A New Hybrid Neutrosophic Multi-Criteria Decision Methodology Model for Ranking Risks in International Business Administration

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Abstract

Due to the complexity and unpredictability of today's globalized business world, managing an international business administration (IBAS) is not without its share of risks. The necessity of efficient risk management in international business administrations is highlighted, and a summary of the main hazards that companies encounter when doing business across borders is provided in this paper. The political, economic, legal, cultural, operational, financial, compliance, competitive, environmental, sustainability, and cybersecurity risks are identified and categorized in the paper as the most significant risks in international company administrations. It stresses how important it is to recognize and manage these threats to international corporate success and longevity. This article examines the effects of political risks on international commerce, including political instability, changes in government policy, and trade barriers. It draws attention to economic risks that might have an impact on pricing, profitability, and financial performance, such as swings in exchange rates, inflation, and economic instability. This work applied the neutrosophic set with multi-criteria decision-making (MCDM) models to rank the risks in IBAS. This paper used the neutrosophic MABAC and neutrosophic COPRAS methods to rank these risks. These methods are compared with the PROMETHEE method. The results show the suggested technique is an effective model to deal with this kind of problem.

Keywords: Neutrosophic Set; MABAC; COPRAS; PROMETHEE; Risks; MCDM

1. Introduction

As markets have become more interconnected worldwide, international business administration has been met with a wide range of new possibilities and problems. When businesses begin operating on a global scale, they face several hazards that might have a severe effect on their long-term viability. For success in the worldwide market, organizations must understand and manage these risks. This work aims to examine and analyze the many threats that come with managing an international firm, illuminating the elements that most affect risk exposure and recommending methods for lowering those risks[1], [2].

Recent decades have seen a rise in the importance of international business administration due to developments in trade liberalization, technological breakthroughs, and the connectivity of economies throughout the world. More and more businesses are expanding into untapped areas in search of more customers, better resources, and a leg up on the competition. However, there are several potential threats to a company's operations, finances, and ultimate goals that arise with international expansion. Successfully navigating the intricacies of global business depends on companies recognizing and managing these risks[3], [4].

This study's overarching goal is to familiarize the companies with all the potential downsides of managing a worldwide firm. The study tries to identify the primary causes of risk exposure encountered by organizations functioning on a global scale by investigating the interplay of political, economic, legal, cultural, and technical issues. The study also intends to examine how these risks affect company output and to provide practical risk management approaches that businesses may use to lessen their negative effects. This means that ranking the risks in IBAS is best understood as a kind of MCDM. In today's increasingly complicated world, a single DM can't handle all the problems that may arise[5], [6].

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There is growing ambiguity and uncertainty in describing and judging things as a result of the growing complexity of objective objects and the limits of human intellect. Because of this ambiguity, it is difficult for DMs to provide concrete evaluations of their cognitive preferences. To cope with indecision and vagueness in decision-making, a more realistic method may use language evaluations with interim values rather than precise numerical values. As a result, several effective ways for collecting the ratings of DMs have developed. While these methods are useful, they are limited in that they can only be used to characterize the unknown in terms of groups of membership degrees and non-membership degrees. Based on a generalization of these sets, Smarandache created the neutrosophic set, which quantifies the indeterminacy by taking into account the impact of truth-membership and falsity-membership[7], [8].

Mathematical simulations of hesitation, vagueness, and inaccuracy may be represented using neutrosophic set logic, and the logic can be used to pre-digest the undefined, incomplete, and conflicting information that is characteristic of real-world issues[9], [10]. Smarandache [11]built the pathogenic set off of the neutrosophic set to get the essential information features among standards, and he also accounted for the grade of appurtenance and inconsistency when mixing standards assessment data, which is crucial for increasing the reliability of DMs' personal judgments and decreasing vagueness. Since then, several academics have successfully applied this idea in MCDM problem-solving[12], [13].

This means using the right method of decision-making to rank the available options is essential. Numerous traditional ranking methods, including TOPSIS, VIKOR, and COPRAS (complex proportional assessment), have been created by researchers to address MCDM issues with ambiguous data[14], [15]. Additionally, the COPRAS approach offers the benefits of easy operation, less time required, and the ability to concurrently examine the proportions of multiple feature standards, in contrast to other techniques such as SAW, TODIM, and DEMATEL[16], [17].

Therefore, DMs may augment their decision-making approach under ambiguity by using COPRAS in order to achieve the best financing option based on the relative relevance and usefulness value of the criterion data[18], [19]. To cope with the inaccuracy and ambiguity that may happen in daily life[20], Wei et al. and Mishra et al. expanded the COPRAS-with making choices framework to the neutrosophic 2-tuple language and intuitionistic fuzzy surroundings, accordingly[21], [22].

Both major multinational organizations and smaller, medium-sized businesses (SMEs) with worldwide operations will be taken into account as this study examines the unique hazards associated with international business administration. Political, economic, legal, cultural, technical, and strategic aspects are only some of the areas that will be covered in this article while discussing potential dangers. It will also look at how these risks interact with one another and affect things like corporate strategy, supply chain management, legal adherence, and bottom-line results. The article will follow a logical outline, starting with an introduction to the main types of risk and moving on to more in-depth discussions of individual risks and their consequences[23], [24].

Organizations seeking long-term development and profitability in today's increasingly interconnected world must understand international business administration risks and develop strategies to mitigate them. This study will help businesses negotiate the intricacies of global marketplaces by providing essential insights and actionable suggestions for risk identification, assessment, and mitigation. This work intends to add to the current form of information and provide the groundwork for well-informed decision-making and strategic planning by emphasizing the importance of risk management in international business administration[25], [26].

2. Risks in International Business Administration

Risks in international business administration may be evaluated in terms of their possible effect and probability using several factors. In international business administration, risks are often assessed using the following criteria:

The probable monetary effects of a risk occurrence on the company are evaluated according to these criteria. It entails calculating what may be lost or gained financially as a result of the risk. Loss of income, higher costs, changes in exchange rates, and possible legal or regulatory fines or penalties are just some of the things to keep in mind.[27], [28]

These criteria look at how a risk occurrence could affect the company's day-to-day operations. Production, supply chain management, logistics, distribution networks, and business continuity are all factors that need to be considered. The possible effect on customer service, product quality, and delivery times is also taken into account in this criteria[29], [30].

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The probable repercussions of breaking local laws, rules, and standards are evaluated concerning these criteria. Assessing the legal risks of doing business in the target market entails examining the local legal system and regulations. It's important to think about things like trade rules, intellectual property protection, labor legislation, and possible legal conflicts.

Reputational Impact Considers how a risk occurrence could affect public perception of the company and its products. Problems with a company's reputation may result from things like unethical behavior, social responsibility lapses, recalled products, accidents, or bad press. Damage to a company's image may have a significant impact on its ability to attract and retain customers, as well as on its ability to attract and retain investors.

Potential effects of political, economic, and social elements that are unique to the target nation or area are taken into account in this criteria. It entails taking into account things like the state of the government and its policies, the state of the economy, the level of civil discontent, and the possible dangers posed by other countries. Assessing the entire business climate and making educated judgments requires an understanding of the political and country-specific risks involved[30], [31].

The possible effect of a risk occurrence on the organization's long-term strategies and objectives is evaluated using this criterion. Implications for market entrance, expansion, partnership, acquisition, or new product introduction strategies are analyzed. Strategic impact analysis aids in determining whether or not the risk is in line with the organization's overall goals and whether or not the benefits exceed the costs.

Likelihood or probability is a metric that determines how likely it is that a danger will materialize. Estimating the possibility of a risk occurring entails looking at past data, trends in the sector, expert views, and market research. Probability analysis aids in risk prioritization and resource distribution.

Organizations may perform a thorough risk assessment in international business administration by thinking about these factors and using the results to identify and rank hazards.

Managing a company's affairs across international boundaries is a complex task that requires knowledge of and experience with a wide range of dangers and opportunities. The following are examples of some of the most significant dangers in managing a worldwide business:

International companies face risks associated with the governmental and legal systems of the states in which their processes are based. Disruptions in operations, altered market access, and monetary losses are all possible outcomes of political turmoil, civil strife, and rapid policy adjustments[29], [30].

Exchange rate fluctuations, inflation, economic downturns, and financial crises in foreign markets are all examples of economic risks that may hurt the profitability and financial stability of multinational firms. Import prices may rise, and income obtained in foreign currencies may be worth less if the local currency has been devalued.

Compliance and Regulatory Dangers Doing business internationally requires familiarity with a wide variety of legal and regulatory systems. Legal challenges, penalties, reputational harm, and interruptions in operations are all possible outcomes of failing to comply with local laws, rules, and standards[32], [33].

Business operations, communication, and the ability to create relationships may all be hampered by linguistic and cultural hurdles. International company management may be hampered by misunderstandings, cultural incompatibilities, and the inability to adapt to local conventions and practices.

International supply networks face risks from factors including transportation and logistical issues, natural catastrophes, and geopolitical conflicts. Businesses may be more susceptible to supply chain disruptions if they rely on international suppliers and/or have elaborate logistical networks.

Threats to Safety and Security International firms and their employees may be in danger if they operate in countries or areas with high crime rates, political instability, or terrorism. If you're worried about safety, you may need to spend more money on guards, insurance, and other precautions[34], [35].

Intellectual Property Dangers: It might be difficult to safeguard your IP in a global marketplace. Theft of intellectual property, unauthorized use of intellectual property, and the sale of counterfeit goods all threaten a company's capacity to compete and make a profit.

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International corporations are under more pressure to perform ethically and responsibly in response to rising public expectations in this area. Reputational damages, legal penalties, and customer backlash may result from failing to satisfy ethical norms, such as violating workers' rights, damaging the environment, or engaging in corruption.

Challenges may arise in operations management when dealing with employees in diverse locations, time zones, languages, and cultures. Efficiency, productivity, and customer happiness might be negatively affected if problems with logistics, communication, coordination, and quality control arise.

International companies can lessen their exposure to these hazards by conducting risk analyses, planning for the unexpected, setting up robust legal and compliance frameworks, researching the local market, forming strong partnerships with regional players, and keeping their operations fluid and adaptable. Working together with local professionals and consultants is another useful strategy for handling the challenges and minimizing the dangers of managing a worldwide firm[36], [37].

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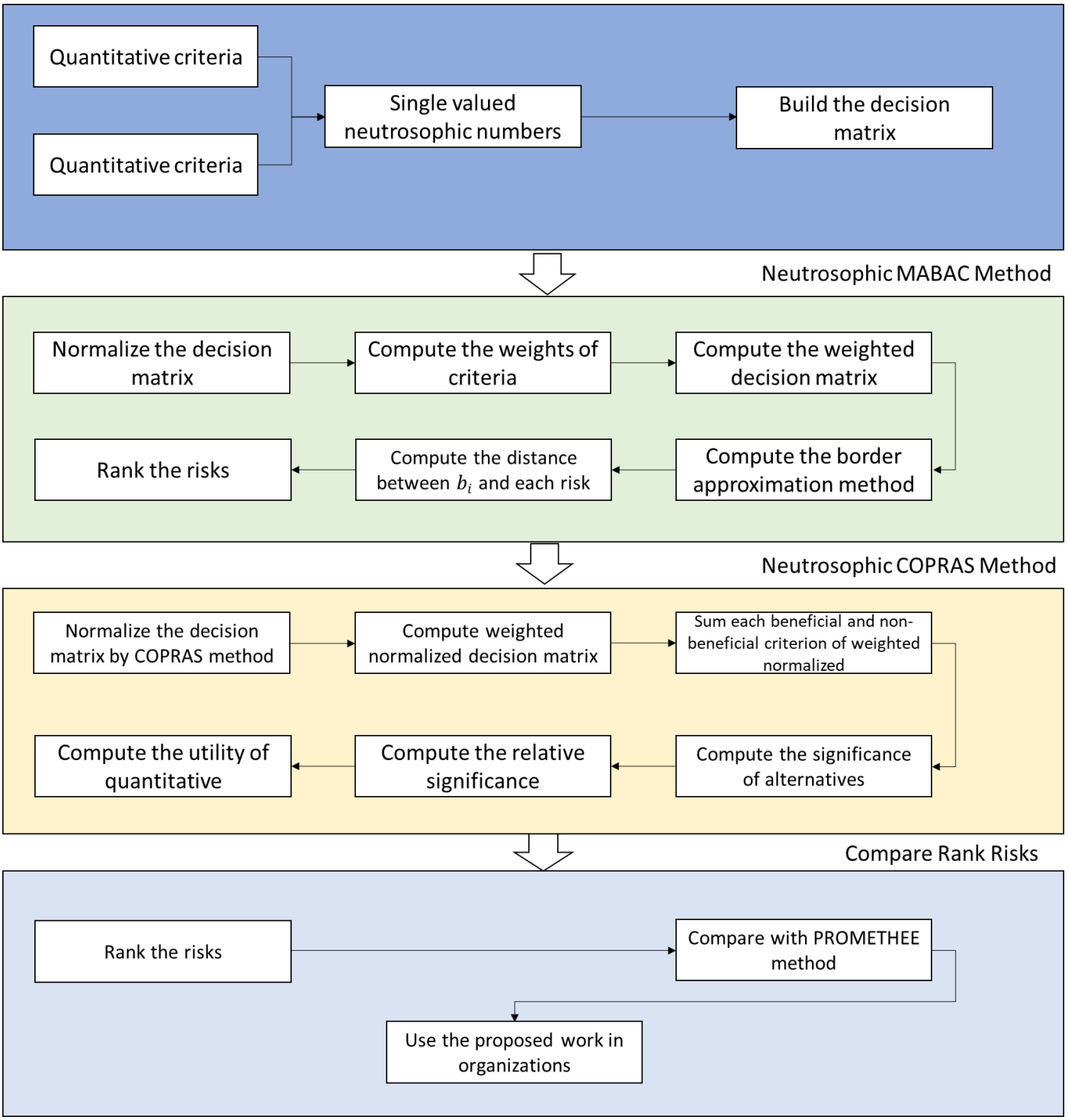

Figure 1: The framework of the hybrid proposed model.

3. Methodologies

Here, we develop a hybrid decision-making framework for ranking risks in IBAS by bringing together the extended MABAC, and COPRAS approaches [38], [39] as shown in Figure 1.

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Smarandache created the mathematical idea of the neutrosophic set (NS) as an overview of the traditional fuzzy set (FS) to better deal with uncertainty. Wang et al. offer a discrete version of NS theory called the single-valued neutrosophic set (SVNS for short). There have been several successful deployments of SVNSs in the real world so far.

Consider two single-valued neutrosophic numbers as $Q_1 = (q_1, q_2, q_3)\ and\ Y_1 = (y_1, y_2, y_3)$, then the mathematical equation is organized as:

$$Q_1^c = (q_3, 1 - q_2, q_1) \quad 1.1$$

$$Q_1 \cup Y_1 = (\max\{q_1, y_1\}, \min\{q_2, y_2\}, \min\{q_3, y_3\}) \quad 1.2$$

$$Q_1 \cap Y_1 = (\min\{q_1, y_1\}, \max\{q_2, y_2\}, \max\{q_3, y_3\}) \quad 1.3$$

$$Q_1 \oplus Y_1 = (q_1 + y_1 - q_1 y_1, q_2 y_2, q_3 y_3) \quad 1.4$$

$$Q_1 \otimes Y_1 = (q_1 y_1, q_2 + y_2 - q_2 y_2, q_3 + y_3 - q_3 y_3) \quad 1.5$$

$$\prec Q_1 = (1 - (1 - q_1)^{\wedge}, q_2^{\wedge}, q_3^{\wedge}) \quad 1.6$$

We can compute the border approximation area by a single-valued neutrosophic set as:

$$g_i = \left(\prod_{i=1}^{m}(T_{ij})^{\frac{1}{m}}, 1 - \prod_{i=1}^{m}(I_{ij})^{\frac{1}{m}}, 1 - \prod_{i=1}^{m}(F_{ij})^{\frac{1}{m}}\right) \quad 1.7$$

$$w_j r_{ij} = \left(1 - \left(1 - T_{ij}\right)^{w_j}, \left(I_{ij}\right)^{w_j}, \left(F_{ij}\right)^{w_j}\right) \quad 1.8$$

The Hausdorff distance between single-valued neutrosophic numbers is computed as

$$D = \max\{|q_1 - y_1|^u, |q_2 - y_2|^u, |q_3 - y_3|^u\}^{\frac{1}{u}} \quad 1.9$$

$$D_w = \begin{pmatrix} \frac{v}{3}\left(|q_1 - y_1|^\lambda + |q_2 - y_2|^\lambda + |q_3 - y_3|^\lambda\right), \\ (1 - v)\max\{|q_1 - y_1|, |q_2 - y_2|, |q_3 - y_3|\} \end{pmatrix} \quad 1.10$$

The similarity measure:

$$S(Q, Y) = 1 - D_w = \begin{pmatrix} 1 - \frac{v}{3}(|q_1 - y_1|, |q_2 - y_2|, |q_3 - y_3|) \\ -(1 - v)\max\{|q_1 - y_1|, |q_2 - y_2|, |q_3 - y_3|\} \end{pmatrix} \quad 1.11$$

3.1 Neutrosophic MABAC Technique

Step 1. Build the decision matrix

The primary stage, building the initial assessment matrix between criteria and alternatives.

$$X = \begin{bmatrix} a_{11} & \cdots & a_{1m} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nm} \end{bmatrix} \quad (1)$$

Step 2. Normalize the assessment matrix.

The assessment matrix should be standardized as:

$$o_{ij} = \begin{cases} \frac{x_{ij} - \min a_{ij}}{\max a_{ij} - \min a_{ij}}\ for\ beneficial\ criteria \\ \frac{\max a_{ij} - x_{ij}}{\max a_{ij} - \min a_{ij}}\ for\ non - beneficial\ criteria \end{cases} \quad (2)$$

Where $n = 1,2,3 \ldots . i; m = 1,2,3, \ldots . j$

Step 3. Calculate the weights of standards

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Step 4. Compute the weighted assessment matrix

$$r_{ij} = w_i \cdot (n_{ij} + 1) \quad (3)$$

Step 5. Calculate the border approximation method

$$b_i = \left(\prod_{j=1}^{m} r_{ij}\right)^{\frac{1}{m}} \quad (4)$$

Step 6. Compute the distance between b_i and each risk

$$Q = R - B \quad (5)$$

Step 7. Rank the risks

$$S_i = \sum_{j=1}^{n} q_{ij} \quad (6)$$

The risks are ranked according to the largest value of S_i

3.2 Neutrosophic COPRAS Method

Zavadskas and Kaklauskas presented the "Complex Proportional Assessment" (or COPRAS) approach, which allows for a comparison of several options and an assessment of which is better. When doing an evaluation that requires taking into account more than one criterion, this technique may be used to either maximize or decrease the impact of each criterion. Step-by-step, the COPRAS technique assesses and ranks options based on their significance and usefulness. Here are the COPRAS procedure's stages:

Step 1. Standardize the assessment matrix

$$d_{ij} = \frac{x_{ij}}{\sum_{j=1}^{m} a_{ij}} \quad (7)$$

Step 2. Calculate a weighted standardized assessment matrix

$$h_{ij} = w_i d_{ij} \quad (8)$$

Step 3. Sum each beneficial and non-beneficial criterion of weighted normalized

$$K_j^+ = \sum_{i=1}^{n} h_{ij}^+ \quad (9)$$

$$K_j^- = \sum_{i=1}^{n} h_{ij}^- \quad (10)$$

Step 4. Calculate the significance of alternatives

Step 5. Compute the relative significance

$$L_j = K_j^+ + \left(\frac{\min K \sum_{j=1}^{m} K_j^-}{K_j^- \sum_{j=1}^{m} (\min K / \sum_{j=1}^{m} K_j^-)}\right) \quad (11)$$

Step 6. Compute the utility of quantitative

$$U_j = \left[\frac{L_j}{L_{max}}\right] \times 100 \quad (12)$$

Step 7. Order the risks

The risks are ordered by the largest value of U_j

4. Results

In this section, we introduce the results of the two suggested techniques under a single-valued neutrosophic set.

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4.1 Neutrosophic MABAC Method

This sub-section introduces the results of the neutrosophic MABAC method.

Step 1. Build the decision matrix

We used in this section nine risks and eight criteria to be ranked. Then we invite three experts and decision-makers who have expertise in the field of IBAS and risk assessment. Eq. (1) is used to build the assessment matrix among standards and risks. Then we replace the opinions of experts with single-valued neutrosophic numbers.

Step 2. Standardize the decision matrix.

Then we used Eq. (2) to standardize the assessment matrix according to cost and positive standards. All criteria in this paper are positive criteria. Table 1 shows the normalized assessment matrix by the MABAC method. Figure 2 demonstrates the weights of standards.

Step 3. Compute the weights of the criteria

Table 1: The normalized assessment matrix

	$CINB_1$	$CINB_2$	$CINB_3$	$CINB_4$	$CINB_5$	$CINB_6$	$CINB_7$	$CINB_8$
$RINB_1$	0	0.043495	0.458697	0.569355	0.219008	0.385714286	0	0.154795
$RINB_2$	0.545455	0	0.179066	0.63871	0.399449	0.151428571	1	0.191781
$RINB_3$	0.421488	0.568982	0.186762	0.467742	1	0.407142857	0.482658	0.547945
$RINB_4$	0.629477	0.175359	0.181375	0.467742	0.183196	0.151428571	0.673918	0.178493
$RINB_5$	0.573003	0.692974	0.179066	0	0	0.385714286	0.59865	0
$RINB_6$	1	0.568982	0.620318	0.032258	0.027548	0.161428571	0.549887	0.452466
$RINB_7$	0.399449	0.043299	0.179066	0.348387	0.399449	0	0.368592	1
$RINB_8$	0	0.901594	1	1	0.307163	0.385714286	0.133533	0.332877
$RINB_9$	0.545455	1	0	0.627419	0.297796	1	0.874969	0.730137

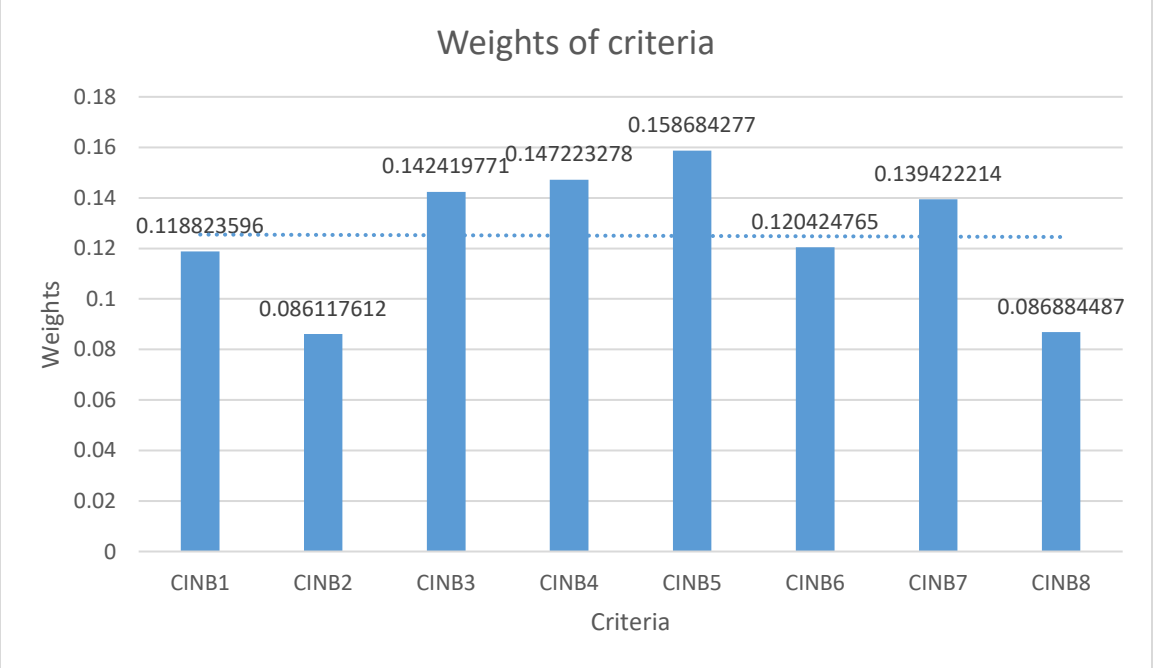

Figure 2: The weights of criteria in risks in IBAS.

Step 4. Calculate the weighted assessment matrix

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Then compute the weighted decision matrix by using Eq. (3) as presented in Table 2.

Table 2: The weighted assessment matrix

	$CINB_1$	$CINB_2$	$CINB_3$	$CINB_4$	$CINB_5$	$CINB_6$	$CINB_7$	$CINB_8$
$RINB_1$	0.118824	0.089863	0.207747	0.231046	0.193437	0.166874317	0.139422	0.100334
$RINB_2$	0.183636	0.086118	0.167922	0.241256	0.222071	0.138660515	0.278844	0.103547
$RINB_3$	0.168906	0.135117	0.169018	0.216086	0.317369	0.169454848	0.206715	0.134492
$RINB_4$	0.19362	0.101219	0.168251	0.216086	0.187755	0.138660515	0.233381	0.102393
$RINB_5$	0.18691	0.145795	0.167922	0.147223	0.158684	0.166874317	0.222887	0.086884
$RINB_6$	0.237647	0.135117	0.230765	0.151972	0.163056	0.139864763	0.216089	0.126197
$RINB_7$	0.166288	0.089846	0.167922	0.198514	0.222071	0.120424765	0.190812	0.173769
$RINB_8$	0.118824	0.163761	0.28484	0.294447	0.207426	0.166874317	0.15804	0.115806
$RINB_9$	0.183636	0.172235	0.14242	0.239594	0.20594	0.24084953	0.261412	0.150322

Step 5. Calculate the border approximation (BAA) method

Then compute the BAA by using Eq. (4).

Step 6. Calculate the distance among b_i and each risk

Then compute the distance among b_i and each risk by using Eq. (5) as presented in Table 3.

Table 3: The distance matrix between b_i and each risk.

	$CINB_1$	$CINB_2$	$CINB_3$	$CINB_4$	$CINB_5$	$CINB_6$	$CINB_7$	$CINB_8$
$RINB_1$	-0.9317	-0.92272	-0.85346	-0.84513	-0.87908	-0.87515778	-0.93498	-0.90967
$RINB_2$	-0.86689	-0.92646	-0.89328	-0.83492	-0.85045	-0.90337158	-0.79555	-0.90646
$RINB_3$	-0.88162	-0.87746	-0.89218	-0.86009	-0.75515	-0.87257725	-0.86768	-0.87551
$RINB_4$	-0.8569	-0.91136	-0.89295	-0.86009	-0.88477	-0.90337158	-0.84102	-0.90761
$RINB_5$	-0.86361	-0.86678	-0.89328	-0.92895	-0.91384	-0.87515778	-0.85151	-0.92312
$RINB_6$	-0.81288	-0.87746	-0.83044	-0.92421	-0.90946	-0.90216733	-0.85831	-0.88381
$RINB_7$	-0.88424	-0.92273	-0.89328	-0.87766	-0.85045	-0.92160733	-0.88359	-0.83624
$RINB_8$	-0.9317	-0.84882	-0.77636	-0.78173	-0.86509	-0.87515778	-0.91636	-0.8942
$RINB_9$	-0.86689	-0.84034	-0.91878	-0.83658	-0.86658	-0.80118256	-0.81299	-0.85968

Step 7. Order the risks

The risks are ranked based on largest importance of S_i by using Eq. (6) as shown in Figure 3. The security risk is the highest risk between nine risks.

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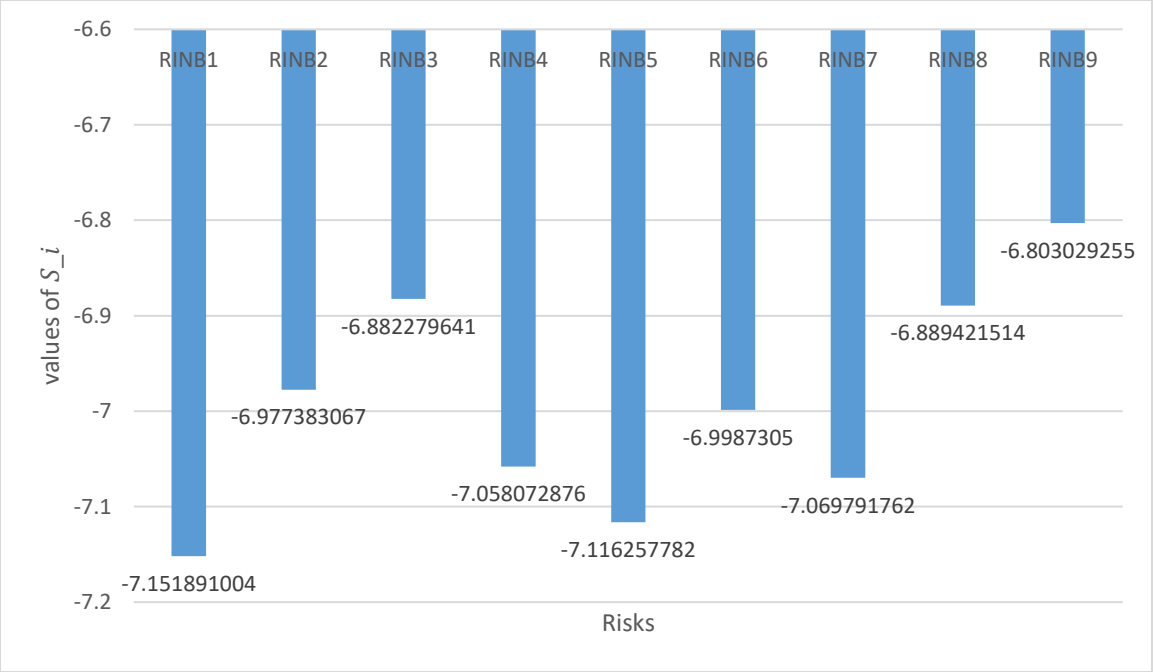

Figure 3: The summation of the distance between b_i and each risk

4.2 Neutrosophic COPRAS Method

This sub-section displays the results of the neutrosophic COPRAS technique.

Step 1. Normalize the decision matrix

Normalize the decision matrix by using Eq. (7) as presented in Table 4.

Table 4: The normalization assessment matrix by the COPRAS method.

	$CINB_1$	$CINB_2$	$CINB_3$	$CINB_4$	$CINB_5$	$CINB_6$	$CINB_7$	$CINB_8$
$RINB_1$	0.046175	0.062233	0.120514	0.125372	0.09447	0.118897	0.030326	0.063672
$RINB_2$	0.123655	0.056922	0.099827	0.134525	0.125801	0.081826	0.185608	0.070865
$RINB_3$	0.106046	0.126388	0.100397	0.111963	0.230077	0.122288	0.105275	0.140132
$RINB_4$	0.13559	0.078331	0.099998	0.111963	0.088252	0.081826	0.134974	0.068281
$RINB_5$	0.127568	0.141525	0.099827	0.050234	0.056443	0.118897	0.123286	0.033568
$RINB_6$	0.188221	0.126388	0.13247	0.054491	0.061226	0.083409	0.115714	0.121563
$RINB_7$	0.102915	0.062209	0.099827	0.096211	0.125801	0.057866	0.087562	0.228048
$RINB_8$	0.046175	0.166995	0.160559	0.182205	0.109777	0.118897	0.051062	0.098306
$RINB_9$	0.123655	0.179009	0.08658	0.133035	0.108151	0.216094	0.166193	0.175565

Step 2. Compute weighted standardized assessment matrix

Then compute the weighted standardized assessment matrix by using Eq. (8) as shown in Table 5.

Table 5. The weighted normalized decision matrix.

	$CINB_1$	$CINB_2$	$CINB_3$	$CINB_4$	$CINB_5$	$CINB_6$	$CINB_7$	$CINB_8$
$RINB_1$	0.005487	0.005359	0.017164	0.018458	0.014991	0.014318	0.004228	0.005532
$RINB_2$	0.014693	0.004902	0.014217	0.019805	0.019963	0.009854	0.025878	0.006157

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$RINB_3$	0.012601	0.010884	0.014298	0.016483	0.03651	0.014726	0.014678	0.012175
$RINB_4$	0.016111	0.006746	0.014242	0.016483	0.014004	0.009854	0.018818	0.005933
$RINB_5$	0.015158	0.012188	0.014217	0.007396	0.008957	0.014318	0.017189	0.002917
$RINB_6$	0.022365	0.010884	0.018866	0.008022	0.009716	0.010044	0.016133	0.010562
$RINB_7$	0.012229	0.005357	0.014217	0.014165	0.019963	0.006969	0.012208	0.019814
$RINB_8$	0.005487	0.014381	0.022867	0.026825	0.01742	0.014318	0.007119	0.008541
$RINB_9$	0.014693	0.015416	0.012331	0.019586	0.017162	0.026023	0.023171	0.015254

Step 3. Sum each beneficial and non-beneficial criterion of weighted normalized

All criteria are positive, so we sum of weighted standardized assessment matrix by using Eqs. (9 and 10).

Step 4. Calculate the significance of alternatives

Step 5. Compute the relative significance

Then compute the relative significance by using Eq. (11)

Step 6. Calculate the utility of quantitative

Then compute the quantitative degree by using Eq. (12) as displayed in Figure 4.

Step 7. Order the risks

The alternatives are ranked by the largest value of U_j

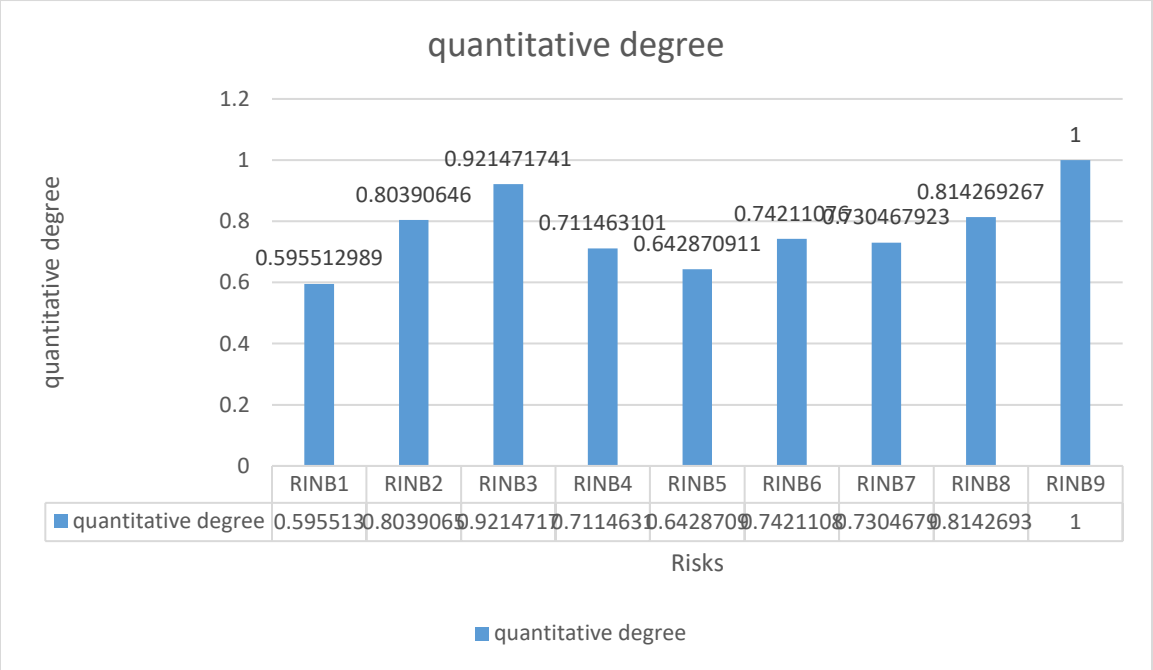

Figure 4: The quantitative degree.

We compared the two proposed methods with the PROMETHEE technique to display the robustness of the suggested technique. We show that risk 9 is the highest risk and risk is the lowest risk. So, the three methods agreed the security risk is the highest risk of all nine risks as shown in Figure 5.

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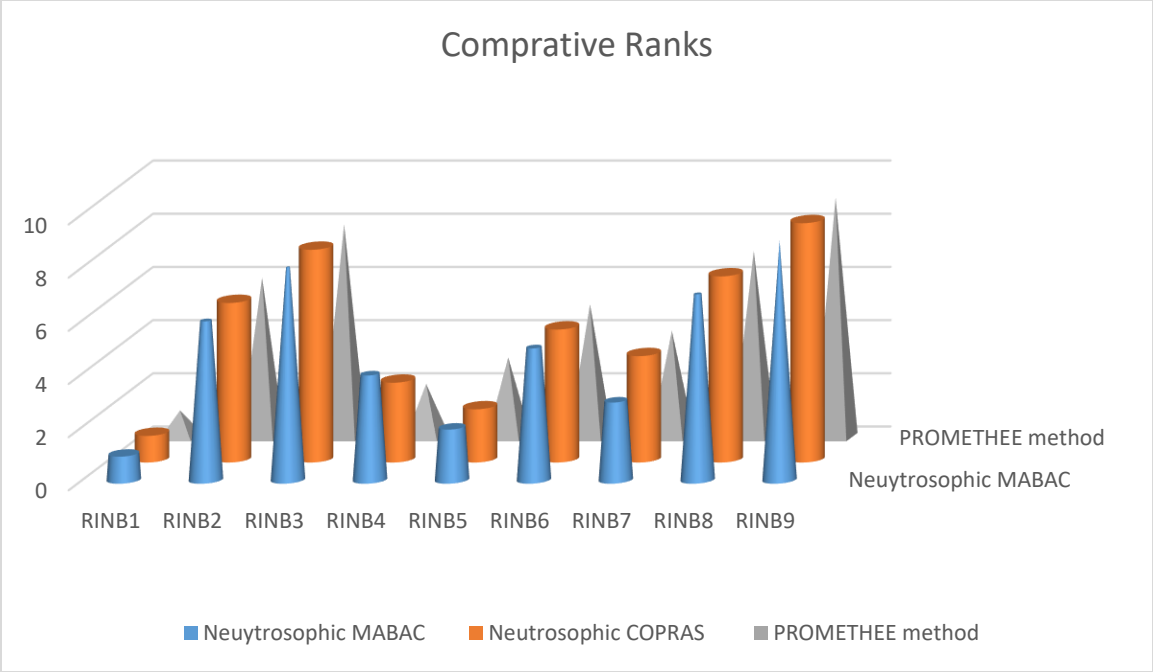

Figure 5: The comparative rank between the proposed method and the PROMETHEE method.

5. Conclusions

International business administration is fraught with perils that must be overcome by companies if they are to succeed in today's global economy. The risk picture is complicated by factors such as cross-border operations, variations in culture, political unpredictability, economic instability, the need to comply with laws and regulations, and technological progress. Organizations need to take a preventative and all-encompassing stance to successfully handle these risks. Thorough risk assessments, solid risk management techniques, and constant monitoring and adaptation to a changing business climate all fall under this category. This allows organizations to lessen the blow of possible dangers and make the most of promising possibilities. It is also important to have a multidisciplinary strategy while managing risks in international business administration. A company's financial, legal, operations, supply chain, and marketing divisions must all work together on this. Risk reduction measures may also benefit from doing extensive market research, establishing solid relationships with local organizations, and assembling a team of reliable consultants and specialists.

In addition, businesses should emphasize risk avoidance and have backup plans in case of emergencies. Among them include monitoring political, economic, and legal shifts in target areas, diversifying supply chains, investing in cybersecurity, doing due diligence on partners and suppliers, and more. Although there are certain dangers involved in managing a worldwide firm, they are not insurmountable. By taking a preventative and strategic stance towards risk management, businesses may overcome obstacles, seize opportunities, and secure long-term success in the competitive global market. We applied the neutrosophic set with MCDM methods to show the rank of risks. This paper used nine risks and eight criteria to be evaluated. This work applied the single-valued neutrosophic set with the MABAC and COPRAS techniques. The results show the security risks has the highest risk. We compared the two proposed method with the PROMETHEE method. The three method agreed the security is the highest risk.

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