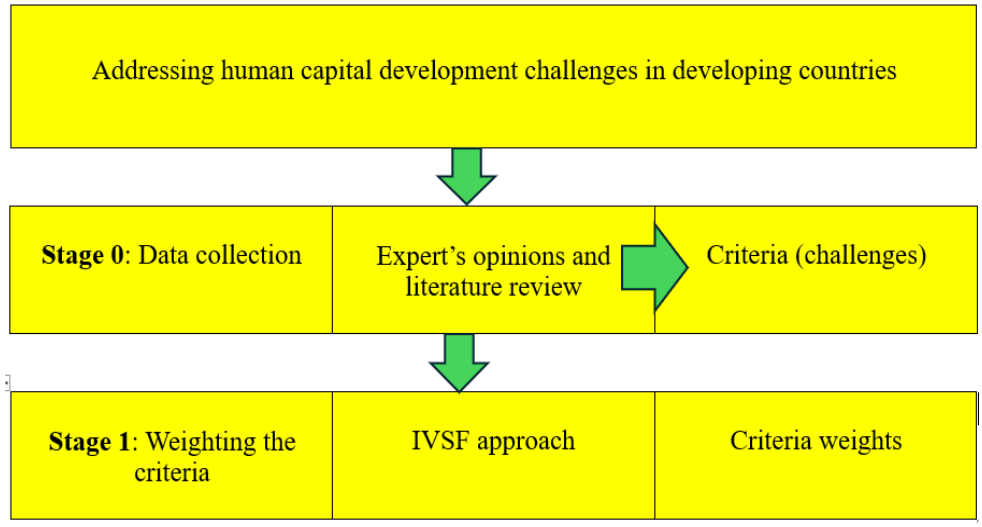

Fig. 1. Flowchart of our study approach

Nine steps have characterized the IVSF-SWARA approach.

Step 1. Problem evaluation via various challenges.

Step 2. Using the IVSF linguistic scale (refer to Table A1 in the appendix), experts rank the challenges in order of critical severity.

Eq. (1) indicates the weight matrix establishment.

$$\widetilde{W} = \begin{bmatrix} \tilde{\mu}_{11} & \tilde{\mu}_{12} & \cdots & \tilde{\mu}_{1t} \\ \tilde{\mu}_{21} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & \vdots \\ \tilde{\mu}_{n1} & \cdots & \cdots & \tilde{\mu}_{nt} \end{bmatrix} \quad (1)$$

where n –criteria numbers, t-experts (p=1, 2……, t).

Step 3. Once experts assign significance scores, the scores are averaged using the arithmetic mean, and the experts' weights are then determined using IVSWAM.

Step 4. The score function from Eq. (2) is used to calculate positive score values in the aggregated matrix $\tilde{A}$ for IVSF weights.

$$s_j = \text{Score}\left(\tilde{\beta}_j\right) + 1 \quad (2)$$

Step 5. Challenges are organized according to their practical scores.

Step 6. The importance of each criterion $\left(c_j\right)$ is determined by analyzing the scores s_j.

Step 7. Computation of k_j.

$$k_j = \begin{cases} 1 & j = 1 \\ c_j + 1 & j > 1 \end{cases} \quad (3)$$

Step 8. Determination of unscaled weights q_j.

$$q_j = \begin{cases} 1 & j = 1 \\ \frac{x_{j-1}}{k_j} & j > 1 \end{cases} \quad (4)$$

Step 9. Determination of corresponding weights through the normalization of challenges weights.

$$w_j = \frac{q_j}{\sum_{j=1}^{n} q_k} \quad (5)$$

4. Application

Using the IVSF-SWARA method, the study assessed and ranked challenges with input from a panel of four experts (Table A2). Details on the six challenges, identified through literature and expert opinions, are provided in Table A3. Experts provided data based on Table A1, which was used to evaluate the challenges outlined in Table A3.

4.1 Prioritizing challenges

Step 1. Assessment of six challenges to human capital development in Africa.

Step 2. Determination of challenges weights by four experts based on their evaluation from Table 1.

Table 1
Challenges evaluation

Criteria	E-1	E-2	E-3	E-4
C1	AMI	HI	AMI	VHI
C2	VHI	SLI	SLI	VHI
C3	AMI	AMI	SMI	AMI
C4	HI	VHI	VHI	HI
C5	SMI	VHI	SLI	SLI
C6	AMI	VHI	VHI	HI

Note: E: Expert.

Step 3. Initially, mathematical expressions are employed to convert the linguistic variables (LV) from Table A1. Next, experts' ideas are compiled in Table 2, assuming equal weights for all experts.

Table 2
Aggregated evaluations of challenges

Criteria	a	b	c	d	e	f
C1	0.7915	0.9032	0.1316	0.1831	0.0131	0.0347
C2	0.5996	0.7053	0.2872	0.3606	0.0378	0.0612
C3	0.8066	0.9208	0.1257	0.1784	0.0104	0.0324
C4	0.7052	0.8072	0.1732	0.2236	0.0304	0.0500
C5	0.5295	0.6296	0.3264	0.3990	0.0494	0.0753
C6	0.7626	0.8721	0.1456	0.1968	0.0191	0.0398

Step 4. Provision of the computation of results for challenges in Table 3.

Table 3
Positive scores of challenges

	C1	C2	C3	C4	C5	C6
s_j	1.6955	1.3216	1.7253	1.5340	1.2045	1.6408

Step 5. The rank of challenges is $C3 > C1 > C6 > C4 > C2 > C5$.
Step 6. Calculation of comparative importance of challenges in Table 4.

Table 4
Comparative significances of challenges

	C3	C1	C6	C4	C2	C5
c_j	-	0.030	0.055	0.107	0.212	0.117

Step 7. Provision of coefficients calculation in Table 5.

Table 5
Coefficients for challenges

	C3	C1	C6	C4	C2	C5
k_j	1	1.030	1.055	1.107	1.212	1.117

Step 8. Presentation of disorganized challenges weights in Table 6.

Table 6
Disorganized challenges weights

	C3	C1	C6	C4	C2	C5
q_j	1	0.971	0.921	0.832	0.686	0.614

Step 9. Figure 2 indicated the final weights of challenges.

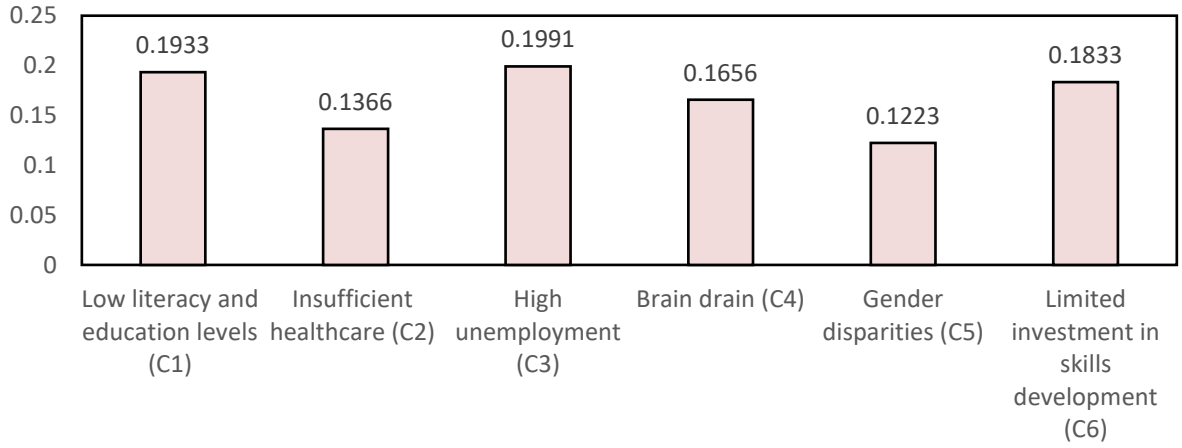

Fig. 2. Final weights of challenges

4.2 Findings and Discussion

Our study, utilizing the IVSF-SWARA method, identifies high unemployment (C3) as a major barrier to human capital development. This supports findings by Njifen and Meungwe [30], who emphasized its negative impact on economic growth and social stability. Many African nations face high youth and graduate unemployment due to mismatched education systems, limited job opportunities, and skill gaps. As Olanipekun [31] noted, this exacerbates inequality, poverty, and economic stagnation. To address this, education must align with labor market demands, emphasizing technical and vocational skills. Creating jobs in key sectors, offering workforce training, and supporting entrepreneurship with funding and resources are critical. Strengthened labor policies can promote inclusive opportunities, unlocking Africa's human capital and fostering sustainable development.

Low literacy and education levels are another critical challenge to human capital development in Africa. Many African countries face barriers to providing quality education, particularly in rural areas, due to underfunded systems [4]. This leads to a low-skilled workforce ill-equipped for modern industries. The educational gap limits individual opportunities, stifles societal progress, and increases poverty, as uneducated populations are often trapped in low-wage, informal jobs. It also deters foreign investment and global competitiveness in knowledge-intensive sectors. To overcome this issue, reforms should focus on improving access, quality, and funding in education. Expanding infrastructure in rural areas, investing in teacher training, and strengthening vocational programs are essential. Prioritizing universal education and adult literacy, alongside partnerships for funding and technology, will build a skilled workforce, reduce poverty, and drive sustainable development.

Limited investment in skills development is a major challenge to human capital growth in Africa. Education systems often fail to equip individuals with technical and vocational skills needed in sectors like technology, manufacturing, and services, contributing to high youth unemployment even in growing economies. Insufficient funding for vocational training restricts access to quality skill-building opportunities, hindering productivity, innovation, and global competitiveness [11]. This underinvestment exacerbates poverty and inequality, as low-skilled workers are confined to low-wage jobs, disproportionately affecting marginalized groups. To overcome this, governments should prioritize funding for technical and vocational education, aligning curricula with sector demands. Expanding access to training, improving teacher quality, and modernizing facilities are key. Public-private partnerships and international support can enhance resources, boosting productivity, innovation, and global competitiveness, and unlocking Africa's human capital potential.

5. Managerial implications

This study provides recommendations for African governments to address key challenges in human capital development, including high unemployment, low literacy and education levels, and limited investment in skills development. To tackle these, education systems should align with labor market needs, emphasizing technical and vocational skills. Creating jobs in high-growth sectors, offering workforce training, and supporting entrepreneurship with funding are essential. Strengthening labor policies to promote inclusive opportunities is also crucial. Educational reforms must focus on improving access, quality, and funding, especially in rural areas, alongside investing in teacher training and vocational programs. Prioritizing universal education and adult literacy, with partnerships for funding and technology, will build a skilled workforce. Increased funding for technical education, curriculum alignment, and modernizing facilities will address the skills gap. Public-private partnerships and international support can further enhance resources, boosting productivity and global competitiveness.

6. Conclusions and future recommendations

This study utilizes the IVSF-SWARA method to examine key challenges faced by developing countries, integrating expert insights to guide informed policymaking. Using Africa as a case study, the research illustrates the practical application of this approach to identify critical issues. The analysis reveals three primary challenges: high unemployment, low levels of literacy and education, and insufficient investment in skills development. While the study provides valuable insights, it has certain limitations. Conducted at a continental scale, it does not fully account for the unique circumstances of individual African nations. Future research should consider comparative analyses across countries or regional blocks to gain more nuanced perspectives. Furthermore, the study relied on input from a relatively small group of experts. Expanding the expert base and employing a consensus-based approach with measures such as a consensus coefficient in future studies would enhance the robustness of the findings.

Appendix

Table A1
Linguistic terms

Linguistic Terms	IVSF Number	Score Index
Absolutely more important (AMI)	([0.85, 0.95], [0.10, 0.15], [0.05, 0.15])	9.00
Very high important (VHI)	([0.75, 0.85], [0.15, 0.20], [0.15, 0.20])	7.00
High important (HI)	([0.65, 0.75], [0.20, 0.25], [0.20, 0.25])	5.00
Slightly more important (SMI)	([0.55, 0.65], [0.25, 0.30], [0.25, 0.30])	3.00
Equally important (EI)	([0.50, 0.55], [0.45, 0.55], [0.30, 0.40])	1.00
Slightly low important (SLI)	([0.25, 0.30], [0.55, 0.65], [0.25, 0.30])	0.33
Low important (LI)	([0.20, 0.25], [0.65, 0.75], [0.20, 0.25])	0.20
Very low important (VLI)	([0.15, 0.20], [0.75, 0.85], [0.15, 0.20])	0.14
Absolutely low important (ALI)	([0.10, 0.15], [0.85, 0.95], [0.05, 0.15])	0.11

Table A2
Expert characteristics

Experts (Es)	Gender	Occupation	Experience
E_1	Male	Academia	10
E_2	Female	Academia	11
E_3	Male	Industry	13
E_4	Female	Academia	9

Table A3
Human capital development challenges

Criteria	References
Low literacy and education levels (C1) Insufficient healthcare (C2) High unemployment (C3) Brain drains (C4) Gender disparities (C5) Limited investment in skills development (C6)	[1, 4, 8]

Author Contributions

Conceptualization, M.B.B. and S.Q.; methodology, M.B.B. and S.Q.; software, M.B.B. and S.Q.; validation, Y.Q. and I.B.; formal analysis, S.Q. and Y.Q.; investigation, I.B.; resources, S.Q.; data curation, M.B.B. and I.B.; writing—original draft preparation, M.B.B. and S.Q.; writing—review and editing, M.M.S.O.; visualization, Y.Q.; supervision, M.M.S.O. and I.B.; project administration, M.M.S.O. and I.B .; funding acquisition, M.B.B. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

Data will be made available on request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

[1] Shuaibu, M. (2016). Determinants of human capital development in Africa: a panel data analysis. Oeconomia Copernicana, 7(4), 523-549. https://doi.org/10.12775/OeC.2016.030

[2] Schultz, T. P. (1998). The formation of human capital and the economic development of Africa: Returns to health and schooling investments (Vol. 37). Economic Research Papers No37. African Development Bank Côte d'Ivoire. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/00157608-FR-ERP-37.PDF

[3] Becker, G. S. (2009). Human capital: A theoretical and empirical analysis, with special reference to education. University of Chicago press. https://www.nber.org/books-and-chapters/human-capital-theoretical-and-empirical-analysis-special-reference-education-third-edition

[4] Entekhabi, M. (2023). Human Capital in Developing Countries: Common Challenges and the Path Forward. Journal of Emerging Trends in Marketing and Management, 1(2), 18-29. https://ideas.repec.org/a/aes/jetimm/v1y2023i2p18-29.html#:~:text=The%20literature%20review%20identifies%20six,limited%20investment%20in%20skills%20development.

[5] Benavot, A., Antoninis, M., Bella, N., Delprato, M., Härmä, J., Jere, C., Joshi, P., Köseleci Blanchy, N., Longlands, H., & McWilliam, A. (2015). Education for all 2000-2015: Review and perspectives. ZEP: Zeitschrift für internationale Bildungsforschung und Entwicklungspädagogik, 38(2), 10-15. https://doi.org/10.1002/9781118468005.ch13

[6] Unterhalter, E., Longlands, H., & Peppin Vaughan, R. (2022). Gender and intersecting inequalities in education: Reflections on a framework for measurement. Journal of Human Development and Capabilities, 23(4), 509-538. https://doi.org/10.1080/19452829.2022.2090523

[7] Chen, L., Evans, T., Anand, S., Boufford, J. I., Brown, H., Chowdhury, M., Cueto, M., Dare, L., Dussault, G., & Elzinga, G. (2004). Human resources for health: overcoming the crisis. The Lancet, 364(9449), 1984-1990. https://doi.org/10.1016/S0140-6736(04)17482-5

[8] Peiró, J. M., Hernández, A., & Ramos, J. (2015). The Challenge of Building Human Capital and Benefiting from It: A Person-Centric View of Youth Unemployment and Underemployment 1. In Facing the challenges of a multi-age workforce (pp. 83-107). Routledge/Taylor & Francis Group.

[9] Docquier, F., & Marfouk, A. (2006). International migration by education attainment, 1990-2000. International migration, remittances and the brain drain, 151-199. Palgrave Macmillan. https://openknowledge.worldbank.org/bitstream/handle/10986/6929/339880rev.pdf?sequence=1&isAllowed=y

[10] Klasen, S., & Lamanna, F. (2009). The impact of gender inequality in education and employment on economic growth: new evidence for a panel of countries. Feminist economics, 15(3), 91-132. https://doi.org/10.1080/13545700902893106

[11] Psacharopoulos, G., & Patrinos, H. A. (2018). Returns to investment in education: a decennial review of the global literature. Education Economics, 26(5), 445-458. https://doi.org/10.1080/09645292.2018.1484426

[12] Oketch, M. O. (2006). Determinants of human capital formation and economic growth of African countries. Economics of Education Review, 25(5), 554-564. https://doi.org/10.1016/j.econedurev.2005.07.003

[13] Ouedraogo, I., Tabi, H. N., Ondoa, H. A., & Jiya, A. N. (2022). Institutional quality and human capital development in Africa. Economic Systems, 46(1), 100937. https://doi.org/10.1016/j.ecosys.2021.100937

[14] Masuku, S., & Nkala, S. (2021). Human capital development and skilled immigrants labour market experiences in South Africa: an overview. Work and Migration: Case Studies from Around the World, 87-102.

[15] Bekele, M., Sassi, M., Jemal, K., & Ahmed, B. (2024). Human capital development and economic sustainability linkage in Sub-Saharan African countries: Novel evidence from augmented mean group approach. Heliyon, 10(2). https://doi.org/10.1016/j.heliyon.2024.e24323

[16] Chusi, T. N., Qian, S., Edalatpanah, S. A., Qiu, Y., Bouraima, M. B., & Ajayi, A. B. (2024). Interval-valued spherical fuzzy extension of SWARA for prioritizing strategies to unlock Africa's potential in the carbon credit market. Computational Algorithms and Numerical Dimensions, 3(3), 217-227. https://doi.org/10.22105/cand.2024.474739.1106

[17] Su, Q., Qiu, Y., Bouraima, M., Zonon, B., Badi, I., & Maraka, N. (2024). Addressing the crucial factors affecting the implementation of carbon credit concept using a comprehensive decision-making analysis: A case study. J. Oper. Strateg Anal, 2(3), 136-143. https://doi.org/10.56578/josa020301

[18] Qian, S., Qiu, Y., Bouraima, M. B., Badi, I., & Chusi, T. N. (2024). Assessing the Challenges to Leverage Carbon Markets for Renewable Energy in Developing Countries: A Multi-Criteria Decision-Making Approach. Spectrum of Engineering and Management Sciences, 2(1), 151-160. https://doi.org/10.31181/sems21202412s

[19] Bouraima, M. B., Oyaro, J., Ayyildiz, E., Erdogan, M., & Maraka, N. K. (2023). An integrated decision support model for effective institutional coordination framework in planning for public transportation. Soft Computing, 1-27. https://doi.org/10.1007/s00500-023-09425-w

[20] Keršuliene, V., Zavadskas, E. K., & Turskis, Z. (2010). Selection of rational dispute resolution method by applying new step-wise weight assessment ratio analysis (SWARA). Journal of business economics and management, 11(2), 243-258. https://doi.org/10.3846/jbem.2010.12

[21] Ubaka, C. K., Nnachi, D. N., & Ifeaka, B. (2022). Impact of Human Capital Development on Economic Growth: Evidence from Nigeria. Economic and Business Review, 3(3).

[22] Abubakar, A. A., Al-Mamary, Y. H., Singh, H. P., Singh, A., Alam, F., & Agrawal, V. (2024). Exploring factors influencing sustainable human capital development: Insights from Saudi Arabia. Heliyon, 10(16). https://doi.org/10.1016/j.heliyon.2024.e35676

[23] Hakooma, M. R., & Seshamani, V. (2017). The impact of human capital development on economic growth in Zambia: an econometric analysis. International Journal of Economics, Commerce and Management, 4(4), 71-87.

[24] Md, S. A. K. J. A., & Noor, T. (2016). An econometric analysis of human capital development and economic growth in Bangladesh. Journal of economics and sustainable development.

[25] Abel, S., Mhaka, N., & Le Roux, P. (2019). Human capital development and economic growth nexus in Zimbabwe. Southern African Business Review, 23(1). https://doi.org/10.25159/1998-8125/5128

[26] Brodny, J., & Tutak, M. (2024). A multi-criteria measurement and assessment of human capital development in EU-27 countries: A 10-year perspective. Journal of Open Innovation: Technology, Market, and Complexity, 10(4), 100394. https://doi.org/10.1016/j.joitmc.2024.100394

[27] Valmohammadi, C., & Shahrashoob, V. (2022). Determinants of the human capital department development programs toward achieving functional strategic objectives: a fuzzy hybrid approach. Industrial and Commercial Training, 54(3), 377-395. https://doi.org/10.1108/ICT-02-2021-0012
[28] Aggarwal, R. (2014). Identifying and prioritizing human capital measurement indicators for personnel selection using fuzzy MADM. Proceedings of the Third International Conference on Soft Computing for Problem Solving: SocProS 2013, Volume 1, https://doi.org/10.1007/978-81-322-1771-8_37
[29] Bozbura, F. T., Beskese, A., & Kahraman, C. (2007). Prioritization of human capital measurement indicators using fuzzy AHP. Expert systems with applications, 32(4), 1100-1112. https://doi.org/10.1016/j.eswa.2006.02.006
[30] Njifen, I., & Meungwe, C. N. (2024). African youth and unemployment: does human capital investment still matter? Journal of Contemporary African Studies, 1-24. https://doi.org/10.1080/02589001.2024.2341620
[31] Olanipekun, D. B. (2019). Human Capital Development and Growth in Africa: Does Youth Unemployment Matter? Asian Journal of Economic Modelling, 7(4), 191-202. https://doi.org/10.18488/journal.8.2019.74.191.202