Journal of Expert Systems and Sustainable Development

Journal homepage: www.essd-journal.org
eISSN: 3104-3313

# Evaluating Sustainability Achievements in China-Africa Relations under the Forum for China-Africa Cooperation (FOCAC): A Fuzzy SIWEC Methodology

Ibrahim Badi[1], Mouhamed Bayane Bouraima[2,*], Jamal Musbah[3]

[1] Department of Mechanical Engineering, Libyan Academy-Misrata, Misrata, Libya
[2] Organization of African Academic Doctors (OAAD), Off Kamiti Road, P.O Box 25305-00100, Nairobi, Kenya
[3] School of Engineering and Applied Sciences, Libyan Academy, 2449, Misrata, Libya

**ARTICLE INFO**

***Article history:***
Received 11 December 2025
Received in revised form 26 January 2026
Accepted 24 February 2026
Available online 2 March 2026

***Keywords:***
Forum on China-Africa Cooperation; Achievement; Fuzzy SIWEC; MCDM; Fuzzy Sets

**ABSTRACT**

The Forum on China-Africa Cooperation (FOCAC) serves as a key multilateral platform for coordinating relations between China and African countries in support of long-term sustainable development goals. Since its inception in October 2000, FOCAC has produced a range of accomplishments contributing to economic, social, and environmental sustainability in Africa. This study identifies eight major achievements of FOCAC based on prior research and evaluates their relative importance through the input of four experts from a sustainability-oriented development perspective. The fuzzy simple weight calculation (F-SIWEC) method is employed to determine the weight of these achievements with respect to sustainable cooperation outcomes. The results indicate that the expansion of Chinese investment and funding across Africa ranks as the most significant achievement. In contrast, the strengthening of public and institutional support for China-Africa cooperation is regarded as the least significant accomplishment.

## 1. Introduction

The relationship between China and Africa have been done through localization and internationalization as cooperation has been strengthened through increasing exchanges between people to people and frequent summits [1]. The Forum for China-Africa (FOCAC), that direct this commitment, plays an important role in fostering comprehensive and equal development [2]. While there is continuous growth in China and Africa ties, and the continent is impacted by the competition between international powers, localization and internationalization still encounter critical challenges. Overcoming these challenges become important for cooperative development protection from geopolitical forces and guarantee important advantages for local people.

Localization is considerably modeling the collaboration between China and Africa, necessitating powerful focus on the social necessities of people in the continent [3]. Real localization also needs

* *Corresponding author.*
*E-mail address: mouba121286@yahoo.fr*

https://doi.org/10.65069/jessd21202611

stronger commitment from the people, practical policies, and appropriate concepts. However, although many measures on inclusive development have been implemented from Chinese side, the final outcomes do not frequently prioritize localization.

Selormey and Sanny [4] indicated that although there is extensive cooperation between China and the continent, there is a slight improvement about the opinions of African towards the economic role and aid of China. This strengthens the necessity of extensive international assistance and powerful multilateral measures. Structural issues aggravated by COVID-19 make such cooperation very pressing. While Chinese becomes a main development partner, their endeavor will be more successful if backed by people at local level and other stakeholders at international level. Working along with progressive security, technological, and financial support from Western countries, the commitment of China can help ameliorate the continent's larger security and development needs.

Although there is a consolidating tie between China and Africa, new accountability, inequality, and environmental concerns emerged. Therefore, the FOCAC has continuously extended its center of attention on inclusive development since 2006. These efforts comprise assistance in agricultural, education, public health sectors among others, with China rising investment and training for sustainable growth and continent's inclusive promotion.

Numerous studies have examined FOCAC from different perspectives. For instance, Lemmy [5] used a cybernetic framework to analyze FOCAC's functioning and impact, examining the flow of information, people, services, and goods between China and Africa to provide a structured understanding of its evolution and operational dynamics from 2000 to 2018. Building on this, Kyirewiah and Xiaolong [6] explored FOCAC's formation by assessing the processes, developments, and achievements of both China and Africa, questioning whether the Forum's 20-year milestone warrants celebration. Complementing these perspectives, Zhou [7] highlighted FOCAC's potential as a premier platform for China Africa cooperation, emphasizing its role in promoting Africa's economic, social, and human development while strengthening multilateral coordination across the continent. While these studies provide valuable insights into various aspects of FOCAC, they do not offer a managerial ranking of its achievements. In recent years, many scholars have used the multi-criteria decision-making (MCDM) approaches because of their ability to deal with uncertainty [8, 9]. In this study, a fuzzy simple weight calculation (F-SIWEC) is applied to identify and evaluate the achievements related to the FOCAC initiative. The remaining of the study is comprised of seven sections.

## 2. Literature Review

### *2.1 Overview of approaches related to the FOCAC initiative*

Extensive research has examined the FOCAC initiative and its multifaceted impact on Africa. Shelton [10] highlighted that the trajectory of FOCAC is shaped by the active engagement of all stakeholders, suggesting that sustained collaboration between China and Africa can strengthen a mutually beneficial partnership. Building on this, Wen [11] emphasized that investment initiatives have been central to FOCAC from the outset, encompassing consistent promotion, legal protection, growing facilitation, and innovative dispute-resolution mechanisms, which collectively underpin the economic dimension of the partnership. Complementing these findings, Sun and Omoruyi [12] showed that China's zero-tariff policy significantly promotes export diversification in African countries, particularly within the manufacturing sector, while its influence on agriculture and mining remains limited, with varying regional effects across major African economic communities. In parallel, Ibonye [13] noted that FOCAC advances knowledge sharing through capacity-building programs, including training, technical support, and technology cooperation, though critics contend that its modest effect on industrialization reflects a Beijing-centered globalization model. Similarly, Khalid *et*

*al.,* [14] observed that FOCAC initiatives support capacity building, knowledge exchange, and infrastructure development in African higher education, yet persistent challenges remain in aligning programs with African development priorities, ensuring sustainability, and assessing long-term institutional impact.

### *2.2 Applications and extensions of SIWEC approach*

Since the introduction of SIWEC approach by Puška *et al.,* [15], various studies have used in different extensions. Badi *et al.,* [16] adopted it in a fuzzy environment to assess potential alternatives for strategic railway infrastructure planning in Libya. Their results indicated the strategy related to the development of coastal corridor as the most appropriate one. Katrancı *et al.,* [17] applied it for the choice of durable disposal technology and revealed how composting is considered the most appropriate technology. Şimşek *et al.,* [18] proposed an approach to pinpoint the most influential parameters to the procurement performance in the investment of solar energy projects. Their findings indicated how important strategy definition is during this process. Štilić *et al.,* [19] evaluated the ability to valorize tourist in botanical gardens and found that how these gardens playing an important role in varying tourist offerings. Yalçın *et al.,* [20] adopted a new integrated framework for choosing a transport policy in Northern Russia. Cao *et al.,* [21] assisted countries in the selection of transport policies in Northern Sea route. Çizmecioğlu *et al.,* [22] adopted an integrated framework to evaluate the most appropriate investment strategies for enhancing the technologies related to digital twins. Puška *et al.,* [23] adopted a fuzzy rough technique for the choice of electric vehicles for small farming. Eti *et al.,* [24] assessed the main strategies for the adoption of renewable energy in localized supply chain networks. The application and extensions of SIWEC approach is indicated in Table 1.

**Table 1**
Application and extensions of SIWEC method

| Authors | Objective | Methodology | Location |
|---|---|---|---|
| Puška *et al.,* [15] | Choice in the sale channels of agricultural things | SIWEC, F-SIWEC | Bosnia and Herzegovina |
| Badi *et al.,* [16] | Strategic railway planning development | F-SIWEC, RAWEC | Libya |
| Katrancı *et al.,* [17] | Choice of sustainable waste disposal | F-SIWEC, F-RAWEC | Turkish |
| Şimşek *et al.,* [18] | Assessment of purchasing procedure in solar energy project investment | SIWEC | - |
| Štilić *et al.,* [19] | Valorizing tourism in botanical gardens | F-SIWEC, TOPSIS | Croatia |
| Yalçın *et al.,* [20] | Choice of transportation policy | IF-SIWEC-ARLON | Northern Russia |
| Cao *et al.,* [21] | Implementing new techniques to green digital twins | SF-SIWEC-SAW | - |
| Çizmecioğlu *et al.,* [22] | Strategic choice of competitive intelligence platforms | p, q-QOFN, SIWEC-MABAC | - |
| Puška *et al.,* [23] | Choice of electric cars | FR-SIWEC-RAWEC | - |
| Eti *et al.,* [24] | Strategy building for the adoption of renewable energy in localized supply chain networks | FF-SIWEC-EDAS | - |

Note: ARLON- Alternative Ranking using two-step LOgarithmic Normalization; EDAS- Evaluation Based on Distance from Average Solution ; FF-Fermatean Fuzzy; FR-Fuzzy Rough; MABAC- Multi-Attributive Border Approximation area Comparison ; p, q-QOFN-p , q-quasirung orthopair fuzzy number; RAWEC- Ranking of Alternatives with Weights of Criterion; SAW - Simple Additive Weighting; TOPSIS- Technique for Order of Preference by Similarity to Ideal Solution.

## 3. Problem Definition

Table 2 outlines the achievements related to FOCAC initiative based on experts' opinions and previous studies [7].

**Table 2**
Acheivements related to FOCAC initiative

| Achievements | References |
|---|---|
| Increasing access for African goods in the Chinese market (ACH1) | [7] |
| Supporting training and skills development for African professionals (ACH2) | |
| Reducing or canceling debt owed by African nations (ACH3) | |
| Improving healthcare systems and medical services in Africa (ACH4) | |
| Assisting Africa in boosting agricultural production and technology (ACH5) | |
| Growing Chinese investment and funding support across Africa (ACH6) | |
| Strengthening public and institutional backing for China–Africa cooperation (ACH7) | |
| Positively engaging in peace and security initiatives within Africa (ACH8) | |

Note: ACH-Achievement

## 4. Methodology

A fuzzy SIWEC methodology is adopted to identify and evaluate the achievements related to the FOCAC initiative through following steps.

*Step 1*. The relative significance of each criterion is assessed by experts.

*Step 2*. Experts offered linguistic evaluations which are transferred to triangular fuzzy numbers, which are defined as lower, middle, and upper bounds, thereby apprehending the subjectivity in experts' opinions.

$$\tilde{x}_{ij} = \left(x_{ij}^{l}, x_{ij}^{m}, x_{ij}^{u}\right) \tag{1}$$

*Step 3*. The original fuzzy decision matrix is established according to fuzzy numbers obtained from the assessment of the experts. Each parameter represents the observed significance of a defined criterion, including the ambiguity apprehended through the evaluation of linguistics. This matrix represents the foundation for criteria weights computation using the F-SIWEC technique.

$$\begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \ldots. & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \ldots. & \tilde{x}_{2n} \\ . & . & \ldots. & . \\ . & . & \ldots. & . \\ . & . & \ldots. & . \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \ldots. & \tilde{x}_{mn} \end{bmatrix} \tag{2}$$

*Step 4*. In this stage, there is a normalization of fuzzy values from the decision matrix by dividing them by the greater upper bound ($\max x_{ij}^{u}$) seen through all criteria and experts.

$$\tilde{n}_{ij} = \frac{x_{ij}^{l}}{\max x_{ij}^{u}}, \frac{x_{ij}^{m}}{\max x_{ij}^{u}}, \frac{x_{ij}^{u}}{\max x_{ij}^{u}} \tag{3}$$

*Step 5*. There is a calculation of standard deviation (std.$dev_j$) according to fuzzy numbers obtained from experts. This calculation represents consistency or variation in the criteria assessment, permitting the approach to highlight criteria where the judgments of experts indicate higher differentiation, an important characteristic of the F-SIWEC technique for apprehending the associated importance under ambiguity.

*Step 6*. A multiplication of normalized fuzzy rating by related values of standard deviation is made to reflect the normalized fuzzy rating.

$$\tilde{v}_{ij} = \tilde{n}_{ij} \times st.dev_j \tag{4}$$

*Step 7*. An aggregation of fuzzy weighted values for each parameter is made through the summation of weighted fuzzy assessment offered by all experts. This produced a general representation of each parameter's significance, allowing both independent expert opinions and the ambiguity captured in antecedent steps. The results are an integrated fuzzy weight for each parameter, which becomes a foundation for finding the final significance rankings.

$$\tilde{S}_{ij} = \sum_{j=1}^{n} \tilde{v}_j \tag{5}$$

*Step 8*. There is a division of each independent fuzzy value by total sum of all fuzzy values to acquire the normalized fuzzy weight for each parameter. During this procedure, it is important to guarantee that the lower bound is less or equal to the middle value. This is possible only if the logical order of the fuzzy numbers is maintained.

$$\widetilde{w}_{ij} = \frac{S_{ij}^{l}}{\sum_{j=1}^{n} S_{ij}^{u}}, \frac{S_{ij}^{m}}{\sum_{j=1}^{n} S_{ij}^{m}}, \frac{S_{ij}^{u}}{\sum_{j=1}^{n} S_{ij}^{l}} \tag{6}$$

*Step 9*. There is a retention in the final fuzzy weights of each criterion through their fuzzy form or de-fuzzified into crisp values, based on the analytical necessities. In this study, there is a de-fuzzified of fuzzy weights employing a suitable defuzzification approach to transfer each fuzzy number into a unique representative value.

$$w_{jdef} = \frac{w_{ij}^{l} + 4 \times w_{ij}^{m} + w_{ij}^{l}}{6} \tag{7}$$

## 5. Application

In this study, the F-SEWIC process follows a three-step methodological strategy: i) fuzzification of expert input judgments, ii) generating crisp weights for each criterion, and iii) calculating the weighted scores for all the achievements. The process enables the researchers to develop a data-driven ranked list of the achievements, in terms of contribution to Africa, from the most to least significant achievement. In order to create a systematic guide for the analysis of this study, we rate and rank the eight major FOCAC achievements developed from reviewing official documents produced since the inception of the FOCAC in 2000. These eight achievements form the basis for our ranking and are essential to the China-Africa partnership. The ordering of the overarching set of impact accomplishments serves as foundational for the order of quantitative prioritization of the F-SEWIC method. Each accomplishment, in their own way, will uncover their relative perceived impact in the African vernacular. In order to ascertain the relative importance of the F-SEWIC criteria, a panel of five experts from the realm of specializing in China-Africa relations, African development studies, and international cooperation was convened. Each expert evaluated the criteria on a pre-defined linguistic scale. The linguistic scale was converted to triangular fuzzy numbers to enable the fuzzy weight calculations. The weights determined by the mentioned criteria were applied to evaluate and rank the eight FOCAC achievements, thereby creating a clear hierarchy of perceived impact in the African context. The linguistic scale is presented in Table 3.

The foundation of the fuzzy weight calculation is the linguistic decision-making matrix, populated by expert assessments for each main strategy. This matrix, detailed in Table 4, captures the initial judgments of the five specialists in China-Africa relations and African development.

**Table 3**
Fuzzy linguistic evaluation scale

| Linguistic terms | Membership function |
|---|---|
| Absolutely bad (AB) | (1,1,1) |
| Very bad (VB) | (1,2,3) |
| Bad (B) | (2,3,4) |
| Medium-bad (MB) | (3,4,5) |
| Equal (E) | (4,56) |
| Medium-good (MG) | (5,6,7) |
| Good (G) | (6,7,8) |
| Extremely good (EG) | (7,8,9) |
| Absolutely good (AG) | (8,9,10) |
| Perfect (P) | (9,10,10) |

**Table 4**
Linguistic decision-making matrix

| | ACH1 | ACH2 | ACH3 | ACH4 | ACH5 | ACH6 | ACH7 | ACH8 |
|---|---|---|---|---|---|---|---|---|
| E1 | EG | MG | G | MG | EG | P | B | E |
| E2 | G | MG | G | MG | AB | AB | MB | MB |
| E3 | G | E | MG | G | EG | P | VB | B |
| E4 | EG | MB | G | E | EG | P | AB | B |
| E5 | EG | MB | MG | E | G | P | VB | MB |

To create the initial fuzzy decision matrix based on the expert judgments, it was necessary to first normalize the data in order to be able to compare data using a consistent scale basis. As stipulated in the F-SEWIC methodology, the normalization was undertaken by dividing each triangular fuzzy number by the highest upper-bound number for each of the expert assessments with respect to all criteria. This process reorganized the entire range of data into a [0, 1] normalized range. It is important to emphasize that this step maintains the proportional relationships of the original expert assessments, leaving the relative value of importance intact with no distortions in the results. The initial fuzzy decision matrix of expert assessment and the normalized, fuzzy decision matrix appears in Table 5 and this process corrected for bias based on the scale of the number and establishes a strong consistent baseline for the subsequent stage of deriving weights for each criterion and therefore provides the direct input for stage 2 of the process.

**Table 5**
Normalized fuzzy decision-making matrix

| | ACH1 | ACH2 | ACH3 | ACH4 | ACH5 | ACH6 | ACH7 | ACH8 |
|---|---|---|---|---|---|---|---|---|
| E1 | (0.7,0.8,0.9) | (0.5,0.6,0.7) | (0.7,0.8,0.9) | (0.5,0.6,0.7) | (0.7,0.8,0.9) | (0.9,1.0, 1.0) | (0.2,0.3,0.4) | (0.4,0.5,0.6) |
| E2 | (0.6,0.7,0.8) | (0.5,0.6,0.7) | (0.6,0.7,0.8) | (0.5,0.6,0.7) | (0.1,0.1,0.2) | (0.1,0.1,0.2) | (0.3,0.4,0.5) | (0.3,0.4,0.5) |
| E3 | (0.6,0.7,0.8) | (0.4,0.5,0.6) | (0.5,0.6,0.7) | (0.6,0.7,0.8) | (0.7,0.8,0.9) | (0.9,1.0, 1.0) | (0.1,0.1,0.2) | (0.2,0.3,0.4) |
| E4 | (0.7,0.8,0.9) | (0.3,0.4,0.5) | (0.6,0.7,0.8) | (0.4,0.5,0.6) | (0.7,0.8,0.9) | (0.9,1.0, 1.0) | (0.1,0.1,0.2) | (0.2,0.3,0.4) |
| E5 | (0.7,0.8,0.9) | (0.3,0.4,0.5) | (0.5,0.6,0.7) | (0.4,0.5,0.6) | (0.6,0.7,0.8) | (0.9,1.0, 1.0) | (0.1,0.1,0.2) | (0.3,0.4,0.5) |

Following normalization, the F-SEWIC method moves forward by incorporating the degree of consensus among the experts by taking the normalized fuzzy values and multiplying them by the standard deviation of each criterion. This action, by design, incorporates experts' opinion variability directly into the weighting process of the criteria, allowing criteria where experts disagreed to carry more weight, essentially indicating that those criteria were either pertinent to a relevant controversy or were variable within context. In the next stage, the summed values are calculated. Table 6 shows the sum of the normalized fuzzy weight and expert's opinion variability in the weighting calculation.

The sum of the weighted value produces the first level fuzzy weights for each criterion as quantified by the expert team while recognizing and representing embedded uncertainty. During this arithmetic stage, care was taken to maintain the three-step fuzzy number sequence that maintains that (lower bound ≤mode ≥ upper bound) is true for each fuzzy weight quantity produced.

**Table 6**
Obtaining final values of the criteria by using fuzzy SIWEC method

| Achievement | $\tilde{s}_{ij}$ | $\widetilde{w}_{ij}$ |
|---|---|---|
| ACH1 | (0.82,0.94,0.98) | (0.13,0.17,0.22) |
| ACH2 | (0.49,0.61,0.73) | (0.07,0.11,0.16) |
| ACH3 | (0.69,0.82,0.94) | (0.11,0.14,0.20) |
| ACH4 | (0.59,0.71,0.84) | (0.09,0.13,0.18) |
| ACH5 | (0.70,0.80,0.92) | (0.11,0.14,0.20) |
| ACH6 | (0.93,0.98,0.99) | (0.14,0.18,0.22) |
| ACH7 | (0.19,0.29,0.41) | (0.03,0.05,0.09) |
| ACH8 | (0.34,0.46,0.59) | (0.05,0.08,0.12) |

The results displayed in Figure 1 for the defuzzified criterion weights suggest a clear ranking regarding the perceived influence of the achievements of FOCAC from an African perspective.

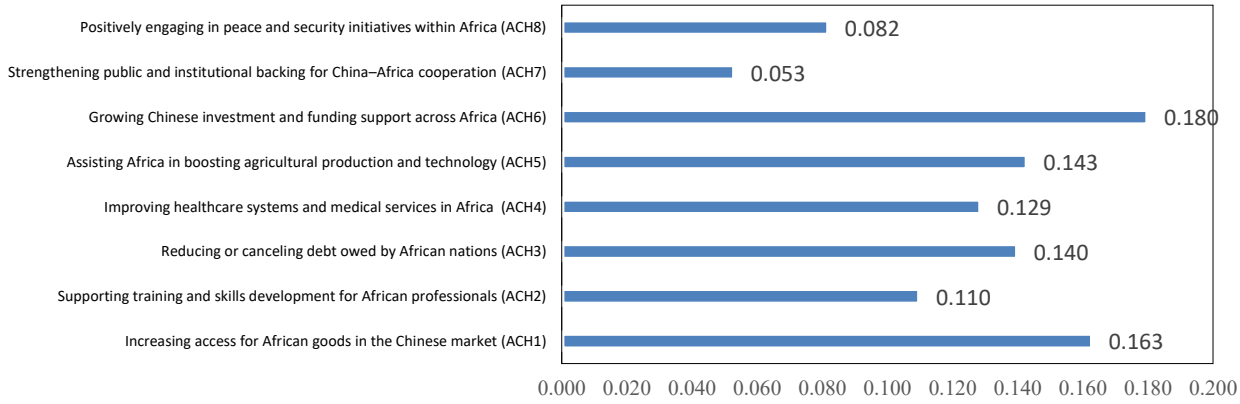


**Fig. 1.** Defuzzified value of the weights of achievements

## 6. Discussion

The importance of rankings assigned to the eight FOCAC achievements yields an unambiguous parameter of how each item is perceived to impact the respective countries, in spite of the recent event's implications. The highest achievement, ACH6 = 0.180, concerned growing Chinese investment and funding across Africa. By contrast, ACH7 (i.e., strengthening public and institutional backing for China-Africa cooperation) as the lowest achievement weight of 0.053 suggests this policy domain appears benign for soft diplomacy (in which stakeholders believe it may lead to developing friendly relations), but it is perceived as having less of a direct or proximate (meaning soft diplomacy does not secure policy changes) impact on core developmental outcomes when comparing it to financial and economic interventions.

## 7. Comparative analysis

To validate the robustness of our methodology adopted, we compare it with two other popular fuzzy approaches: the Fuzzy Technique for Order Preference by Similarity to Ideal Solution (F-TOPSIS) method and the Fuzzy Additive Ratio Assessment (F-ARAS) method. The criterion weighting for the

F-TOPSIS method was conducted by first aggregating the five experts' linguistic ratings for the eight criteria (ACH1–ACH8) into a single triangular fuzzy number $\widetilde{w}_j$ via the fuzzy average. These $\widetilde{w}_j$ vectors were then defuzzified using the center of area (COA) method and normalized to yield the final crisp weights $w_j$. The results demonstrated a clear priority hierarchy in Table 7. The ACH6 achievement was assigned the highest weight of 0.154 (reflecting high expert consensus), while ACH7 received the lowest weight (0.043).

**Table 7**
F-TOPSIS evaluation of the achievements

| Achievement | Fuzzy Weight $\widetilde{w}_j$ | De-fuzzified Weight $w_j'$ | Normalized Crisp Weight $w_j$ |
|---|---|---|---|
| ACH1 | (7.200, 8.400, 9.400) | 8.3500 | 0.136 |
| ACH2 | (3.400, 4.800, 6.200) | 4.8000 | 0.078 |
| ACH3 | (5.600, 6.800, 7.800) | 6.7500 | 0.110 |
| ACH4 | (4.800, 5.800, 6.800) | 5.8000 | 0.095 |
| ACH5 | (5.200, 6.000, 7.000) | 6.0500 | 0.099 |
| ACH6 | (8.400, 9.600, 9.600) | 9.4000 | 0.154 |
| ACH7 | (1.600, 2.600, 3.800) | 2.6500 | 0.043 |
| ACH8 | (2.800, 4.000, 5.200) | 4.0000 | 0.065 |

The F-ARAS method was employed, utilizing the exact same aggregated fuzzy importance vectors $\acute{I}_j$ derived from the expert evaluations. The F-ARAS fuzzy weight $\widetilde{w}_j$ was calculated as the ratio of each criterion's $\acute{I}_j$ to the optimal fuzzy importance $\acute{I}_0$= (10, 10, 10). Following defuzzification and normalization, the final crisp weights $w_j$ obtained from F-ARAS are shown in Table 8 and were mathematically identical to those calculated for F-TOPSIS (and F-WASPAS), reaffirming the stability and consistency of the initial aggregation step. This calculation confirms that ACH6 maintains the dominant importance, validating the derived criterion hierarchy across multiple robust fuzzy weighting techniques.

**Table 8**
F-ARAS evaluation of the achievements

| Achievement | Fuzzy Importance $\acute{I}_j$ | Fuzzy Weight $\widetilde{w}_j$ | Defuzzified Weight $d(w_j)$ | Final Crisp Weight $w_j$ |
|---|---|---|---|---|
| ACH1 | (7.20, 8.40, 9.40) | (0.720, 0.840, 0.940) | 0.835 | 0.1368 |
| ACH2 | (3.40, 4.80, 6.20) | (0.340, 0.480, 0.620) | 0.480 | 0.0787 |
| ACH3 | (5.60, 6.80, 7.80) | (0.560, 0.680, 0.780) | 0.675 | 0.1107 |
| ACH4 | (4.80, 5.80, 6.80) | (0.480, 0.580, 0.680) | 0.580 | 0.0951 |
| ACH5 | (5.20, 6.00, 7.00) | (0.520, 0.600, 0.700) | 0.605 | 0.0992 |
| ACH6 | (8.40, 9.60, 9.60) | (0.840, 0.960, 0.960) | 0.940 | 0.1542 |
| ACH7 | (1.60, 2.60, 3.80) | (0.160, 0.260, 0.380) | 0.265 | 0.0434 |
| ACH8 | (2.80, 4.00, 5.20) | (0.280, 0.400, 0.520) | 0.400 | 0.0656 |

Figure 2 compares the final rankings of the achievements derived from the F-SEWIC, F-ARAS and F-TOPSIS methods. It clearly demonstrates that all techniques yield the same result. The perfect correlation in the ranking order across these three approaches provides compelling evidence for the robustness and reliability of the achievements.

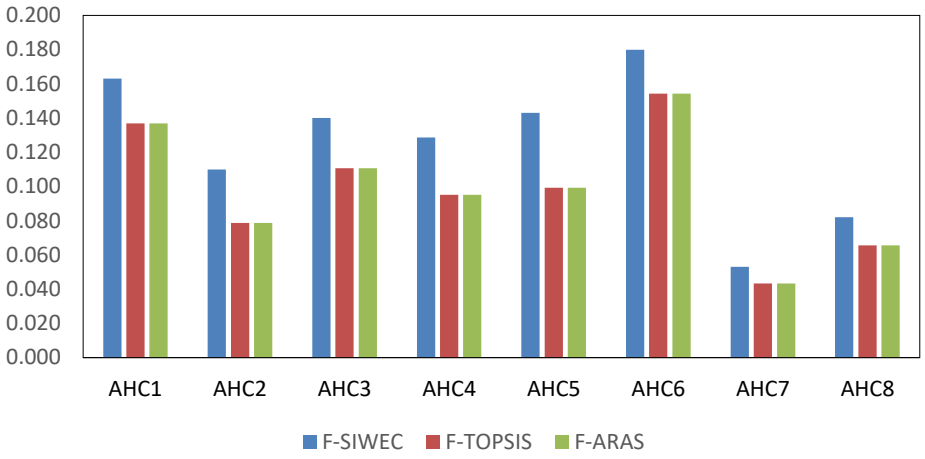


**Fig. 2.** F-SEWIC, S-ARAS and F-TOPSIS results comparison

## 8. Conclusions and future recommendations

In this study, a fuzzy SIWEC technique is adopted to assess and prioritize eight achievements of the FOCAC initiative. The results of the study revealed that the growing Chinese investment and funding across Africa is the most significant achievement of the initiative, as it serves as a key driver of economic development, infrastructure expansion, and industrial growth, while also fostering stronger bilateral ties, facilitating trade, and enhancing Africa's capacity to achieve sustainable development goals. While the study has made greater contribution through the provision of most appropriate achievement, there is a limitation. There are a few experts that are involved in data collection. Future study should consider increasing this number to 10 or more. Also, since the continent comprised of 54 countries, the achievements should assessment with respect to each country or region.

## Acknowledgement

This research was not funded by any grant

## Conflicts of Interest

The authors declare no conflicts of interest.

## References

[1] Fei, D. (2021). Employee management strategies of Chinese telecommunications companies in Ethiopia: Half-way localization and internationalization. *Journal of Contemporary China*, 30(130), 661-676. https://doi.org/10.1080/10670564.2020.1852740

[2] Omolo, L. A. (2022). Assessing China-Africa Relations under the Forum for China-Africa Cooperation (FOCAC)(2000-2019). *Africa Review*, 15(1), 24-42. https://doi.org/10.1163/09744061-tat00009

[3] Aiping, Z., & Zhan, S. (2018). Origin, achievements, and the prospects of the Forum on China-Africa Cooperation. *China Int'l Stud.*, 72, 88.

[4] Selormey, E., & Sanny, J. A.-N. (2021). Africans welcome China's influence but maintain democratic aspirations. *Afrobarometer Dispatch*, 23.

[5] Lemmy, N. (2020). Forum on China-Africa cooperation: An assessment of modes of diplomatic engagements, its achievements, and aspirations. *Africa Journal of International Studies*, 1(1), 28-37.

[6] Kyirewiah, F. K., & Xiaolong, Z. (2022). 20-Years of China-Africa Cooperation: Processes, Developments and Achievements. *Journal of African Foreign Affairs*, 9(2). https://doi.org/10.31920/2056-5658/2022/v9n2a2

[7] Zhou, Y. (2022). Advancing China-Africa cooperation in the new era: Achievements and challenges. *China Quarterly of International Strategic Studies*, 8(03n04), 325-342. https://doi.org/10.1142/S2377740022500117

[8] Badi, I., Bouraima, M. B., Qiu, Y., & Stević, Ž. (2024). Optimizing Priority Sequencing Rules in Parallel Machine Scheduling: An Evaluation and Selection Approach using Hybrid MCDM Techniques. *Decision Making Advances*, 2(1), 22-31. https://doi.org/10.31181/dma21202422

[9] Bouraima, M. B., Więckowski, J., & Qian, S. (2025). A decision support system for prioritizing electric vehicles transition policies. *Transportation research part D: transport and environment*, 146, 104880. https://doi.org/10.1016/j.trd.2025.104880

[10] Shelton, G. (2016). The FOCAC process and sino-African strategic partnership. *China Quarterly of International Strategic Studies*, 2(02), 259-276. https://doi.org/10.1142/S2377740016500123

[11] Wen, Z. (2019). The forum on China-Africa cooperation: An investment perspective. *China and WTO Review*, 5(1), 195-206. https://doi.org/10.14330/cwr.2019.5.1.10

[12] Sun, Z., & Omoruyi, E. M. M. (2021). Effect of China's Zero-Tariff Treatment under Forum on China-Africa Cooperation (FOCAC) on Export Diversification in Beneficiary Countries in Africa. *Journal of African Trade*, 8(1), 23-32. https://doi.org/10.2991/jat.k.210618.001

[13] Ibonye, V. (2022). The Forum on China-Africa Cooperation (FOCAC) and knowledge transfer in Sino-Nigerian development cooperation. *Asian Journal of Comparative Politics*, 7(4), 1045-1069. https://doi.org/10.1177/2057891120912333

[14] Khalid, S., Tadesse, E., & Huang, X. (2025). Sino-African higher education under FOCAC: an integrative review of initiatives, structural impacts, and enduring challenges. *Higher Education*, 1-41. https://doi.org/10.1007/s10734-025-01556-3

[15] Puška, A., Nedeljković, M., Pamučar, D., Božanić, D., & Simić, V. (2024). Application of the new simple weight calculation (SIWEC) method in the case study in the sales channels of agricultural products. *MethodsX*, 13, 102930. https://doi.org/10.1016/j.mex.2024.102930

[16] Badi, I., Baryannis, G., & Bouraima, M. B. (2025). Decision Support for Railway Infrastructure Planning Using the SIWEC-RAWEC Framework. *X International Conference New Horizons of Transport and Communications 2025*. https://doi.org/10.1007/978-3-032-14078-4_46

[17] Katrancı, A., Kundakcı, N., & Arman, K. (2026). Fuzzy SIWEC and Fuzzy RAWEC methods for sustainable waste disposal technology selection. *Spectrum of Operational Research*, 87-102. https://doi.org/10.31181/sor31202633

[18] Şimşek, E., Eti, S., Yüksel, S., & Dinçer, H. (2026). Evaluation of Purchasing Process in Solar Energy Investment Projects via SIWEC Methodology. *Spectrum of Operational Research*, 81-86. https://doi.org/10.31181/sor31202636

[19] Štilić, A., Bosna, J., Puška, A., & Nedeljković, M. (2025). Examining Tourism Valorization of Botanical Gardens Through a Fuzzy SiWeC-TOPSIS Framework. *Journal of Zoological and Botanical Gardens*, 6(4), 55. https://doi.org/10.3390/jzbg6040055

[20] Yalçın, G. C., Limon, E. G., Kara, K., Limon, O., Gürol, P., Deveci, M., Demirayak, Ö., & Tomášková, H. (2025). A hybrid decision support system for transport policy selection: A case study on Russia's Northern Sea route in Artic region. *Socio-Economic Planning Sciences*, 98, 102171. https://doi.org/10.1016/j.seps.2025.102171

[21] Cao, J., Spulbar, C., Eti, S., Horobet, A., Yüksel, S., & Dincer, H. (2025). Innovative approaches to green digital twin technologies of sustainable smart cities using a novel hybrid decision-making system. *Journal of Innovation & Knowledge*, 10(1), 100651. https://doi.org/10.1016/j.jik.2025.100651

[22] Çizmecioğlu, S., Çalık, A., & Tirkolaee, E. B. (2025). An integrated p, q-quasirung orthopair fuzzy decision-making approach for strategic selection of competitive intelligence platforms. *Engineering Applications of Artificial Intelligence*, 158, 111498. https://doi.org/10.1016/j.engappai.2025.111498

[23] Puška, A., Božanić, D., Štilić, A., Nedeljković, M., & Khalilzadeh, M. (2025). Application of fuzzy-rough methodology to the selection of electric tractors for small farms in Semberija. *Journal of fuzzy extension and applications*, e212931.

[24] Eti, S., Yüksel, S., Dinçer, H., Çırak, A. N., Deveci, M., & Kadry, S. (2025). Strategy building for renewable energy adoption in regionalized supply chains-based logistic systems using a hybrid fuzzy decision-making approach. *Case studies on transport policy*, 101479. https://doi.org/10.1016/j.cstp.2025.101479