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Research Article

Novel EDAS Methodology Based on Single-Valued Neutrosophic Aczel-Alsina Aggregation Information and Their Application in Complex Decision-Making

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In this article, we proposed an extended EDAS (Evaluation based on Distance from Average Solution) method based on the single-valued neutrosophic (SVN) Aczel-Alsina aggregation information. The fundamental concept of a single-valued neutrosophic (SVN) set is a universal mathematical tool for effectively managing uncertain and imprecise information. To accomplish our goal, we first extend the Aczel-Alsina t-norm and t-conorm to SVN scenarios and introduce a few new SVN operations on which we construct novel SVN aggregation operators. Furthermore, a decision support strategy is built in the SVN framework using the EDAS methodology and the suggested Aczel-Alsina aggregation operators. This method computes the aggregated outcomes of each investigated alternative, as well as their score values. Finally, to demonstrate the functionality of the developed SVN- EDAS, an application has been made related to the role of commercial banks in providing loans to their customers, which has recently affected our world, and the results are compared with other existing methods. The results suggest that the proposed method may overcome the inadequacies of the existing decision method's lack of decision flexibility by using SVN aggregation operators.

1. Introduction

Multi-attribute group decision making (MAGDM) is the practice of utilizing expert evaluation information to analyze, rank and pick the best solutions using a given decision-making (DM) approach. Making a decision entails providing relevant information and making a choice amongst several DM approaches. Enhancing the MADM approach has become a hot topic in today's DM area since it is difficult to predict the future and because experts' expertise is limited. In the DM procedure, there is vagueness and uncertainty, and Zadeh's theory [1] of fuzzy sets gives an extremely effective technique to cope with these challenges. Atanasov [2] devised the concept of intuitionistic fuzzy sets to reflect uncertainty in DM (IFS). IFS comprise membership functions and non-membership functions. Some decision-makers started using intuitionistic fuzzy numbers to express their preferences for alternatives in the DM dilemma [3–5]. Because of this, intuitionistic fuzzy information is becoming more popular among academics.

Following the acquisition of the expert data, we must integrate it using various aggregating operators (Agop). Several Agops, such as the IF averaging operator, were created by Xu [6]. Jana and Pal [7] introduced the decision making EDAS method to tackle the uncertainty in decision support problems. Several Einstein Agops, such as IFE averaging/geometric operators (Aveg/GAOs), were introduced by Liu and Liu [8]. Xu and Xu [9] created a prioritized list of Agops and explained how they could be used to solve DM challenges (Dcmp). Under the linguistic IF strategy, Wang and Wang [10] produced various unique Agops and proposed an algorithm to address the difficult uncertain Dcmp. Jana et al. [11] presented the multi-attribute decision making method using power Dombi operators and MABAC method to tackle the uncertain information in decision support problems. IF Bonferroni means Agop, Xu and Yager [12] established the DM technique (DMA). The Group DMA was created by Arora and Garg [13] built on the prioritized IF Agop under the linguistic set of data. Zhao et al. [14] examined the uses of generalized IF Agops, such as the generalized IF averaging/geometric operators, to deal with uncertainty in Dcmp. Yu [15] demonstrated certain IF Agops depending on levels of confidence and handled challenging real-world Dcmps. Yu [16] created the IF Agop and discussed its usefulness in DM using Heronian mean. Jiang et al. [17] devised a DM strategy depends on the IF power Agop and the entropy measurement. Senapati et al. [18] developed various IF Aczel-Alsina (Acz-Als) Agops depending on the Acz-Als norm and used them in the IF multi-attribute DM process. Khan et al. [19] created the unique generalized IF soft evidence Agops and investigated their use in DM.

Even though all of these approaches are beneficial for representing incomplete data, they are unable to deal with indeterminate (neutral) data and inconsistent data in actual practice. Cuong [20] consider the three type of uncertain situation at a time to developed the picture fuzzy set (PFS). It is clear that PFS interpretations of ambiguous data are more rational and accurate than those provided by the FS and IFS models. Many researchers began researching on PFS after its development. The synthesis of the achievement degree of criterion necessitates the collection of information. To understand the various uncertain data in Dcmp, Ashraf et al. [21] proposed the list of novel picture fuzzy (PF) algebraic Agop and decision support (D-S) strategy. Riaz et al. [22] introduced the decision making method under bipolar picture fuzzy operators and distance measures. Some Agops, such as PF geometic operators, were created by Garg [23]. Wei [24] compiled a list of PF Agops and discussed their use in DM challenges. Ashraf et al. [25] presented decision based application for Internet finance soft power evaluation under fuzzy information. Khan et al. [26] proposed and investigated the use of generalized PF soft details Agops in DM. Some Einstein Agops, such as PF Einstein (Aveg/GAOs), were introduced by Khan et al. [27]. Under algebraic norm and linguistic deta set, Qiyas et al. [28] created some PF averaging/geometric Agop. Jana et al. [29] investigated certain Dombi Agops in PF situations, such as PF Dombi averaging/geometric operators. Jana and Pal [30] presented the dynamical hybrid method using GRA technique to tackle decision support problems. PF Hamacher averaging/geometric operators employing Hamacher t-norm and s-norm were presented by Wei [31]. In a cubic PF setting, Ashraf et al. [32] devised a novel distance measure dependent on algebraic Agops. Khan et al. [33] created some logarithmic PF Agops and discussed how to use them in DM. Qiyas et al. [34] introduced the linguistic approach to tackle the decision problems using picture fuzzy Dombi information.

The portrayal of fuzzy sets and their extensions allow greater flexibility for DM, although there are still certain limitations. Data discontinuity and inconsistency cannot be solved such that the NS emerges as required by time. In this study, the degree of truth, uncertainty, and falsity are all taken into account. This theory can assist decision-makers in expressing their ideas more accurately and in detail and addresses issues that the fuzzy sets are unable to address. The concept of neutrosophic sets was first introduced by Smarandache [35]. This epistemology is a mathematical model that describes not only the origins, nature, and scope of impartiality, but also the interactions between their many conceptualization ranges. In order to overcome DM difficulties in unclear contexts, such enhancements have been developed. Smarandache [36] presented the plithogeny, plithogenic set, logic as a novel neutrosophic information. Ye [37] developed an AgOs-depends strategy for DM, while Peng et al. [38] highlighted the power of AgOs in dealing with uncertainty in NS data and examined their usefulness in the context of uncertainty in data management. In order to deal with uncertain data in the form of neutrosophic numbers, Chen and Ye [39] defined the SVN information depends Dombi AgOs, while Liu et al. [40] established the generalized Hamacher AgOs. Al-Hamido [41] described the novel algebraic structure of neutrosophic set. Garg and Nancy [42] presented the novel methodology depends on SVNSs with linguistic terms. Ashraf et al. [43] proposed novel decision model for hydrogen power plant selection using SVN sine trigonometric AgOs. The flexible DM correlating to favoured rankings of alternatives was not studied thoroughly in the MADM process, despite the fact that these operators provide some motivation for solving MADM difficulties.

The EDAS approach was initially defined by Keshavarz Ghorabaee et al. [44] and used it to multi-criteria inventory categorization issues. Kahraman et al. [45] developed a novel EDAS model for solid waste disposal site selection. Batool et al. [46] proposed the EDAS method with Pythagorean probabilistic hesitant information and discussed their applicability in decision making. Peng and Liu [47] proposed approaches for neutrosophic soft decision making depends on the EDAS algorithm using similarity measure. Karasan and Kahraman [48] developed the novel interval-valued neutrosophic EDAS approach. The EDAS method was used to develop the dynamic fuzzy approach for multi-criteria evaluation of subcontractors by Keshavarz-Ghorabaee et al. [49]. For more study, we refer to.

In fuzzy sets and their extended fuzzy architectures, the t-norms and t-conorms are commonly acknowledged as important operations. The Acz-Als t-norm and t-conorm procedures, created by Aczel and Alsina, have the advantage of changeability by modifying a parameter [50]. Under the single valued neutrosophic framework, the Acz-Als t-norm and t-conorm procedures, [51–57] as well as a number of additional aggregation operators [58–60] (AOs), are proposed. In addition, to deal with uncertain data in complex real-life decision scenarios, an expanded EDAS (Evaluation based on Distance from Average Solution) method depends on the SVN Acz-Als aggregation operations is described.

Our technique's objectives are represented as follows:

(1) We devised certain Acz-Als operations for SVNNs in order to overcome the lack of algebraic, Einstein, and Hamacher processes and represent the relationship between the various SVNNs.
(2) In support of SVN data, we extended Acz-Als operators to SVN Acz-Als operators: SVN Aczel-Alsina weighted geometric (SV-NAWG) operator and SVN Aczel-Alsina order weighted geometric (SV-NAOWG) operator, which overcome the present operator's drawbacks.
(3) Based on the suggested SVN Aczel-Alsina aggregation technique, we developed an expanded EDAS approach.
(4) Using SVN data, we developed an approach to deal with MAGDM difficulties.
(5) The suggested Aczel-Alsina aggregate operators and the EDAS technique are applied to the MAGDM issue in order to demonstrate their usability and reliability.
(6) The results suggest that the proposed process is more powerful and generates more authentic results when compared to existing methodologies.

The remaining sections of the document are formatted in the following order: Under SVN information, Section 2 provides some basic information on t-norms, SVNSs, and a few functional rules. Section 3 discusses the Aczel-Alsina working guidelines as well as the characteristics of SVNNs. In Section 4, we look at the various desirable qualities of several SVN Aczel-Alsina AOs. The next section develops an expanded EDAS method depends decision making algorithm using SVN Aczel-Alsina aggregation operations. In Section 6, we use an example to demonstrate the applicability of the suggested hybrid method. In Section 7, we examine at how a factor effects DM results. The comparison study for new and existing aggregating operators was developed in Section 8. Section 8 concludes the research work and elaborates future directions.

2. Preliminaries

We will look at some key topics in this section that will be significant in the creation of this article.

Definition 1 (see [50]). A mapping $(\widehat{W}_a^{\wp})_{\wp\in[0,\infty]}$ is a Acz-Als t-norm if

$$\widehat{W}_a^{\wp}(\Delta,\hbar)=\begin{cases}\widehat{W}_{\mathscr{D}}(\Delta,\hbar) & \text{if} \quad \wp=0\\ \min(\Delta,) & \text{if} \quad \wp=\infty,\\ e^{-((-\ell n'\Delta)^{\wp}+(-\ell n')^{\wp})^{1/\wp}} & \text{otherwise}\end{cases} \tag{1}$$

where $\Delta, \in[0,1]$, $\wp$ is $+ve$ fixed and $\widehat{W}_{\mathscr{D}}$ is extreme t-norm defined as

$$\widehat{W}_{\mathscr{D}}(\Delta,)=\begin{cases}\Delta & \text{if} \quad \Delta=1\\ & \text{if} \quad \Delta=1\\ 0 & \text{otherwise.}\end{cases}. \tag{2}$$

Definition 2 (see [50]). A mapping $(\beta_a^{\wp})_{\wp\in[0,\infty]}$ is a Acz-Als s-norm if

$$\beta_a^{\wp}(\Delta,)=\begin{cases}\beta_{\mathscr{D}}(\Delta,) & \text{if} \quad \wp=0\\ \max(\Delta,) & \text{if} \quad \wp=\infty\\ 1-e^{-\left((-\ell n_{\prime}(1-\Delta))^{\wp}+(-\ell n_{\prime}(1-))^{\wp}\right)^{1/\wp}} & \text{otherwise}\end{cases}, \tag{3}$$

where $\Delta, \in[0,1]$, $\wp$ is positive constant and $\beta_{\mathscr{D}}$ is drastic s-norm defined as

$$\beta_{\mathscr{D}}(\Delta,)=\begin{cases}\Delta & \text{if} \quad \Delta=0\\ & \text{if} \quad \Delta=0\\ 0 & \text{otherwise.}\end{cases}. \tag{4}$$

For every $\wp\in[0,\infty]$, the t-norm $\widehat{W}_a^{\wp}$ and s-norm $\beta_a^{\wp}$ are dual to each other.

Definition 3 (see [35]). A neutrosophic set Ξ in a fixed set $\Bbbk$ is defined as

$$\Xi=\{\overline{O}_{\Xi}(\flat),\Delta_{\Xi}(\flat),\mathscr{G}_{\Xi}(\flat)\in\,]0^-,1^+[\,|\flat\in\Bbbk\}, \tag{5}$$

where $\overline{O}_{\Xi}$ positive grade, Δ_{Ξ} neutral grade and $\mathscr{G}_{\Xi}$ negative grade of the value $\flat$ to neutrosophic set Ξ, satisfying $0^-\le\overline{O}_{\Xi}+\Delta_{\Xi}+\mathscr{G}_{\Xi}\le 3^+$, for each $\flat\in\Bbbk$.

Definition 4 (see [35]). A single valued neutrosophic set (SV-NS) Ξ in $\Bbbk$ is defined as

$$\Xi=\{\overline{O}_{\Xi}(\flat),\Delta_{\Xi}(\flat),\mathscr{G}_{\Xi}(\flat)\in[0,1]|\flat\in\Bbbk\}, \tag{6}$$

where $\overline{O}_{\Xi}$ positive grade, Δ_{Ξ} neutral grade and $\mathscr{G}_{\Xi}$ negative grade of the element $\flat$ to SV-NS Ξ, satisfying $0\le\overline{O}_{\Xi}+\Delta_{\Xi}+\mathscr{G}_{\Xi}\le 3$, for each $\flat\in\Bbbk$.

Definition 5 (see [35]). Let $\Xi_{\mathfrak{I}}=\{\overline{O}_{\Xi_{\mathfrak{I}}},\Delta_{\Xi_{\mathfrak{I}}},\mathscr{G}_{\Xi_{\mathfrak{I}}}\}$ be two single valued neutrosophic numbers (SVNNs), where $(\mathfrak{I}=1,2)$. Then:

(1) $\Xi_1\subseteq\Xi_2$ iff $\overline{O}_{\Xi_1}\le\overline{O}_{\Xi_2},\Delta_{\Xi_1}\le\Delta_{\Xi_2}$ and $\mathscr{G}_{\Xi_1}\ge\mathscr{G}_{\Xi_2}$ for all $\flat\in\Bbbk$;
(2) $\Xi_1=\Xi_2$ if $\Xi_1\subseteq\Xi_2$ and $\Xi_2\subseteq\Xi_1$;
(3) $\Xi_1=\Xi_2=\{\min(\overline{O}_{\Xi_1},\overline{O}_{\Xi_2}),\max(\Delta_{\Xi_1},\Delta_{\Xi_2}),\max(\mathscr{G}_{\Xi_1},\mathscr{G}_{\Xi_2})\}$;
(4) $\Xi_1=\Xi_2=\{\max(\overline{O}_{\Xi_1},\overline{O}_{\Xi_2}),\min(\Delta_{\Xi_1},\Delta_{\Xi_2}),\min(\mathscr{G}_{\Xi_1},\mathscr{G}_{\Xi_2})\}$;
(5) $(\Xi_1)^c=\{\mathscr{G}_{\Xi_1},\Delta_{\Xi_1},\overline{O}_{\Xi_1}\}$.

Definition 6 (see [35]). Let $\Xi_{\mathfrak{J}} = \{\overline{O}_{\Xi_{\mathfrak{J}}}, \Delta_{\Xi_{\mathfrak{J}}}, \mathcal{G}_{\Xi_{\mathfrak{J}}}\}$ be two SVNNs, where $(\mathfrak{J} = 1, 2)$. Then the operations about any two SVNNs are defined as follows:

(1) $\Xi_1 \oplus \Xi_2 = \{\overline{O}_{\Xi_1} + \overline{O}_{\Xi_2} - \overline{O}_{\Xi_1}\overline{O}_{\Xi_2}, \Delta_{\Xi_1}\Delta_{\Xi_2}, \mathcal{G}_{\Xi_1}\mathcal{G}_{\Xi_2}\}$;
(2) $\Xi_1 \otimes \Xi_2 = \{\overline{O}_{\Xi_1}\overline{O}_{\Xi_2}, \Delta_{\Xi_1} + \Delta_{\Xi_2} - \Delta_{\Xi_1}.\Delta_{\Xi_2}, \mathcal{G}_{\Xi_1} + \mathcal{G}_{\Xi_2} - \mathcal{G}_{\Xi_1}.\mathcal{G}_{\Xi_2}\}$;
(3) $\eta \cdot \Xi_1 = \{1 - (1 - \overline{O}_{\Xi_1})^{\eta}, (\Delta_{\Xi_1})^{\eta}, (\mathcal{G}_{\Xi_1})^{\eta}\},, \eta > 0$;
(4) $(\Xi_1)^{\eta} = \{(\overline{O}_{\Xi_1})^{\eta}, 1 - (1 - \Delta_{\Xi_1})^{\eta}, 1 - (1 - \mathcal{G}_{\Xi_1})^{\eta}\}, \eta > 0$.

On the basis of Definition 6, Ashraf [6] derived several operations in the following ways:

Definition 7 (see [51]). Let $\Xi_{\mathfrak{J}} = \{\overline{O}_{\Xi_{\mathfrak{J}}}, \Delta_{\Xi_{\mathfrak{J}}}, \mathcal{G}_{\Xi_{\mathfrak{J}}}\}$ be a collection of SVNNs, where $(\mathfrak{J} = 1, 2, \ldots, n)$ and $\eta_1, \eta_1 > 0$. Then

(1) $\Xi_1 \oplus \Xi_2 = \Xi_2 \oplus \Xi_1$;
(2) $\Xi_1 \otimes \Xi_2 = \Xi_2 \otimes \Xi_1$;
(3) $\eta_1(\Xi_1 \oplus \Xi_2) = \eta_1\Xi_1 \oplus \eta_1\Xi_2$;
(4) $(\Xi_1 \otimes \Xi_2)^{\eta_1} = \Xi_1^{\eta_1} \otimes \Xi_2^{\eta_1}$;
(5) $\eta_1\Xi_1 \oplus \eta_2\Xi_1 = (\eta_1 + \eta_2)\Xi_1$;
(6) $\Xi_1^{\eta_1} \otimes \Xi_1^{\eta_2} = \Xi_1^{(\eta_1+\eta_2)}$;
(7) $(\Xi_1^{\eta_1})^{\eta_2} = \Xi_1^{\eta_1\eta_2}$.

Definition 8 (see [43]). Let $\Xi = \{\overline{O}_{\Xi}, \Delta_{\Xi}, \mathcal{G}_{\Xi}\}$ be SV-NN. Then the score $\mathcal{Q}(\Xi)$ and accuracy $a(\Xi)$ are given as follows:

(1) $\mathcal{Q}(\Xi) = (\overline{O}_{\Xi} - \Delta_{\Xi} - \mathcal{G}_{\Xi})$;
(2) $a(\Xi) = (\overline{O}_{\Xi} + \Delta_{\Xi} + \mathcal{G}_{\Xi})$.

Definition 9 (see [43]). Let $\Xi_{\mathfrak{J}} = \{\overline{O}_{\Xi_{\mathfrak{J}}}, \Delta_{\Xi_{\mathfrak{J}}}, \mathcal{G}_{\Xi_{\mathfrak{J}}}\}$ be two SVNNs, where $(\mathfrak{J} = 1, 2)$. Then the comparison technique of SVNNs can be defined as:

(1) $\mathcal{Q}(\Xi_1) > \mathcal{Q}(\Xi_2)$ implies that $\Xi_1 > \Xi_2$;
(2) $\mathcal{Q}(\Xi_1) = \mathcal{Q}(\Xi_2)$ and $a(\Xi_1) > a(\Xi_2)$ implies that $\Xi_1 > \Xi_2$;
(3) $\mathcal{Q}(\Xi_1) = \mathcal{Q}(\Xi_2)$ and $a(\Xi_1) = a(\Xi_2)$ implies that $\Xi_1 = \Xi_2$.

Ashraf et al. [6] developed the algebraic AO under SVNNs illustrate in the superseding definition.

Definition 10 (see [52]). Let $\Xi_{\mathfrak{J}} = \{\overline{O}_{\Xi_{\mathfrak{J}}}, \Delta_{\Xi_{\mathfrak{J}}}, \mathcal{G}_{\Xi_{\mathfrak{J}}}\}$ be a collection of SVNNs, where $(\mathfrak{J} = 1, 2, \ldots, \ell)$. A single valued neutrosophic weighted geometric (SV-NWG) AO of dimention ℓ is a mapping $\mathfrak{J}^{\ell} \longrightarrow \mathfrak{J}$ with weight vector $\varpi = (\varpi_1, \varpi_1, \ldots, \varpi_{\ell})^T$ such that $\varpi_{\mathfrak{J}} > 0$ and as

$$SV - NWG(\Xi_1, \Xi_2, \ldots, \Xi_{\ell}) = \prod_{\mathfrak{J}=1}^{\ell} (\Xi_{\mathfrak{J}})^{\varpi_{\mathfrak{J}}} = \left\{ \begin{array}{c} \prod_{\mathfrak{J}=1}^{\ell} (\overline{O}_{\Xi_{\mathfrak{J}}})^{\varpi_{\mathfrak{J}}}, 1 - \prod_{\mathfrak{J}=1}^{\ell} (1 - \Delta_{\Xi_{\mathfrak{J}}})^{\varpi_{\mathfrak{J}}}, \\ 1 - \prod_{\mathfrak{J}=1}^{\ell} (1 - \mathcal{G}_{\Xi_{\mathfrak{J}}})^{\varpi_{\mathfrak{J}}} \end{array} \right\}. \quad (7)$$

3. Aczel–Alsina Operation for SVNNs

We discussed Acz-Als operations in relation to SVNNs, taking into account the Acz-Als t-norm and Acz-Als t-conorm.

Definition 11. Let $\Xi_{\mathfrak{J}} = \{\overline{O}_{\Xi_{\mathfrak{J}}}, \Delta_{\Xi_{\mathfrak{J}}}, \mathcal{G}_{\Xi_{\mathfrak{J}}}\}$ be two SVNNs, where $(\mathfrak{J} = 1, 2)$ and $\wp$ is *+ve* fixed. Then Acz-Als norms depends operations for SVNNs are defined as follows:

(1) $\Xi_1 \oplus \Xi_2 = \{1 - e^{-((-\ell n'(1-\overline{O}_{\Xi_1}))^{\wp} + (-\ell n'(1-\overline{O}_{\Xi_2}))^{\wp})^{1/\wp}}, e^{-((-\ell n'\Delta_{\Xi_1})^{\wp} + (-\ell n'\Delta_{\Xi_2})^{\wp})^{1/\wp}}, e^{-((-\ell n'\mathcal{G}_{\Xi_1})^{\wp} + (-\ell n'\mathcal{G}_{\Xi_2})^{\wp})^{1/\wp}}\}$;
(2) $\Xi_1 \otimes \Xi_2 = \{e^{-((-\ell n'\overline{O}_{\Xi_1})^{\wp} + (-\ell n'\overline{O}_{\Xi_2})^{\wp})^{1/\wp}}, 1 - e^{-((-\ell n'(1-\Delta_{\Xi_1}))^{\wp} + (-\ell n'(1-\Delta_{\Xi_2}))^{\wp})^{1/\wp}}, 1 - e^{-((-\ell n'(1-\mathcal{G}_{\Xi_1}))^{\wp} + (-\ell n'(1-\mathcal{G}_{\Xi_2}))^{\wp})^{1/\wp}}\}$;
(3) $\eta \cdot \Xi_1 = \left\{ \begin{array}{l} 1 - e^{-(\eta(-\ell n'(1-\overline{O}_{\Xi_1}))^{\wp})^{1/\wp}}, \\ e^{-(\eta(-\ell n'\Delta_{\Xi_1})^{\wp})^{1/\wp}}, e^{-(\eta(-\ell n'\mathcal{G}_{\Xi_1})^{\wp})^{1/\wp}} \end{array} \right\},, \eta > 0$;
(4) $(\Xi_1)^{\eta} = \left\{ \begin{array}{l} e^{-(\eta(-\ell n'\overline{O}_{\Xi_1})^{\wp})^{1/\wp}}, 1 - e^{-(\eta(-\ell n'(1-\Delta_{\Xi_1}))^{\wp})^{1/\wp}}, 1 - e^{-(\eta(-\ell n'(1-\mathcal{G}_{\Xi_1}))^{\wp})^{1/\wp}} \end{array} \right\}, \eta > 0$.

Theorem 1. *Let $\Xi_{\mathfrak{J}} = \{\overline{O}_{\Xi_{\mathfrak{J}}}, \Delta_{\Xi_{\mathfrak{J}}}, \mathcal{G}_{\Xi_{\mathfrak{J}}}\}$ be a collection of SVNNs, where $(\mathfrak{J} = 1, 2, \ldots, n)$ and $\eta_1, \eta_1 > 0$. Then:*

(1) $\Gamma_1 \oplus \Gamma_2 = \Gamma_2 \oplus \Gamma_1$;
(2) $\Gamma_1 \otimes \Gamma_2 = \Gamma_2 \otimes \Gamma_1$;
(3) $\eta_1(\Gamma_1 \oplus \Gamma_2) = \eta_1\Gamma_1 \oplus \eta_1\Gamma_2$;
(4) $(\Gamma_1 \otimes \Gamma_2)^{\eta_1} = \Gamma_1^{\eta_1} \otimes \Gamma_2^{\eta_1}$;
(5) $\eta_1\Gamma_1 \oplus \eta_2\Gamma_1 = (\eta_1 + \eta_2)\Gamma_1$;
(6) $\Gamma_1^{\eta_1} \otimes \Gamma_1^{\eta_2} = \Gamma_1^{(\eta_1+\eta_2)}$;
(7) $(\Gamma_1^{\eta_1})^{\eta_2} = \Gamma_1^{\eta_1\eta_2}$.

Proof.

(1) Let $\Xi_{\mathfrak{J}} = \{\overline{O}_{\Xi_{\mathfrak{J}}}, \Delta_{\Xi_{\mathfrak{J}}}, \mathscr{G}_{\Xi_{\mathfrak{J}}}\}$ be collection of SVNNs, where $(\mathfrak{J} = 1, 2, \ldots, n)$ and $\eta_1, \eta_1 > 0$. Then by the Definition 11, it follows that

$$
\begin{aligned}
\Xi_1 \oplus \Xi_2 &= \left\{ \begin{array}{c} 1 - e^{-\left(\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp} + \left(-\ell n'\left(1-\overline{O}_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}}, e^{-\left(\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp} + \left(-\ell n'\Delta_{\Xi_2}\right)^{\wp}\right)^{1/\wp}}, \\ e^{-\left(\left(-\ell n'\mathscr{G}_{\Xi_1}\right)^{\wp} + \left(-\ell n'\mathscr{G}_{\Xi_2}\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \\
&= \left\{ \begin{array}{c} 1 - e^{-\left(\left(-\ell n'\left(1-\overline{O}_{\Xi_2}\right)\right)^{\wp} + \left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}}, e^{-\left(\left(-\ell n'\Delta_{\Xi_2}\right)^{\wp} + \left(-\ell n'\Delta_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}, \\ e^{-\left(\left(-\ell n'\mathscr{G}_{\Xi_2}\right)^{\wp} + \left(-\ell n'\mathscr{G}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \\
&= \Xi_2 \oplus \Xi_1.
\end{aligned}
\tag{8}
$$

(2) Utilizing the Definition 11, it follows that

$$
\begin{aligned}
\Xi_1 \otimes \Xi_2 &= \left\{ \begin{array}{c} e^{-\left(\left(-\ell n'\overline{O}_{\Xi_1}\right)^{\wp} + \left(-\ell n'\overline{O}_{\Xi_2}\right)^{\wp}\right)^{1/\wp}}, 1 - e^{-\left(\left(-\ell n'\left(1-\Delta_{\Xi_1}\right)\right)^{\wp} + \left(-\ell n'\left(1-\Delta_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1 - e^{-\left(\left(-\ell n'\left(1-\mathscr{G}_{\Xi_1}\right)\right)^{\wp} + \left(-\ell n'\left(1-\mathscr{G}_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \\
&= \left\{ \begin{array}{c} e^{-\left(\left(-\ell n'\overline{O}_{\Xi_2}\right)^{\wp} + \left(-\ell n'\overline{O}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}, 1 - e^{-\left(\left(-\ell n'\left(1-\Delta_{\Xi_2}\right)\right)^{\wp} + \left(-\ell n'\left(1-\Delta_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1 - e^{-\left(\left(-\ell n'\left(1-\mathscr{G}_{\Xi_2}\right)\right)^{\wp} + \left(-\ell n'\left(1-\mathscr{G}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \\
&= \Xi_2 \otimes \Xi_1.
\end{aligned}
\tag{9}
$$

(3) Utilizing the Definition 11, it follows that

$$
\begin{aligned}
\eta_1\left(\Xi_1 \oplus \Xi_2\right) &= \eta_1 \left\{ \begin{array}{c} 1 - e^{-\left(\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp} + \left(-\ell n'\left(1-\overline{O}_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}}, e^{-\left(\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp} + \left(-\ell n'\Delta_{\Xi_2}\right)^{\wp}\right)^{1/\wp}}, \\ e^{-\left(\left(-\ell n'\mathscr{G}_{\Xi_1}\right)^{\wp} + \left(-\ell n'\mathscr{G}_{\Xi_2}\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \\
&= \left\{ \begin{array}{c} 1 - e^{-\left(\eta_1\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp} + \eta_1\left(-\ell n'\left(1-\overline{O}_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}}, e^{-\left(\eta_1\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp} + \eta_1\left(-\ell n'\Delta_{\Xi_2}\right)^{\wp}\right)^{1/\wp}}, \\ e^{-\left(\eta_1\left(-\ell n'\mathscr{G}_{\Xi_1}\right)^{\wp} + \eta_1\left(-\ell n'\mathscr{G}_{\Xi_2}\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \\
&= \left\{ \begin{array}{c} 1 - e^{-\left(\eta_1\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}}, \\ e^{-\left(\eta_1\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}, \\ e^{-\left(\eta_1\left(-\ell n'\mathscr{G}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \oplus \left\{ \begin{array}{c} 1 - e^{-\left(\eta_1\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}}, \\ e^{-\left(\eta_1\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}, \\ e^{-\left(\eta_1\left(-\ell n'\mathscr{G}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \\
&= \eta_1\Xi_1 \oplus \eta_1\Xi_2.
\end{aligned}
\tag{10}
$$

(4) It is similar of the proof of (3).

(5) Utilizing the Definition 11, it follows that

$$\begin{aligned}\eta_1\Xi_1\oplus\eta_2\Xi_1 &= \left\{\begin{array}{c}1-e^{-\left(\eta_1\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}},\\ e^{-\left(\eta_1\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp}\right)^{1/\wp}},\\ e^{-\left(\eta_1\left(-\ell n'\mathcal{G}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}\end{array}\right\}\oplus\left\{\begin{array}{c}1-e^{-\left(\eta_2\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}},\\ e^{-\left(\eta_2\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp}\right)^{1/\wp}},\\ e^{-\left(\eta_2\left(-\ell n'\mathcal{G}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}\end{array}\right\}\\ &= \left\{\begin{array}{c}1-e^{-\left(\eta_1\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp}+\eta_2\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}}, e^{-\left(\eta_1\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp}+\eta_2\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp}\right)^{1/\wp}},\\ e^{-\left(\eta_1\left(-\ell n'\mathcal{G}_{\Xi_1}\right)^{\wp}+\eta_2\left(-\ell n'\mathcal{G}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}\end{array}\right\}\\ &= \left\{\begin{array}{c}1-e^{-\left(\eta_1+\eta_2\left(-\ell n'\left(1-\overline{O}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}}, e^{-\left(\eta_1+\eta_2\left(-\ell n'\Delta_{\Xi_1}\right)^{\wp}\right)^{1/\wp}},\\ e^{-\left(\eta_1+\eta_2\left(-\ell n'\mathcal{G}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}\end{array}\right\}\\ &= (\eta_1+\eta_2)\Xi_1.\end{aligned} \tag{11}$$

(6) and (7) are similar to the proof of (5). □

4. Aczel–Alsina Geometric Aggregation Operators for SVNNs

Acz-Als norms depends list of novel AOs under single valued neutrosophic settings are construct in this section.

Definition 12. Let $\Xi_{\mathfrak{J}} = \left\{\overline{O}_{\Xi_{\mathfrak{J}}}, \Delta_{\Xi_{\mathfrak{J}}}, \mathcal{G}_{\Xi_{\mathfrak{J}}}\right\}$ be collection of SVNNs, where $(\mathfrak{J} = 1, 2, \ldots, \ell)$. A SVN Acz-Als weighted geometric (SVNAWG) AO of dimention ℓ is a mapping with weight vector $\varpi = (\varpi_1, \varpi_1, \ldots, \varpi_\ell)^T$ such that $\varpi_{\mathfrak{J}} > 0$ and $\sum_{\mathfrak{J}=1}^{\ell}\varpi_{\mathfrak{J}} =$ as

$$SV-NAWG(\Xi_1, \Xi_2, \ldots, \Xi_\ell) = \prod_{\mathfrak{J}=1}^{\ell}(\Xi_{\mathfrak{J}})^{\varpi_{\mathfrak{J}}}. \tag{12}$$

Theorem 2. *Suppose $\Xi_{\mathfrak{J}} = \left\{\overline{O}_{\Xi_{\mathfrak{J}}}, \Delta_{\Xi_{\mathfrak{J}}}, \mathcal{G}_{\Xi_{\mathfrak{J}}}\right\}$ be collection of SVNNs, where $(\mathfrak{J} = 1, 2, \ldots, \ell)$. A SVN Acz-Als weighted geometric (SVNAWG) AO of dimention ℓ is a mapping with weight vector $\varpi = (\varpi_1, \varpi_1, \ldots, \varpi_\ell)^T$ such that $\varpi_{\mathfrak{J}} > 0$ and $\sum_{\mathfrak{J}=1}^{\ell}\varpi_{\mathfrak{J}} =$ is defined as:*

$$SV-NAWG(\Xi_1, \Xi_2, \ldots, \Xi_\ell) = \prod_{\mathfrak{J}=1}^{\ell}(\Xi_{\mathfrak{J}})^{\varpi_{\mathfrak{J}}} = \left\{\begin{array}{c} e^{-\left(\sum_{\mathfrak{J}=1}^{\ell}\varpi_{\mathfrak{J}}\left(-\ell n'\overline{O}_{\Xi_{\mathfrak{J}}}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\sum_{\mathfrak{J}=1}^{\ell}\varpi_{\mathfrak{J}}\left(-\ell n'\left(1-\Delta_{\Xi\mathfrak{J}}\right)\right)^{\wp}\right)^{1/\wp}},\\ 1-e^{-\left(\sum_{\mathfrak{J}=1}^{\ell}\varpi_{\mathfrak{J}}\left(-\ell n'\left(1-\mathcal{G}_{\Xi_{\mathfrak{J}}}\right)\right)^{\wp}\right)^{1/\wp}}\end{array}\right\}. \tag{13}$$

Proof. Theorem's 2 proof is derived by implemention of induction method as follows: □

Step 1. for $\ell = 2$, we have

$$SV-NAWG(\Xi_1, \Xi_2) = (\Xi_1)^{\varpi_1} \otimes (\Xi_2)^{\varpi_2}. \tag{14}$$

Utilizing the Definition 11, it follows that

$$(\Xi_1)^{\varpi_1} = \left\{e^{-\left(\varpi_1\left(-\ell n'\overline{O}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\varpi_1\left(-\ell n'\left(1-\Delta_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\varpi_1\left(-\ell n'\left(1-\mathcal{G}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}}\right\}, \tag{15}$$

and

$$(\Xi_2)^{\varpi_2} = \left\{e^{-\left(\varpi_2\left(-\ell n'\overline{O}_{\Xi_2}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\varpi_2\left(-\ell n'\left(1-\Delta_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\varpi_2\left(-\ell n'\left(1-\mathcal{G}_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}}\right\}. \tag{16}$$

Therefore

$$SV-NAWG(\Xi_1,\Xi_2)=\left\{\begin{array}{c} e^{-\left(\varpi_1\left(-\ell n'\overline{O}_{\Xi_1}\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\varpi_1\left(-\ell n'\left(1-\Delta_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\varpi_1\left(-\ell n'\left(1-\mathscr{G}_{\Xi_1}\right)\right)^{\wp}\right)^{1/\wp}} \end{array}\right\}\otimes\left\{\begin{array}{c} e^{-\left(\varpi_2\left(-\ell n'\overline{O}_{\Xi_2}\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\varpi_2\left(-\ell n'\left(1-\Delta_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\varpi_2\left(-\ell n'\left(1-\mathscr{G}_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}} \end{array}\right\}$$
$$=\left\{\begin{array}{c} e^{-\left(\varpi_1\left(-\ell n'\overline{O}_{\Xi_1}\right)^{\wp}+\varpi_2\left(-\ell n'\overline{O}_{\Xi_2}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\varpi_1\left(-\ell n'\left(1-\Delta_{\Xi_1}\right)\right)^{\wp}+\varpi_2\left(-\ell n'\left(1-\Delta_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\varpi_1\left(-\ell n'\left(1-\mathscr{G}_{\Xi_1}\right)\right)^{\wp}+\varpi_2\left(-\ell n'\left(1-\mathscr{G}_{\Xi_2}\right)\right)^{\wp}\right)^{1/\wp}} \end{array}\right\}$$
$$=\left\{\begin{array}{c} e^{-\left(\sum_{\mathfrak{z}=1}^{2}\varpi_{\mathfrak{z}}\left(-\ell n'\overline{O}_{\Xi_{\mathfrak{z}}}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\sum_{\mathfrak{z}=1}^{2}\varpi_{\mathfrak{z}}\left(-\ell n'\left(1-\Delta_{\Xi_{\mathfrak{z}}}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{z}=1}^{2}\varpi_{\mathfrak{z}}\left(-\ell n'\left(1-\mathscr{G}_{\Xi_{\mathfrak{z}}}\right)\right)^{\wp}\right)^{1/\wp}} \end{array}\right\}. \tag{17}$$

Thus, Theorem 2 is valid. $\ell=2$.

Now, we assume that, Theorem 2 is valid for $\ell=d$, that is

$$SV-NAWG(\Xi_1,\Xi_2,\ldots,\Xi_d)$$
$$=\left\{\begin{array}{c} e^{-\left(\sum_{\mathfrak{z}=1}^{d}\varpi_{\mathfrak{z}}\left(-\ell n'\overline{O}_{\Xi_{\mathfrak{z}}}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\sum_{\mathfrak{z}=1}^{d}\varpi_{\mathfrak{z}}\left(-\ell n'\left(1-\Delta_{\Xi_{\mathfrak{z}}}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{z}=1}^{d}\varpi_{\mathfrak{z}}\left(-\ell n'\left(1-\mathscr{G}_{\Xi_{\mathfrak{z}}}\right)\right)^{\wp}\right)^{1/\wp}} \end{array}\right\}. \tag{18}$$

Now we prove that Theorem 2 is valid for $\ell=d+1$. That is, we prove

$$SV-NAWG(\Xi_1,\Xi_2,\ldots,\Xi_d,\Xi_{d+1})=\prod_{\mathfrak{z}=1}^{\ell}\left(\Xi_{\mathfrak{z}}\right)^{\varpi_{\mathfrak{z}}}\otimes\left(\Xi_{d+1}\right)^{\varpi_{d+1}}$$

$$\prod_{\mathfrak{z}=1}^{\ell}\left(\Xi_{\mathfrak{z}}\right)^{\varpi_{\mathfrak{z}}}\otimes\left(\Xi_{d+1}\right)^{\varpi_{d+1}}=\left\{\begin{array}{c} e^{-\left(\sum_{\mathfrak{z}=1}^{d}\varpi_{\mathfrak{z}}\left(-\ell n'\overline{O}_{\Xi_{\mathfrak{z}}}\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{z}=1}^{d}\varpi_{\mathfrak{z}}\left(-\ell n'\left(1-\Delta_{\Xi_{\mathfrak{z}}}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{z}=1}^{d}\varpi_{\mathfrak{z}}\left(-\ell n'\left(1-\mathscr{G}_{\Xi_{\mathfrak{z}}}\right)\right)^{\wp}\right)^{1/\wp}} \end{array}\right\}\otimes\left\{\begin{array}{c} e^{-\left(\varpi_{d+1}\left(-\ell n'\overline{O}_{\Xi_{d+1}}\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\varpi_{d+1}\left(-\ell n'\left(1-\Delta_{\Xi_{d+1}}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\varpi_{d+1}\left(-\ell n'\left(1-\mathscr{G}_{\Xi_{d+1}}\right)\right)^{\wp}\right)^{1/\wp}} \end{array}\right\}$$

$$= \left\{ \begin{array}{c} e^{-\left(\sum_{\mathfrak{I}=1}^{d} \varpi_{\mathfrak{I}}\left(-\ell n'\overline{O}_{\Xi_{\mathfrak{I}}}\right)^{\wp} + \varpi_{d+1}\left(-\ell n'\overline{O}_{\Xi d+1}\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{I}=1}^{d} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\Delta_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp} + \varpi_{d+1}\left(-\ell n'\left(1-\Delta_{\Xi d+1}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{I}=1}^{d} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\mathscr{G}_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp} + \varpi_{d+1}\left(-\ell n'\left(1-\mathscr{G}_{\Xi d+1}\right)\right)^{\wp}\right)^{1/\wp}} \end{array} \right\}$$

$$= \left\{ \begin{array}{c} e^{-\left(\sum_{\mathfrak{I}=1}^{d+1} \varpi_{\mathfrak{I}}\left(-\ell n'\overline{O}_{\Xi_{\mathfrak{I}}}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\sum_{\mathfrak{I}=1}^{d+1} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\Delta_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{I}=1}^{d+1} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\mathscr{G}_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp}\right)^{1/\wp}} \end{array} \right\}. \tag{19}$$

Prove that, Theorem 2 is valid for all ℓ.

Using the operator SVNAWG, we can efficiently illustrate the following characteristics.

Theorem 3. *(Idempotency) Let* $\Xi_{\mathfrak{I}} = \left\{\overline{O}_{\Xi_{\mathfrak{I}}}, \Delta_{\Xi_{\mathfrak{I}}}, \mathscr{G}_{\Xi_{\mathfrak{I}}}\right\}$ $(\mathfrak{I} = 1, 2, \ldots, \ell)$ *be a collection of equivalent SVNNs,* $\Xi_{\mathfrak{I}} = \Xi$ *for each* $(\mathfrak{I} = 1, 2, \ldots, \ell)$. *Then*

$$SV-NAWG\left(\Xi_1, \Xi_2, \ldots, \Xi_{\ell}\right) = \Xi. \tag{20}$$

Proof. Since

$$SV-NAWG\left(\Xi_1, \Xi_2, \ldots, \Xi_{\ell}\right) = \left\{ \begin{array}{c} e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\overline{O}_{\Xi_{\mathfrak{I}}}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\Delta_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\mathscr{G}_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp}\right)^{1/\wp}} \end{array} \right\}. \tag{21}$$

Put

$$\Xi_{\mathfrak{I}} = \left\{\overline{O}_{\Xi_{\mathfrak{I}}}, \Delta_{\Xi_{\mathfrak{I}}}, \mathscr{G}_{\Xi_{\mathfrak{I}}}\right\} = \Xi\left(\mathfrak{I} = 1, 2, \ldots, \ell\right), \tag{22}$$

we have

$$\begin{aligned} SV-NAWG\left(\Xi_1, \Xi_2, \ldots, \Xi_{\ell}\right) &= \left\{ \begin{array}{c} e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\overline{O}_{\Xi}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\Delta_{\Xi}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\mathscr{G}_{\Xi}\right)\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \\ &= \left\{ \begin{array}{c} e^{-\left(\left(-\ell n'\overline{O}_{\Xi}\right)^{\wp}\right)^{1/\wp}}, 1-e^{-\left(\left(-\ell n'\left(1-\Delta_{\Xi}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\left(-\ell n'\left(1-\mathscr{G}_{\Xi}\right)\right)^{\wp}\right)^{1/\wp}} \end{array} \right\} \\ &= \left(\overline{O}_{\Xi}, \Delta_{\Xi}, \mathscr{G}_{\Xi}\right) = \Xi. \end{aligned} \tag{23}$$

Thus, $SV-NAWG\left(\Xi_1, \Xi_2, \ldots, \Xi_{\ell}\right) = \Xi$ holds. □

Theorem 4. *(Boundedness) Let $\Xi_{\mathfrak{I}} = \{\overline{O}_{\Xi_{\mathfrak{I}}}, \Delta_{\Xi_{\mathfrak{I}}}, \mathscr{G}_{\Xi_{\mathfrak{I}}}\}$ ($\mathfrak{I} = 1, 2, \ldots, \ell$) be collection of SVNNs. Let $\Xi_{\mathfrak{I}}^{-} = \left(min_{\mathfrak{I}}\{\overline{O}_{\Xi_{\mathfrak{I}}}\}, max_{\mathfrak{I}}\{\Delta_{\Xi_{\mathfrak{I}}}\}, max_{\mathfrak{I}}\{\mathscr{G}_{\Xi_{\mathfrak{I}}}\}\right)$ and $\Xi_{\mathfrak{I}}^{+} = \left(max_{\mathfrak{I}}\{\overline{O}_{\Xi_{\mathfrak{I}}}\}, min_{\mathfrak{I}}\{\Delta_{\Xi_{\mathfrak{I}}}\}, min_{\mathfrak{I}}\{\mathscr{G}_{\Xi_{\mathfrak{I}}}\}\right)$ ($\mathfrak{I} = 1, 2, \ldots, \ell$). Then,*

$$\Xi_{\mathfrak{I}}^{-} \leq SV - NAWG(\Xi_1, \Xi_2, \ldots, \Xi_\ell) \leq \Xi_{\mathfrak{I}}^{+}. \tag{24}$$

Proof. Since $\min_{\mathfrak{I}}\{\overline{O}_{\Xi_{\mathfrak{I}}}\} \leq \overline{O}_{\Xi_{\mathfrak{I}}} \leq \max_{\mathfrak{I}}\{\overline{O}_{\Xi_{\mathfrak{I}}}\}$, it follows that

$$e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\left(\min \overline{O}_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp}\right)^{1/\wp}} \leq e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n' \overline{O}_{\Xi_{\mathfrak{I}}}\right)^{\wp}\right)^{1/\wp}} \leq e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\left(\max \overline{O}_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp}\right)^{1/\wp}}. \tag{25}$$

Similarly

$$\begin{aligned} 1 - e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\left(\max\left(1-\Delta_{\Xi_{\mathfrak{I}}}\right)\right)\right)^{\wp}\right)^{1/\wp}} &\leq 1 - e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\Delta_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp}\right)^{1/\wp}} \\ &\leq 1 - e^{-\left(\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}}\left(-\ell n'\left(\min\left(1-\Delta_{\Xi_{\mathfrak{I}}}\right)\right)\right)^{\wp}\right)^{1/\wp}}. \end{aligned} \tag{26}$$

Now we have

$$\begin{aligned} 1 - e^{-\left(\sum_{\mathfrak{I}=1}^{d} \varpi_{\mathfrak{I}}\left(-\ell n'\left(\max\left(1-\mathscr{G}_{\Xi_{\mathfrak{I}}}\right)\right)\right)^{\wp}\right)^{1/\wp}} &\leq 1 - e^{-\left(\sum_{\mathfrak{I}=1}^{d} \varpi_{\mathfrak{I}}\left(-\ell n'\left(1-\mathscr{G}_{\Xi_{\mathfrak{I}}}\right)\right)^{\wp}\right)^{1/\wp}} \\ &\leq 1 - e^{-\left(\sum_{\mathfrak{I}=1}^{d} \varpi_{\mathfrak{I}}\left(-\ell n'\left(\min\left(1-\mathscr{G}_{\Xi_{\mathfrak{I}}}\right)\right)\right)^{\wp}\right)^{1/\wp}}. \end{aligned} \tag{27}$$

Therefore

$$\Xi_{\mathfrak{I}}^{-} \leq SV - NAWG(\Xi_1, \Xi_2, \ldots, \Xi_\ell) \leq \Xi_{\mathfrak{I}}^{+}. \tag{28}$$

□

Theorem 5. *Let $\Xi_{\mathfrak{I}} = \{\overline{O}_{\Xi_{\mathfrak{I}}}, \Delta_{\Xi_{\mathfrak{I}}}, \mathscr{G}_{\Xi_{\mathfrak{I}}}\}$ and $\Xi_{\mathfrak{I}}^{*} = \{\overline{O}_{\Xi_{\mathfrak{I}}}^{*}, \Delta_{\Xi_{\mathfrak{I}}}^{*}, \mathscr{G}_{\Xi_{\mathfrak{I}}}^{*}\}$ ($\mathfrak{I} = 1, 2, \ldots, \ell$) be two collections of SVNNs. If $\Xi_{\mathfrak{I}} \leq \Xi_{\mathfrak{I}}^{*}$ for ($\mathfrak{I} = 1, 2, \ldots, \ell$). Then,*

$$SV - NAWG(\Xi_1, \Xi_2, \ldots, \Xi_\ell) \leq SV - NAWG(\Xi_1^{*}, \Xi_2^{*}, \ldots, \Xi_\ell^{*}). \tag{29}$$

Proof. The proof is straightforward. □

Definition 13. Let $\Xi_{\mathfrak{I}} = \{\overline{O}_{\Xi_{\mathfrak{I}}}, \Delta_{\Xi_{\mathfrak{I}}}, \mathscr{G}_{\Xi_{\mathfrak{I}}}\}$ be a collection of SVNNs, where ($\mathfrak{I} = 1, 2, \ldots, \ell$). An SVN Acz-Als ordered weighted geometric (SV-NAOWG) AO of dimention ℓ is a mapping $\mathfrak{I}^{\ell} \longrightarrow \mathfrak{I}$ with $\varpi = (\varpi_1, \varpi_1, \ldots, \varpi_\ell)^T$ such that $\varpi_{\mathfrak{I}} > 0$ and $\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}} =$ as

$$SV - NAOWG(\Xi_1, \Xi_2, \ldots, \Xi_\ell) = \prod_{\mathfrak{I}=1}^{\ell} \left(\Xi_{\tau(\mathfrak{I})}\right)^{\varpi_{\mathfrak{I}}}, \tag{30}$$

where $(\tau(1), \tau(2), \ldots, \tau(\ell))$ are the permutation in such a way that. $\Xi_{\tau(\mathfrak{I})} \leq \Xi_{\tau(\mathfrak{I}-1)}$.

Theorem 6. *Suppose $\Xi_{\mathfrak{I}} = \{\overline{O}_{\Xi_{\mathfrak{I}}}, \Delta_{\Xi_{\mathfrak{I}}}, \mathscr{G}_{\Xi_{\mathfrak{I}}}\}$ be a collection of SVNNs, where ($\mathfrak{I} = 1, 2, \ldots, \ell$). An SVN Acz-Als ordered weighted geometric (SV-NAOWG) AO of dimention ℓ is a mapping $\mathfrak{I}^{\ell} \longrightarrow \mathfrak{I}$ with weight vector $\varpi = (\varpi_1, \varpi_1, \ldots, \varpi_\ell)^T$ such that $\varpi_{\mathfrak{I}} > 0$ and $\sum_{\mathfrak{I}=1}^{\ell} \varpi_{\mathfrak{I}} =$ is defined as:*

$$SV-NAOWG(\Xi_1,\Xi_2,\ldots,\Xi_\ell)=\prod_{\mathfrak{J}=1}^{\ell}\left(\Xi_{\tau(\mathfrak{J})}\right)^{\varpi_{\mathfrak{J}}}$$
$$=\left\{\begin{array}{c} e^{-\left(\sum_{\mathfrak{J}=1}^{\ell}\varpi_{\mathfrak{J}}\left(-\ell n'\overline{O}_{\Xi_{\tau(\mathfrak{J})}}\right)^{\wp}\right)^{1/\wp}},1-e^{-\left(\sum_{\mathfrak{J}=1}^{\ell}\varpi_{\mathfrak{J}}\left(-\ell n'\left(1-\Delta_{\Xi_{\tau(\mathfrak{J})}}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1-e^{-\left(\sum_{\mathfrak{J}=1}^{\ell}\varpi_{\mathfrak{J}}\left(-\ell n'\left(1-\mathscr{G}_{\Xi_{\tau(\mathfrak{J})}}\right)\right)^{\wp}\right)^{1/\wp}}\end{array}\right\}, \tag{31}$$

where $(\tau(1),\tau(2),\ldots,\tau(\ell))$ *are the permutation in such a way as.* $\Gamma_{\tau(\mathfrak{J})}\leq\Gamma_{\tau(\mathfrak{J}-1)}$.

Using the operator SV-NAOWG, we can efficiently illustrate the following characteristics.

Theorem 7.

(1) *(Idempotency) Let* $\Xi_{\mathfrak{J}}=\left\{\overline{O}_{\Xi_{\mathfrak{J}}},\Delta_{\Xi_{\mathfrak{J}}},\mathscr{G}_{\Xi_{\mathfrak{J}}}\right\}(\mathfrak{J}=1,2,\ldots,\ell)$ *be collection of equivalent SVNNs,* $\Xi_{\mathfrak{J}}=\Xi$ *for each* $(\mathfrak{J}=1,2,\ldots,\ell)$. *Then*

$$SV-NAOWG(\Xi_1,\Xi_2,\ldots,\Xi_\ell)=\Xi. \tag{32}$$

(2) *(Boundedness) Let* $\Gamma_{\mathfrak{J}}=\left\{\overline{O}_{\Gamma_{\mathfrak{J}}},\Delta_{\Gamma_{\mathfrak{J}}},\mathscr{G}_{\Gamma_{\mathfrak{J}}}\right\}(\mathfrak{J}=1,2,\ldots,\ell)$ *be a collection of SVNNs. Let* $\Gamma_{\mathfrak{J}}^{-}=(min_{\mathfrak{J}}\{\overline{O}_{\Gamma_{\mathfrak{J}}}\},max_{\mathfrak{J}}\{\Delta_{\Gamma_{\mathfrak{J}}}\},max_{\mathfrak{J}}\{\mathscr{G}_{\Gamma_{\mathfrak{J}}}\})$ *and* $\Gamma_{\mathfrak{J}}^{+}=(\max_{\mathfrak{J}}\{\overline{O}_{\Gamma_{\mathfrak{J}}}\},\min_{\mathfrak{J}}\{\Delta_{\Gamma_{\mathfrak{J}}}\},\min_{\mathfrak{J}}\{\mathscr{G}_{\Gamma_{\mathfrak{J}}}\})(\mathfrak{J}=1,2,\ldots,\ell)$. *Then*

$$\Xi_{\mathfrak{J}}^{-}\leq SV-NAOWG(\Xi_1,\Xi_2,\ldots,\Xi_\ell)\leq\Xi_{\mathfrak{J}}^{+}. \tag{33}$$

(3) *Let* $\Gamma_{\mathfrak{J}}=\left\{\overline{O}_{\Gamma_{\mathfrak{J}}},\Delta_{\Gamma_{\mathfrak{J}}},\mathscr{G}_{\Gamma_{\mathfrak{J}}}\right\}$ *and* $\Gamma_{\mathfrak{J}}^{*}=\left\{\overline{O}_{\Gamma_{\mathfrak{J}}}^{*},\Delta_{\Gamma_{\mathfrak{J}}}^{*},\mathscr{G}_{\Gamma_{\mathfrak{J}}}^{*}\right\}(\mathfrak{J}=1,2,\ldots,\ell)$ *be two collection of SVNNs. If* $\Gamma_{\mathfrak{J}}\leq\Gamma_{\mathfrak{J}}^{*}$ *for* $(\mathfrak{J}=1,2,\ldots,\ell)$. *Then*

$$\begin{aligned}&SV-NAOWG(\Xi_1,\Xi_2,\ldots,\Xi_\ell)\\&\leq SV-NAOWG(\Xi_1^{*},\Xi_2^{*},\ldots,\Xi_\ell^{*}).\end{aligned} \tag{34}$$

Proof. Using Theorem 2, 3 and 4, the proof is straightforward. □

5. EDAS Method Based on SVN Aczel–Alsina Aggregation Information

A novel extended EDAS approach is built here to handle the complex uncertain data in real-life D-S issues in order to validate the effectiveness of the SVN Acz-Als geometric AOs. The following are the particular measures to take.

Assume, that there is a set of ℓ alternatives, and an acceptable rating by the attributes $\{\mathbb{R}_1,\mathbb{R}_2,\ldots,\mathbb{R}_m\}$. Then, the usefulness of different attributes $\mathbb{R}_\imath\,(\imath=1,2,\ldots,\mathrm{m})$ is specified by $\varpi=(\varpi_1,\varpi_1,\ldots,\varpi_m)^T$ such that $\varpi_\imath>0$ and $\sum_{\imath=1}^{m}\varpi_\imath=$.

Let $\Xi_{\mathfrak{J}\imath}=\left\{\overline{O}_{\Xi_{\mathfrak{J}\imath}},\Delta_{\Xi_{\mathfrak{J}\imath}},\mathscr{G}_{\Xi_{\mathfrak{J}\imath}}\right\}$ for $\overline{O}_{\Xi_{\mathfrak{J}\imath}},\Delta_{\Xi_{\mathfrak{J}\imath}},\mathscr{G}_{\Xi_{\mathfrak{J}\imath}}\in[0,1]$ be the acceptable rating of every attribute for each alternative, where $\overline{O}_{\Xi_{\ell m}}$ depicts the *+ve* grade function the alternative $(\mathfrak{J}=1,2,\ldots,\ell)$ satisfies $\mathbb{R}_\imath\,(\imath=1,2,\ldots,\mathrm{m})$. $\Delta_{\Xi_{\ell m}}$ and $\mathscr{G}_{\Xi_{\ell m}}$ designate the nutral grade function and *−ve* grade function, respectively. The decision matrix of SVNNs can be obtained based from assessment data: $\Xi=(\Xi_{\mathfrak{J}\imath})_{\ell m}$.

The procedure for determining the best alternative using EDAS methodology depends on SVN Acz-Als aggregation information is prsented as the following steps: Step-1: Select a series of attributes that are suitable for use in evaluating the problem under consideration:

The prospective assessment characteristics are gathered via a study of the literature, and an expert DM committee is created to screen the attributes in order to develop an acceptable collection of evaluation attributes $\mathbb{R}_\imath\,(\imath=1,2,\ldots,\mathrm{m})$.

$$D_{\mathfrak{J}\times\imath}=\begin{array}{c}\\ R_1\\ R_2\\ \vdots\\ R_\ell\end{array}\begin{array}{c}\begin{array}{ccc}\mathbb{R}_1 & \mathbb{R}_2 & \mathbb{R}_m\end{array}\\ \left(\begin{array}{cccc}\left(\overline{O}_{\Xi_{11}},\Delta_{\Xi_{11}},\mathscr{G}_{\Xi_{11}}\right) & \left(\overline{O}_{\Xi_{12}},\Delta_{\Xi_{12}},\mathscr{G}_{\Xi_{12}}\right) & \cdots & \left(\overline{O}_{\Xi_{1m}},\Delta_{\Xi_{1m}},\mathscr{G}_{\Xi_{1m}}\right)\\ \left(\overline{O}_{\Xi_{21}},\Delta_{\Xi_{21}},\mathscr{G}_{\Xi_{21}}\right) & \left(\overline{O}_{\Xi_{22}},\Delta_{\Xi_{22}},\mathscr{G}_{\Xi_{22}}\right) & \cdots & \left(\overline{O}_{\Xi_{2m}},\Delta_{\Xi_{2m}},\mathscr{G}_{\Xi_{2m}}\right)\\ \vdots & \vdots & \ddots & \vdots\\ \left(\overline{O}_{\Xi_{\ell1}},\Delta_{\Xi_{\ell1}},\mathscr{G}_{\Xi_{\ell1}}\right) & \left(\overline{O}_{\Xi_{\ell2}},\Delta_{\Xi_{\ell2}},\mathscr{G}_{\Xi_{\ell2}}\right) & \cdots & \left(\overline{O}_{\Xi_{\ell m}},\Delta_{\Xi_{\ell m}},\mathscr{G}_{\Xi_{\ell m}}\right)\end{array}\right)\end{array}. \tag{35}$$

Step 2. Normalization is used to obtain the normalised decision matrix as:

$$\mathcal{N}_{\mathfrak{J}\times 1} = \begin{cases} \left(\overline{O}_{\Xi_{\mathfrak{J}_1}}, \Delta_{\Xi_{\mathfrak{J}_1}}, \mathcal{G}_{\Xi_{\mathfrak{J}_1}}\right) & if \quad C_I \\ \left(\mathcal{G}_{\Xi_{\mathfrak{J}_1}}, \Delta_{\Xi_{\mathfrak{J}_1}}, \overline{O}_{\Xi_{\mathfrak{J}_1}}\right) & if \quad C_{II} \end{cases}, \tag{36}$$

where C_I refers to "if $\mathbb{R}_\imath$ ($\imath = 1, 2, ..., m$) is a benefit criterion" and C_{II} refers to "if $\mathbb{R}_\imath$ ($\imath = 1, 2, ..., m$) is a cost criterion".

Step 3. Aggregated Data: Established SVN Acz-Als operators are utilized to aggregate the specialists uncertain data of D-S problems.

$$SV-NAWG(\Xi_1, \Xi_2, \ldots, \Xi_\ell) = \prod_{\mathfrak{J}=1}^{\ell} (\Xi_{\mathfrak{J}})^{\varpi_{\mathfrak{J}}} = \left\{ \begin{array}{c} e^{-\left(\sum_{\mathfrak{J}=1}^{\ell} \varpi_{\mathfrak{J}}\left(-\ell n' \overline{O}_{\Xi_{\mathfrak{J}}}\right)^{\wp}\right)^{1/\wp}}, 1 - e^{-\left(\sum_{\mathfrak{J}=1}^{\ell} \varpi_{\mathfrak{J}}\left(-\ell n'\left(1 - \Delta_{\Xi_{\mathfrak{J}}}\right)\right)^{\wp}\right)^{1/\wp}}, \\ 1 - e^{-\left(\sum_{\mathfrak{J}=1}^{\ell} \varpi_{\mathfrak{J}}\left(-\ell n'\left(1 - \mathcal{G}_{\Xi_{\mathfrak{J}}}\right)\right)^{\wp}\right)^{1/\wp}} \end{array} \right\}. \tag{37}$$

Step 4. Determine the average solution ($A_V S$) depends on all provided characteristics:

$$A_V S = [A_V S_\imath]_{1\times m} = \left[\frac{\sum_{\mathfrak{J}=1}^{\ell} (\Xi_{\mathfrak{J}_1})}{\ell}\right]_{1\times m} \tag{38}$$

Based on Definition 11, we get

$$A_V S = [A_V S_\imath]_{1\times m} = \left[\frac{\sum_{\mathfrak{J}=1}^{\ell} (\Xi_{\mathfrak{J}_1})}{\ell}\right]_{1\times m} = \left\{ \begin{array}{c} 1 - e^{-\left(\sum_{\mathfrak{J}=1}^{\ell} 1/\ell\left(-\ell n'\left(1 - \overline{O}_{\Xi_{\mathfrak{J}_1}}\right)\right)^{\wp}\right)^{1/\wp}}, e^{-\left(\sum_{\mathfrak{J}=1}^{\ell} 1/\ell\left(-\ell n' \Delta_{\Xi\mathfrak{J}_1}\right)^{\wp}\right)^{1/\wp}}, \\ e^{-\left(\sum_{\mathfrak{J}=1}^{\ell} 1/\ell\left(-\ell n' \mathcal{G}_{\Xi_{\mathfrak{J}_1}}\right)^{\wp}\right)^{1/\wp}} \end{array} \right\}. \tag{39}$$

Step 5. According to the results of $A_V S$, we can compute the positive distance from average ($\mathrm{PDA_v}$) and negative distance from average ($\mathrm{NDA_v}$) by using the following formula:

$$\begin{aligned} PDA_{v_{\mathfrak{J}_1}} &= \frac{\max\left(0, \left(\Xi_{\mathfrak{J}_1} - A_V S_\imath\right)\right)}{A_V S_\imath}, \\ NDA_{v_{\mathfrak{J}_1}} &= \frac{\max\left(0, \left(A_V S_\imath - \Xi_{\mathfrak{J}_1}\right)\right)}{A_V S_\imath}. \end{aligned} \tag{40}$$

We may adopt the score function of SVNNs described in Definition 8 to compute the PDA and NDA as follows:

$$\begin{aligned} PDA_{v_{\mathfrak{J}_1}} &= \frac{\max\left(0, \left(\mathcal{Q}\left(\Xi_{\mathfrak{J}_1}\right) - \mathcal{Q}\left(A_V S_\imath\right)\right)\right)}{\mathcal{Q}\left(A_V S_\imath\right)}, \\ NDA_{v_{\mathfrak{J}_1}} &= \frac{\max\left(0, \left(\mathcal{Q}\left(A_V S_\imath\right) - \mathcal{Q}\left(\Xi_{\mathfrak{J}_1}\right)\right)\right)}{\mathcal{Q}\left(A_V S_\imath\right)}, \end{aligned} \tag{41}$$

where $\mathcal{Q}$ represented the score value.

Step 6. Determine SPDA and SNDA, which represent the weighted average of PDA and NDA as follows:

$$\begin{aligned} SPDA_{\mathfrak{J}} &= \sum_{\imath=1}^{m} \varpi_\imath PDA_{v_{\mathfrak{J}_1}}, \\ SNDA_{\mathfrak{J}} &= \sum_{\imath=1}^{m} \varpi_\imath NDA_{v\mathfrak{J}_1}, \end{aligned} \tag{42}$$

Where $\varpi_\imath \in [0, 1], \sum_{\imath=1}^{m} \varpi_\imath = 1$.

Step 7. Normalize weighted sum of PDA and NDA is denoted and defined as respectively:

$$\begin{aligned} NSPDA_{\mathfrak{J}} &= \frac{SPDA_{\mathfrak{J}}}{\max\left(SP\ DA_{\mathfrak{J}}\right)}, \\ NSNDA_{\mathfrak{J}} &= \frac{SNDA_{\mathfrak{J}}}{\max\left(SNDA_{\mathfrak{J}}\right)}. \end{aligned} \tag{43}$$

Step 8. Compute the values of appraisal score (ASC) depends on each alternative's as:

$$ASC_{\mathfrak{J}} = \frac{1}{2}\left(NSPDA_{\mathfrak{J}} + 1 - NSNDA_{\mathfrak{J}}\right). \tag{44}$$

Step 9. Depending on the calculating values of ASC,alternatives are ranked in a decreasing order, and the bigger value of $ASC_{\mathfrak{J}}$ is the best alternative selected will be.

6. Numerical Illustration of EDAS Method

In order to authenticate the effectiveness and appropriate of the developed technique, We call on Akram and Khan [53]'s example related to the role of commercial banks in providing loans to their customers to validate the MAGDM method, and perform a sensitivity analysis and comparative analysis with other existing methods. The problem is described below.

6.1. Case Study. Low pricing are offered to clients by commercial banks. Like wholesale corporations, clients purchase large quantities and then resell them at a lower price to other customers. Discounts include free checking, no fees for creating accounts, and reduced interest rates for real estate loans. A debit card, credit card, or both are all options available at commercial banks, as are investment accounts, commercial real estate loans, and mortgage plans. In addition to managing their checking and savings accounts, customers may use Internet banking to pay bills, move money between accounts, apply for short- and long-term loans, and more. Using a 24-hour ATM, a client may maintain control of their accounts even if their bank is closed. Long and short-term loans are both available from commercial banks. Long-term loans are available to help a variety of businesses get their start-up capital. Suppose a customer is looking for financing for his food business. He had a list of five banks and wanted to check out. He called a DM specialist to help him choose a bank that could lend him money, and the expert looked at the following criteria:

(1) Markup and penalty ($\mathbb{R}_1$);
(2) Customers' guarantee requirements and regulations ($\mathbb{R}_2$);
(3) Paperwork costs and customer packages ($\mathbb{R}_3$);
(4) Procedural time and credit time ($\mathbb{R}_4$);
(5) safe and secure banking ($\mathbb{R}_5$).

In this evaluation, experts were requested to utilize SV neutrosophic information to determine the best bank for business loans.

Table 1 summarizes the expert assessment data for SVNNs:

Cost type SVN information is given in I_2 and I_4. Therefore the normalised expert evaluation decision information matrix is enclosed in Table 2:

Because there is just one expert in this case study, we do not need to calculate the cumulative decision matrix.

As per Table 2, we may use formula (3) to get the $A_V S$ depends on all provided characteristics.

$$A_V S_2 = \left\{ \begin{array}{c} \left(1 - e^{-\left(\begin{array}{c} 1/5 * (-\ell og(1-0.5))^5 + 1/5 * (-\ell og(1-0.7))^5 + 1/5 * (-\ell og(1-0.6))^5 + \\ 1/5 * (-\ell og(1-0.7))^5 + 1/5 * (-\ell og(1-0.5))^5 \end{array} \right)^{1/5}} \right) \\ \left(e^{-\left(1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.1))^5\right)^{1/5}} \right) \\ \left(e^{-\left(1/5 * (-\ell og(0.3))^5 + 1/5 * (-\ell og(0.3))^5 + 1/5 * (-\ell og(0.4))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.2))^5\right)^{1/5}} \right) \end{array} \right\}$$

$$= (0.447278, 0.157468, 0.245549).$$

$$A_V S_3 = \left\{ \begin{array}{c} \left(1 - e^{-\left(\begin{array}{c} 1/5 * (-\ell og(1-0.2))^5 + 1/5 * (-\ell og(1-0.6))^5 + 1/5 * (-\ell og(1-0.6))^5 + \\ 1/5 * (-\ell og(1-0.4))^5 + 1/5 * (-\ell og(1-0.4))^5 \end{array} \right)^{1/5}} \right) \\ \left(e^{-\left(1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.3))^5 + 1/5 * (-\ell og(0.1))^5 + 1/5 * (-\ell og(0.5))^5 + 1/5 * (-\ell og(0.1))^5\right)^{1/5}} \right) \\ \left(e^{-\left(1/5 * (-\ell og(0.6))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.5))^5\right)^{1/5}} \right) \end{array} \right\}$$

$$= (0.69715, 0.141507, 0.23343).$$

$$A_V S_4 = \left\{ \begin{array}{c} \left(1 - e^{-\left(\begin{array}{c} 1/5 * (-\ell og(1-0.3))^5 + 1/5 * (-\ell og(1-0.6))^5 + 1/5 * (-\ell og(1-0.5))^5 + \\ 1/5 * (-\ell og(1-0.5))^5 + 1/5 * (-\ell og(1-0.4))^5 \end{array} \right)^{1/5}} \right) \\ \left(e^{-\left(1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.4))^5 + 1/5 * (-\ell og(0.1))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.3))^5\right)^{1/5}} \right) \\ \left(e^{-\left(1/5 * (-\ell og(0.4))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.3))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.6))^5\right)^{1/5}} \right) \end{array} \right\}$$
$$= (0.606536, 0.168535, 0.252183).$$
$$A_V S_5 = \left\{ \begin{array}{c} \left(1 - e^{-\left(\begin{array}{c} 1/5 * (-\ell og(1-0.3))^5 + 1/5 * (-\ell og(1-0.7))^5 + 1/5 * (-\ell og(1-0.6))^5 + \\ 1/5 * (-\ell og(1-0.4))^5 + 1/5 * (-\ell og(1-0.3))^5 \end{array} \right)^{1/5}} \right) \\ \left(e^{-\left(1/5 * (-\ell og(0.3))^5 + 1/5 * (-\ell og(0.1))^5 + 1/5 * (-\ell og(0.4))^5 + 1/5 * (-\ell og(0.5))^5 + 1/5 * (-\ell og(0.2))^5\right)^{1/5}} \right) \\ \left(e^{-\left(1/5 * (-\ell og(0.4))^5 + 1/5 * (-\ell og(0.2))^5 + 1/5 * (-\ell og(0.3))^5 + 1/5 * (-\ell og(0.4))^5 + 1/5 * (-\ell og(0.4))^5\right)^{1/5}} \right) \end{array} \right\}$$
$$= (0.642351, 0.176204, 0.28647). \tag{45}$$

Then we can get the value of $A_V S_1$ as

$$A_V S_1 = \left\{ \begin{array}{c} (0.513968, 0.143849, 0.278161), (0.447278, 0.157468, 0.245549), \\ (0.69715, 0.141507, 0.23343), (0.606536, 0.168535, 0.252183), \\ (0.642351, 0.176204, 0.28647) \end{array} \right\}. \tag{46}$$

According to the results of average solution $A_V S_1$, we can compute the positive distance from average (PDA ν) and negative distance from average (NDA ν) by using formula (5) which are listed in Tables 3–5.

Calculate the values of $SP\ DA_{\mathfrak{J}}$ and $SN\ DA_{\mathfrak{J}}$ by (6) and attributes weighting vector $\varpi = (0.15, 0.28, 0.20, 0.22, 0.15)$, we can obtain the results as:

$$\begin{aligned} SPDA_1 &= 0.00\, SP\ DA_2 = 1.50\, SP\ DA_3 = 0.00\, SP\ DA_4 = 1.79\, SP\ DA_5 = 0.98 \\ SNDA_1 &= 2.38\, SN\ DA_1 = 0.35\, SN\ DA_1 = 1.10\, SN\ DA_1 = 1.05\, SN\ DA_1 = 1.68 \\ NSNDA_1 &= 2.16\, NSN\ DA_2 = 0.323\, NSND_3 = 1.00 \\ NSNDA_4 &= 0.95\, NSN\ DA_5 = 1.526. \end{aligned} \tag{47}$$

Normalize weighted sum of PDA and NDA are evaluated by (7) as follows:

$$\begin{aligned} &NSP\ DA_1 = 0.00\, NSP\ DA_2 = 1.53\, NSP\ DA_3 = 0.00 \\ &NSP\ DA_4 = 1.82\, NSP\ DA_5 = 1.00. \end{aligned} \tag{48}$$

Compute the values of appraisal score (ASC) depends on each alternative's NSPDA and NSNDA as:

$$\begin{aligned} &ASC_1 = -0.580\, ASC_2 = 1.103\, ASC_3 = 0.000 \\ &ASC_4 = 0.933\, ASC_5 = 0.236. \end{aligned} \tag{49}$$

Based on ASC results, we may rate all of the possibilities; the greater ASC, the better the alternative selected. Obviously, ranking results are and is the best alternative.

7. Comparison of EDAS Method with Some Aggregation Operators under SVNNs

In order to evaluate the established EDAS approach's potential and effectiveness and to compare it with new discoveries, we've included some applicable instances below.

Table 1: Expert evaluation information.

	R_1	R_2	R_3	R_4	R_5
$\varnothing_1$	$(0.5, 0.3, 0.4)$	$(0.3, 0.2, 0.5)$	$(0.2, 0.2, 0.6)$	$(0.4, 0.2, 0.3)$	$(0.3, 0.3, 0.4)$
$\varnothing_2$	$(0.7, 0.1, 0.3)$	$(0.3, 0.2, 0.7)$	$(0.6, 0.3, 0.2)$	$(0.2, 0.4, 0.6)$	$(0.7, 0.1, 0.2)$
$\varnothing_3$	$(0.5, 0.3, 0.4)$	$(0.4, 0.2, 0.6)$	$(0.6, 0.1, 0.2)$	$(0.3, 0.1, 0.5)$	$(0.6, 0.4, 0.3)$
$\varnothing_4$	$(0.7, 0.3, 0.2)$	$(0.2, 0.2, 0.7)$	$(0.4, 0.5, 0.2)$	$(0.2, 0.2, 0.5)$	$(0.4, 0.5, 0.4)$
$\varnothing_5$	$(0.4, 0.1, 0.3)$	$(0.2, 0.1, 0.5)$	$(0.4, 0.1, 0.5)$	$(0.6, 0.3, 0.4)$	$(0.3, 0.2, 0.4)$

Table 2: Normalized expert data.

	R_1	R_2	R_3	R_4	R_5
$\varnothing_1$	$(0.5, 0.3, 0.4)$	$(0.5, 0.2, 0.3)$	$(0.2, 0.2, 0.6)$	$(0.3, 0.2, 0.4)$	$(0.3, 0.3, 0.4)$
$\varnothing_2$	$(0.7, 0.1, 0.3)$	$(0.7, 0.2, 0.3)$	$(0.6, 0.3, 0.2)$	$(0.6, 0.4, 0.2)$	$(0.7, 0.1, 0.2)$
$\varnothing_3$	$(0.5, 0.3, 0.4)$	$(0.6, 0.2, 0.4)$	$(0.6, 0.1, 0.2)$	$(0.5, 0.1, 0.3)$	$(0.6, 0.4, 0.3)$
$\varnothing_4$	$(0.7, 0.3, 0.2)$	$(0.7, 0.2, 0.2)$	$(0.4, 0.5, 0.2)$	$(0.5, 0.2, 0.2)$	$(0.4, 0.5, 0.4)$
$\varnothing_5$	$(0.4, 0.1, 0.3)$	$(0.5, 0.1, 0.2)$	$(0.4, 0.1, 0.5)$	$(0.4, 0.3, 0.6)$	$(0.3, 0.2, 0.4)$

Table 4: The valus of $P\ DA_v$.

	R_1	R_2	R_3	R_4	R_5
$\varnothing_1$	0.0	0.0	0.0	0.0	0.0
$\varnothing_2$	2.262	3.518	0.0	0.0	1.226
$\varnothing_3$	0.0	0.0	0.0	0.0	0.0
$\varnothing_4$	1.174	5.777	0.0	0.0	0.0
$\varnothing_5$	0.0	3.518	0.0	0.0	0.0

Table 3: Score value of $Z_{\mathfrak{J}_1}$ and $A_V S_1$.

	R_1	R_2	R_3	R_4	R_5
$\varnothing_1$	0.2	0	−0.6	−0.3	−0.4
$\varnothing_2$	0.3	0.2	0.1	0	0.4
$\varnothing_3$	−0.2	0	0.3	0.1	−0.1
$\varnothing_4$	0.2	0.3	−0.3	0.1	−0.5
$\varnothing_5$	0	0.2	−0.2	−0.5	−0.3
$A_V S_1$	0.0919	0.0442	0.3222	0.1858	0.1796

Table 5: The valus of NDA_v.

	R_1	R_2	R_3	R_4	R_5
$\varnothing_1$	3.174	1.00	2.862	2.614	3.226
$\varnothing_2$	0.00	0.00	0.689	1.00	0.00
$\varnothing_3$	3.174	1.00	0.068	0.461	3.782
$\varnothing_4$	0.00	0.00	1.931	0.461	3.782
$\varnothing_5$	1.00	0.00	1.620	3.690	2.669

Table 6: SVN Acz-A1s geometric $AOSVNAWG$.

$\varnothing_1$	$(0.354965, 0.228894, 0.413376)$
$\varnothing_2$	$(0.658326, 0.226143, 0.24175)$
$\varnothing_3$	$(0.562678, 0.194736, 0.321488)$
$\varnothing_4$	$(0.54847, 0.316751, 0.228029)$
$\varnothing_5$	$(0.410712, 0.152477, 0.392657)$

Table 7: Exisiting Aggregated SVN information.

	$SVNWA$ [54]	$SVNOWA$ [54]	NWA [55]	$SVNFWA$ [42]
$\varnothing_1$	$(0.37, 0.22, 0.40)$	$(0.38, 0.24, 0.40)$	$(0.37, 0.23, 0.42)$	$(0.37, 0.22, 0.40)$
$\varnothing_2$	$(0.66, 0.20, 0.23)$	$(0.66, 0.18, 0.24)$	$(0.66, 0.24, 0.24)$	$(0.66, 0.20, 0.23)$
$\varnothing_3$	$(0.56, 0.17, 0.31)$	$(0.55, 0.18, 0.31)$	$(0.56, 0.21, 0.32)$	$(0.56, 0.17, 0.31)$
$\varnothing_4$	$(0.57, 0.29, 0.22)$	$(0.57, 0.31, 0.22)$	$(0.57, 0.33, 0.23)$	$(0.56, 0.29, 0.22)$
$\varnothing_5$	$(0.41, 0.14, 0.36)$	$(0.39, 0.13, 0.36)$	$(0.41, 0.16, 0.41)$	$(0.41, 0.14, 0.36)$

Table 8: Existing aggregated SVN information.

	$SVNHWA$ [40]	$SVNHWA$ [40]	$L-SVNWA$ [55]	$L-SVNOWA$ [55]
$\varnothing_1$	$(0.37, 0.22, 0.40)$	$(0.36, 0.22, 0.40)$	$(0.31, 0.17, 0.35)$	$(0.32, 0.19, 0.36)$
$\varnothing_2$	$(0.66, 0.20, 0.23)$	$(0.66, 0.20, 0.23)$	$(0.64, 0.19, 0.23)$	$(0.65, 0.17, 0.23)$
$\varnothing_3$	$(0.56, 0.17, 0.31)$	$(0.56, 0.30, 0.22)$	$(0.49, 0.17, 0.33)$	$(0.48, 0.18, 0.33)$
$\varnothing_4$	$(0.56, 0.29, 0.22)$	$(0.56, 0.30, 0.22)$	$(0.55, 0.27, 0.19)$	$(0.55, 0.29, 0.19)$
$\varnothing_5$	$(0.41, 0.14, 0.36)$	$(0.41, 0.14, 0.37)$	$(0.28, 0.12, 0.37)$	$(0.24, 0.12, 0.38)$

Table 9: Existing aggregated SVN information.

	$ST-SVNWA$ [43]	$ST-SVNWG$ [43]	$ST-SVNOWA$ [43]	$ST-SVNOWG$ [43]
$\varnothing_1$	$(0.56, 0.02, 0.07)$	$(0.50, 0.02, 0.08)$	$(0.56, 0.02, 0.08)$	$(0.51, 0.03, 0.08)$
$\varnothing_2$	$(0.86, 0.02, 0.02)$	$(0.85, 0.03, 0.03)$	$(0.86, 0.01, 0.02)$	$(0.85, 0.02, 0.03)$
$\varnothing_3$	$(0.77, 0.01, 0.04)$	$(0.76, 0.02, 0.05)$	$(0.77, 0.01, 0.04)$	$(0.76, 0.03, 0.05)$
$\varnothing_4$	$(0.78, 0.04, 0.02)$	$(0.73, 0.06, 0.02)$	$(0.78, 0.04, 0.02)$	$(0.72, 0.06, 0.02)$
$\varnothing_5$	$(0.60, 0.09, 0.06)$	$(0.59, 0.01, 0.08)$	$(0.58, 0.09, 0.06)$	$(0.57, 0.01, 0.08)$

Table 10: Overall ranking of the alternatives.

Exsisting operations	Ranking	Best alternative
NWA [55]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$SVNWA$ [54]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$SVNOWA$ [54]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$SVNFWA$ [42]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$SVNHWA$ for $\gamma = 2$ [40]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$SVNHWA$ for $\gamma = 3$ [40]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$L-SVNWA$ [55]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$L-SVNOWA$ [55]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$ST-SVNWA$ [43]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$ST-SVNWG$ [43]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$ST-SVNOWA$ [43]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
$ST-SVNOWG$ [43]	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$
SVNAWG (proposed)	$\mathcal{Q}(\varnothing_2) > \mathcal{Q}(\varnothing_3) > \mathcal{Q}(\varnothing_1) > \mathcal{Q}(\varnothing_5) > \mathcal{Q}(\varnothing_4)$	$\varnothing_2$

Table 11: Sensitivity analysis of parameter $\wp$.

Υ	Operators	Score					Ranking best alternative
		$\mathcal{Q}(\varnothing_1)$	$\mathcal{Q}(\varnothing_2)$	$\mathcal{Q}(\varnothing_3)$	$\mathcal{Q}(\varnothing_4)$	$\mathcal{Q}(\varnothing_5)$	
$\longrightarrow 0.2$	$SVNAWG$	−0.274	0.203	0.060	0.025	−0.113	$\varnothing_2$
$\longrightarrow 1$	$SVNAWG$	−0.309	0.168	0.022	−0.034	−0.168	$\varnothing_2$
$\longrightarrow 2$	$SVNAWG$	−0.352	0.129	−0.022	−0.107	−0.232	$\varnothing_2$
$\longrightarrow 5$	$SVNAWG$	−0.464	0.051	−0.116	−0.265	−0.357	$\varnothing_2$
$\longrightarrow 10$	$SVNAWG$	−0.562	−0.010	−0.189	−0.372	−0.450	$\varnothing_2$
$\longrightarrow 15$	$SVNAWG$	−0.606	−0.038	−0.223	−0.413	−0.494	$\varnothing_2$
$\longrightarrow 30$	$SVNAWG$	−0.652	−0.068	−0.260	−0.456	−0.546	$\varnothing_2$

Table 12: Comparision.

Techniques	Whether utilized fuzzy data	Whether make a data aggregationthrough parameter
Peng et al. [54]	Yes	No
Nancy and Gar [55]	Yes	No
Developed method	Yes	Yes

The expert evaluation information under SVNNs is given in Table 1.

Now we apply proposed single valued neutrosophic Acz-Als geometric AOs to adrress the uncertainty and chose the best alternative as follows in Table 6:

Tables 7–9 illustrate how existing techniques of AOs are used to aggregate the ambiguous information.

Now, according to collective data, the overall ranking of alternative is in the following Table 10.

Based on the outcomes of the recommended operators and the previously employed methodologies, we may deduce that the ranking lists are identical. Based on Acz-Als aggregation operations depends EDAS technique is generalized and new way to dealing with uncertainty in DM situations. It is more flexible and economical in real-world issues to use Acz-Als norm-depends aggregate operators in a single valued NS context.

7.1. Sensitivity Analysis. Using the given SVN Acz-Als aggregation approaches, we change the parameter $\wp$ value from 0 to 30 in this section to investigate the different patterns of scores and ranking of the alternatives. The findings from suggested SVNAWG operator is listed in Table 11. The obtained results illustrate to decision-makers that they can obtain the best option depends on their preferences.

Attribute analysis within a few previous techniques are as follows in Table 12.

8. Conclusion

In this study, we extended Acz-Als t-norm and t-conorm to single-valued neutrosophic scenarios, suggested a few novel working rules for SVNNs, and studied their properties and linkages in this research. This led to the development of an additional set of aggregate operators, including an Acz-Als depends approach for dealing with conflicts in SVNNs, which were introduced at that time. Various attractive qualities and special circumstances of these operators, as well as the connections between these operators, have recently been investigated in more depth. The suggested operators and decision making methodology, along with SVN data, were placed on MAGDM problems, and to demonstrate the DM procedure, a mathematical formulation was offered. The influence of parameter $\wp$ on the results of DM has been investigated. Operators may be used to find the best solution by adjusting a parameter $\wp$. This means that decision-makers now have a more flexible way for addressing the problems of SVN-MAGDM. The aggregation process is more clearly observable when a parameter is provided, making it easier to represent ambiguous information than other existing methodologies. The existing AOs [54, 55], on the other hand, do not make data aggregation more flexible. It is because of this that our suggested AOs in SVN data DM are more complex and trustworthy.

We will investigate the use of Acz-Als weighted AOs of SVNNs in additional domains, such as intelligent manufacturing, machine learning, and data mining, in future research.

Data Availability

The data utilized in this article is hypothetical any one can be use just citing this article.

Ethical Approval

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

Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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