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A Multi-Criteria Framework for Addressing Youth Unemployment In Developing Countries: Pathways To Sustainable Solutions

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ABSTRACT

Youth unemployment is among Africa's most urgent challenges, with over 60% of its population under 25, the largest youth demographic globally. This youthful population presents a significant opportunity to drive economic growth, innovation, and development. However, the lack of sufficient employment opportunities risks perpetuating poverty, inequality, and social instability. To address this issue and unlock Africa's potential, this study evaluates and prioritizes six strategies identified through a comprehensive literature review and expert input. Using the Stepwise Weight Assessment Ratio Analysis (SWARA) method within an interval-valued spherical fuzzy (IVSF) framework, the research facilitates collective decision-making. It highlights three key strategies as the most appropriates: reforming education systems to align skills with labor market demands, fostering growth in sectors such as agriculture, manufacturing, and tourism, and promoting entrepreneurship to empower Africa's young innovators. The study offers actionable insights for policymakers to effectively combat youth unemployment and maximize the continent's demographic advantage.

1. Introduction

Africa is experiencing a significant surge in its youth population, with individuals aged 10 to 24 accounting for nearly one-third of the region's total population, or approximately 297 million. By 2050, this demographic is expected to almost double, reaching an estimated 561 million [1]. At the same time, educational attainment among the youth is on the rise, with the percentage of 20-to-24-year-olds completing secondary education projected to increase from 42% to 59% over the next two decades [2]. This combination of a rapidly expanding and increasingly educated workforce presents a unique opportunity for the region to unlock substantial economic growth and development.

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Harnessing this potential requires strategic investments in youth development, equipping them with the skills, resources, and opportunities necessary to drive innovation and prosperity.

Youth unemployment is a significant challenge in Africa, with southern Africa facing some of the highest rates—51% of young women and 43% of young men are jobless. This widespread unemployment wastes valuable potential, as young people's contributions to economic and social progress remain untapped. It also reduces their lifetime productivity and income, trapping many in poverty and limiting opportunities for advancement.

Youth unemployment in Africa is driven by a severe shortage of job opportunities, with only one-third of the 74 million jobs created between 2000 and 2008 benefiting those aged 15 to 24 [3]. This forces many young people into undesirable work conditions, including low wages, temporary roles, or unsafe environments, while others turn to informal work or give up job-seeking entirely, often excluded from official unemployment data. Adding to the challenge, education systems fall short in providing many youths with the foundational or market-specific skills needed for employment, despite gradual improvements.

In many African countries, over half of young people aged 15 to 19 lack basic skills, often due to school dropout or never having attended school [3]. In Eastern Africa, 37% of girls and 32% of boys of lower secondary age are out of school, with even worse figures in countries like Niger, where 83% of girls and 74% of boys are not in school [3]. Many young people enter low-skill jobs with limited chances for advancement, while education systems fail to provide opportunities for them to acquire essential skills later in life. Chances for young people to acquire job-specific skills are often scarce. Even if they complete primary school, many do not advance to secondary education or gain the skills that employers require.

Recent recommendations from the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Labour Organization emphasize the need for governments, the private sector, and international donors to work together on integrated, all-encompassing strategies. These strategies should focus on generating employment opportunities for youth while also ensuring a more seamless transition from education to the workforce, addressing both the creation of jobs and the development of skills needed for employment [4]. In his reports, Lere [5] highlighted youth unemployment as one of Africa's most urgent challenges and proposed several strategies for the continent to tap into the potential of its youth while addressing the unemployment issue. However, he did not prioritize these strategies based on their relative importance. Addressing the youth unemployment in Africa require a comprehensive approach using multi-criteria decision making (MCDM) techniques for better decisions [6, 7].

1.1 Objectives, contributions, and motivations

Our study seeks to achieve two primary objectives: (1) identify effective strategies for leveraging Africa's youth potential while tackling the unemployment crisis, and (2) to prioritize these strategies based on their significance.

This research makes two key contributions: (a) it introduces an approach by utilizing interval-valued spherical fuzzy (IVSF) within an MCDM framework to rank strategies aimed at addressing youth unemployment in Africa, and (b) it offers actionable recommendations for implementing these strategies effectively. The novelty of the study consists of applying for the first time an MCDM approach to rank strategies for addressing youth unemployment, particularly in Africa. And also, provide the most appropriate strategies to be implemented.

Fuzzy sets (FSs) have become prominent in research, with spherical fuzzy sets (SFSs) and IVFSs providing better ways to address ambiguity [8, 9]. IVSFSs, by combining these benefits, enable decision-makers to handle uncertainty more effectively than traditional FSs [10-12]. They are particularly valuable for comprehensive uncertainty modeling and integrating various evaluation methods. Keršuliene et al. [13] introduced the stepwise weight assessment ratio analysis (SWARA) technique to determine criterion weights. Because of this method's clarity and effectiveness, our study applied it within the IVSF framework. The remainder of the paper is organized into five sections.

2. Literature Review

Youth unemployment remains a critical global issue, posing significant challenges in both the immediate and long-term future. In certain nations, its prevalence is striking, with more than 50% of young individuals unable to secure productive employment. This pressing concern has drawn the attention of many scholars, leading to extensive research on its underlying challenges. For instance, Uchechukwu et al. [14] examined youth unemployment in Ogbaru, Anambra State, linking it to rising crime such as robbery and kidnapping. They urged governments to address this by creating jobs and establishing vocational training and talent development centers to equip youths with employable skills. Liotti [15] studied how the economic crisis affected youth and adult unemployment in Italy, investigating whether labor market reforms had alleviated or worsened its impact on young people. The research further explored the key economic and institutional factors that contribute to reducing unemployment overall. Liotti [16] analyzed youth unemployment and labor market regulation in 28 European countries (2000–2018). The study found that economic growth and active labor market policies are crucial for reducing youth unemployment, while questioning the effectiveness of flexibility measures alone in addressing the issue. Alfonsi et al. [17] investigated strategies to address youth unemployment in low-income countries. Their study showed that providing vocational training to young people before they enter the job market is more effective than offering wage subsidies to firms for hiring and training them.

In the MCDM area, Zhang et al. [18] examined factors influencing youth unemployment in emerging countries, highlighting economic and social inequalities as the primary causes. They also identified the economic crisis and inadequate education as key contributors. To address these issues, they recommended improving tax policies to reduce inequalities and enhancing education conditions. Nguyen et al. [19] used an MCDM approach to develop sustainable indexes for assessing unemployment, identifying the top ten factors with the greatest impact on unemployment rates during the COVID-19 pandemic. Shieh and Shah [20] created a detailed multidimensional index to evaluate energy poverty in developing nations through a hybrid fuzzy approach. Their analysis pinpointed electricity consumption per capita as the key factor driving energy poverty. The results underscore the importance of focused policies and interventions to improve energy access and reduce socioeconomic disparities, contributing to the progress of Sustainable Development Goal 7. Nguyen et al. [21] developed an improved forecasting method for predicting unemployment rates in Vietnam, addressing challenges related to limited data and uncertainty. Their findings highlight how the model can support policymakers in designing effective labor and economic policies for the future. Xie et al. [22] introduced an innovative method to assess college graduates' employment quality. Mao et al. [23] introduced a new method for evaluating college graduates' employment quality using probabilistic linguistic multi-attribute group decision-making. Kittiyankajon et al. [24] introduced a hybrid MCDM method to assess employer satisfaction with graduates from higher education institutions (HEIs), prioritizing various aspects of graduate quality. Setiawan et al. [25]

designed a model to reduce competency mismatches by comparing job qualifications with the skills of industrial engineering graduates from the University of Surabaya.

3. Methodology

The methodology involves two steps: collecting data from experts and previous studies, followed by evaluating six strategies addressing the youth unemployment issue in Africa using the SWARA method within an IVSF framework. Fig. 1 shows the study's flowchart.

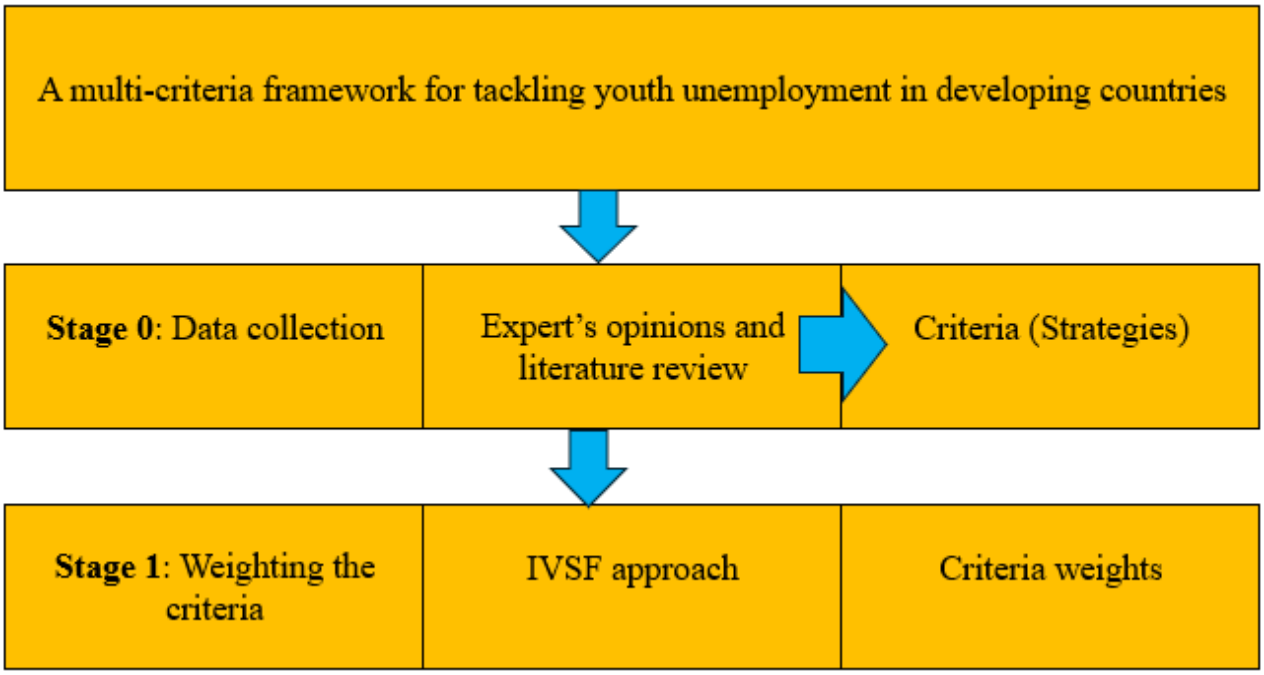

Fig.1. Flowchart of our study approach.

Nine steps have characterized the IVSF-SWARA approach.

Step 1. Problem evaluation via various strategies.

Step 2. Using the IVSF linguistic scale (refer to Table A1 in the appendix), experts prioritize strategies in descending order.

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. Strategies 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 strategies 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 strategies with input from a panel of four experts (Table A2). Details on the six strategies, identified through literature and expert opinions, are provided in Table A3. Experts provided data based on Table A1, which was used to evaluate the strategies outlined in Table A3.

4.1 Prioritizing strategies

Step 1. Assessment of six strategies to address the youth unemployment rate in Africa.

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

Table 1
Factors evaluation

Criteria	E-1	E-2	E-3	E-4
S1	AMI	AMI	VHI	AMI
S2	HI	AMI	AMI	SMI
S3	VHI	HI	HI	SLI
S4	AMI	AMI	VHI	VHI
S5	HI	VHI	AMI	HI
S6	SMI	VHI	VHI	EI

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 strategies

Criteria	a	b	c	d	e	f
S1	0.8301	0.9345	0.1107	0.1612	0.0062	0.0266
S2	0.7618	0.8824	0.1495	0.2027	0.0188	0.0423
S3	0.6260	0.7288	0.2397	0.3002	0.0390	0.0621
S4	0.8072	0.9141	0.1225	0.1732	0.0106	0.0310
S5	0.7426	0.8554	0.1565	0.2081	0.0225	0.0445
S6	0.6251	0.7255	0.2848	0.3584	0.0406	0.0701

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

Table 3
Positive scores of strategies

	S1	S2	S3	S4	S5	S6
s_j	1.7620	1.6475	1.3870	1.7209	1.6074	1.3529

Step 5. The rank of strategies is $S1 > S4 > S2 > S5 > S3 > S6$.
Step 6. Calculation of comparative importance of strategies in Table 4**.**

Table 4 Comparative significances of strategies

	S1	S4	S2	S5	S3	S6
c_j	-	0.041	0.073	0.040	0.220	0.034

Step 7. Provision of coefficients calculation in Table 5.

Table 5
Coefficients for strategies

	S1	S4	S2	S5	S3	S6
k_j	1	1.041	1.073	1.040	1.220	1.034

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

Table 6
Disorganized strategies weights

	S1	S4	S2	S5	S3	S6
q_j	1	0.961	0.895	0.860	0.705	0.682

Step 9. **Fig.2** indicated the final weights of strategies.

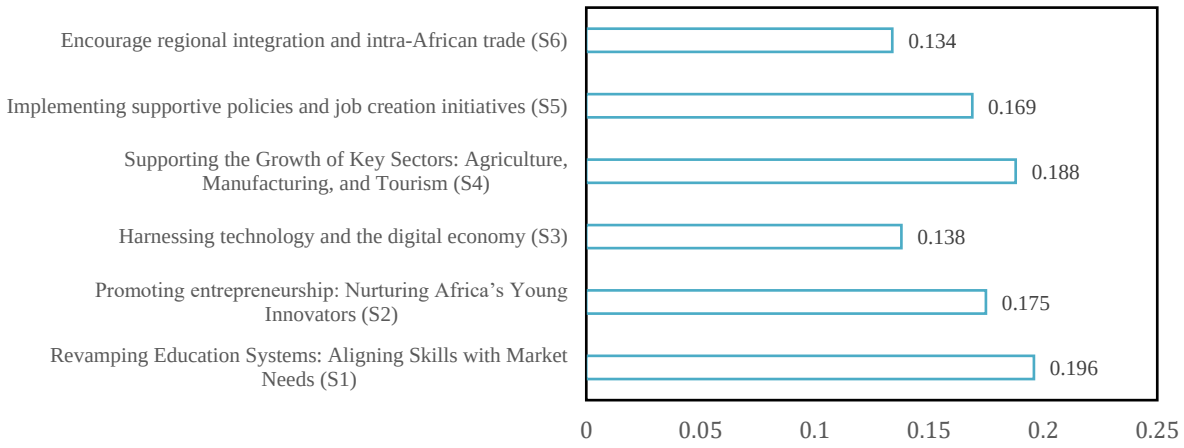

Fig.2. Final weights of strategies.

4.2 Findings and Discussion

Our research, utilizing the IVSF-SWARA method, underscores that "*revamping education systems: aligning skills with market needs-(S1)*" is the most appropriate strategy for addressing youth unemployment rates. This finding resonates with insights shared during the February 15, 2022, event by the African Center for Economic Transformation [26], which highlighted the growing challenge of youth unemployment. Contributing factors include low secondary school enrollment and a lack of high-quality, market-relevant education, which together undermine the potential of Africa's youthful

workforce. By prioritizing the development of practical, job-relevant skills—such as vocational training, technical education, digital literacy, and entrepreneurship—education systems can better equip young people to meet employer expectations. Integrating technical and vocational education and training (TVET) into curricula is particularly effective in preparing youth for careers in high-demand sectors such as technology, healthcare, and agriculture.

The second most impactful strategy is "*supporting the growth of key sectors such as agriculture, manufacturing, and tourism-(S4)*." This is consistent with findings by Fox et al. [27], who emphasized the potential of this approach to address youth unemployment in Africa by generating a wide array of job opportunities. In agriculture, introducing modern farming practices, promoting agribusiness ventures, and fostering value addition can engage young people in rural and urban settings, creating employment in areas such as cultivation, processing, and distribution. The manufacturing sector offers prospects for employment in industries like textiles, food processing, and electronics, while also promoting skill development and entrepreneurial initiatives. Similarly, tourism, with its capacity to draw international visitors, can stimulate job creation in hospitality, travel, and related local services.

The third most appropriate strategy is "*promoting entrepreneurship: nurturing Africa's young innovators- (S2)*" This aligns with the findings of Aja-Okorie and Adali [28], who highlighted this approach as a robust solution to the challenge of youth unemployment on the continent. With Africa's youth population expanding rapidly, driving innovation to create job opportunities is imperative. By equipping young people with essential skills, access to resources, and guidance through mentorship, they can transform their innovative ideas into successful enterprises, shifting from being job seekers to job creators. Entrepreneurship stimulates the establishment of new ventures, particularly in high-potential sectors such as technology, agriculture, and manufacturing, which can drive economic growth and provide long-term employment opportunities.

5. Managerial Implications

This study highlights actionable strategies for African governments to combat youth unemployment, emphasizing key managerial implications. First, reforming education systems to prioritize practical, job-specific skills—such as vocational training, digital literacy, and entrepreneurship—can better align workforce competencies with market demands. Integrating technical and vocational education and training (TVET) into curricula can be essential to prepare youth for high-demand sectors. Second, fostering growth in strategic industries like agriculture, manufacturing, and tourism can create diverse employment opportunities. Governments should promote modern farming practices, agribusiness ventures, and value addition in agriculture, while supporting skill development and entrepreneurship in manufacturing and leveraging tourism's potential to drive job creation in hospitality and related services. Finally, promoting entrepreneurship by providing young innovators with skills, resources, and mentorship can catalyze the establishment of new enterprises, transforming job seekers into job creators.

6. Policy Implications

This paper seeks to address notable gaps in the current research on youth unemployment. Its primary objective is to identify effective strategies by critically assessing existing approaches to tackling this issue, thereby providing governments with a valuable framework for action. Additionally, the paper highlights a significant challenge: the lack of universally accepted criteria for evaluating

strategies aimed at reducing youth unemployment. This issue is further complicated by the scarcity of literature on multi-criteria frameworks in this context. To overcome these challenges, the study employs a dual approach: it first conducts a thorough literature review to identify previously used strategies and then incorporates insights from experts in the field. By offering a well-rounded compilation of strategies, this research aims to guide policymakers in selecting the most effective measures to combat youth unemployment across the continent.

7. Conclusions and future recommendations

This study applies the IVSF-SWARA technique to prioritize strategies for addressing youth unemployment in Africa, providing valuable insights for policymakers. By leveraging expert input, it evaluates and ranks strategies to inform effective decision-making. Using a case study approach, the research highlights the technique's efficacy in identifying the most appropriate strategies. The findings emphasize three most appropriate strategies: revamping education systems: aligning skills with market needs, supporting the growth of key sectors such as agriculture, manufacturing, and tourism, and promoting entrepreneurship: nurturing Africa's young innovators. However, the study has notable limitations. Conducted at a continental scale, it does not fully account for the diverse socioeconomic contexts of individual African countries. Future research should focus on country-specific studies for greater contextual accuracy. Additionally, the reliance on a small pool of experts limits the generalizability of the findings. Expanding the expert group and utilizing a consensus-based model with a consensus coefficient in future research could enhance the reliability and robustness of the findings. Additionally, employing an improved SWARA approach or other variations of SWARA should be considered [29].

Author Contributions

Conceptualization, M.B.B. and S.Q.; methodology, M.B.B. and S.Q.; software, M.B.B. and S.Q.; validation, M.M.S.O. and Y.Q.; formal analysis, S.Q. and Y.Q.; investigation, Y.Q.; resources, S.Q.; data curation, M.B.B. and B.I.P.Z.; writing—original draft preparation, M.B.B. and S.Q.; writing—review and editing, B.I.P.Z.; visualization, Y.Q.; supervision, M.M.S.O. and B.I.P.Z.; project administration, M.M.S.O. and B.I.P.Z. All authors have read and agreed to the published version of the manuscript. Authorship must be limited to those who have contributed substantially to the work reported.

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Data Availability Statement

The article contains all the data within the text as well as in the appendix that has been utilized in this study.

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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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	Degree	Experience
E_1	Female	Academia	Ph.D.	10
E_2	Male	Industry	M.Sc.	17
E_3	Male	Industry	B.Sc.	20
E_4	Male	Academia	M.Sc.	12

Table A3
Strategies addressing the youth unemployment issue in Africa

Strategies	References
Revamping Education Systems: Aligning Skills with Market Needs (**S1**)	[3, 5, 14]
Promoting entrepreneurship: Nurturing Africa's Young Innovators (**S2**)	
Harnessing technology and the digital economy (**S3**)	
Supporting the Growth of Key Sectors: Agriculture, Manufacturing, and Tourism (**S4**)	
Implementing supportive policies and job creation initiatives (**S5**)	
Encourage regional integration and intra-African trade (**S6**)	