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Analyzing Global Economic Shifts Due to the Afghan–America War Using Complex Cubic Fuzzy TODIM method

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Abstract. This paper presents a significant extension of the classical TODIM (an acronym in Portuguese for Interactive and Multicriteria Decision-Making) method, originally grounded in prospect theory, by integrating it with Complex Cubic Fuzzy data to form a novel decision-making framework, CCF-TODIM. The primary contribution lies in extending the classical TODIM technique by incorporating CCF sets, which offer a more expressive representation of uncertainty by simultaneously capturing membership, non-membership, hesitation, and complex evaluations. The proposed CCF-TODIM method is systematically developed, and its operational steps are detailed through a comprehensive numerical example. To demonstrate practical relevance and robustness, the framework is applied to a real-world case study that assesses the global economic impacts of the Afghan-American War. A comparative analysis with existing MADM approaches reveals the superiority of the CCF-TODIM model in terms of accuracy and adaptability. Furthermore, the impact of different distance measures on the final ranking of alternatives is investigated to validate the sensitivity and stability of the method. The study establishes CCF-TODIM as a powerful tool for handling ambiguous and complex decision environments, with broad applicability in socio economic growth and geopolitical analysis.

Key Words and Phrases: Intuitionistic fuzzy sets, Complex cubic fuzzy sets, MADM

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1. Introduction

The influx of foreigners, the establishment of new trade routes with surrounding and regional nations, and the growth of its mining, energy, and agriculture sectors all contributed to the notable expansion of the Afghan economy. Billions of dollars in aid from the international community and expatriates, which soared during a period of increased political stability following NATO's invasion of Afghanistan, further aided this expansion. Afghanistan was still one of the least developed countries in the world, despite having undeveloped natural resources worth [1–21]. With a rate of unemployment higher than 23 percent with almost half of its people living below the poverty line, protracted fighting has seriously impeded the nation's progress. This continuous conflict has hindered the country's progress internationally by discouraging corporate investment and escalating internal conflict. Afghanistan has continuously looked for outside funding to boost its economy [21–43]. The GDP surged eightfold between 2001 and 2014, while the population grew by more than 50While offering strategies for decolonization, the article explored the risks and effectiveness of these feminist movements, which aimed to counter the tide of Islamist ideology in both countries by promoting solidarity with international governmental and nongovernmental human rights organizations, and also pointed out how neo-imperial agendas selectively acknowledged and appropriated the activism of Iranian and Afghan women [42–48, 48–55]. Over the thirteen-year duration of these operations, the reasons for the changes made in response to the situations encountered in each were detailed to understand the causes that justified them [12, 13]. Nonetheless, Afghan immigration to the United States began in the early 1980s and has a history spanning more than 40 years [54]. This study examined how Hosseini challenged the patriarchal structures that surrounded women's identities and examined the political and social prejudices aimed at the female characters, who demonstrated socio-political engagement during their traumatic ordeal [1].
Figure 1 is given as

To support aggregations directed by certain imperatives, a class of operators called RQ-star aggregation operators was introduced. These operators could, for example, obey instructions. Choose the maximum if the majority of the scores are higher than the identity, pick the minimum [50]. When evaluating the quality of instruction for overseas Chinese courses in higher vocational colleges, probabilistic hesitant fuzzy sets were utilized as a practical technique for representing uncertain information. To handle the MADM under PHFSs, the probabilistic hesitant fuzzy TODIM-EDAS technique was created in that work [56]. The goal of the practice was to establish new operational laws and aggregation operators to aggregate different choices in the CIFS environment, as well as to define the potential degree measure to arrange the numbers to achieve full utilization of these assets. The advantages of the suggested geometric AOs and weighted averaging were discussed [27]. The features and homomorphic properties of the Complex cubic intuitionistic fuzzy set were examined. It was proposed to use the Complex cubic intuitionistic fuzzy set level sets of bemiring [28]. The Cartesian product of two Bipolar Complex Fuzzy Soft

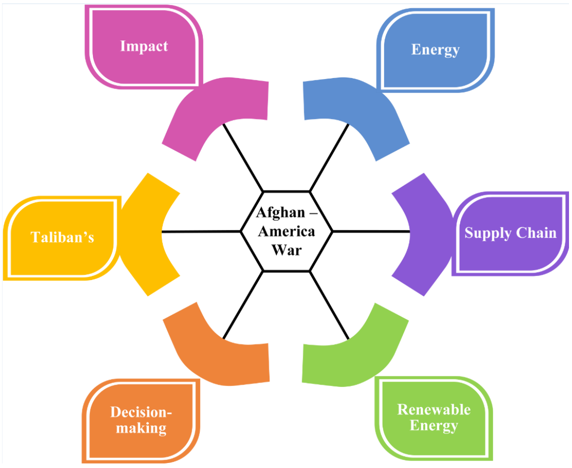

Figure 1: CCF-TODIM method's framework used to evaluate the Afghan-American War's effects on the world economy.

Sets (BCFSSs) was used to illustrate these mathematical concepts, and by succinctly and presenting the BCFSSs, it facilitated decision-making. The BCFSRs' creative concept clarified the combined advantages and disadvantages of everything that uses parameterization [34]. In this regard, the study's main goal was to develop several distance measurements using Hausdorff, Euclidean, and Hamming metrics. Several important relationships were then thoroughly examined and analyzed using these metrics [47]. Furthermore, the curriculum was created to be sufficiently flexible to accommodate the various demands of students from other countries. Students gained specific abilities in key competency areas by using their cultural and linguistic knowledge to support language mastery [55]. To prioritize the sustainable supply chain for electric ferries, a new weighted aggregated total product assessment method was put out, employing the fuzzy Hamacher weighted averaging function and weighted geometric averaging function [44]. The primary contribution of this study was the creation and application of a thorough and reliable framework for the ex-ante assessment and project prioritization of railway infrastructure projects [46]. Based on the suggested methodology, a case study was carried out to assess three possibilities using twelve sub-criteria split into four components [15, 16]. Because of their steadily rising emissions, these regions needed more international cooperation and policy attention [56]. For Kolkata's drinking water supplies, long-term development efficiency was essential [25]. The TOPSIS approach was based on generalized dice similarity measures [26]. For the purpose of aggregating applicants' discrimination intuitionistic fuzzy assessments, new intuitionistic aggregation operations were defined and studied, including As P-IFOWA and As P-IFOWG [4]. A comparative study was carried out with the spherical fuzzy TOPSIS approach [36], which employed a fuzzy decision matrix. As a result, a modified Failure Mode and Effect Analysis, based on prospect theory and the interval-valued intuitionistic fuzzy Analytic Hierarchy Process (AHP) [51], was used for the first time to evaluate the risks of investments in renewable energy, with a case study using the opening of a drug abuse recovery center [7] to validate and illustrate the applicability of this approach. The spherical fuzzy PROMETHEE II approach was praised for its benefit of removing incomparable pairs cite 8. Two approaches for resolving multiple attribute decision-making problems based on probabilistic generalized orthopair fuzzy sets were presented [23]. The outcomes demonstrated the efficacy of the suggested approach and offered a thorough flow analysis linked to several real-world performances [2]. Additionally, the main goal of this work was to apply PF distance and similarity metrics in a minimum spanning tree agglomerative hierarchical clustering algorithm [3–7]. Numerical examples about the selection of construction firms and McDonald's franchisees were used to illustrate the effectiveness of the suggested expanded CODAS technique [5]. The LPF-EDAS technique was used to assess the rank of alternatives, and the LPF-CRITIC approach was used to calculate the criteria weights in the created framework [6]. One important benefit of the WIFIOWAWA operator was its capacity to overcome the drawbacks of other operators because of the various functions of its order-inducing components [53]. A clear and simple approach to choosing an appropriate maintenance plan was proposed: a strategic multi-attribute group decision-making process [54]. Based on the given attributes, these score functions evaluated how well each alternative performed in comparison to the others [31]. Given their psychological realities, the TODIM approach took into consideration the limited rationality of decision-makers in choosing the optimal course of action [40]. For each criterion, the Hamming distance measure between two probabilistic hesitant fuzzy elements was calculated, and gain and loss matrices were obtained [30].

1.1. Literature review

In 1965, Zadeh [52] first introduced the theory of fuzzy sets, which was widely used to solve problems requiring uncertainty and fuzziness in real-world situations. Intuitionistic fuzzy sets were defined by Atanassov [10], who assumed that the total of the membership and non-membership values should be less than or equal to 1. By extending the range of membership and non-membership values to a sum of squares less than or equal to 1, Yager [49] introduced Pythagorean fuzzy sets. Several linear programming models were created in order to extract priority weights from a hesitant fuzzy preference relation [48]. For hesitant fuzzy sets (HFSs), a set of special distance metrics was provided [55], and these techniques utilized the MABAC method [45]. Position L1 was found to be the most appropriate using the MAIRCA approach [29]. The new rough interval MAIRCA method was used, which offered mathematical resources and showed excellent stability concerning modifications in the criteria's nature and properties [41]. The fuzzy measurement of alternatives and ranking based on the compromise solution was adjusted to create the FMARCOS approach [42]. To find a solution that had the greatest distance from the negative-ideal solution and the least distance from the ideal solution [24, 26–28, 28, 30, 31]. Jun et al. [35] introduced the idea of cubic sets, to address the MADM approach based on triangular cubic fuzzy numbers, the relationship between the proposed operators and existing aggregate operators was inferred, and various attributes of these operators were established [16–22] A real-world example was provided, and the solutions' existence and dependability were confirmed [12–14, 57]. Utilizing a chemotherapeutic agent that has been shown to be safe, the objective was to efficiently target and eradicate leukemic cells

(L-cells) while maintaining a sufficient number of healthy cells [37–39].

Aims The aims of the complex cubic fuzzy TODIM method are outlined as follows. First, the method seeks to provide a comprehensive framework for managing uncertainty, ambiguity, and vagueness in decision-making processes. It enhances the flexibility and granularity of decision-maker preferences by employing complex cubic membership functions, which enable a more detailed and structured representation of evaluations, resulting in more accurate and insightful outcomes. Additionally, the method strives to strike a balance between interpretability and model complexity; although its structure is intricate, it maintains clarity and offers a coherent approach to addressing multifaceted decision scenarios. Furthermore, the technique is designed to more effectively address incompleteness and inconsistency in assessments by capturing overlapping and conflicting preferences through the use of complex cubic membership functions, thereby supporting the resolution of contradictory judgments in a robust manner.

To improve the TODIM technique's applicability, the complex cubic set is used. We provide a new method for multi-attribute decision-making called the CCF-TODIM technique The use of the CCF-TODIM technique is illustrated using a numerical example.

Complex cubic fuzzy sets (CCFSs) are the basis for the adaptation of the TODIM method. Under CCFSs, weight values are determined using the TODIM approach. In the context of CCFSs, multi-attribute decision-making is addressed by the CCF-TODIM technique. In order to evaluate the proposed CCF-TODIM technique, comparative analyses are presented together with a mathematical case study that focuses on the evaluation of educational excellence in worldwide courses at advanced vocational institutions.

We exhibit the notion of CCF TODIM way and define the case study. We define the numerical example and Complex Cubic fuzzy TODIM can facilitate Analyzing Global Economic Shifts Due to the Afghan-America War framework for aggregating individual preferences and achieving consensus among group members.

The complex cubic fuzzy TODIM method and its main characteristics are presented. The algorithms for the method are presented, with an emphasis on the evaluation of the Afghan-American war. The complex cubic fuzzy TODIM system exhibits its practical significance and applicability by showcasing its effectiveness in resolving real-world issues, such as analyzing global economic shifts brought on by the Afghan-American war.

The rest of the material is organized in the following fashion:In Sect. 2, the main ideas of TODIM techniques are explained. In Section 3, the TODIM approach is extended to the CCF environment. Sect. 4 develops the numerical example for the Afghan-American War, explains the comparison method, Sensitivity and Comparative Examinations, Experiment results, and Analysis concerning the different distance measures and Superiority of their proposed method . Some conclusions and future work are presented in Sect. 5.

2. Backgroud

Definition 1. *[52] Let us consider that* $\Phi \neq X$ *and by a fuzzy set* $\gamma = \left\{ \begin{array}{c} \left\langle x, \mu_{\gamma(x)} \right\rangle \\ : x \in X \end{array} \right\}$, $\mu_{\gamma(x)}$ *is a mapping from* X *to* $[0,1]$ *present membership task of a component* x *in* X *.*

Definition 2. *[10] Let* $G_1 = [\xi_1, \chi_1]$ *and* $G_2 = [\xi_2, \chi_2]$ *be two intuitionistic fuzzy sets,* $\lambda > 0$*, then*

$$G_1 \oplus G_2 = [(\xi_1 + \xi_2 - \xi_1\xi_2), (\chi_1, \chi_2)],$$
$$G_1 \otimes G_2 = [(\xi_1\xi_2), (\chi_1 + \chi_2 - \chi_1\chi_2)],$$
$$\lambda G_1 = [1 - (1 - \xi_1)^\lambda, \chi_1],$$
$$G_1^\lambda = [(\xi_1^-)^\lambda, 1 - (1 - \chi_1^-)^\lambda].$$

Definition 3. *[35] Let* $G_1 = \left\langle \left[\xi_1^-, \chi_1^+\right], r_1 \right\rangle$ *and* $G_2 = \left\langle \left[\xi_2^-, \chi_2^+\right], r_2 \right\rangle$ *be two cubic fuzzy sets,* $\lambda > 0$*, then*

$$G_1 \oplus G_2 = \left\langle [(\xi_1^- + \xi_2^- - \xi_1^-\xi_2^-), (\chi_1^+ + \chi_2^+ - \chi_1^+\chi_2^+)], (r_1, r_2) \right\rangle;$$
$$G_1 \otimes G_2 = \left\langle [(\xi_1^-\xi_2^-), (\chi_1^+\chi_2^+)], r_1 + r_2 - r_1 + r_2 \right\rangle;$$
$$\lambda G_1 = \left\langle [1 - (1 - \xi_1^-)^\lambda, 1 - (1 - \chi_1^+)^\lambda], r_1 \right\rangle;$$
$$G_1^\lambda = \left\langle [(\xi_1^-), (\chi_1^-)^\lambda], 1 - (1 - r_1^-)^\lambda \right\rangle.$$

Definition 4. *[35] Let* $G_j = \left\langle \left[\xi_j^-, \chi_j^+\right], r_j \right\rangle$ *be the cubic fuzzy sets, then the score function is presented as* $G_j = \frac{\langle [\xi_1 + \chi_1] - r_1 \rangle}{3}$.

Definition 5. *[27] Let* $G_1 = \left\langle \xi_1 e^{i2\pi\xi_1}, r_1 e^{i2\pi r_1} \right\rangle$ *and* $G_2 = \left\langle \xi_2 e^{i2\pi\xi_2}, r_2 e^{i2\pi r_2} \right\rangle$ *be two complex intuitionistic fuzzy sets,* $\lambda > 0$*, then*

$$G_1 \oplus G_2 = \left\langle (\xi_1 + \xi_2 - \xi_1\xi_2) e^{i2\pi((\xi_1 + \xi_2 - \xi_1\xi_2))}, (r_1 e^{i2\pi r_1}, r_2 e^{i2\pi r_2}) \right\rangle;$$
$$G_1 \otimes G_2 = \left\langle (\xi_1\xi_2) e^{i2\pi(\xi_1\xi_2)}, (r_1 + r_2 - r_1 + r_2) e^{i2\pi(r_1 + r_2 - r_1 + r_2)} \right\rangle;$$
$$\lambda G_1 = \left\langle 1 - (1 - \xi_1)^\lambda e^{i2\pi(1 - (1 - \xi_1)^\lambda)}, r_1 e^{i2\pi(r_1)} \right\rangle;$$
$$G_1^\lambda = \left\langle [(\xi_1)^\lambda e^{i2\pi(\xi_1^-)^\lambda}, 1 - (1 - r_1)^\lambda e^{i2\pi(1 - (1 - r_1)^\lambda)} \right\rangle.$$

Definition 6. *[27] Let* $H_1 = \left\langle \xi_1 e^{i2\pi\xi_1}, r_1 e^{i2\pi r_1} \right\rangle$ *be the complex intuitionistic fuzzy sets, then the score function is presented as* $H_1 = \xi_1 e^{i2\pi\xi_1} - r_1 e^{i2\pi r_1}$.

Definition 7. *[45] Let* $G_1 = \left\langle \xi_1 e^{i2\pi\xi_1}, r_1 e^{i2\pi r_1} \right\rangle$ *be the complex intuitionistic fuzzy sets, then the accuracy function is presented as* $G_1 = \xi_1 e^{i2\pi\xi_1} + r_1 e^{i2\pi r_1}$.

2.1. Operational laws of Complex cubic fuzzy sets

Definition 8. *Let* $G_1 = \left\langle \begin{array}{c} \left[\begin{array}{c} \xi_1^- e^{i2\pi\xi_1^-}, \\ \chi_1^+ e^{i2\pi\chi_1^+} \end{array} \right], \\ r_1 e^{i2\pi r_1} \end{array} \right\rangle$ *and* $G_2 = \left\langle \begin{array}{c} \left[\begin{array}{c} \xi_2^- e^{i2\pi\xi_2^-}, \\ \chi_2^+ e^{i2\pi\chi_2^+} \end{array} \right], \\ r_2 e^{i2\pi r_2} \end{array} \right\rangle$ *be two complex cubic fuzzy sets,* $\lambda > 0$*, then*

$$G_1 \oplus G_2 = \left\langle \begin{array}{c} [(\xi_1^- + \xi_2^- - \xi_1^-\xi_2^-) e^{i2\pi(\xi_1^- + \xi_2^- - \xi_1^-\xi_2^-)}, \\ (\chi_1^+ + \chi_2^+ - \chi_1^+\chi_2^+) e^{i2\pi(\chi_1^+ + \chi_2^+ - \chi_1^+\chi_2^+)}], \\ (r_1 e^{i2\pi r_1}, r_2 e^{i2\pi r_2}) \end{array} \right\rangle;$$

$$G_1 \otimes G_2 = \left\langle \begin{array}{c} [(\xi_1^- \xi_2^-) e^{i2\pi(\xi_1^- \xi_2^-)}, (\chi_1^+ \chi_2^+) e^{i2\pi(\chi_1^+ \chi_2^+)}], \\ (r_1 + r_2 - r_1 + r_2) e^{i2\pi(r_1 + r_2 - r_1 + r_2)} \end{array} \right\rangle;$$

$$\lambda G_1 = \left\langle \begin{array}{c} [1 - (1 - \xi_1^-)^\lambda e^{i2\pi(1-(1-\xi_1^-)^\lambda)}, \\ 1 - (1 - \chi_1^+)^\lambda e^{i2\pi(1-(1-\chi_1^+)^\lambda)}], r_1 e^{i2\pi(r_1)} \end{array} \right\rangle;$$

$$G_1^\lambda = \left\langle \begin{array}{c} [(\xi_1^-)^\lambda e^{i2\pi(\xi_1^-)^\lambda}, (\chi_1^-)^\lambda e^{i2\pi(\chi_1^-)^\lambda}], \\ 1 - (1 - r_1^-)^\lambda e^{i2\pi(1-(1-r_1^-)^\lambda)} \end{array} \right\rangle.$$

Definition 9. *Let* $H_j = \left\langle \begin{array}{c} \left[\begin{array}{c} \xi_j^- e^{i2\pi\xi_j^-}, \\ \chi_j^+ e^{i2\pi\chi_j^+} \end{array} \right], \\ r_j e^{i2\pi r_j} \end{array} \right\rangle$ *be the complex cubic fuzzy sets, then the score function is presented as* $H_j = \frac{\left\langle \left[\xi_j^- e^{i2\pi\xi_j^-} + \chi_j^+ e^{i2\pi\chi_j^+} \right] - r_1 e^{i2\pi r_j} \right\rangle}{3}$.

2.2. TODIM Technique (an acronym in Portuguese for Iterative Multi-criteria Decision Making)

The TODIM (an acronym in Portuguese for interactive and multi-criteria decision-making) system projected by Gomes and Lima in 1992 is diverse from additional MADM approaches, it positions dissimilar alternatives founded on general dominance grade is slightly higher than the concluding score of each alternative. Owing to the TODIM ((an acronym in Portuguese for interactive and multi-criteria decision-making) technique is founded on prospect theory (Kahneman & Tversky, 1979), unique of its unresolved compensations is of imprisonment persons' psychological conduct. TODIM technique is clear for commerce with the MADM difficulties in which the standards councils are in the arrangement of crisp standards. A TODIM technique is providing [40].

Step 1:Calculate the decision matrix

Step 2: To normalize choice framework $X = x$

Step 3: The reference model GH is decided and the relative weight w_i of GH can at that point be gotten, i.e. $GH = \frac{w_i}{\max w_i}$

Step 4: Dominance degree for the alternative A_i over the rest of the other alternatives A_j for a particular criteria

$$QF = \left\{ \begin{array}{ll} \sqrt{\frac{\frac{w_j(p_{ij} - p_{kj})}{n}}{\sum_{j=1} w_j}} & \text{if } \ p_{ij} - p_{kj} > 0 \\ \frac{-1}{\theta} \sqrt{\frac{\frac{w_j(p_{ij} - p_{kj})}{n}}{\sum_{j=1} w_j}} & \text{if } \ p_{ij} - p_{kj} < 0 \end{array} \right\}$$

Step 5:The dominance degree, QF, of an elective A_i over the rest of alternatives QF is calculated, i.e $QF = \sum_{j=1}^{n} QF$

Step 6:The overall dominance degree, $\xi_i(A_i)$ is presented

$$\xi_i(A_i) = \frac{\sum_{k=1}^{m} QF - \min \sum_{k=1}^{m} QF}{\max \sum_{k=1}^{m} QF - \min \sum_{k=1}^{m} QF}$$

Step 7:Calculate the ranking.

2.3. Numerical example

The evaluation criteria must be modified to take into account the strategic realities of the Afghan-American struggle to determine the "best road" in that setting. The evaluation should concentrate on three important factors: Strategic Importance, Security, and Accessibility and Upkeep, rather than traditional criteria like cost-efficiency or building speed. The degree to which a road facilitates military goals, including troop movements or logistics, is referred to as its strategic importance. Assessing the road's vulnerability to dangers, such as geographical impediments, hostile threats, and the possibility of ambushes, is part of security.

The road's long-term usage and the viability of maintaining it in times of war are the subjects of accessibility and maintenance. The objective is to identify the road that provides the most operational value and sustainability in the conflict area by taking into account these three different routes, each of which represents one of the criteria.

Would you prefer this to be presented in terms of a multi-criteria evaluation or transformed into a paragraph that serves as a model for decision-making?

Step 1:Calculate the decision matrix in table 1.

TODIM technique decision matrix table 1.

	Strategic Importance	Security	Accessibility
WIS_1	0.3	0.6	0.11
WIS_2	0.9	0.03	0.45
WIS_3	0.07	0.16	0.08

Step 2:Calculate the Standardize in table 2.

Standardize the table 2

	Strategic Importance	Security	Accessibility
WIS_1	0.1209	0.1987	0.7098
WIS_2	0.5876	0.6985	0.0934
WIS_3	0.1234	0.1697	0.3412

Step 3: The reference model GH is decided and the relative weight w_i of GH can at that point be gotten

$GH_1 = 0.1205, GH_2 = 0.4566$, $GH_2 = 0.3412$.

Step 4:Dominance degree for the alternative A_i over the rest of the other alternatives A_j for a particular criteria in table 3.

Particular criteria Table 3	
WIS_1	0.0628
WIS_2	0.0123
WIS_3	0.7026

Step 5:The dominance degree, QF, of an elective A_i over the rest of alter-natives QF is calculated, i.e

$QF_1 = 0.0981, QF_2 = 0.0123, QF_3 = 0.2098.$

Step 6:The overall dominance degree, $\xi_i(A_i)$ is presented

$YI_1 = 0.0905, YI_2 = 0.1089, YI_3 = 0.1788.$

Step 7: The ranking is $YI_3 > YI_2 > YI_1$ and best is YI_3.

3. Complex cubic fuzzy TODIM Technique for Multi-Attribute Decision-Making

A development of the traditional TODIM technique, the suggested complicated Cubic Fuzzy TODIM (CCF-TODIM) method aims to improve its capacity to handle imprecision, hesitation, and uncertainty in complicated decision-making situations. The traditional TODIM approach, which has its roots in Prospect Theory, works well in clear or simple fuzzy contexts but is unable to capture higher-order ambiguity and overlapping judgments that frequently occur in real-world issues. The new feature of the CCF-TODIM method is the use of complex cubic fuzzy sets, a potent hybrid structure that combines fuzzy logic, cubic sets, and complex numbers. This structure enables the modeling of both the phase and amplitude of preferences as well as interval-valued evaluations. Decision-makers are able to communicate their assessments with more flexibility and granularity thanks to this enhanced representation. Although the extension into the complex cubic domain offers a much more expressive and subtle framework, the theoretical relation is still consistent with the TODIM foundation, especially in its use of dominance measurement and value functions. This improvement enables the CCF-TODIM approach to handle multidimensional ambiguity and opposing expert opinions more strongly, making it more than just an application but a significant theoretical and practical generalization of the conventional TODIM. In this stage of the projected complex cubic fuzzy weight averaging (CCFWA) TODIM method, decision-makers are permissible to brand presentation appraisal of alternatives through admiration to criteria. The data composed is in the procedure of complex cubic fuzzy matrices. Contract the decision matrix be signified

Step 1:Describe the complex cubic fuzzy decision matrix

Step 2:Standardize the UD and $\lambda = (\lambda_1, \lambda_2, ..., \lambda_n)$.

$$\text{CCFWA}(e_1, e_2, ..., e_n) = \left\langle \begin{bmatrix} 1 - \prod_{j=1}^{n}(1-CL^-)^\lambda e^{i2\pi\left(1-\prod_{j=1}^{n}(1-CL^-)^\lambda\right)}, \\ 1 - \prod_{j=1}^{n}(1-CL^+)^\lambda e^{i2\pi\left(1-\prod_{j=1}^{n}(1-CL^+)^\lambda\right)} \end{bmatrix}, \prod_{j=1}^{n}(CL)^\lambda e^{i2\pi\left(\prod_{j=1}^{n}(CL)^\lambda\right)} \right\rangle$$

Step 3:Achieve the weights statistics of quality

$$w_j = \frac{PT\sum(1-PT)}{\sum(1-PT)} e^{i2\pi\left(\frac{PT\sum(1-PT)}{\sum(1-PT)}\right)}$$

Step 4:This regularization term can be written as the sum of squares of the network weights

$$F = \beta E + \alpha G = \left(\beta\sum(t-a)^T(t-a) + \alpha\sum x_i^2\right) e^{i2\pi\left(\beta\sum(t-a)^T(t-a)+\alpha\sum x_i^2\right)}$$

Step 5:Compute new estimates for the regularization parameters $\alpha = \frac{\zeta}{2E}, \beta = \frac{N-\zeta}{2E}$

Step 6:Dominance degree for the alternative A_i over the rest of the other alternatives A_j for a particular criteria

$$QF = \begin{Bmatrix} \sqrt{\frac{w_j(p_{ij}-p_{kj})}{\sum_{j=1}^{n} w_j}} & \text{if } p_{ij} - p_{kj} > 0 \\ 0 & \text{if } p_{ij} - p_{kj} = 0 \\ \frac{-1}{\theta}\sqrt{\frac{w_j(p_{ij}-p_{kj})}{\sum_{j=1}^{n} w_j}} & \text{if } p_{ij} - p_{kj} < 0 \end{Bmatrix}$$

Some formulations handle the zero-case, particularly in the dominance degree calculation under the complex cubic fuzzy TODIM approach.

$p_{ij} - p_{kj} = 0$

w_j:Weight criteria;

p_{ij} :Value of alternative A_i performance under criterion j;

p_{kj} :Value of alternative A_i performance under criterion j;

θ ::Loss attenuation factor

Step 7:The overall dominance degree, $\xi_i(A_i)$ is presented

$$\xi_i(A_i) = \left(\frac{\sum_{k=1}^{m} QF - \min \sum_{k=1}^{m} QF}{\max \sum_{k=1}^{m} QF - \min \sum_{k=1}^{m} QF} \right) e^{i2\pi \left(\frac{\sum_{k=1}^{m} QF - \min \sum_{k=1}^{m} QF}{\max \sum_{k=1}^{m} QF - \min \sum_{k=1}^{m} QF} \right)}$$

Step 8:Find the ranking.

4. Case study

The al-Qaeda-planned September 11, 2001 terrorist strikes, which claimed almost 3,000 lives, led to the United States' immediate and forceful military reaction. According to intelligence sources, Osama bin Laden was being held hostage and al-Qaeda was using Afghanistan as a base of operations while it was ruled by the Taliban. With widespread international support, the United States responded by launching a military intervention. In addition to a strategic partnership with Russia, Iran, India, and the anti-Taliban Northern partnership in Afghanistan, the Organization of American States and all 19 NATO members also declared solidarity. China maintained its public neutrality despite not opposing the action. On September 12, 2001, the UN Security Council adopted Resolution 1368, which upheld the right to self-defense. Later that same month, NATO formally approved military participation with Resolution 1373. On October 7, 2001, Operation Enduring Freedom got underway to overthrow the Taliban and destroy al-Qaeda networks. Despite having international support, including from traditional allies and nations like Japan, the war was primarily spearheaded by the United States and significantly relied on cooperation with local anti-Taliban forces. Decision matrix Table 4 is given as.

Decision Matrix Table 4

Alternative	Cost Efficiency	Reliability	Impact
Military Spending	Boost to the global defense industry	US defense expenditure exceeded $2 trillion	32
Energy Markets	Disruption of Energy Supply routes	Middle East instability	45
Trade and Commerce	Regional trade route disruption	Decrease in Afghan exports	43

Energy:The Afghan-American War highlighted the relationship between conflict and energy security and had a substantial impact on the world's energy landscape. Afghanistan is at the center of possible energy transit routes, such the Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline, because of its advantageous location close to resource-rich Central Asia and energy-hungry South Asia. Prolonged fighting, however, caused these initiatives to be delayed, which limited the region's ability to use its position to sell energy. Because of worries about safe energy supply brought on by geopolitical unrest in Afghanistan and the neighboring areas, the war indirectly increased the volatility of oil prices. Large volumes of energy were also needed for military activities throughout the conflict, which prompted advancements in fuel economy and renewable technology in the defense industry. The circumstance made it clear that countries must diversify their energy sources, increase their investments in renewable energy, and lessen their reliance on areas that are prone to conflict for essential energy supplies.

Supply Chains:Global and regional supply networks were greatly disrupted by the Afghan-American War, which exposed weaknesses in trade routes, logistics, and resource allocation. Because of ongoing insecurity, Afghanistan's unique location as a possible transit point for trade between Central and South Asia was not fully used. The transportation of fuel, food, and equipment through difficult terrain and conflict zones often depending on precarious routes via Pakistan was necessitated by military operations, which created complex supply chain demands. The TAPI pipeline and other projects that could have improved regional energy commerce were delayed by the war's disruption of infrastructure development. The delivery of aid to millions of displaced Afghans was beset by delays and increased prices, posing significant hurdles to humanitarian supply systems. Globally, the conflict made it clear how crucial it is to diversify supply chains, make investments in robust logistical systems, and reduce geopolitical risks in order to maintain continuity in vital industries.

Food Supply:Food supplies were significantly impacted by the Afghan-American War, both domestically and internationally. Prolonged fighting in Afghanistan caused millions to be displaced, damaged infrastructure, and interrupted agricultural production, which resulted in food insecurity and a need for humanitarian assistance. Hunger and malnutrition were made worse by the frequent disruptions in supply chains for basic food products caused by instability, roadblocks, and inadequate logistics. The war brought to light the need for strong contingency planning and the vulnerability of food supply chains in conflict areas on a global scale. To deliver aid, humanitarian organizations had to deal with complicated logistics and growing transportation costs, frequently depending on neighboring nations for access. The circumstance emphasized how crucial locally driven, sustainable agricultural development is to ensuring food security during the post-conflict recovery process.

Figure 2 is differently used in the Afghan-American war There are three Afghan-American war $WIS_i(i = 1, 2, 3)$ to be chosen is utilized in Tables 5 and 6.

Complex Cubic Fuzzy decision matrix table 5.

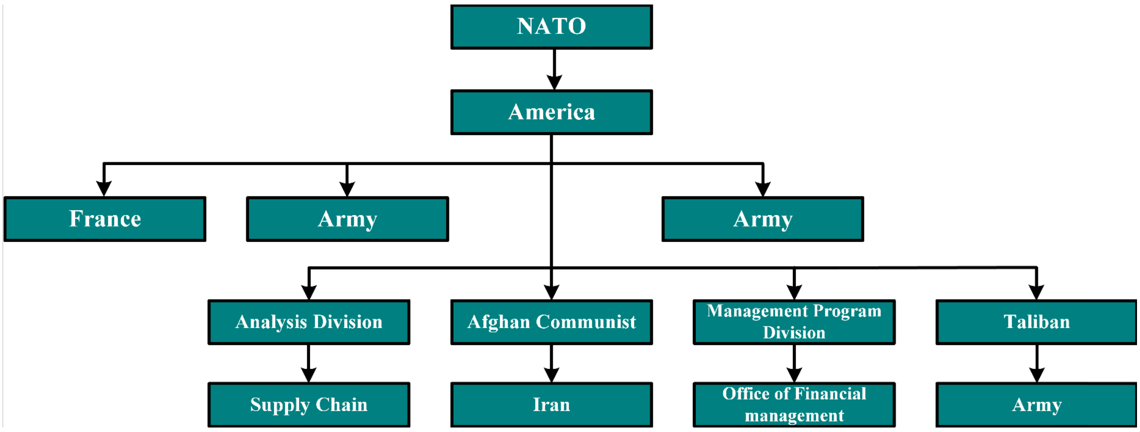

Figure 2: different used in Afghan-American war.

	S	F	R
WIS_1	$\left\langle \left[0.2e^{i2\pi(0.3)}, 0.4e^{i2\pi(0.4)} \right], 0.3e^{i2\pi(0.5)} \right\rangle$	$\left\langle \left[0.1e^{i2\pi(0.2)}, 0.2e^{i2\pi(0.3)} \right], 0.3e^{i2\pi(0.4)} \right\rangle$	$\left\langle \left[0.11e^{i2\pi(0.4)}, 0.15e^{i2\pi(0.3)} \right], 0.22e^{i2\pi(0.8)} \right\rangle$
WIS_2	$\left\langle \left[0.11e^{i2\pi(0.4)}, 0.15e^{i2\pi(0.3)} \right], 0.5e^{i2\pi(0.8)} \right\rangle$	$\left\langle \left[0.11e^{i2\pi(0.4)}, 0.15e^{i2\pi(0.3)} \right], 0.22e^{i2\pi(0.8)} \right\rangle$	$\left\langle \left[0.1e^{i2\pi(0.01)}, 0.43e^{i2\pi(0.03)} \right], 0.31e^{i2\pi(0.05)} \right\rangle$
WIS_3	$\left\langle \left[0.1e^{i2\pi(0.01)}, 0.43e^{i2\pi(0.03)} \right], 0.31e^{i2\pi(0.04)} \right\rangle$	$\left\langle \left[0.1e^{i2\pi(0.01)}, 0.43e^{i2\pi(0.03)} \right], 0.31e^{i2\pi(0.04)} \right\rangle$	$\left\langle \left[0.16e^{i2\pi(0.01)}, 0.18e^{i2\pi(0.03)} \right], 0.2e^{i2\pi(0.04)} \right\rangle$

Complex Cubic Fuzzy decision matrix table 6.

	S	F	R
WIS_1	$\left\langle \left[0.1e^{i2\pi(0.01)}, 0.3e^{i2\pi(0.03)} \right], 0.05e^{i2\pi(0.04)} \right\rangle$	$\left\langle \left[0.01e^{i2\pi(0.4)}, 0.3e^{i2\pi(0.5)} \right], 0.5e^{i2\pi(0.06)} \right\rangle$	$\left\langle \left[0.05e^{i2\pi(0.02)}, 0.06e^{i2\pi(0.5)} \right], 0.02e^{i2\pi(0.6)} \right\rangle$
WIS_2	$\left\langle \left[0.05e^{i2\pi(0.02)}, 0.06e^{i2\pi(0.5)} \right], 0.02e^{i2\pi(0.6)} \right\rangle$	$\left\langle \left[0.11e^{i2\pi(0.4)}, 0.15e^{i2\pi(0.3)} \right], 0.22e^{i2\pi(0.8)} \right\rangle$	$\left\langle \left[0.1e^{i2\pi(0.01)}, 0.43e^{i2\pi(0.03)} \right], 0.31e^{i2\pi(0.05)} \right\rangle$
WIS_3	$\left\langle \left[0.03e^{i2\pi(0.02)}, 0.4e^{i2\pi(0.04)} \right], 0.06e^{i2\pi(0.07)} \right\rangle$	$\left\langle \left[0.1e^{i2\pi(0.01)}, 0.3e^{i2\pi(0.03)} \right], 0.05e^{i2\pi(0.04)} \right\rangle$	$\left\langle \left[0.01e^{i2\pi(0.4)}, 0.3e^{i2\pi(0.5)} \right], 0.5e^{i2\pi(0.06)} \right\rangle$

Step 2:Standardize the Complex cubic fuzzy weighted averaging operator and Table 7. The Complex cubic fuzzy weight averaging operator in table 7.

	S	F	R
WIS_1	$\left\langle \begin{bmatrix} 0.1034e^{i2\pi(0.0115)}, \\ 0.3098e^{i2\pi(0.1239)} \end{bmatrix}, 0.0187e^{i2\pi(0.0123)} \right\rangle$	$\left\langle \begin{bmatrix} 0.2563e^{i2\pi(0.0034)}, \\ 0.5369e^{i2\pi(0.0176)} \end{bmatrix}, 0.4321e^{i2\pi(0.0887)} \right\rangle$	$\left\langle \begin{bmatrix} 0.1123e^{i2\pi(0.0234)}, \\ 0.4369e^{i2\pi(0.569)} \end{bmatrix}, 0.3123e^{i2\pi(0.7896)} \right\rangle$
WIS_2	$\left\langle \begin{bmatrix} 0.0232e^{i2\pi(0.0736)}, \\ 0.1216e^{i2\pi(0.0987)} \end{bmatrix}, 0.4564e^{i2\pi(0.0697)} \right\rangle$	$\left\langle \begin{bmatrix} 0.1456e^{i2\pi(0.0109)}, \\ 0.4323e^{i2\pi(0.0742)} \end{bmatrix}, 0.2145e^{i2\pi(0.0456)} \right\rangle$	$\left\langle \begin{bmatrix} 0.2012e^{i2\pi(0.0741)}, \\ 0.6369e^{i2\pi(0.0963)} \end{bmatrix}, 0.1456e^{i2\pi(0.0785)} \right\rangle$
WIS_3	$\left\langle \begin{bmatrix} 0.1125e^{i2\pi(0.01963)}, \\ 0.4789e^{i2\pi(0.0796)} \end{bmatrix}, 0.6369e^{i2\pi(0.0123)} \right\rangle$	$\left\langle \begin{bmatrix} 0.2236e^{i2\pi(0.0739)}, \\ 0.3456e^{i2\pi(0.0578)} \end{bmatrix}, 0.6236e^{i2\pi(0.01982)} \right\rangle$	$\left\langle \begin{bmatrix} 0.0123e^{i2\pi(0.1028)}, \\ 0.4356e^{i2\pi(0.1145)} \end{bmatrix}, 0.3178e^{i2\pi(0.1489)} \right\rangle$

Step 3:Achieve the weights statistics of quality
$w_1 = 0.2365, w_2 = 0.9687, w_3 = 0.9874.$

Step 4 This regularization term can be written as the sum of squares of the network weights
$F_1 = 0.2895e^{i2\pi(0.0109)}, F_2 = 0.2123e^{i2\pi(0.0456)}, F_3 = 0.3123e^{i2\pi(0.0498)}.$

Step 5:Compute new estimates for the regularization parameters in table 8

Regularization parameters table 8

α	β
0.0399	0.0402
0.0852	0.1296
0.0167	0.6045

Step 6:Dominance degree for the alternative A_i over the rest of the other alternatives A_j for a particular criteria in table 9.

	Particular criteria Table 9
WIS_1	$\left\langle \left[0.0091e^{i2\pi(0.0074)}, 0.1453e^{i2\pi(0.0904)} \right], 0.1098e^{i2\pi(0.0364)} \right\rangle$
WIS_2	$\left\langle \left[0.0565e^{i2\pi(0.0187)}, 0.5698e^{i2\pi(0.1987)} \right], 0.5645e^{i2\pi(0.0197)} \right\rangle$
WIS_3	$\left\langle \left[0.0786e^{i2\pi(0.0198)}, 0.5645e^{i2\pi(0.0176)} \right], 0.9876e^{i2\pi(0.1789)} \right\rangle$

Step 7:The overall dominance degree, $\Lambda_i(A_i)$ is presented
$YI_1 = 0.5785, YI_2 = 0.5785, YI_3 = 0.6156.$

Step 8: The ranking is $YI_3 > YI_2 > YI_1$ and best is YI_3.

4.1. Complex Intuitionistic Fuzzy method with existing method

Step 1 The complex intuitionistic fuzzy decision matrix is in Table 10 is assumed.

Complex Intuitionistic Fuzzy Decision Table 10.

	S	F	R
WIS_1	$\left[0.1e^{i2\pi(0.01)}, 0.3e^{i2\pi(0.03)}\right]$	$\left[0.2e^{i2\pi(0.01)}, 0.4e^{i2\pi(0.04)}\right]$	$\left[0.2e^{i2\pi(0.03)}, 0.11e^{i2\pi(0.04)}\right]$
WIS_2	$\left[0.2e^{i2\pi(0.06)}, 0.4e^{i2\pi(0.4)}\right]$	$\left[0.01e^{i2\pi(0.03)}, 0.5e^{i2\pi(0.04)}\right]$	$\left[0.11e^{i2\pi(0.01)}, 0.14e^{i2\pi(0.05)}\right]$
WIS_3	$\left[0.024e^{i2\pi(0.03)}, 0.34e^{i2\pi(0.04)}\right]$	$\left[0.1e^{i2\pi(0.01)}, 0.3e^{i2\pi(0.02)}\right]$	$\left[0.09e^{i2\pi(0.02)}, 0.4e^{i2\pi(0.06)}\right]$

Step 2:Provide the complex intuitionistic fuzzy weighted averaging operator in table 11 and $(0.1, 0.2, 0.7)$.

	CIFWA operator table 11
WIS_1	$\left[0.4567e^{i2\pi(0.0112)}, 0.9865e^{i2\pi(0.01234)}\right]$
WIS_2	$\left[0.5134e^{i2\pi(0.0321)}, 0.5646e^{i2\pi(0.0234)}\right]$
WIS_3	$\left[0.6754e^{i2\pi(0.1239)}, 0.3987e^{i2\pi(0.1045)}\right]$

Step 3 The score function is
$YI_1 = 0.3002$, $YI_2 = 0.3132$, $YI_3 = 0.4449$.
Step 4:Given the ranking $YI_3 > YI_2 > YI_1$ and the YI_3 is the best.
Different existing techniques Table 12.
existing techniques Table 12

Techniques	Score function	Ranking	Final ranking
CIFS [27]	$\left\{\begin{array}{c} YI_1 = 0.0002, \\ YI_2 = 0.0139, \\ YI_3 = 0.0466 \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$
MADM [46]	$\left\{\begin{array}{c} YI_1 = 0.0013, \\ YI_2 = 0.0708, \\ YI_3 = 0.2787 \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$
Hybrid [44]	$\left\{\begin{array}{c} YI_1 = 0.0131, \\ YI_2 = 0.1008, \\ YI_3 = 0.4078 \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$
TODIM [40]	$\left\{\begin{array}{c} YI_1 = 0.0234, \\ YI_2 = 0.2087, \\ YI_3 = 0.3876 \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$
BCFS [45]	$\left\{\begin{array}{c} YI_1 = 0.0124, \\ YI_2 = 0.2457, \\ YI_3 = 0.5609 \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$
Induced [54]	$\left\{\begin{array}{c} YI_1 = 0.0321, \\ YI_2 = 0.2998, \\ YI_3 = 0.6998 \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$
Measure [28]	$\left\{\begin{array}{c} YI_1 = 0.0288, \\ YI_2 = 0.2012, \\ YI_3 = 0.5013 \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$
Codes [5]	$\left\{\begin{array}{c} YI_1 = 0.0119, \\ YI_2 = 0.3212, \\ YI_3 = 0.6765 \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$	$\left\{\begin{array}{c} YI_3 > \\ YI_2 > \\ YI_1 > \end{array}\right\}$

The efficiency of different decision-making strategies under uncertainty is illustrated by the comparison study shown in Table 12. The TODIM-based techniques consistently yielded better score values among the studied methods (CIFS, MADM, Hamacher, and multiple variants of TODIM), especially for the third alternative YI_3, indicating stronger performance in prioritizing choice possibilities. This implies that the complex cubic fuzzy TODIM technique provides improved ambiguity modeling capabilities and more sensitively captures decision-maker preferences. The quantity of the scores under TODIM indicates a more thorough and discriminative review process, even if all approaches ranked the options identically. These results demonstrate how well complex cubic fuzzy sets can be included in frameworks for decision-making, particularly in settings where delicate judgment is needed.

4.2. Experiment results

In this subsection, the experiment results is given below in table 13.

Experiment results in table 13.

Fail	Normal	Good	Best	Final
no	yes	no	no	no
Yes	no	yes	yes	yes
Yes	yes	yes	yes	yes

4.3. Analysis concerning the different distance measures

The rankings inwards are founded on Hamming distances. An examination of the resulting standards of the dominance score and so the positions of the replacements under thought with the employability of additional distance measures at each worth of the weakening issue have been assumed in this unit of the effort. Table 14 portrays the consequences of the complex cubic fuzzy-ordered weighted averaging TODIM method. As experiential, there is constancy in the position consequences for an assumed worth of weakening issue excluding in suitcases where the worth of the weakening issue is very tall. Also, the positions show differences by the distance measures at an advanced worth of weakening issue. The finest and the nastiest applicant changes are reliable with the distance measures as healthy as the weakening issue.

CCFOWA fuzzy TODIM method Table 14

$\xi_i(A_i)$	Alternative	F_α	F_β	F_Γ
$\theta = 0$	HG_1	0.0347	0.1234	0.1241
$\theta = 0$	HG_2	0.0129	0.0987	0.4512
$\theta = 0$	HG_3	0.0119	0.0678	0.7412
$\theta = 1$	HG_1	0.0009	0.0066	0.0123
$\theta = 1$	HG_2	0.0238	0.0009	0.0006
$\theta = 1$	HG_3	0.0038	0.0667	0.0898
$\theta = 2$	HG_1	0.0019	0.0105	0.0166
$\theta = 2$	HG_2	0.0107	0.0105	0.0109
$\theta = 2$	HG_3	0.0179	0.0105	0.0089
$\theta = 2$	HG_4	0.0759	0.0105	0.0096
$\theta = 3$	HG_1	0.1035	0.1101	0.2205
$\theta = 3$	HG_2	0.1485	0.1123	0.2401
$\theta = 3$	HG_3	0.0197	0.0199	0.2225
$\theta = 3$	HG_4	0.0968	0.0191	0.5555
$\theta = 4$	HG_1	0.0455	0.0181	0.8881
$\theta = 4$	HG_2	0.0179	0.1105	0.9804
$\theta = 4$	HG_3	0.0198	0.2104	0.0598
$\theta = 5$	HG_1	0.0112	0.0836	0.9636
$\theta = 5$	HG_2	0.1209	0.0867	0.7834
$\theta = 5$	HG_3	0.0101	0.0788	0.7537
$\theta = 6$	HG_1	0.0111	0.0109	0.0209
$\theta = 6$	HG_2	0.0167	0.2102	0.0102
$\theta = 6$	HG_3	0.0459	0.2099	0.0912

The fallout found using the complex cubic fuzzy ordered weighted averaging TODIM tactic for diverse distance measures have been testified in Table 15. The statuses are practically constant with the weakening feature as well by way of the distance measures. Advanced standards of dominance scores are engaged in all the gears of the outcomes using Complex cubic fuzzy ordered weighted averaging TODIM practice in comparison to the other projected Complex cubic fuzzy ordered weighted averaging TODIM scheme

CCFOWA fuzzy TODIM method Table 15.

$\xi_i(A_i)$	Alternative	F_α	F_β	F_Γ
$\theta = 0.1$	HG_1	0.0121	0.1256	0.6241
$\theta = 0.1$	HG_2	0.0189	0.0956	0.4596
$\theta = 0.1$	HG_3	0.0189	0.0123	0.7025
$\theta = 1$	HG_1	0.0078	0.0466	0.0166
$\theta = 1$	HG_2	0.0234	0.0049	0.0009
$\theta = 1$	HG_3	0.0043	0.4667	0.0894
$\theta = 2$	HG_1	0.0892	0.0145	0.0168
$\theta = 2$	HG_2	0.4569	0.0163	0.0145
$\theta = 2$	HG_3	0.0898	0.0178	0.0085
$\theta = 3$	HG_1	0.8522	0.1189	0.2245
$\theta = 3$	HG_2	0.5639	0.1122	0.2463
$\theta = 3$	HG_3	0.0666	0.0166	0.2263
$\theta = 4$	HG_1	0.0405	0.0135	0.8889
$\theta = 4$	HG_2	0.0109	0.1145	0.9899
$\theta = 4$	HG_3	0.4568	0.2155	0.0501
$\theta = 5$	HG_1	0.2102	0.2876	0.4876
$\theta = 5$	HG_2	0.2188	0.2098	0.7878
$\theta = 5$	HG_3	0.3229	0.2345	0.8769
$\theta = 6$	HG_1	0.8734	0.3002	0.1207
$\theta = 6$	HG_2	0.1262	0.3055	0.9687
$\theta = 6$	HG_3	0.3698	0.3207	0.3202

4.4. Superiority of their proposed method

1. The complex cubic fuzzy set offers a more adaptable and comprehensive framework for representing uncertainty, ambiguity, and vagueness in decision-making. This allows decision-makers to express their preferences more accurately and concisely.
2. While complex intuitionistic fuzzy sets handle certain levels of uncertainty, they are generally less effective than cubic fuzzy sets in representing ambiguity. The complex cubic fuzzy TODIM technique enhances the robustness of modeling both uncertainty and ambiguity.
3. The complex cubic fuzzy TODIM method provides greater flexibility and detail in capturing decision-makers' preferences. Its cubic membership function enables a more nuanced and fine-grained representation of judgments.
4. Despite its complexity, the complex cubic fuzzy TODIM technique maintains a balance

between interpretability and model sophistication. It offers a structured framework capable of addressing complex decision-making scenarios without sacrificing clarity.
5. However, in extremely complex or ambiguous decision-making contexts, the technique may face challenges in preserving interpretability. As the model becomes more intricate, ensuring user comprehension can be difficult.

4.5. Discussion

Analysis of Identified Trends
This study's application of CCF-TODIM to the tissue paper manufacturing sector revealed several significant trends. The growing acceptance of CCF-TODIM as a technique for decision-making among Afghan-American war experts was one notable development. The increased acceptance of CCF-TODIM can be attributed to its flexibility and resilience, which enable a nuanced evaluation of complicated decision-making circumstances.
Causes of Popularity
There are various reasons why CCF-TODIM is so well-liked. First, it is especially well-suited for industries like the Afghan-American War, where judgments frequently entail many criteria and uncertainties, because to its capacity to manage complicated and unpredictable decision-making circumstances. Second, a broad spectrum of users, including policymakers and professionals in the sector, may easily understand and utilize the method due to its simple mathematics and graphical representation. Finally, CCF-TODIM's versatility makes it possible to integrate and customize it with other frameworks and tools for decision-making, increasing its usefulness in a variety of settings and industries. Although CCF-TODIM has historically been used in the Afghan-American War, its potential is becoming more widely acknowledged in other disciplines and sectors of the economy. Supply chain optimization, environmental management, and healthcare are a few examples of emerging application fields. These advancements demonstrate the method's adaptability and the increasing awareness of its benefits in handling difficult decision-making situations in a variety of fields.
Limitations and Challenges
Despite its strengths, CCF-TODIM is not without limitations. One of the primary challenges is the subjective nature of criteria weighting, which can introduce bias and affect the reliability of results. Additionally, the method's computational complexity may pose challenges for users without sufficient technical expertise or access to specialized software. Furthermore, the interpretation of CCF-TODIM results requires careful consideration and expert judgment to ensure meaningful and actionable insights.

5. Conclusion

This study proposes an innovative approach to Multi-Attribute Decision-Making (MADM) by integrating the TODIM method within the framework of Complex Cubic

Fuzzy (CCF) information. The paper begins with a detailed overview of the TODIM technique and demonstrates its application through a numerical example. Building on this foundation, the CCF-TODIM method is developed to effectively capture uncertainty, hesitation, and complex evaluations inherent in real-world decision-making. The proposed method is applied to a case study analyzing the global economic impacts of the Afghan–America war, offering a practical demonstration of its capabilities. Comparative evaluations against existing MADM techniques, supported by experimental results and sensitivity analysis using various distance measures, confirm the superiority and robustness of the CCF-TODIM approach. The findings highlight the method's adaptability and precision in addressing complex decision environments. By offering actionable insights for decision-makers in volatile global economic contexts, this study establishes CCF-TODIM as a powerful and practical advancement in MADM under uncertainty. Future studies may embrace algorithmic progress for efficient multiplication, evaluation of added graph operations, and application to everyday datasets. This development advances science theory as well as its application in intricate, data-rich settings.

Compliance with Ethical Standards

Disclosure of potential conflicts of interest: The authors declare that there is no conflict of interests regarding the publication of this paper.

Compliance with Ethical Standards: This study is not sup-ported by any source or any organizations.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of interest The authors declare that they have no conflict of interest.

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