UNIVERSIDADE TECNOLÓGICA FEDERAL DO PARANÁ

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INTERNATIONAL MARKET SELECTION FOR SMALL AND MEDIUM-SIZED ENTERPRISE IN LANDLOCKED COUNTRIES: A HYBRID MULTICRITERIA DECISION SUPPORT MODEL

PONTA GROSSA

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Seleção de mercado internacional para pequenas e médias empresas em países sem acesso ao mar: um modelo híbrido de apoio à decisão multicritério

Dissertação de Mestrado apresentada como requisito para obtenção do título de Mestre em Engenharia de Produção no Programa de Pós-Graduação em Engenharia de Produção da Universidade Tecnológica Federal do Paraná.

Orientador: Prof. Dr. Flávio Trojan

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INTERNATIONAL MARKET SELECTION FOR SMALL AND MEDIUM-SIZED ENTERPRISE IN LANDLOCKED COUNTRIES: A HYBRID MULTICRITERIA DECISION SUPPORT MODEL

Trabalho de pesquisa de mestrado apresentado como requisito para obtenção do título de Mestre Em Engenharia De Produção da Universidade Tecnológica Federal do Paraná (UTFPR). Área de concentração: Gestão Industrial.

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To God, who gave me life and the opportunities that allowed me to achieve this goal. To my family, who always believed in me and supported me at all times. Their love and support were the driving force behind me.

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ABSTRACT

The international market selection process remains complex, especially for small and medium-sized enterprises in landlocked countries. In this context, this research contributes to this field in two key aspects. Firstly, this study seeks to provide a tool to small and medium-sized companies in the sector of cereal-insufflated food products such as quinoa, amaranth, and canahua in a landlocked country like Bolivia. In this sense, this tool assists in the systematic selection of potential markets and enables the international presence of these companies in foreign markets. On the other hand, the theoretical contribution lies in integrating multiple criteria decision-making methodologies in the global market selection process. In this context, this study proposes a four-step model. Firstly, the model determines potential export markets through reliable databases. Secondly, the model identifies and selects the criteria for evaluating these markets through an extensive literature review and applying the Fuzzy Delphi method with experts. Thirdly, the model employs the entropy and the rank order centroid method to determine the relative importance of each criterion. Fourthly, the model uses the Topsis method to rank these markets. Then, the best market is evaluated through a sensitivity analysis to validate the results' stability. This approach has the potential to be adapted to various industries beyond small and medium-sized food enterprises in landlocked countries, thus contributing to the broader field of international market research.

Keywords: international market selection; multi-criteria decision-making; landlocked countries

RESUMO

O processo de seleção de mercados internacionais permanece complexa, especialmente para pequenas e médias empresas em países sem litoral. Nesse contexto, esta pesquisa contribui para este campo em dois aspectos-chave. Primeiramente, este estudo busca fornecer uma ferramenta para pequenas e médias empresas do setor de produtos alimentícios de cereais insuflados, como quinoa, amaranto e canahua, em um país sem litoral como a Bolívia. Nesse sentido, essa ferramenta auxilia na seleção sistemática de mercados potenciais e viabiliza a presença internacional destas empresas em mercados estrangeiros. Por outro lado, a contribuição teórica está na integração de metodologias de tomada de decisão de múltiplos critérios no campo da seleção de mercados internacionais. Nesse contexto, é proposta uma metodologia de 4 etapas. Em primeiro lugar, o modelo determina potenciais mercados de exportação através de bases de dados fiáveis. Em segundo lugar, o modelo identifica e seleciona os critérios de avaliação destes mercados através de uma extensa revisão de literatura e aplicação do método Fuzzy Delphi com especialistas. Em terceiro lugar, o modelo emprega o método da entropia e "Rank Order Centroid" para determinar a importância relativa de cada critério. Em quarto lugar, o modelo utiliza o método Topsis para classificar estes mercados. Em seguida, o melhor mercado é avaliado através de uma análise de sensibilidade para validar a estabilidade dos resultados. Esta abordagem tem o potencial de ser adaptado a diversas indústrias além das pequenas e médias empresas alimentares de produtos insuflados em países sem litoral, contribuindo assim para o campo mais amplo da investigação de mercados internacionais.

Palavras-chave: seleção internacional de mercados; tomada de decisão multicritério; países sem litoral

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ABNT	Associação Brasileira de Normas Técnicas
AHP	Analytic Hierarchy Process
DM	Decision Makers
FDI	Foreign Direct Investment
FDM	Fuzzy Delphi Method
GP	Goal Programming
IMS	International Market Selection
LLDC	Landlocked countries
MCDA	Multi-Criteria Decision-Analisis
MCDM	Multi-Criteria Decision-Making
NIS	Negative Ideal Solution
PIS	Positive Ideal Solution
PPGEP	Programa de Pós-Graduação em Engenharia de Produção
SAW	Simple Additive Weights
SEM	Structural equation modeling
SME	Small Medium Sized Enterprises
TOPSIS	Technique for Order of Preference by Similarity to the Ideal Solution
UK	United Kingdom
UTFPR	Universidade Tecnológica Federal do Paraná
VIKOR	Multi-Criteria Compromise Ranking Method

SUMMARY

1 INTRODUCTION

International economic integration, also known as globalization, has become widespread across the globe (NUNES; LEQUAIN, 2017). The growth of global markets has stimulated competition and increased the interdependence of national economies, prompting governments to adopt market-oriented measures at both national and international levels (LIÑÁN; PAUL; FAYOLLE, 2020). These measures were driven by market liberalization, border opening, intensified competition, and expanded business opportunities (PAPADOPOULOS *et al*., 2011), leading to an increasingly globalized environment for international businesses.

However, the company's cross-border expansion remains a complex process, as highlighted in the literature (PAPADOPOULOS *et al*., 2011; OZTURK; JOINER; CAVUSGIL, 2015; CLARK; LI; SHEPHERD, 2018). This complexity arises from several factors, including the inherent features of the internationalization process; the need for systematic and effective decision-making based on prior information and knowledge; the level of analysis used; the characteristics of decision-makers (PAPADOPOULOS; MARTÍN, 2011).

In this context, numerous quantitative studies have demonstrated that a systematic approach to International Market Selection (IMS) is a critical determinant of international performance (BROUTHERS *et al*., 2009; OZTURK; JOINER; CAVUSGIL, 2015; PAPADOPOULOS; MARTÍN, 2011). In these sense, various systematic approaches have been proposed within the multi-criteria decision-making field, such as value measurement, hybrid, and outranking models.

Firstly, a practical application of value measurement models can be found in the Analytic Hierarchy Process (AHP). AHP enables companies to make structured decisions in the international market selection process. In other words, it facilitates a peer-to-peer comparison of the studied markets based on multiple criteria weighted by decision-makers (ARAYA-PIZARRO; ARAYA-PIZARRO, 2019; BAENA-ROJAS *et al*., 2022; LÓPEZ-CADAVID; VANEGAS-LÓPEZ; BAENA-ROJAS, 2020; SCHÜHLY; TENZER, 2017).

Secondly, the hybrid models combine and leverage the strengths of different methods, techniques, or tools to enhance the accuracy and effectiveness in multi-criteria decision-making. This approach solves complex problems that cannot be

resolved with a single method. A specific example of the application of hybrid models involves using the AHP for criteria weighting and the Technique for Order of Preference by Similarity to an Ideal Solution (TOPSIS) to classify the international markets (AGHDAIE; ALIMARDANI, 2015; GOKMENOGLU; ALAGHEMAND, 2015; VANEGAS-LÓPEZ *et al*., 2021).

Finally, the main idea of the outranking models is to assess and classify markets based on their ability to surpass or be surpassed by other markets instead of assigning numerical scores to each criterion. A practical example for evaluating and classifying markets is the application of the Preference Ranking Organization Method for Enrichment Evaluation II (PROMETHEE II); this method allows decision-makers to express their personal preferences and establish thresholds of indifference or preference for each criterion, which helps companies make strategic decisions in their international expansion (GÓRECKA, 2013).

Nevertheless, companies still follow a non-systematic IMS process and tend to be underperformed compared to those that adopt a systematic approach (MUSSO; FRANCIONI, 2014). Ozturk (2015) strengthens the previous statement and says that many Small and Medium-Sized Enterprises (SMEs) exhibit non-systematic and passive behavior during their internationalization process. The lack of a systematic approach may result from limited managerial experience in export research, difficulties gathering relevant data, and the absence of proven practical methods (PAPADOPOULOS; CHEN; THOMAS, 2002).

The underperformed mentioned above is even more critical for SMEs in landlocked countries (LLDCs) because they must consider additional factors, such as a lack of scale, capital, technology, inadequate transportation, logistics infrastructure, high trade costs, non-tariff barriers, underdeveloped financial systems, and limited management capacity to access markets beyond their immediate neighbors (PAUDEL; COORAY, 2018; UN OHRLLS, 2020; UNCTAD, 2012; WTO, 2021). Consequently, maritime confinement poses significant challenges for companies in fully participating in international trade and maximizing their comparative advantage.

Although the literature offers diverse approaches to address the market selection process for a product or service (OZTURK; JOINER; CAVUSGIL, 2015; VANEGAS-LÓPEZ *et al*., 2021), Sakarya (2007) points out that an IMS model may be effective only for a specific internationalization process and each model is influenced

by the host country characteristics and the industry specifics, affecting the criteria used during the IMS process.

Remarkably, studies have yet to consider the attributes of SMEs in LLDCs during the international market selection process. As a result, this study aims to fill this gap in the literature by addressing the following research question: How can an SME from an LLDC country systematically select its export markets? In response, this study seeks to create a framework that systematically identifies potential markets for SMEs in LLDC countries.

1.1 Study justification

In 2020, the report of the “United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States” (UN-OHRLLS), stays that approximately 22.2% of countries recognized by the United Nations lack direct access to the sea. This geographical limitation results in the isolation of these countries from the world's major markets, imposing significant constraints on their economic development (WTO, 2021).

According to the World Trade Organization in 2021, International trade plays a pivotal role in the economies of landlocked developing countries (LLDCs), However, data of this organization indicates that between April 2019 and April 2020, exports from these countries decreased nearly twice as much as the global trade decline, primarily due to the COVID-19 pandemic effects. Even with global trade rebounding by late 2020, LLDC exports decreased, reaching an 8 percent reduction, while global exports grew by 7 percent.

This trend in LLDC trade underscores the importance of streamlining export and import processes in these economies. The COVID-19 pandemic has highlighted the need to swiftly and cost-effectively identify potential markets. Therefore, leveraging available digital technologies to support informed decision-making is crucial. In this context, this study proposes to develop a flexible tool for strategically identifying export markets. As an example, the food industry has been selected, specifically the insufflated cereals sector.

Among the products related to the insufflated cereals sector, we have cereals based on quinoa, amaranth, and cañahua. These cereals, also known as super-foods, play a fundamental role in the diets of Andean populations and have been studied by

nutritionists and food experts, who have highlighted their high nutritional properties capable of enhancing people's immune systems (GIULIANI *et al.*, 2012).

These super-foods come from plants native to the Andes, cultivated for thousands of years in Bolivia, Peru, and Ecuador. These grains are a significant source of sustenance for indigenous communities in the region, and in recent years, they have gained popularity worldwide for their nutritional properties (YUSSEFI-MENZLER, 2019).

According to the Bolivian Institute of Foreign Trade in 2022, Bolivia has enormous potential to market these super-foods abroad. Consequently, the export of these grains in all their forms would not only boost economic development in the Andean regions but also promote food security through the dissemination of nutritional products globally and help conserve the biodiversity of the Andes.

1.2 Objectives

In this section, we define the fundamental objectives of this research. These objectives represent specific goals we aim to achieve, guiding our approach and providing a structured framework for exploring the underlying issues. Each objective has been carefully designed to contribute significantly to the overall achievement of the research, giving direction and purpose to each step of our analysis. By precisely defining these objectives, we aim not only to address the central question of the research but also to generate substantial contributions to the field of study.

1.2.1 Main objective

Develop and validate a new empirical tool for the international market selection process of insufflated cereal companies operating within a landlocked country.

1.2.2 Specific objectives

- Conduct a comprehensive trade statistics analysis to identify the top insufflated product importers;
- Perform a systematic literature review to identify the criteria commonly used for international market selection in the multi-criteria decision-making field;

- Facilitate a consensus-building process among academic and business experts to determine the most relevant criteria for international market selection in the context of insufflated food products within a landlocked country;
- Determine the appropriate relative importance for each criterion by aggregating the weights obtained by entropy and rank-order centroid methods;
- Apply a robust multi-criteria support model that addresses the complexities of the market selection problem for insufflated cereals;
- Validate the effectiveness and practicality of the multi-criteria support model by applying it to a decision-making process.

1.3 Dissertation structuring

Figure 1 presents the overall structure of this study, which is organized into five general chapters that systematically address the research issue. The content of each chapter is described below.

Chapter 1 provides the initial considerations, contextualizes the problem, justifies the research, and establishes the study's objectives.

Chapter 2 presents the theoretical foundations, encompassing the main concepts and definitions that underpin the research proposal.

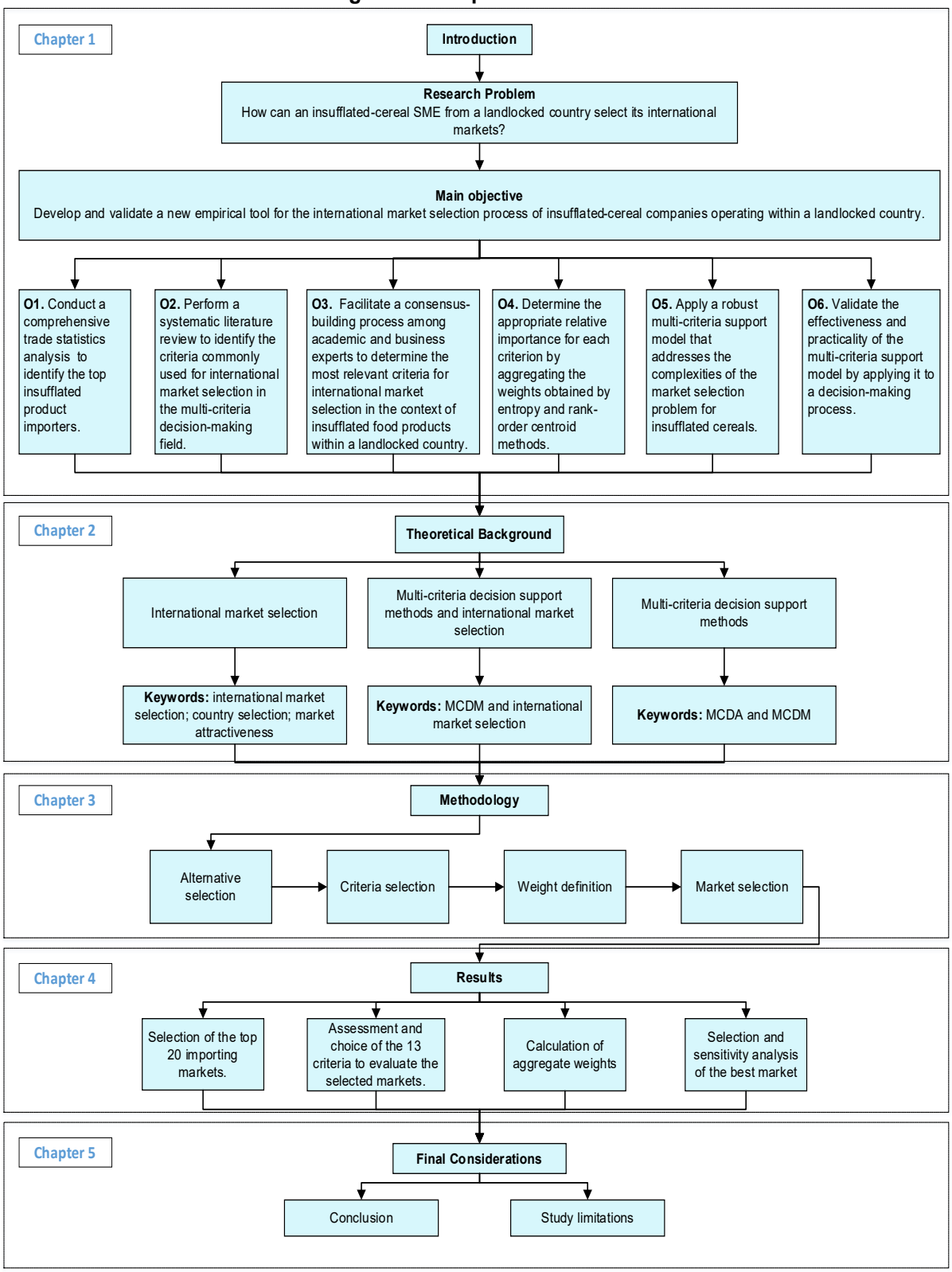
Chapter 3 presents the proposed methodology, divided into four sequential stages. The first stage focuses on the pre-selection of international markets based on the amount of insufflated food products imported. The second stage involves identifying and selecting criteria to evaluate these markets through a systematic literature review and applying the Fuzzy Delphi method to the perspectives of industrial and academic experts in landlocked countries. The third stage defines the relative importance of each criterion using two well-known approaches, entropy and the rank order centroid. Finally, the fourth stage encompasses the selection of markets through the TOPSIS method.

Chapter 4 presents the results obtained by this study and discusses the findings with similar studies.

Chapter 5 presents the final considerations of this dissertation. This section synthesizes the key research findings, highlighting the contribution to knowledge in the field. Additionally, both practical and theoretical implications results are discussed, inherent study limitations are acknowledged, and guidance for future research is

presented. Finally, a comprehensive conclusion is provided that underscores the significance of the research and its impact on the field of study.

Figure 1 - Chapters flowchart



Source: Own authorship (2023)

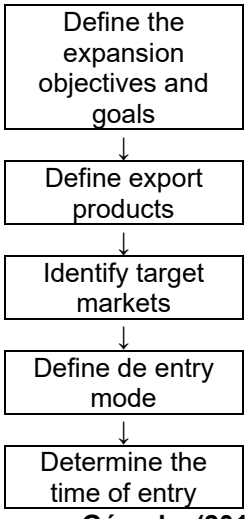
2 BIBLIOGRAPHICAL BACKGROUND

This section succinctly expounds upon the fundamental tenets underpinning this research endeavor's genesis. Given the comprehensive bibliography, procuring additional indispensable particulars and achieving a more profound comprehension of the subject matter is feasible.

2.1 Exporting in a global market

International business operations are conducted within a progressively globalized milieu characterized by fewer barriers, heightened competition, and greater expansion prospects. However, despite the general trend of globalization, the particular environments in which a firm operates result of the various strategic decisions it takes throughout its internationalization process (PAPADOPOULOS; MARTÍN, 2011). In essence, as the global economy becomes more interconnected and markets progressively become more accessible (VANEGAS-LÓPEZ *et al*., 2021), the company's performance in this scenario will depend more on the strategic decisions taken throughout the internationalization process. Górecka (2013), posited five indispensable stages for the efficacious formulation of an international market entry strategy (see Figure 2).

Figure 2 - International market entry strategy



Source: Górecka (2013)

- The first step involves the establishment of the objectives and goals, whereby the organization must specify the rationale for venturing into the international arena.

- The subsequent step entails delineating the export product's characteristics, encompassing quality, price, and distinctive attributes.
- The third stage, international market selection (IMS), entails systematically identifying the export market, an aspect that numerous research works have addressed independently (see Frame 1). It is noteworthy, however, that this research shall exclusively focus on this particular phase.
- The fourth phase involves determining the mode of entry, which can adopt diverse forms such as export, franchising, licensing, management contracts, subcontracting, or turnkey contracts.
- Ultimately, the final phase culminates in determining the optimal timing for market entry.

2.1.1 Overview of the international market selection literature

The international market selection process has emerged as one of the main domains in international marketing research (RANA *et al*., 2021). As mentioned above, it is a major determining performance factor (BROUTHERS *et al*., 2009), especially in the early stages of the international process (MARTIN; DROGENDIJK, 2014). It involves searching for comparative information about countries, industries, products, or consumers and using knowledge of market and market selection. Although the IMS has several features, at the same time, it presents interesting research opportunities, as it constitutes a challenge for researchers and decision-makers (PAPADOPOULOS; MARTÍN, 2011).

In this sense, the literature considers two major traditional approaches to the IMS: non-systematic and systematic (MUSSO; FRANCIONI, 2014). Firstly, a non-systematic approach arises when the company chooses its markets for "non-rational" reasons that defy the optimizing logic of the market (MUSSO; FRANCIONI, 2012, 2014). "Non-systematic, strong personalized and essentially belief-driven" processes are common characteristics of this approach (HE; WEI, 2011). However, firms following non-systematic IMS processes were found to be underperforming in comparison to those following systematic approaches in terms of duration of export (PIERCY, 1981), market share, number of markets served, and new technology gained (YIP; BISCARRI; MONTI, 2000).

Secondly, when firms adopt a systematic approach, they often follow a formalized decision process, using sophisticated techniques for data collection or statistical methods to analyses the diverse data collected in order to evaluate the attractiveness of potential markets (SILVA; MENESES; RADOMSKA, 2018). A systematic approach to IMS helps researchers minimize two possible errors: ignoring the prospective countries and spending too much time investigating poor prospects (OEY; NOVIYANTI; LIM, 2018). Moreover, there are costs of venturing into the wrong markets and opportunity costs associated with failing to enter the right markets (PAPADOPOULOS; MARTÍN, 2011).

2.1.2 IMS models

The selection of international markets is a complex process that requires evaluating a series of variables. Different methodological proposals have been developed in the last fifty years to address this problem. The first qualitative approaches were based on double-entry matrices with a simple score. Subsequently, more sophisticated proposals were developed, such as weighted matrices, which include a differentiated assessment for each variable according to the importance given to it by the decision maker.

In the 1990s and 2000s, a trend emerged toward quantitative models using multicriteria methods. These models are characterized by having a broad set of information that cannot be reduced to a variable or indicator. For this reason, statistical methods are used to analyze the data and make a decision. Quantitative models can be classified according to the variables considered essential for the evaluation. Some models focus on macroeconomic components, others on mesoeconomic elements, and others on microeconomic features. Only some models integrate the three types of variables, which could be considered the most complete to facilitate decision-making (DEAZA *et al*., 2020).

However, when a company intends to select an IMS model to internationalize, the literature emphasizes that no single method exists since each company must adapt its model to its specific context (GÓRECKA, 2013). In general, some stages may differ for each company, but the initial and final steps are usually common (MIEČINSKIENĖ *et al*., 2014). Frame 1 summarizes some systematic IMS models.

Frame 1 - Overview of systematic IMS approaches

Study	Purpose	Design/Methodology	Propositions/Findings	Contributions/Implications
1. CONCEPTUAL STUDIES				
(CAVUSGIL, 1985)	Provide essential guidelines for researching foreign market potential	Conceptual framework	Three sequential stages are suggested for IMS: market screening, identification, and selection	Represents one of the earliest and practical approaches in IMS
(PAPADOPOULOS; DENIS, 1988)	Classify existing IMS models	Literature review	Three groups of IMS models identified: decision making frameworks (e.g., conceptual models); grouping models (e.g., clustering); and estimation models (e.g., ranking)	Provides a comprehensive coverage and evaluation of methodology in IMS research
(ARNOLD; QUELCH, 1998)	Assess the market potential exclusively for EMs	Conceptual and managerial framework	MNCs need to consider additional sources of first-mover advantage and adopt a demand-driven model of market assessment when evaluating entry to EMs	Provides managerial precriptions for entry to EMs
(WHITELOCK; JOBBER, 2004)	Discuss and suggest a model incorporating key elements of four theories of internationalization: the Uppsala model of internationalization, eclectic paradigm and transaction cost analysis, industrial network approach, and business strategy approach	Conceptual study on theories of internationalization and market entry	The diversity of perspective have different emphasis on internationalization, market entry and mode selection	An attempt to incorporate various perspectives in developing a model of international market entry
2. GROUPING STUDIES				
(CAVUSGIL, 1997)	Propose a method for quantifying and ranking market potential of countries	Indexing based on market potential indicators	The overall Market Opportunity Index (OMOI) was developed based on ranking market potential of countries, indexing market potentials, and weighting each measure to obtain an overall index	Influential new approach for subsequent studies, e.g., Mullen & Sheng (2006), Cavusgil, Kiyak, & Yeniyurt (2004)
(CAVUSGIL; KIYAK; YENIYURT, 2004)	Propose and illustrate two complementary approaches in foreign market assessment and selection: country clustering and country ranking	Cluster analysis and indexing based on extended measures of market potential	The two complementary methods (clustering and ranking) offer objective and comprehensive analytical techniques for evaluating markets	Provides prescriptions to assist in managerial decision making in the early stages of foreign market selection

(MULLEN; SHENG, 2006)	Extend and evaluate the OMOI method proposed by Cavusgil (1997)	Indexing based on extended set of measures and countries	OMOI is a stable tool but weights for measures should be determined carefully because they can change the outcome	The modified OMOI is an improved version of previously suggested approach as aflexible, valid and fairly stable tool for preliminary FMOA
3. ESTIMATION STUDIES				
(JOHANSON; VAHLNE, 1977)	Develop a model of the internationalization process of the firm	Empircal observations from international business studies on Swedish firms: A case study of the internationalization process of Swedish firms	The gradual acquisition, integration, and use of knowledge about foreign markets and operations help firms with their internationalization decisions	The proposed approach is useful for firms in planning and decision making of international operations
(TATOGLU; GLAISTER, 2007)	Examine the motives and characteristics of western MNEs' foreign direct investment (FDI) in Turkey	Binomial logit regression models used to test the relative importance of FDI motives and the sample characteristics	-Relative importance of the OLI (Dunning's ownership, location, internalization) factors vary most with the industry of the investment. -Market potential found to be a main factor in determining the extent of FDI activities.	The first large empirical study of the motives of western MNEs to engage in FDI in Turkey over a substantial period of time 260-1040
(SHAMA, 2000)	Test the determinants of entry strategies of US companies to Eastern Europe, and the factors that determine the satisfaction of companies in foreign markets	Survey data and multivariable research design	Market potential is the most important determinant of entry strategies, and an important determinant of the satisfaction of companies doing business abroad	Provides considerations for entry modes and satisfaction in doing business in foreign markets
(SAKARYA; ECKMAN; HYLLEGARD, 2007)	-Propose a market selection approach accounting for dynamism and future potential of emerging markets. -Develop a tool based on four criteria specific to the assessment of emerging markets (EM) as international expansion opportunities.	Use secondary data and primary data from a sample of 500 US apparel specialty retailers, the proposed criteria are applied to the assessment of an emerging market	The proposed tool specific to assessing EMs revealed growth and sourcing opportunities that might otherwise have been overlooked	Contribute to the development of an assessment model for EM
(OZTURK; JOINER; CAVUSGIL, 2015)	Propose a new, flexible and practical approach to assist in IMS decisions based on industry-level analysis	Regression analysis with longitudinal data	The model estimates market potential based on country responsiveness (i.e., income elasticity), growth potentials, and relevant macroeconomic variables. Best foreign markets would differ by industry	-The introduced concept of "country responsiveness'' integrated with forward-looking growth potential and macroeconomic variables facilitates more precise managerial decision making for IMS -A more focused industry-level approach provides more refined insights for businesses than country-level macro models

Source: Ozturk (2015)

2.2 International market selection and multi-criteria decision-making

Selecting a suitable target market is often considered a challenging and time-consuming task in many companies, primarily due to numerous feasible alternatives, conflicting objectives, and various decision-making factors (AGHDAIE; ALIMARDANI, 2015). To address these challenges, the IMS methods has become increasingly popular. It enables companies to meticulously analyze and measure the decision-making variables/criteria and their respective proportions to select the most viable market (OEY; NOVIYANTI; LIM, 2018). This target market selection process could be classified as a Multi-Criteria Decision-Making (MCDM) problem, as it involves evaluating and prioritizing multiple criteria, often with varying degrees of importance or significance, to arrive at a comprehensive and informed decision (AGHDAIE; ALIMARDANI, 2015).

MCDM methods represent a family of decision-making tools that facilitate identifying optimal solutions in the presence of multiple, often conflicting, decision criteria (AGHDAIE; ALIMARDANI, 2015). In the international business context, companies are increasingly aware of the benefits of these decision-making methods (SHABANI; SAEN, 2016). More specifically, marketing and the IMS process have benefited from MCDM methods (GÓRECKA, 2013).

The marketing literature emphasizes the importance of selecting a target market for export. In this sense, adopting a data-driven approach that utilizes various MDCM methods is recommended. In recent years, numerous studies have been proposed to evaluate the IMS process for industries using different MDCM methods. In this sense, some MCDM models in the IMS field will be described below.

- Baena-Rojas (2022), introduces a novel decision-making approach for selecting international markets, which involves a hybrid methodology that combines the multivariable technique with the Analytic Hierarchy Process (AHP). The proposed model assists companies, particularly the Colombian Garment Industry, in evaluating and ranking potential international markets based on various macro-factors, including cost, cultural environment, economics, logistics, and trade barriers.
- Vanegas López (2021), consolidated and applied a systematic methodology using the Analytic Hierarchy Process (AHP) and the Technique for Order of

Preference by Similarity to the Ideal Solution (TOPSIS) to select international markets in the Colombian textile sector. The hybrid multi-criteria decision-making (MCDM) technique considers aspects such as cost, trade barriers, logistics, cultural environment, and economics as macro-factors for the IMS process.

- López Cadavid (2020), conducted a comprehensive investigation that employed a multi-criteria decision analysis to identify and evaluate essential criteria in selecting global markets for ten chemical companies. The study uses the Analytic Hierarchy Process (AHP) to measure criteria such as cost, logistics, trade barriers, economics, and cultural environments. By adopting such a method, decision-makers can use pertinent information that enables them to make well-informed judgments concerning the identification of feasible international markets.
- Baena-Rojas (2020), identifies the factors influencing the choice of export markets for Colombian chemical products using a decision-making tool such as the Analytic Hierarchy Process (AHP) to rank the alternatives. He identifies five critical factors in selecting export markets: cost, logistics, trade barriers, economics, and cultural environment.
- Araya Pizarro (2019), describes a multi-criteria prioritization approach for selecting potential fair-trade markets in Chile's fresh fruit agro-industrial sector. The author presents a methodology based on the hierarchical analysis technique (AHP) to evaluate and weigh the relevant criteria such as market potential, accessibility, and risk that impact economic, social, and environmental factors. The methodology proposed may be helpful for other organizations and companies seeking to select potential fair-trade markets in a more informed and responsible manner.
- Oey (2018), uses the Analytic Hierarchy Process (AHP) and the goal programming technique (GP) to identify the most suitable market for an Indonesian metallurgical company. The study evaluated various factors, including strategic aspects, marketing-related, supply chain, and risk. The study provides valuable insights for managers and decision-makers to make informed decisions seeking international expansion.

- Schühly (2017), suggests a multidimensional framework for assessing Sub-Saharan African countries' attractiveness. The study applied the analytical hierarchy process (AHP) to weigh five dimensions - economic, political, socio-cultural, technological, and infrastructural - and several sub-dimensions in pharmaceutics, manufacturing, and fast-moving consumer goods industries. The study provides valuable insights for companies seeking to expand their business in this region and emphasizes the need to understand its unique characteristics and context.
- Lee (2017), proposes a model based on a hybrid approach using both Fuzzy Linear Programming for Ratio Analysis (FLinPreRa) and Analytical Hierarchy Process (AHP) to integrate objective and subjective information. The model utilizes objective data to narrow down potential countries (Country risk and project reward), and then the subjective data evaluates these countries based on their sustainability value.
- Gokmenoglu (2015), introduces a multi-criteria decision-making (MCDM) model to evaluate nine developed countries as home countries for foreign direct investment (FDI) from the vantage point of US investors. The model employs the Analytic Hierarchy Process (AHP), the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), and Multi-Period Multi-Attribute Decision-Making (MPMADM) to rank and prioritize the target market in three time periods (Precrisis, crisis, and postcrisis), and assesses several dimensions, including political & economic risk, trade agreement, monetary policy, productivity, endowment factor, geography, and history. The proposed model provides a valuable tool for policymakers and investors to make informed decisions about FDI priorities in different periods.
- Aghdaie (2015), proposes a multiple-attribute decision-making approach to assess markets for Iran's chair industries. The model uses the Analytic Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods to measure the following dimensions and rank several segment-related, technological, and economical.
- Marchi (2014), propose a novel approach, an International Market Selection decision process method for small firms based on fuzzy logic (Fuzzy Expert System). The fuzzy-based approach involves assigning degrees of

importance to multiple criteria related to accessibility and attractiveness for an Italian stationery industry case study. Overall, this document provides a valuable contribution to the field of international business by proposing a new decision-making framework tailored to small firms' needs.

- Mobin (2014), proposes a decision-making approach for ranking target markets for the Iranian food industry. It involves the use of Shannon's Entropy method, Simple Additive Weights (SAW), the Technique for Order Performance by Similarity to Ideal Solution (TOPSIS), and the multi-criteria compromise ranking method (VIKOR) to measure the following dimension such as regulation, cultural, transport, distance, economy, market potential, politics. The article contributes to the food industry's decision-making by introducing a systematic and comprehensive approach to target market selection.
- Aghdaie (2013), proposes a market segment evaluation and selection methodology for the Iranian steel industry using two multi-criteria decision-making (MCDM) methods. The methodology employs a fuzzy Analytical Hierarchy Process (AHP) to determine the relative importance of different criteria (degree of concentration, laws and government agency regulations, types of competitors, contribution margins, manufacturing process technology required, complexity, growth rate per year, size, and leveraging factors) and COmplex PRoportional Assessment (COPRAS-G) to rank and select the most suitable market segments. The results show that the proposed approach effectively evaluates and determines market segments based on multiple criteria and provides a valuable contribution to market segmentation by introducing a method to help decision-makers push informed decisions.
- Górecka (2013), presents a methodology for country market selection using Multi-Criteria Decision-Aiding (MCDA) methods and employs it in a Polish manufacturer and distributor. The proposed approach involves the use of the following MCDA methods: EXPROM II, PROMETHEE II, and ELECTRE III to rank potential markets. Finally, the veto threshold is used as a decision rule to eliminate alternatives that do not meet a minimum level of

concordance with the criteria (macroeconomic, demand, socio-political, or cost factors).

- Mehdi (2012), advances a paradigm for discerning the most desirable target market by leveraging two multi-criteria decision-making methods: the Fuzzy Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The former technique is utilized to appraise the relative importance of selection criteria. Conversely, the latter method facilitates the grading of candidate markets based on their proximity to the optimum solution. The findings suggest that the proposed framework can assist executives in pinpointing the optimal target market.
- Duan (2010), puts forth a Multi-Criteria Analysis (MCA) paradigm aimed at assessing and electing electronic markets for electronic business (e-business) in Small and Medium-Sized Enterprises (SMEs). The proposed scheme implements the geometric center-based defuzzification method to convert the weighting fuzzy performance matrix into a crisp performance matrix, facilitating the application of TOPSIS that evaluates the overall performance of individual e-markets vis-à-vis selection criteria (e-market & SME's capability, e-market attractiveness, and electronic business environment). The findings demonstrate that the presented approach is efficacious in guiding SMEs to select the most suitable e-market for their e-business, thereby amplifying their market competitiveness.

In this study, a four-step model is proposed. Firstly, the model determines potential export markets through reliable databases. Secondly, the model identifies and selects the criteria for evaluating these markets through an extensive literature review and applying the Fuzzy Delphi method with experts. Thirdly, the model employs the entropy and the rank order centroid method to determine the relative importance of each criterion. Fourthly, the model uses the Topsis method to rank these markets. Then, the best market is evaluated through a sensitivity analysis to validate the results' stability. This approach has the potential to be adapted to various industries beyond small and medium-sized food enterprises in landlocked countries, thus contributing to the broader field of international market research. The main characteristics of these models are described in Frame 2 and Frame 5.

Frame 2 - Overview of systematic IMS-MCDM/A approaches

Study	Purpose	Design/Methodology	Propositions/Findings	Contributions/Implications
(DUAN; DENG; CORBITT, 2010)	Evaluate and select the most suitable electronic marketplace	The geometric center based defuzzification method and TOPSIS[3]	The original study proposes using hybrid MCDM tools to evaluate and select markets for small and medium-sized companies.	-This paper represents one of the earliest and most practical approaches in the MCDM field for assisting SMEs. -The article presents a case study demonstrating the proposed model's applicability in selecting the most appropriate e-market in electronic business.
(MEHDI KIANI ABARI, 2012)	Propose a new target market selection approach.	FAHP[10] and TOPSIS[3]	-The study proposes using a hybrid MCDM model to select markets through the qualitative and quantitative criteria trade-offs.	-This work represents the first approach that combines fuzzy logic with AHP, which allows for handling imprecise and vague judgments of decision-makers. -The manuscript presents an empirical study to demonstrate the model applicability.
(GÓRECKA, 2013)	Conduct a simulation of the market selection decision	EXPROM II[12], Modified ELECTRE III[13] and PROMETHEE II[14] - veto threshold	The article proposes to use a hybrid MCDM model to select markets by analyzing qualitative and quantitative criteria.	The article presents an empirical study to demonstrate the model's applicability in the case of a leading company in manufacturing and distributing hygiene, cosmetic, and medical products that seek to expand internationally.
(AGHDAIE; ZOLFANI; ZAVADSKAS, 2013)	Develop a method for market segment evaluation and selection	FAHP[10] and COPRAS-G[11]	-The study proposes a novel approach that integrates the fuzzy analytic hierarchy process (FAHP) and the “COPRAS-G” method to prioritize market segments.	-The study provides a flexible tool for evaluating and selecting market segments. -A case study on a chair manufacturing company is presented to illustrate the performance of the proposed methodology.
(MOBIN, 2014)	Rank 18 potential international markets	SAW[7], TOPSIS, VIKOR[8], and Shannon’s Entropy method	The study proposes a multi-criteria approach for prioritizing food product markets.	-This work represents the first approach incorporating the Shannon entropy method for criteria weighting. -It is the first study that applies multiple MCDM techniques. -The article applies the proposed approach to selecting target markets for Iranian pistachios.
(MARCHI *et al*., 2014)	Build and test an International Market Selection decision process method	FES[6]	For the first time, a decision-process methodology based on an FES is applied to a small firm’s IMS problem.	-The proposed methodology can help the decision maker improve the quality of the IMS process by reducing the effect of cognitive biases that usually affect traditional IMS models. -The article applies the proposed model into a small Italian firm in the stationery industry.

Study	Purpose	Design/Methodology	Propositions/Findings	Contributions/Implications
(AGHDAIE; ALIMARDANI, 2015)	Elicit a suitable target market	AHP and TOPSIS	-The article offers a new hybrid MCDM method that includes AHP and TOPSIS to obtain a suitable market.	The article is based on a single case study applied to a chair manufacturer company to validate the proposed model, which limits the generalization of the results.
(GOKMENOGLU; ALAGHEMAND, 2015)	Assess the attractiveness of host countries for foreign direct investment in different periods	AHP, TOPSIS and MP-MADM[5]	The article proposes a multi-criteria decision-making model to evaluate the priorities of foreign direct investment.	The article evaluates the relative priority of nine markets in different periods.
(LEE; JUNG; HAN, 2017)	Develop a country selection model for sustainable construction companies	Fuzzy LinPreRa- and AHP	The article proposes a hybrid model to select the appropriate country for expanding companies dedicated to sustainable construction.	-The hybrid model provides some different predictions with only subjective opinions in unexperienced countries, which implies that expert opinion is not always reliable. -The study evaluated the model's validity through case applications, expert interviews, and surveys.
(SCHÜHLY; TENZER, 2017)	Assessing the attractiveness of African countries for foreign direct investment	AHP	The study proposes an international market selection model for companies investing in sub-Saharan Africa.	The study is the first in the IMS literature to focus solely on sub-Saharan African markets.
(OEY; NOVIYANTI; LIM, 2018)	Perform an IMS analysis and recommend which market(s) to enter.	AHP and GP[3]	The study proposes a hybrid model to evaluate and select international markets by combining two widely used techniques.	-This article is the first in the literature that introduces the goal programming (GP) technique. -The study evaluates the model's applicability through a case study of a medium-sized Indonesian company that wishes to export its metal products to international markets.
(ARAYA-PIZARRO, 2019)	Assess potential international markets to fair trade	AHP	The study replicates and highlights the strength of the AHP method to prioritize export markets.	The study focuses on markets that have fair trade agreements.
(LÓPEZ-CADAVID; VANEGAS-LÓPEZ; (BAENA-ROJAS 2020)	Assess potential international markets	AHP	The study replicates and highlights the strength of the AHP method to prioritize export markets.	The study determines the critical factors a chemical company must consider to select export markets

Study	Purpose	Design/Methodology	Propositions/Findings	Contributions/Implications
(BAENA-ROJAS; CANO; CAMPO, 2020)	Assess the importance of export factors	AHP	The study proposes a methodology to structure the factors and sub-factors found in the literature that affect a company's international expansion process.	In the same way as the previous study, the factors that a chemical company must consider before exporting are determined. The main difference with the earlier study lies in the factors' relative importance distribution.
(VANEGAS-LÓPEZ *et al*., 2021)	Consolidate and apply a systematic methodology to evaluate international markets	AHP and TOPSIS[2]	The study replicates the AHP - TOPSIS hybrid model for selecting international markets.	The study determines the factors that a textile company in Colombia must consider to evaluate potential export markets.
(BAENA-ROJAS *et al*., 2022)	Find the best export market	AHP[1]	The study replicates a technique to determine export markets.	The study evaluates the model's applicability through a case study of a Colombian company that wishes to export its confectionery products to international markets.
This study	Assess and select potential export markets	Shannon's Entropy with rank order centroid method and TOPSIS	The study proposes a new hybrid MCDM methodology for small and medium-sized companies located in landlocked countries.	-The study presents a technique that identifies and selects the criteria that influence the market selection process. -The study evaluates the model's applicability through a case study of a medium-sized Bolivian company that markets insufflated cereals such as Canahua, Quinoa, and Amaranth. -It is the first study to apply sensitivity analysis to determine the robustness of the results obtained.

Notes: (1) Analytical hierarchical process; (2) Technique for order performance by similarity to ideal solution; (3) Goal programming; (4) Strengths, weaknesses, opportunities, and threats analysis; (5) Multi-period multi-attribute decision-making technique; (6) Fuzzy Expert System; (7) Simple additive weights; (8) Multicriteria compromise ranking method; (9) Data envelopment analysis; (10) Fuzzy analytic hierarchy process; (11) Complex proportional assessment of alternatives with grey relations; (12) Extended PROMETHEE II; (13) The Elimination and Choice Expressing Reality; (14) The Preference Ranking Organization Method for Enrichment Evaluation; (15) Fast-moving consumer goods.

Source: Own authorship (2023)

2.3 Multi-Criteria Decision-Making

The development of MCDM began in 1971. Since then, many terms have been used for MCDM. Some of these terms are given below:

- ✓ Multi-Criteria Decision Analysis (MCDA);
- ✓ Multi-Objective Decision Making (MODM);
- ✓ Multi-Attributes Decision Making (MADM);
- ✓ Multi-Dimensions Decision Making (MDDM).

The main objective of MCDM is to provide decision-makers with a tool to enable them to advance in solving a multi-criteria decision problem, where several conflicting criteria are taken into account (ZARDARI *et al*., 2015). Kabir (2014), said that MCDM provides a systematic approach to evaluate multiple cost/benefit criteria inputs. Zardari (2015) said that the application of MCDM processes offers several advantages; It structures a rational view of the problems; it provides a rational, consistent, and objective ranking for the potential solutions. Therefore, MCDM methods can help decision-makers to:

- ✓ **Identify and prioritize their criteria:** MCDM methods can help decision-makers to determine all of the relevant criteria that should be considered in a decision process, and to prioritize those criteria based on their significance.
- ✓ **Evaluate alternatives:** MCDM methods can help decision-makers to assess different alternatives against the determined criteria, and to compare and contrast the alternatives.
- ✓ **Make informed decisions:** MCDM methods can aid decision-makers to make informed decisions by supplying them with a systematic and objective way to evaluate alternatives and to select the most suitable alternative.
- ✓ **Improve transparency and accountability:** MCDM methods can help decision-makers to be more transparent and accountable by providing a clear and auditable record of the decision-making process
- ✓ **Facilitate communication and collaboration:** MCDM methods can facilitate communication and collaboration between different stakeholders in a decision-making process (TSCHEIKNER-GRATL *et al*., 2017).

- ✓ **Reduce the risk of making bad decisions:** MCDM methods can help decision-makers to reduce the risk of making bad decisions by providing them with a structured and systematic way to evaluate alternatives.

Due to their relevance and strength, as mentioned above, numerous MCDM techniques have been proposed and used in real-world scenarios. The literature on MCDM is rich and diverse. Some popular MCDM methods that researchers have frequently used to solve real-world multiple-criteria problems are named below:

- ✓ Analytic Hierarchy Process (AHP);
- ✓ Analytic Network Process (ANP);
- ✓ Elimination and Choice Translating Reality (ELECTRE);
- ✓ Goal Programming (GP);
- ✓ Measuring Attractiveness by a Categorical-Based Evaluation Technique (MACBETH);
- ✓ Multi-Attribute Utility Theory (MAUT);
- ✓ Multi-Attribute Value Theory (MAVT);
- ✓ Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE);
- ✓ Technique for Order Preference by Similarity to Ideal Solution (TOPSIS);
- ✓ Weighted Sum Model (WSM).

MCDM has been widely used to solve problems involving multiple variables and alternatives, being useful in various fields of knowledge and activities such as supplier selection (GUARNIERI, 2019), forecasting demand (DEINA *et al*., 2023), cost management (LIZOT, 2021), vulnerability assessment (TEDESCO, 2021), budget planning (THESARI, 2021), and systems selection (LIZOT *et al*., 2021).

However, MCDM methods have been criticized by many researchers for their susceptibility to manipulation, which can lead to a false sense of accuracy. Some MCDM criticisms are as follows:

- **Aggregation algorithms:** Different MCDM methods produce different results when applied to the same multi-criteria problem. Choosing an

appropriate MCDM method from a long list of MCDM methods is often complex and can affect the result of the decision-making process.

- **Compensatory methods:** Complete aggregation methods of the additive type, such as the Analytic Hierarchy Process (AHP), allow for trade-offs between good performance on one criterion and poor performance on some other criteria. However, this can often lead to the loss of important information.
- **Elicitation process:** How subjective information (such as weights and preference thresholds) is elicited is not trivial and can influence the results.
- **Incomparable options:** Since the purpose of all MCDM is to reduce the number of incomparability, MCDM problems are often reduced to single-criterion issues for which an optimal solution exists. This action completely changes the decision problem's structure, which is unrealistic. Additionally, alternatives are often reduced to a single abstract value during data aggregation, resulting in the loss of useful information.
- **Problem structuring:** Results can be manipulated by omitting or adding relevant criteria or options.
- **Additional required information:** Depending on how much additional information is needed for the different MCDM methods, "black box" effects are likely to occur. This effect compromises the decision-maker's ability to follow the decision process and evaluate the results.
- **Uncertainty:** Results are often presented with two decimal places, which gives a false sense of precision. This action is because of the uncertainties in the input data and the propagation of errors in the model. Uncertainty is also inherent to the decision-making process, as it is difficult to quantify and represent the performance of most options with a single value.

2.3.1 MCDM classifications

MCDM methods can be categorized in various ways. One of the classifications frequently encountered in the literature, as proposed by Roy (1996), encompasses two primary categories, specifically when exclusively focusing on discrete methods: Unique criterion of synthesis methods and Outranking methods. In a separate classification scheme, Belton (2007) identified three distinct categories for MCDM methods, namely,

value measurement model, Goal aspirational and reference models, and Outranking models. Furthermore, these types of methods can be alternatively classified based on their rationality, as outlined by Banihabib (2017), categorizing them as either compensatory or non-compensatory.

2.3.2 MCDM Method selection

Each MCDM method has strengths and drawbacks, and the most suitable technique for a given case and context must be carefully selected. Abrishamchi (2005) state that selecting a suitable MCDM from a long list of known MCDM methods is a multi-criteria problem. No MCDM method can be outstanding for all decision-making problems, and researchers have distinct opinions on this subject. On the one hand, Guitouni (1998) argue that each MCDM method yields different recommendations. On the other hand, Hajkowicz (2008) say that it is somewhat probable that the classification of alternatives changes notably using a different MCDM method whenever ordinal and cardinal data are handled correctly. However, the literature review of MCDM methods used for the international market selection process (Frame 2) has shown that the most commonly employed methods in this field are TOPSIS for market ranking and AHP for criteria weighting.

2.3.3 Topsis

TOPSIS is a valuable technique for handling real-world MCDM issues (HWANG; YOON, 1981). It helps Decision-Makers (DMs) analyze, compare, and rank available alternatives when multiple criteria are implicated. The primary idea of TOPSIS is straightforward. It stems from the concept of a displaced ideal point from which the solution has the shortest distance identified. Hwang (1981) additionally proposed that the ranking of the alternatives is established on the shortest distance from the ideal solution or Positive-Ideal Solution (PIS) and the most distant distance from the Negative-Ideal Solution (NIS) or anti-ideal solution.

TOPSIS also considers the distances to both PIS and NIS, and a preference order is ranked on account of their relative proximity, a combination of these two distance measures. Although there are myriad versions, the core thinking of the technique is to believe that the distance function represents the decision-makers'

preference or utility. Thus, the alternatives or variants can be ranked based on the mixtures of distances.

The TOPSIS method in based on five computation steps: The first step is the gathering of performances of the alternatives on the different criteria. These performances need to be normalized in the second step. The normalized scores are then weighted and the distances to an ideal and anti-ideal point are calculated. Finally, the closeness is given by the ratio of these distances. These five steps are explained in more detail in the methodology section.

2.3.4 Sensitivity analysis

Sensitivity analysis represents the solution stability or behavior against slight variations in the preference that arise during the solution process or in the face of subtle changes in the values assigned to the criteria (PAMUČAR; ĆIROVIĆ, 2015).

The sensitivity analysis, based on the subtle changes in the values (weights) assigned to the criteria, directs the modifications in the results and demonstrates the effectiveness of the proposed approach. It allows us to observe how the classifications of the alternatives change by altering the weights and contributes to showing stability and robustness in the results. In this sense, stable results can improve the final decision in selecting the most appropriate alternatives (KESHAVARZ GHORABAEE *et al*., 2018).

Despite the lack of academic consensus on selecting the sensitivity analysis method (IRIK; DRAGAN, 2018), this study has adopted the approach proposed by Diaby (2014). In this approach, each criterion varies in 10% intervals, and for the other ones, the weight is recalculated following the proportion determined by the entropy and the rank order centroid method. The weights obtained in each variation were reintegrated into the TOPSIS method to get new proximity coefficients. The steps are explained in more detail in the methodology section.

2.3.5 Weighting methods

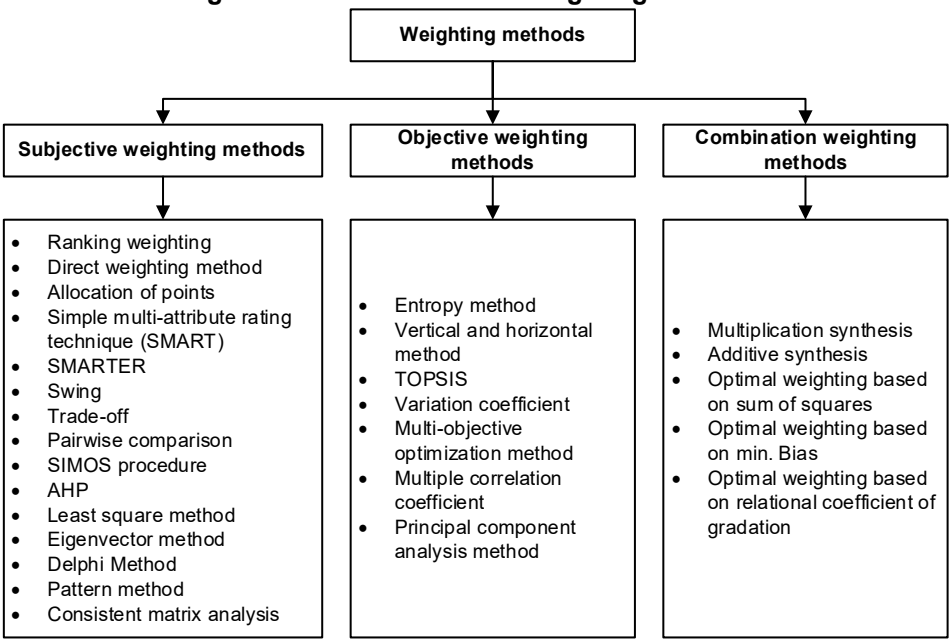
Tervonen (2009) assert that the most challenging task within an MCDM approach is the allocation of weights to criteria. The primary objective of a weighting method is to associate cardinal or ordinal values with different criteria to express their relative significance in a multi-criteria decision-making process (ZARDARI *et al*., 2015).

Subsequently, these values are utilized by the MCDM method in the subsequent evaluation of alternatives. Wang (2009) categorize the rank-order method into three distinct groups: subjective weighting methods, objective weighting methods, and combination weighting methods.

Subjective methods involve determining criteria weights according to the preferences of DMs. These methods provide a more transparent description of the elicitation process and are the most commonly employed in the MCDM field. The most popular weighting methods that have been used in previous multi-criteria-decision-making studies are listed as direct rating, ranking method, point allocation, pairwise comparison, ratio method, swing method, graphical weighting, Delphi method, Simple Multi-Attribute Ranking Technique (SMART) SIMOS method (ZARDARI *et al*., 2015).

On the other hand, objective weights are derived through mathematical techniques rooted in the analysis of initial data, and decision-makers have no role in determining the relative importance of criteria (WANG *et al*., 2009). While this approach lacks transparency, it incorporates methods such as min-max deviation, Least Mean Square (LMS), TOPSIS, entropy, and multi-objective optimization. Lastly, combining the weighting methods represents a hybrid approach that blends multiplication and additive synthesis techniques. Regarding what was presented, the classification of weighing methods is illustrated in Figure 3.

Figure 3 - Classification of weighting methods



Source: Zardari *et al*. (2015)

2.3.5.1 Rank Order Centroid (ROC)

As mentioned above, criterion weighting is a process in which weights are assigned to different criteria based on their importance. The ROC is a criterion weighting method developed by Hutton (1992) in the multicriteria decision-making field. This method is based on the idea that more important criteria should have a higher weight than less essential criteria. The steps of this method comprise the following steps. Firstly, the criterion identification step allows for the identification of criteria, which can be attributes, factors, or characteristics relevant to the decision-maker. Secondly, the criterion ranking step enables sorting criteria based on their importance. In this sense, the most important criterion should be first on the list, and the least important should be the last. Finally, the weight calculation step allows for assigning a weight to each criterion. These three steps are explained in more detail in the methodology section.

2.3.6 Fuzzy Delphi Method (FDM)

The computational analysis based on the FDM allowed the expert responses to be analyzed. FDM is an approach developed by Murray (1985), and combines Delphi method and fuzzy theory analysis to achieve a consensus by solving the vagueness and ambiguity of expert judgments to improve the efficiency and quality of traditional Delphi method surveys through fuzzy set theory, which addresses situations in which humans cannot precisely describe a judgement. According to Kuo (2008), this method is advantageous due to its simplicity and comprehensive coverage of expert opinions.

The use of fuzzy theory avoids the distortion of individual expert opinions, captures the semantic structure of predicted items and considers the unclear nature of the data collected (LEE; HSIEH, 2016). Therefore, the combination provided by FDM requires a small number of samples and offers a complete expression of expert knowledge (MA *et al*., 2011). In other words, the robustness of FDM lies in the fact that every expert opinion is considered and integrated to achieve a consensus and generates additional benefits by reducing investigation times and decision-making costs (KUO; CHEN, 2008; LEE; WU; TSENG, 2018).

This study will address the FMD approach proposed by Padilla (2021) and comprises the following steps. Firstly, expert information is gathered through surveys.

Secondly, fuzzy numbers are calculated, which allows for aggregating all the experts' judgments. Thirdly, a threshold value of β=6 is determined to select the criteria. Finally, those criteria equal to or greater than the threshold value are chosen.

2.3.7 Entropy method

The entropy method (ZELENY, 1998) is an objective method for criteria weighting in the MCDM field, used to assess the uncertainty associated with input data and the variability of decision-makers preferences. This method assigns weights to criteria in proportion to the information they provide. Higher entropy corresponds to lower criterion weight and vice versa. In other words, a higher entropy value indicates more significant uncertainty or lack of consensus among the values of alternatives and criteria. In contrast, a lower value reflects more uniformity or certainty in preferences.

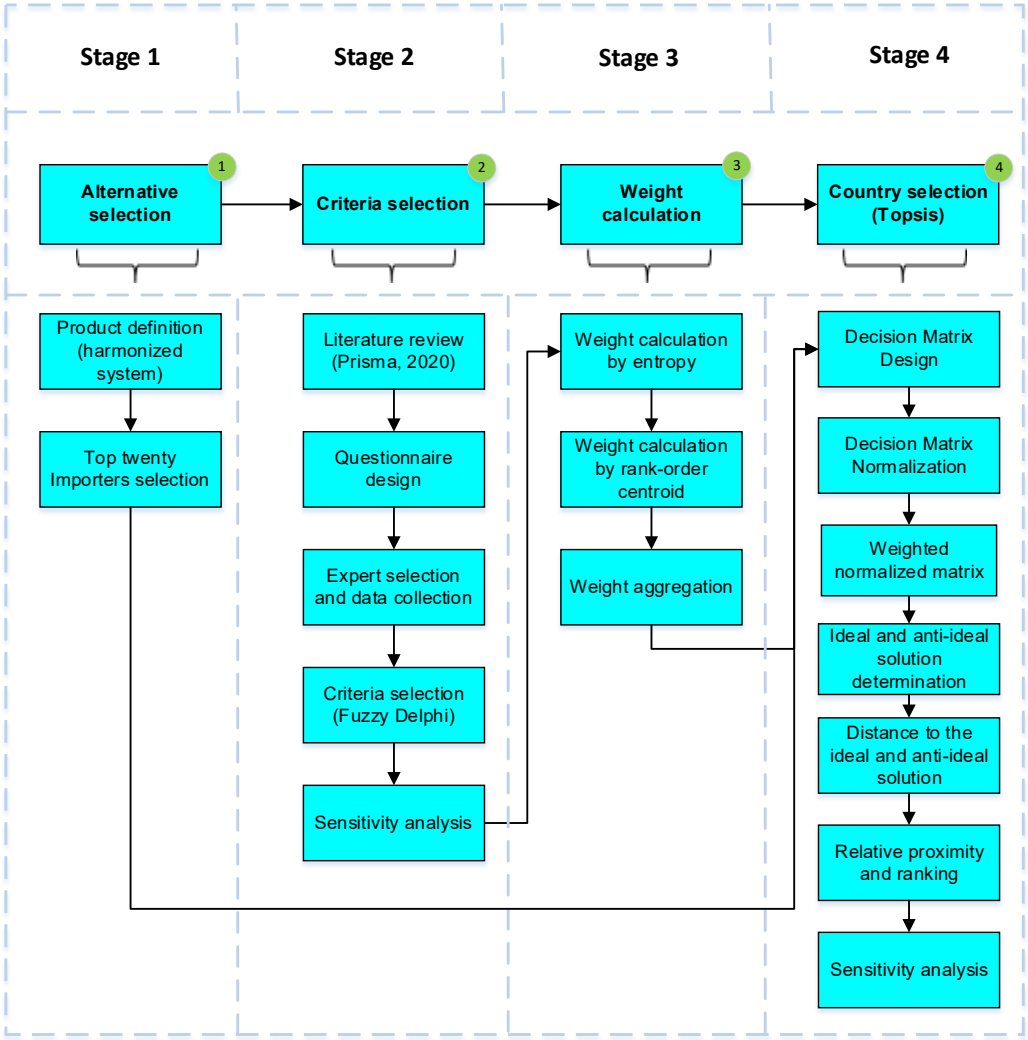
In summary, entropy plays an essential role in MCDM by quantifying data uncertainty and dispersion. This method can be used for a range of MCDM problems, such as supplier selection (SHEMSHADI *et al*., 2011), water quality assessment (ZOU; YUN; SUN, 2006), economic benefit assessment (WANG; LUO, 2010). The typical process of entropy method in MCDM involves the following steps:

- **Identification of Criteria:** Enumerate and define the relevant criteria for the decision-making problem.
- **Data Collection and Criterion Evaluation:** Gather information on how each alternative performs to each criterion.
- **Entropy Calculation:** Calculate entropy for each criterion. This calculation is based on the diversity of evaluations and helps measure how much disorder or uncertainty exists in the criterion evaluations.
- **Determination of Relative Weights:** Use the calculated entropy to determine the relative weights of the criteria. The higher the entropy, the greater the uncertainty and the lower the criterion's weight in decision-making.
- **Normalization of Weights:** Adjust the relative weights to ensure they sum to 1, making them normalized weights.
- **Application in the Decision-Making Process:** Utilize the normalized weights to evaluate and rank alternatives based on the criteria.

3 METHODOLOGY

The present study introduces a comprehensive methodology structured around four distinct steps, each designed to provide an in-depth depiction of the IMS process and organized according to the objectives set out in the introductory section of this study. Figure 4 serves as a visual aid that delineates the various stages of the methodology.

Figure 4 - Methodological framework proposed for international market selection



Source: Own authorship (2023)

3.1 Stage 1 - Alternative selection

The first stage focuses on the pre-selection of global markets that demonstrate a propensity to purchase a product based on its classification in the globally

harmonized system. At this stage, the TRADE MAP tool of the International Trade Center (ITC) identified the twenty leading importers.

3.2 Stage 2 - Criteria selection

The second stage establishes the criteria for the IMS process. At this stage, a systematic review of the literature through the Prisma method (PAGE *et al*., 2021) structurally determines the MCDM criteria for the international market selection process (Step A). Afterward, the identified criteria were evaluated in detail by academics and supply chain experts using the Fuzzy Delphi tool (Steps B to D) developed by Ishikawa (1993). Then, the sensitivity analysis approach proposed by Padilla (2021) aids in determining the robustness and stability of the criteria selected (Step E). Finally, international economy and supply chain experts aid in identifying the indicators that objectively measure the chosen criteria (Step H). In this sense, this stage will give consensus within the panel of experts regarding the most relevant criteria during the internationalization process of SMEs in landlocked countries. The steps of this stage are described below.

a) Systematic literature review: This step will allow the identification of a criteria portfolio for the international market selection process in the MCDM field. The results section provides more details of the phases of the literature review.

b) Gather expert opinions from surveys: Steps B to E will allow us to filter the most relevant criteria for SMEs in landlocked countries. First, professionals were asked to rate the significance of each IMS criterion, then their answers (judgments) were collected using the linguistic parameters shown in Frame 3.

Frame 3 - Linguistic evaluation scale

Linguistic parameter	Description	Numeric scale	Triangular fuzzy numbers (a,b,c)
Absolutely essential	The criterion is fundamental in the IMS process.	9	(7,9,9)
Very important	The criterion is very significant in the IMS process.	7	(5,7,9)
Important	The criterion is significant in the IMS process.	5	(3,5,7)
Moderately important	The criterion is slightly relevant in the IMS process.	3	(1,3,5)
not important	The criterion is not relevant in the IMS process	1	(1,1,3)

Source: Adopted from Padilla-Rivera (2021)

c) Calculation of fuzzy numbers: To derive the fuzzy numbers for each criterion, triangular fuzzy number (*W*) were employed, as shown in equation 1, which aggregates the judgment of all *k* experts.

$$W_j = \left(a_{jL}, b_{jM}, c_{jN}\right) = \left(min_k a_{jL}^k; \left(\prod_{k=1}^{k} b_{jM}^k\right)^{\frac{1}{k}}; max_k c_{jN}^k\right) \quad (1)$$

Here, W_j represents the aggregate triangular fuzzy number for criterion j; *J* denotes the indicator set, while *k* represents the set of experts. a_{jL} denotes the minimum expert assessment, b_{jM} signifies the geometric mean of all expert assessments for criterion *j*, and c_{jN} indicates the maximum expert assessment. This step utilizes the maximum and minimum values of expert opinions as the endpoints of the triangular fuzzy numbers, with the geometric mean serving as the degree of membership for the fuzzy numbers.

d) Defuzzification: The final relative importance is obtained by defuzzifying the fuzzy number of each criterion using the Simple Center of Gravity Method (SCGM) proposed by Hsu (2010). SCGM is a commonly used defuzzification method that calculates the relative importance average of the membership function as equation 2. Here P_j represents a crisp score indicating the aggregate importance of each potential IMS-MCDM criterion.

$$P_j = \frac{a_{jL} + b_{jM} + c_{jN}}{3} \quad (2)$$

e) Selection guideline: A threshold value (β) needs to be established to select the essential IMS-MCDM criteria from the expert group. According to Shen (2010), the threshold value depends on the fuzzy linguistic scale and user preference. Consequently, to achieve a solid convergence between the perspectives of the multifaceted experts panel, a threshold value of β= 6 is applied to each defuzzification number to select the final criteria. Therefore, the condition is given by:

If $P_J \geq \beta = 6$ then the IMS-MCDM criteria is selected.

If $P_J \leq \beta = 6$ then the IMS-MCDM criteria is omitted.

f) Sensitivity analysis application: This analysis will allow us to understand how changes in the threshold values affect the final criteria list. Therefore, as Padilla-Rivera (2021) established, two threshold values were chosen, one being higher and the other lower by 0,5.

g) Definition of indicators for each criterion: This stage allows the criteria selected to be objectively measured using indicators available on globally reliable platforms.

3.3 Stage 3 - Weight calculation

In the third stage, the study employs an integrated or combined weighting method to determine the relative importance of the previously defined indicators. At this stage, the weight obtained by the modified entropy method proposed by Wu (2016) is added to the weight obtained by the rank-order centroid method proposed by Hutton (1992). Thus, the indicators acquire weights that reflect the decision maker's perspective (weights given subjectively) and the information associated with each indicator (weights given objectively). The relative importance obtained through the modified entropy method is deployed in steps A to D. Conversely, the weights obtained through the Rank order centroid method are shown in step E. Finally, the aggregation of both approaches is depicted in steps F to G.

a) Construction and normalization of the decision matrix: The decision matrix (a_{ij}) allows comparing and evaluating different markets based on multiple criteria. At this step, equations 3 and 4 normalize the value of each preselected market regarding the indicators selected in the stage 2.

$$x_{ij} = \frac{a_{ij} - min(a_{ij})}{max(a_{ij}) - min(a_{ij})}; For\ positive\ indicators. \quad (3)$$

$$x_{ij} = \frac{\max(a_{ij}) - a_{ij}}{max(a_{ij}) - min(a_{ij})}; For\ negative\ indicators. \quad (4)$$

b) Alternative performance determination: The market normalized performance $i(i = 1, .., m)$ regarding the indicator $j(j = 1, .., n)$ is determined by equation 5.

$$r_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \quad (5)$$

c) Entropy definition: Equation 6 defines the entropy of the market performance regarding the indicator j.

$$E_J = -(\ln(m))^{-1} * \sum_{i=1}^{m} r_{ij} * \ln(r_{ij}) \quad (6)$$

d) Weights definition by entropy method: The partial weight of each indicator is obtained with the equation 7. Where, $0 \leq \lambda_j \leq 1$ and $\sum_{j=1}^{n} \lambda_j = 1$.

$$\lambda_j = \frac{1 - E_J}{\sum_{j=1}^{n} 1 - E_J} \quad (7)$$

e) Weight definition by the rank-order centroid method: The other partial indicator weight is obtained with the equation 8.

$$w_j = \frac{1}{m} \sum_{k=1}^{m} \left(\frac{1}{p_j}\right); j = 1,2, \dots, m \quad (8)$$

f) Weight aggregation: Equation 9 aggregates the indicator weights obtained from the values given by the entropy method (λ_j) and the indicator weights subjectively assigned by the rank order centroid method (W_j).

$$\tilde{\lambda}_j = \lambda_j * W_j \quad (9)$$

g) Weight normalization: Finally, $\tilde{\lambda}_j$ is normalized with the equation 10.

$$\tilde{\lambda}_n = \frac{\lambda_j * W_j}{\sum_{j=1}^{n} \lambda_j * W_j} \quad (10)$$

3.4 Stage 4 - Market selection

The fourth stage determines the most practical and profitable international export markets using the TOPSIS method proposed by Hwang (1981). Finally, the sensitivity analysis allowed us to evaluate the results' stability before changes in the

indicator weights. Steps A to E represent the sequences for the Topsis method, and steps F to I show the steps for the sensitivity analysis.

a) Decision matrix normalization: The performances (*a*) of the markets (*n*) concerning the indicator (*m*) are collected in a decision matrix *X* = (a_{ij}). Then, the distributive normalization is employed, as shown in Equation 11. Here, the performances are divided by the square root of the sum of each squared element.

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}}; \text{for a} = 1, \dots, \text{n and i} = 1, \dots, \text{m}. \quad (11)$$

b) Weighted Normalized Matrix: At this step, the weighted normalized decision matrix is built by multiplying the normalized scores r_{ij} by their corresponding weights $\tilde{\lambda}_n$ as equation 12.

$$v_{ij} = r_{ij} * \tilde{\lambda}_n \quad (12)$$

c) Ideal and anti-ideal solution definition: The weighted scores will be used to compare each value to an ideal (zenith) and anti-ideal (or nadir or negative ideal) virtual solution. These virtual solutions are the best and worst performance on each indicator of the normalized decision matrix:

$$A^+ = (V_1^+, \dots, V_m^+); \text{ for the ideal solution.} \quad (13)$$

$$A^- = (V_1^-, \dots, V_m^-); \text{ for the anti-ideal solution.} \quad (14)$$

Where: $V_j^+ = \{(max(v_{ij})|\, j \in j_1), (min(v_{ij})|\, j \in j_2)|i = 1, \dots, m\}$ if the indicator j is to be maximized, and $V_j^- = \{(min(v_{ij})|\, j \in j_1), (max(v_{ij})|\, j \in j_2)|i = 1, \dots, m\}$ if the indicator j is to be minimized.

d) Distance to ideal and anti-ideal solution determination: The next step involves calculating the Euclidean distance of each value from the ideal solution (15) and the anti-ideal solution (16).

$$d_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^2}; i = 1, \dots, m. \quad (15)$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2}\,; i = 1, \ldots, m. \quad (16)$$

e) Relative proximity definition: Equation 17 calculate the relative closeness coefficient of each value. The closeness coefficient is always between 0 and 1. If a market value is closer to the ideal solution, then C_i approaches 1, whereas if a market value is closer to the anti-ideal than to the ideal, C_i approaches 0.

$$c_i = \frac{d_i^-}{d_i^- + d_i^+}, c_i \in [0,1]\ \forall = 1, \ldots m. \quad (17)$$

Until the previous step, obtaining a ranking of the preselected markets is possible. However, as mentioned in the bibliographical background, a sensitivity analysis allows us to determine the robustness and stability of the results in the face of subtle changes in the weights assigned to each indicator. In this sense, this study has adopted the approach proposed by Diaby (2014). In this approach, each indicator varies in 10% intervals, and for the others, the weight is recalculated following the proportion determined by the entropy and rank order centroid method. The relative importance obtained in each variation was reintegrated into the TOPSIS method to get new proximity coefficients, following steps F to I:

f) Define the indicator (I_n) that will be varied: This step defines the indicators that will receive new values ($W_{n\alpha}$) varying from 0 to 1.

g) Proportional weight calculation for the other indicators: At this step, the proportional weights ($W_{n\beta}$) for the rest of the indicators are calculated except for the varied indicator I_n, through equation 18. Here, W_n represents the initial indicator weight, and W_β means the weight calculated by the entropy and rank order centroid method for the treated indicator.

$$w_{n\beta} = (1 - w_{n\alpha}) * \frac{w_\beta}{(1 - w_n)} \quad (18)$$

h) New ranking definition: In this step, the new weights are applied in the TOPSIS method without altering the evaluations to calculate the new proximity coefficients (C_i). Finally, the simulated rankings for different weights are determined.

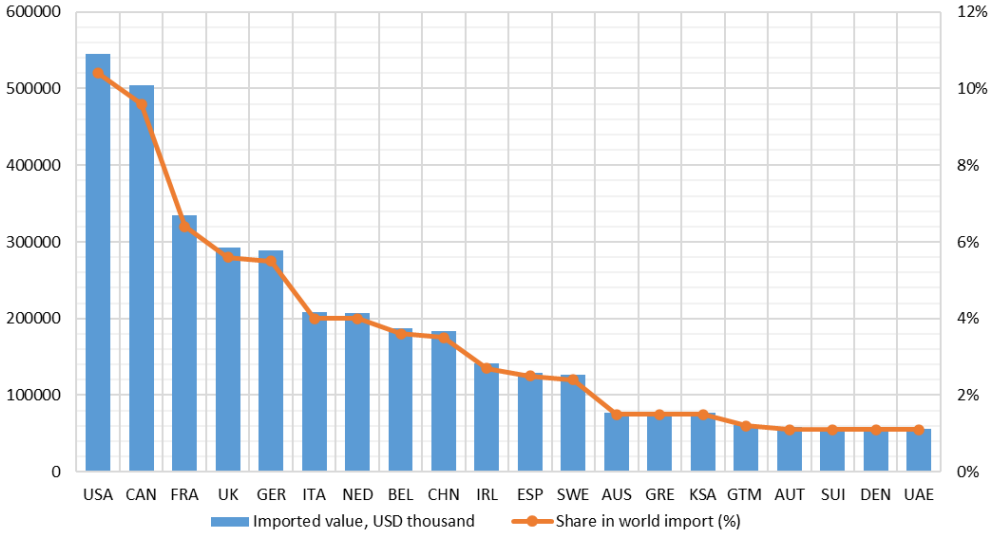
3 RESULTS

This chapter presents the results obtained during the research process. The results are organized based on the proposed methodology and aim to describe the findings generated clearly and concisely.

3.1 Stage 1 - Alternatives selection

A preliminary market selection is necessary to simplify the IMS process through a flexible and cost-effective approach. In this regard, the variable "imported value" initially proposed by Baena-Rojas (2022) for manufactured products allowed us to identify the top 20 importers of insufflated cereals (e.g., corn flakes) in 2022. In this sense, the tariff code used “19.04.10” was essential for determining the imported value per country in the database provided by the International Trade Centre (ITC).

Graphic 1 - Importers list for prepared foods obtained by swelling or roasting cereals or cereal products, e.g., corn flakes in 2022



Source: International Trade Center (2023)

Graphic 1 - summarizes the 20 leading importers of insufflated cereals. These countries represent 70.3% of the global import share for insufflated cereals, totaling 3,668,647 thousand USD. The United States is the top country with 545,541 thousand USD, followed by Canada with 504,183 thousand USD, and France with 334,770 thousand USD. Consequently, The Trade Map tool prevented the unnecessary assessment of 173 markets with low import potential, permitting the proposed model to remain flexible and cost-effective.

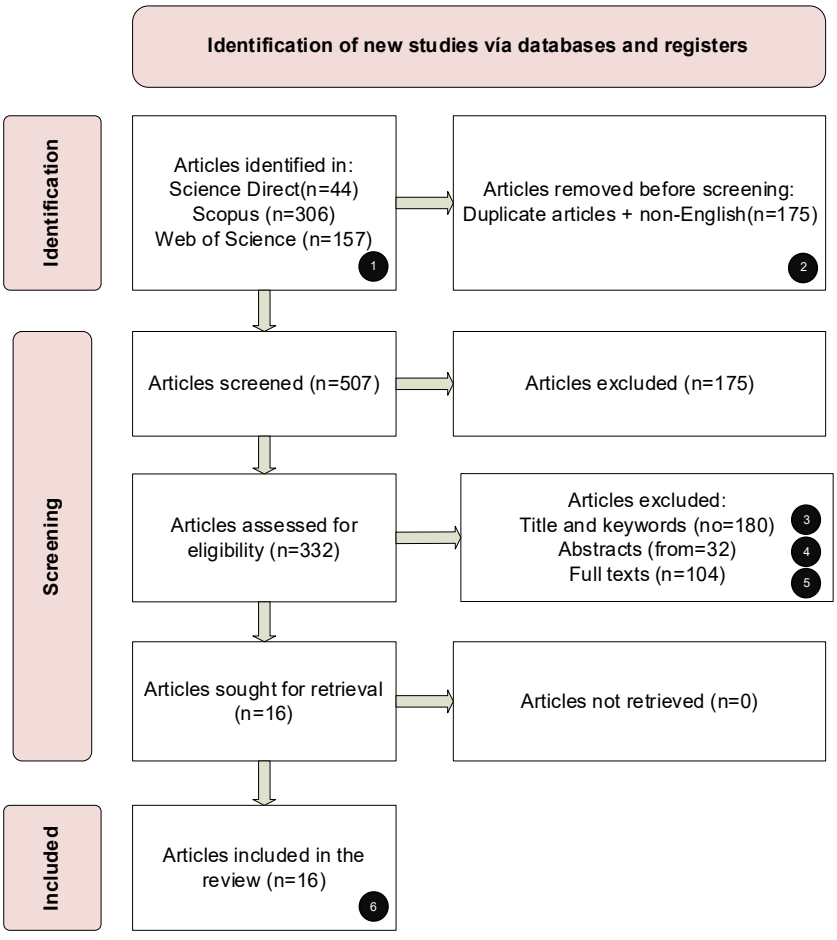
3.2 Stage 2 - Criteria selection

The systematic literature review is a rigorous and comprehensive methodology that enables the identification, evaluation, and synthesis of scientific evidence on a specific topic. This section will present a systematic literature review using the PRISMA method (2020) related to international market assessment criteria. The aim is to critically analyze existing studies and summarize the most relevant findings in the field.

3.2.1 Literature review through the Prisma method 2020

Figure 5 sequentially illustrates the steps inherent to the selected methodology, allowing the identification of new studies via databases and registries. However, at the end a content analysis is presented to analyze the criteria found by the literature review process.

Figure 5 - Steps for systematic literature review



Source: Scheme based on Page (2021)

3.2.1.1 Phase 1: new studies identification via databases and registers

Step 1: **Database Searches.** On November 30, 2022, the ScienceDirect, Scopus, and Web of Science databases were explored to cover all the literature available up to that specific date and without imposing any restriction on the types of documents (journal articles, both research as review, published and in the press, conference papers, books, and book chapters). Table 1 shows the search query combination used in this study. The search returned a total of 507 documents.

Table 1 - Keywords combination

Keywords combination	Science Direct	Web of Science	Scopus
("Decision-making" OR "Multi-Criteria Decision-Making" OR "MCDM") AND ("Country Selection" OR "International Market Selection" OR "IMS")	42	152	300
(“Decision-Analysis” OR “Multi-criteria Decision-Analysis” OR “MCDA”) AND (“Country selection” OR “International Market Selection” OR “IMS”)	2	5	6
Total articles in the Portfolio		**507**	

Source: Own authorship (2023)

Step 2: Elimination of Duplicates and Non-English/Spanish Documents. In this step, we eliminated all duplicated documents and those composed in languages other than English and Spanish. Consequently, this procedure yielded a corpus of 332 distinctive documents.

Step 3: Examination of Titles and Keywords. Each title and keyword were scrutinized, and the guiding question for retaining or excluding papers was, “Do the title and the keywords refer to a study that accounts for aspects of the IMS process?” 152 documents remained after this Step

Step 4: Analysis of Abstracts. The abstracts of all documents were scrutinized, and the guiding question for either retention or exclusion of the papers was, "Does the abstract refers to a study that accounts for aspects of the IMS process?" After this step, 91 documents remained.

Step 5: Analysis of Full Texts. The full texts of the 91 documents were retrieved and meticulously examined. During the comprehensive review, the criteria outlined in Frame 4 served as the guiding principles for determining the inclusion or exclusion of articles. After this rigorous review, 16 documents were deemed suitable for inclusion in the final portfolio, which will serve as the foundation for the forthcoming content analysis.

Frame 4 - Exclusion and inclusion criteria

Inclusion	Exclusion
IMS Articles	Marketing strategies
MCDA/M Articles	Linked to commodities
Manufactured SMEs	Linked service companies.
IMS Methodologies	Related to entry mode
IMS Case studies	Franchise studies

Source: Own authorship (2023)

Step 6: Retrieval of Records. The complete texts of all 16 records were sought and retrieved. No record was found to be lacking its full text.

Step 7: Identifying IMS-MCDA/M criteria. This fundamental step involved a meticulous content analysis of the final portfolio. During this review, a reading form was used to document the above-mentioned variable. The findings emanating from this analysis are presented in the following phase.

3.2.1.2 Phase 2: content analysis

Frame 5 represents the reading form and summarizes the 16 models identified in the literature for the international market selection process. The following aspects characterize the findings:

a) **Models found:** the models proposed in these studies can be grouped into three macro-categories:

   - ✓ Value measurement models, driven mainly by five studies (LÓPEZ-CADAVID; VANEGAS-LÓPEZ; BAENA-ROJAS, 2020; ARAYA-PIZARRO; ARAYA-PIZARRO, 2019; SCHÜHLY; TENZER, 2017). These models aim to assign numerical values to the markets based on how they perform to each criterion. Numerical values may be based on direct measures of performance, scores, or ratings provided by experts. An example of this model found is the Hierarchical Analysis Method.
   - ✓ Hybrid models, driven mainly by ten studies (BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; OEY; NOVIYANTI; LIM, 2018; LEE; JUNG; HAN, 2017; GOKMENOGLU; ALAGHEMAND, 2015; AGHDAIE; ALIMARDANI, 2015; MOBIN; DEHGHANIMOHAMMADABADI; SALMON, 2014; AGHDAIE; ZOLFANI; ZAVADSKAS, 2013; ABARI, 2012). Hybrid models combine different MCDM approaches and techniques into a single

framework to address complex decision-making problems. These models can combine elements of value measurement models, models based on outranking, and other methods depending on the problem's nature and the decision maker's preferences. These models aim to take advantage of the strengths of different approaches to obtain more robust and effective results. Examples of hybrid models found are: AHP-TOPSIS, AHP-GP, Fuzzy LinPreRa-AHP, AHP-TOPSIS-MP, Shannon's Entropy method-TOPSIS, Shannon's Entropy method-SAW, Shannon's Entropy method-VIKOR, FAHP-COPRAS-G, FAHP-TOPSIS.

- ✓ Outranking models, promoted mainly by Górecka (2013). These models are based on the idea that it is more appropriate to classify markets rather than assigning precise numerical values. They are used to solve problems where it is difficult or inappropriate to quantify the performance of alternatives on the criteria accurately. Examples of outranking models found are EXPROM II, ELECTRE III, PROMETHEE II.

b) **Sectors studied:** The studied sectors are diverse and encompass a wide range of industries, including the clothing or textile industry (2 studies), chemical products industry (2 studies), agro-industrial sector (2 studies), metallurgical industry (1 study), pharmaceutical industry (1 study), construction industry (1 study), chair industry (2 studies), stationery industry (1 study), cosmetics and medical products industry (1 study), and electronic industry (1 study). In addition, two studies did not have recorded information about the industrial sector.

c) **Host countries and target markets:** Host countries and target markets in the reviewed studies are diverse, including countries from different regions and development levels. Of the 16 models in the literature, only 14 have provided specific information about the host country and thirteen about the target market. It is important to emphasize that none of the identified host countries exhibit the characteristics of a landlocked country, highlighting a significant research gap in our field of inquiry and further bolstering the rationale for our proposed study.

Frame 5 - MCDM methods and criteria for the international market selection process

MCDM method	Related authors	Research objective	Business sector	IMS criteria and sub-criteria	Host country	Target market
AHP[1]	(BAENA-ROJAS *et al*., 2022)	Find the best export market	Confection industry	**Costs** (cost to import border compliance; internal transport; international transportation cost; official exchange rate; target market price), **cultural environment** (corruption perceptions index; cultural distance; ease of doing business; globalization index), **economics** (cost of living index; GDP per capita; risk country time to resolve insolvency; unemployment rate), **logistics** (frequency; geographic location; geographical distance; logistics performance index; transit time), **trade barriers** (index of economic freedom; international competitiveness; non tariffs barriers; protectionism in general; tariffs barriers)	Colombia	The study evaluated Twenty countries; among. best options are Ireland, Netherlands, Denmark, and United Kingdom,
AHP and TOPSIS[2]	(VANEGAS-LÓPEZ *et al*., 2021)	Consolidate and apply a systematic methodology to evaluate international markets	Textile sector	**Cost** (target market price; international transportation cost; cost to import border compliance; official exchange rate; internal transport), **trade barriers** (tariffs barriers; protectionism in general; index of economic freedom; non tariffs barriers; international competitiveness), **logistics** (logistics performance index; transit time; frequency; geographic distance, geographic location), **cultural environment** (ease of doing business; corruption perceptions index; cultural difference; globalization index), **economics** (GDP per capita; unemployment rate; cost of living index; risk country time to resolve insolvency).	Colombia	12 main buyers in the global textile industry (USA, Germany, Japan, UK, France, Italy, the Netherlands, Korea, Belgium, Canada, Spain and Australia)
AHP	(CADAVID; VANEGAS-LÓPEZ; BAENA-ROJAS *et al*., 2020)	Propose new economic sub-factors and establish the relative importance with the general factors of the literature for the IMS	Chemical sector	**Costs** (Price at destination; International transport cost; Import cost; Internal transport of origin; Exchange rate), **logistics** (Transit time; Shipping frequency; Physical and geographic distance; Logistics performance index; World geographic location), **trade barriers** (Tariff barriers; Non-tariff barriers; Index of economic freedom; Destination market competitiveness; Protectionism in general), **economic** (Country risk; Consumer Price Index; GDP per capita; Unemployment rate), **environment and culture** (Ease of doing business; Corruption index; Globalization index; Cultural mismatch).	Colombia	USA, Honduras, Ecuador, Turkey, Peru, Uruguay

MCDM method	Related authors	Research objective	Business sector	IMS criteria and sub-criteria	Host country	Target market
AHP	(BAENA-ROJAS; CANO; CAMPO *et al*., 2020)	Assess the importance of export factors	Chemical sector	**Cost Factor** (Price at destination; International transportation cost; Cost to import; internal transport of origin; Official exchange rate), **logistic factor** (Transit time; shipping frequency; physical; geographical distance; logistic performance index; world geographic location), **trade barriers factors** (tariff barriers; non-tariff barriers; index of economic freedom; market competitiveness; trade protectionism), **economic factor** (country risk; consumer price index; GDP per capita; unemployment rate), **environment and culture factor** (easy of doing business; corruption index; globalization index; cultural dis-affinity)	Colombia	Markets with favorable characteristics in all the dimensions are Ecuador, the USA, and Honduras
AHP	(ARAYA-PIZARRO, 2019)	Assess potential international markets to fair trade	Agro-industrial sector (fresh fruit)	**Market potential** (economic growth; purchasing power; volume of imports; growth of imports and exports), **accessibility and risk** (economic freedom; country risk; ease of doing business; transparency and corruption)	Chile	The Ranking is USA, Canada, Norway,
AHP and GP[3]	(OEY; NOVIYANTI; LIM, 2018)	Perform an IMS analysis and recommend which market(s) to enter.	Metal-derivatives products	**Strategic** (market value; economic growth; consumption growth), **marketing** (construction industry growth; potential market growth; industry performance), **supply chain** (lead time; bureaucracy; transportation cost), **risks** (net profit amount; political risk; currency risks)	Indonesia	Thailand, Malaysia, and Singapore are considered the best countries.
AHP	(SCHÜHLY; TENZER, 2017)	Assessing the attractiveness of African countries for foreign direct investment	FMCG[15], pharmaceutics and manufacture	**Society** (age distribution; size of the middle class; degree of urbanization; country's health infrastructure; life expectancy; per capita health care spending; education), **culture** (religion; languages)**, transport and infrastructure** (geographic distance; country's general infrastructure in energy and communication; internet usage), **economy** (GDP and GDP per capita; market size; International trade engagement; currency or monetary policy; market Prosperity; Currency & monetary policy), **politics** (political stability, government effectiveness; Rule of law; Corruption control)	Germany	46 Sub-Saharan nations were evaluated and The best countries are Mauritius, South Africa and Seychelles
Fuzzy LinPreRa-and AHP	(LEE; JUNG; HAN, 2017)	Develop a country selection model for sustainable construction companies	Sustainable construction businesses	**Country risk** (market size; construction market growth rate; construction market stability; construction market competition; quality of national governance; ease of doing business; degree of market openness; construction market reward), **project reward** (cumulative number of contracts; cumulative contract amount; bid-hit ratio; average profit rate; stability of profit performance; surplus ratio of projects completed)	South Korea	32 countries

MCDM method	Related authors	Research objective	Business sector	IMS criteria and sub-criteria	Host country	Target market
AHP, TOPSIS and MP-MADM[5]	(GOKMENOGLU, 2015)	Assess the attractiveness of host countries for foreign direct investment in different periods	-	**Gravity** (natural log of bilateral distance; host country natural log of real GDP), **geography/history** (share colonial relationship; share common language), **factor endowment** (host country natural log of real GDP per capita), **growth and productivity** (host country GDP growth rate; sum of host country's distance-weighted GDP to all other countries; host country productivity (real GDP per worker), **fiscal/monetary policy** (host country corporate effective tax rate), **Regional trade agreement/Customs union/investment** (latin american integration agreement; the asia-pacific economic community; dollar currency unions), **economic risk** (host country corruption), **political risk** (host country internal conflict; host country religion in politics)	United States	**Pre-crisis (2004-2006)** - Japan, Canada. **Crisis (2007-2009**) - Australia, Japan. **Post-crisis (2010-2012)** - Japan, Germany.
AHP and TOPSIS	(AGHDAIE; ALIMARDANI, 2015)	Elicit a suitable target market	Chair manufacture company	**Segment related** (growth rate per year; size; suppliers' ability; homogeneity; accessible; sustainable; competition), **financial and economic** (profitability; risk), **technological** (knowledge, experience, information, and manufacturing process technology required; complexity)	Iran	-
FES[6]	(MARCHI *et al.*, 2014)	Build and test an International Market Selection decision process method	Stationery industry	**Level of accessibility** (apparent consumption; consumption trend; per cent university students; per cent population in 10-30 age group; substitutive product; country risk; human development index; GDP per capita; consumption propensity; country of origin advantage; product standardization; psychic distance; imitation risk; product superiority), **level of attractiveness** (import penetration; tariff barriers; geographic distance; market information; international experiential knowledge; foreign network; managerial skills).	Italy	Switzerland was considered the ideal market.
SAW[7], TOPSIS, VIKOR[8], and Shannon's Entropy method	(MOBIN, 2014)	Rank 18 potential international markets	Agro-industrial sector (Pistacho)	Regulation criterion, cultural criterion, transportation distance criterion, economy criterion, market potential, politics criterion.	Iran	Luxembourg is a potential market in SAW and TOPSIS, and Italy in VIKOR.
FAHP[10] and COPRAS-G[11]	(AGHDAIE; ZOLFANI;	Develop a method for market segment	Chair manufacture company	Degree of concentration, laws and government agency regulations, types of competitors, contribution margins,	Iran	-

MCDM method	Related authors	Research objective	Business sector	IMS criteria and sub-criteria	Host country	Target market
	ZAVADSKAS, 2013)	evaluation and selection		manufacturing process technology required, complexity, growth rate per year, size, and leveraging factors.		
EXPROM II[12], Modified ELECTRE III[13] and PROMETHEE II[14] - veto threshold	(GÓRECKA, 2013)	Conduct a simulation of the market selection decision	Manufacturer and distributor (Hygiene, cosmetic and medical products)	**Market size** (total population; urban population), **market growth** (GDP growth rate), **economic development** (electric power consumption), **quality of life** (life expectancy at birth; improved sanitation facilities), **infrastructure** (road density; internet users), **market intensity** (GDP per capita), **market receptivity** (trade), **cultural distance** (cultural distance index), **factors of production** (cotton production; labor force**), investment climate** (foreign direct investment net inflows; economic freedom)	Poland	Target market are China and Thailand
FAHP and TOPSIS	(MEHDI KIANI ABARI, 2012)	Propose a new target market selection approach.	-	Mean import, rate growth, share import, per capita income, distance	-	The ranking is Spain, Italy, the United Arab Emirates, and the USA.
The geometric center based defuzzification method and TOPSIS	(DUAN; DENG; CORBITT, 2010)	Evaluate and select the most suitable electronic marketplace	Electronic Business in Small and Medium Sized Enterprises	**E-market capability** (market orientation; revenue model; technological competency), **e-market attractiveness** (market accessibility; market liquidity; relationship management), **SME's capability** (perceived benefit; SME readiness; top management support), **electronic business environment** (government pressure; trading partner influence)	-	-

Notes: (1) Analytical hierarchical process; (2) Technique for order performance by similarity to ideal solution; (3) Goal programming; (4) Strengths, weaknesses, opportunities, and threats analysis; (5) Multi-period multi-attribute decision-making technique; (6) Fuzzy Expert System; (7) Simple additive weights; (8) Multicriteria compromise ranking method; (9) Data envelopment analysis; (10) Fuzzy analytic hierarchy process; (11) Complex proportional assessment of alternatives with grey relations; (12) Extended PROMETHEE II; (13) The Elimination and Choice Expressing Reality; (14) The Preference Ranking Organization Method for Enrichment Evaluation; (15) Fast-moving consumer goods.

Source: Elaborated by the author based on a systematic literature review (2023)

d) **Criteria for selecting markets:** Concerning the criteria elucidated in Frame 5, it becomes evident that achieving academic consensus regarding the necessary criteria for their incorporation into the IMS process is a complex task. Despite the lack of unanimity regarding the precise criteria, predominant IMS studies consistently cover factors related to market potential (Frame 8), market openness (Frame 9), Political-Economic (Frame 10), supply chain (Frame 11), sociocultural (Frame 12), SME-specific, and others (Frame 13), for more details see Appendix A.

Experts in international economics and supply chain management were consulted to compare the criteria identified in the literature, aiming to eliminate duplicates and merge those that were too similar. The result of this process is shown in Figure 6, this figure summarizes the potential criteria obtained from the previous literature review, and the consensus reached among the experts.

In Figure 6, it is possible to appreciate that six dimensions were created. The first-dimension deals with SME-specific issues, and four criteria were identified. The first criterion is "financial resources," which refers to the company's capital to cover all the administrative costs associated with exports. The second criterion is human capital, which refers to the experience and knowledge of mid to high-level personnel to manage international networks. The third criterion is the "systematic approach" to finding markets, which relates to the company's technological capability to obtain relevant target market information. The fourth criterion is "product quality," which pertains to the company's technical flexibility to adapt its products to the target market standards.

The second-dimension deals with specific issues related to logistics and supply chain, and five criteria were identified. The first criterion is "transportation cost," representing national and international land and sea freight costs. The second criterion is "distance," measuring the distance between the host country capital and the target market capital. The third criterion is "logistic performance," allowing the measurement of logistical efficiency and commercial ease in the target market. The fourth criterion is "transit time," measuring the time to move merchandise from the company to the target market. The fifth criterion is "exchange rate," allowing the measurement of fluctuations in the exchange rate between the host country and the target market.

The third-dimension is the potential of the target market, and two criteria were identified. The first criterion is "perceived benefit," which measures the profit the

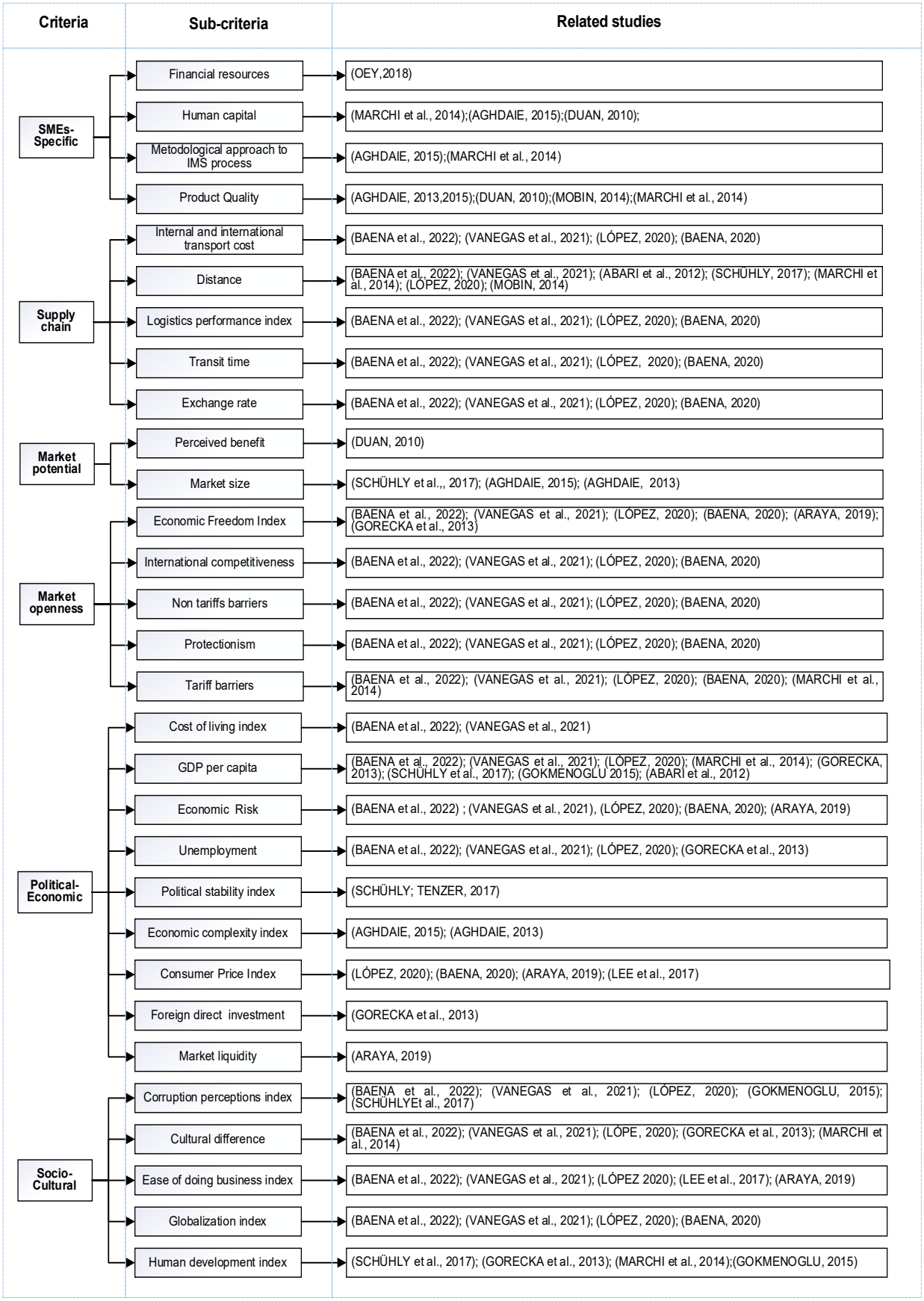
company could receive from exporting to the target market. From a practical standpoint, this criterion becomes challenging to calculate due to the amount of data and forecasts that the marketing team must perform. The second criterion is "market size," allowing measurement of the current apparent product consumption in the target market.

The fourth-dimension is the target market openness, and five criteria were identified. The first criterion is "economic freedom," measuring the ease of entry for foreign competitors into the target market. The second criterion is "international competitiveness," measuring the capacity to generate economic and social development opportunities in the target market. The third criterion is “non-tariff barriers”, measuring licenses, sanitary standards, or other requirements imposed. The fourth criterion is the “level of protectionism”, referring to import restrictions. The fifth criterion is "tariff barriers," referring to rates and quotas applied to imported goods.

The fifth-dimension consists of nine criteria measuring the political and economic aspects of the target market. Here, nine criteria were identified. Among them are the cost of living, gross domestic product, economic risk, unemployment rate, political stability, economic complexity, inflation, foreign investment, and market liquidity. Evaluating these criteria helps understand a market's economic and political situation, risks and opportunities.

The final dimension consists of five criteria that measure the social and cultural aspects of the objective market. The first criterion is the "perception of corruption"; this criterion can increase the costs and risks associated with investing in a given market. The second criterion is "cultural differences"; it is essential to highlight that this criterion can make communication and understanding between the involved parties difficult. The third criterion is "the bureaucracy to do business"; this criterion measures the difficult to comply with legal and regulatory requirements to do business in a given market. The fourth criterion is "globalization"; this criterion measures the degree to which a market is integrated into the global economy. The fifth criterion is "social development"; this criterion evaluates the population's well-being and quality of life in a given market. These criteria complement the previously mentioned economic and political aspects and help companies to have a more complete image of a given market. It is essential to emphasize that these criteria are not absolute and can vary depending on the sector and the company's strategy.

Figure 6 - Potential criterion for the IMS-MCDM/A process



Source: Prepared by the author based on the systematic literature review and specialists consult (2023)

3.2.2 Questionnaire design

As mentioned above, the 30 criteria identified were classified according to six dimensions, namely: market potential (2), market openness (5), political & economic (9), supply chain (5), Socio & cultural (5), SMEs-specifics (4). Based on this classification, the existing literature and the valuable contribution of experts in qualitative methods aid in designing the primary questionnaire.

The survey was elaborated with particular attention to the participant's mother dialect, Spanish. However, for this study, an accurate translation into the English language was carried out, considering all necessary precautions to preserve the question's appropriateness. Finally, A pre-test in collaboration with specific experts permits identifying and adjusting the questions that present ambiguities. The pre-test results allow editing, eliminating, or modifying those unclear questions to achieve greater questionnaire convergence.

The survey has been structured in two sections and consists of 39 questions. The first section, questions 1 through 9, focuses on collecting identifiable information. For its part, the second section, which includes questions 10 to 39, has as its primary objective to identify the IMS criteria relevance based on the experts' opinions. For this, The Google Forms platform aids in designing the semi-structured questionnaire and was available for one month, from 15-June to 15-July 2023 (The questionnaire is available in the appendix B). The questionnaire design permits the experts to issue their judgment through a fuzzy linguistic scale regarding the level of importance attributed to each criterion (see Frame 3).

3.2.3 Experts' selection and data collection

The essential element in forecasting techniques lies in the meticulous selection of duly qualified experts (PADILLA-RIVERA *et al.*, 2021). The panel of experts was made up of two different professionals' categories: the academic sphere, made up by professors, and the business sphere, made up of business specialists. The exploration of relevant websites, and personal contacts allowed to identify a total of six academic experts. On the other hand, the export associations, such as the Bolivian National Chamber of Commerce (BNCC) aid to identified eleven business experts.

The academic group represented only 35,3% of the interviews, in contrast to the business sector, which accounted 64,7%. The valid response rate was 48,57%,

translating into 17 respondents, while 18 questionnaires were discarded as incomplete or invalid. However, this quantity did not significantly impact the decision quality since there is only a weak relationship between the number of participants and the quality of the experts' decisions (OCAMPO *et al*., 2018). Table 2 and Table 3 shows the sample variables of the academic and the business group.

Table 2 - Frequencies of the Sample Variables - Academic group

Variables		Frequency	Percent (%)
Years of experience	6-10	3	50%
	11-20	1	16,66%
	21-35	2	33,33%
Country	Bolivia	6	100%
Studies reached	Master degree	4	66,66%
	Doctorate degree	2	33,33%
Experience concentration	International trade management	2	33,33%
	Logistics and supply chain	5	83,33%
	Customs Management	2	33,33%
	International marketing	1	16,66%
	Business Administration	2	33,33%
	Industrial engineering	5	83,33%

Source: Own authorship (2023)

Table 3 - Frequencies of the Sample Variables - Business group

Variables		Frequency	Percent (%)
Years of experience	1-5	6	54,54%
	6-10	4	36,36%
	10 in advance	1	9,09%
Country	Bolivia	11	100%
Studies reached	Bachelor degree	9	81,81%
	Master degree	2	18,18%
Experience concentration	International trade management	2	18,18%
	Logistics and supply chain	6	54,54%
	Customs Management	1	9,09%
	International marketing	1	9,09%
	Business Administration	3	27,27%
	International economy	1	9,09%
	Industrial engineering	8	72,72%
Business sector	Secondary (industry, civil construction)	6	54,54%
	Tertiary (services, commerce)	5	45,45%
Business Size	Micro (<10 workers)	1	9,09%
	Small (11 to 20 workers)	3	27,27%
	Medium (21 to 49 workers)	1	9,09%
	Large (>50 workers)	6	54,54%

Source: Own authorship (2023)

Table 3 show that all the interviewees are natives of Bolivia and possess vast experience, primarily in two key areas: international logistics and industrial engineering. These findings strengthen the notion that the data collected by the panel of experts are highly relevant and shed light on the minimum attributes that a

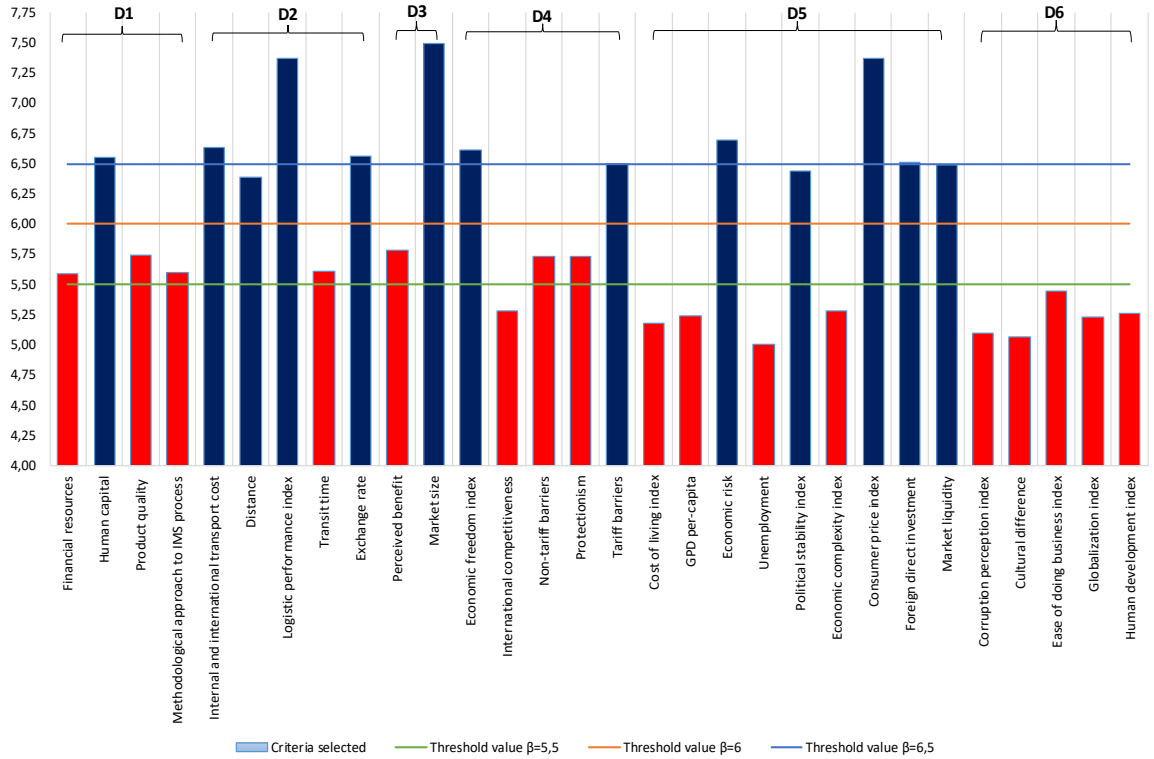
landlocked country-based SME should regard for effective decision-making during its internationalization process.

3.2.4 Criteria selection - Fuzzy Delphi method (FDM)

Graphic 2 summarizes the result of applying the Fuzzy Delphi method described in the theoretical background. This graph shows that the panel of academic and industrial experts discarded 56.6% of the criteria due to their lack of essentiality in the market selection process for SMEs in a landlocked country such as Bolivia.

However, the threshold value (β) strongly influences the criteria selection process. When examining the same graph, it can be observed that a more permissive threshold, set at 0.5, leads to the elimination of 33.3% of the criteria. On the other hand, a more restrictive threshold value produces the opposite effect, resulting in the elimination of 70% of the criteria.

Graphic 2 - Relevant criteria for the IMS-MCDM/A process



D1 = SMEs-Specific dimension; **D2** = Supply chain dimension; **D3** = Market potential dimension; **D4** = Market openness dimension; **D5** = Political economic dimension; **D6** = Socio-cultural dimension

Source: Own authorship (2023) Table 4 shows that 13 of the 30 evaluated criteria surpassed our threshold value (6). In the first dimension, only the criterion "human capital" was selected (6.549). In the second dimension, the chosen criteria were transportation cost (6.639), geographical distance (6.391), logistics performance

(7.372), and exchange rate (6.562). In the third dimension, the selected criteria were "market size" (7.494). In the fourth dimension, the chosen criteria were "economic freedom" (6.613) and "tariff barriers" (6.499). In the fifth dimension, the selected criteria were: "economic risk" (6.692), "political stability" (6.439), "inflation" (7.372), "foreign investment" (6.512), and "market liquidity" (6.487). Interestingly, in the final dimension, the panel of experts determined that none of the criteria had significant importance in the market selection process.

Table 4 - Aggregate fuzzy judgments

Dimension	Criteria	Scores				
		Min	Max	Geom. mean	Aggregate fuzzy number	Final (defuzzification)
SMEs Specific	Financial resources	1	9	6,753	1;9;6,753	5,585
	Human capital	3	9	7,647	3;9;7,647	6,549
	Product quality	1	9	7,237	1;9;7,237	5,746
	Methodological approach to IMS process	1	9	6,787	1;9;6,787	5,596
Supply chain	Internal and international transport cost	3	9	7,916	3;9;7,916	6,639
	Distance	3	9	7,172	3;9;7,172	6,391
	Logistic performance index	5	9	8,115	5;9;8,115	7,372
	Transit time	1	9	6,823	1;9;6,823	5,608
	Exchange rate	3	9	7,685	3;9;7,685	6,562
Market potential	Perceived benefit	1	9	7,348	1;9;7,348	5,783
	Market size	5	9	8,483	5;9;8,483	7,494
Market openness	Economic freedom index	3	9	7,839	3;9;7,839	6,613
	International competitiveness	1	9	5,847	1;9;5,847	5,283
	Non-tariff barriers	1	9	8,194	1;9;8,194	5,734
	Protectionism	1	9	7,201	1;9;7,201	5,734
	Tariff barriers	3	9	7,497	3;9;7,497	6,499
Political-economic	Cost of living index	1	9	5,541	1;9;5,541	5,180
	GPD per-capita	1	9	5,704	1;9;5,704	5,235
	Economic risk	3	9	8,074	3;9;8,074	6,692
	Unemployment	1	9	5,017	1;9;5,017	5,006
	Political stability index	3	9	7,315	3;9;7,315	6,439
	Economic complexity index	1	9	5,850	1;9;5,85	5,284
	Consumer price index	5	9	8,115	5;9;8,115	7,372
	Foreign direct investment	3	9	7,535	3;9;7,535	6,512
	Market liquidity	3	9	7,461	3;9;7,461	6,487
Socio-cultural	Corruption perception index	1	9	5,296	1;9;5,296	5,099
	Cultural difference	1	9	5,191	1;9;5,191	5,064
	Ease of doing business index	1	9	6,334	1;9;6,334	5,445
	Globalization index	1	9	5,681	1;9;5,681	5,227
	Human development index	1	9	5,792	1;9;5,792	5,264

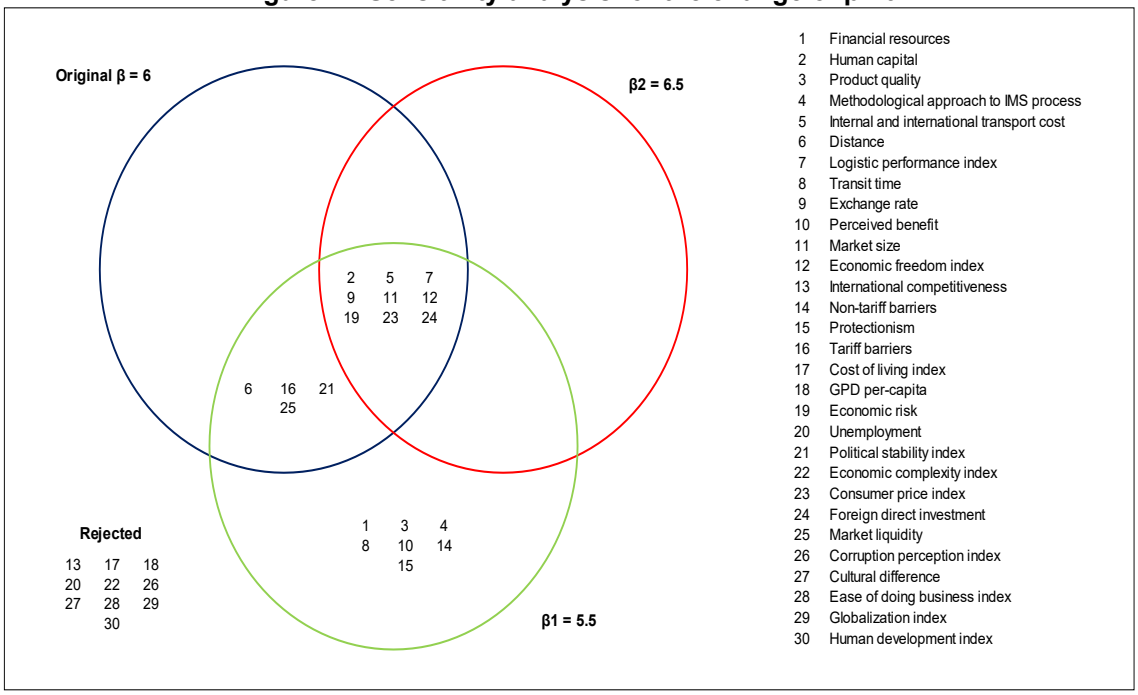
Source: Own authorship (2023)

3.2.5 Sensitive analysis

Notably, the threshold value (β = 6) represents the pivotal factor in selecting or excluding criteria, given that a lower value can engender a more significant criteria adherence (and vice versa). Nevertheless, as previously indicated, establishing a threshold value is contingent upon the linguistic scale employed. Consequently, a sensitivity analysis was conducted to ascertain how much a threshold value (β) variation would influence the final criteria list.

From the pre-established β=6, two alternative threshold values were proposed through a comparable analysis (PADILLA-RIVERA *et al*., 2021). β1 = 6 - 0.5 and β2 = 6 + 0.5, thereby offering an illustrative distinction in the final criteria compilation. Figure 7 depicts a pronounced alteration in the total of acceptable criteria with β1 = 5.5, with a selection of 20 criteria, representing a difference of seven criteria from the original threshold (β = 6). Interestingly, a subtle fluctuation was witnessed with β2 = 6.5, as only nine criteria were deemed acceptable.

Figure 7 - Sensitivity analysis for the change of β= 6



Source: Own authorship (2023)

The sensitivity analysis predominantly influenced criteria close to the defuzzification value of the initial threshold (β = 6). A reduced β value resulted in a higher criteria adherence to the criteria selection guideline, consequently incorporating them into the final list. On the other hand, a higher β value yielded a slightly relevant

change, thereby preserving the essential coherence of the final list. The subtle fluctuations associated with a more permissive and restrictive threshold β, in the FDM context, strongly support the robustness of the proposed approach. Therefore, it can be inferred that the initial threshold (β = 6) was appropriate, solidifying the FDM as a resilient decision-making tool.

This section identified and selected criteria applicable to the IMS process using FDM. It is based on a hybrid approach that amalgamates qualitative techniques, such as the Delphi method, with mathematical tools, such as fuzzy analysis, to address the criteria plurality involved in decision-making. The proposal embraces a holistic approach that attends to the multiple experts' perspectives behind the IMS process. The main virtue of this research lies in its ability to document the various considerations inherent in the decision-making process.

Finally, to obtain a definitive index that integrates the different criteria. The defuzzification value corresponding to the 13 previously selected criteria was used and then aggregated through an algebraic operation. The resulting sum was later transformed into classifications and hierarchical disputes from major to minor. This final ranking (see Frame 6) aims to enable the visualization of the most significant criteria for the expert group.

Frame 6 - Indicators selected by academic and industry experts

Dimension	Indicator selected	Code	Final (Defuzzification)	Ordinal ranking
SMEs-Specific	Human Capital	C1	6,549	8
Supply Chain	Transportation cost	C2	6,639	5
	Distance	C3	6,391	13
	Logistic Performance Index	C4	7,372	2
	Exchange Rate	C5	6,562	7
Market potential	Market Size	C6	7,494	1
Market Openness	Economic Freedom Index	C7	6,613	6
	Tariff Barriers	C8	6,499	10
Political-economic	Economic Risk	C9	6,692	4
	Political Stability Index	C10	6,439	12
	Consumer price Index	C11	7,372	2
	Foreign Direct Investment	C12	6,512	9
	Market Liquidity	C13	6,487	11

Source: Own authorship based on expert surveys (2023)

The frame presented above shows that market size, logistic performance, inflation, economic risk, and transportation costs are criteria with high significant value for the experts group.

3.2.6 Definition of indicators for each criterion

The literature review yielded 30 criteria, and only 13 have a threshold value above 6. After this step, it was necessary to seek the opinions of economists and supply chain experts to identify indicators that could objectively measure each criterion's performance. As a result, Frame 7 and Frame 8 summarize all the indicators selected and present its description.

- First, a Saaty Scale for the "Human Capital" criterion measures the company manager's perception of building a network in the markets;
- Second, the maritime and land freight cost for the "Transportation Cost" criterion measures the price required to transport a container to the target market;
- Third, the distance in kilometers for the "Distance" criterion measures the geographic separation between the host country and the target market;
- Fourth, the Logistics Performance Index for the "Logistic Performance" criterion measures the effectiveness of supply and logistics chains in a specific market;
- Fifth, the exchange rate volatility coefficient for the "Exchange Rate" criterion measures the instability of a currency's value to other currencies;
- Sixth, the import value for the "Market Size" criterion measures the amount of insufflated food entering a specific market;
- Seventh, the Economic Freedom Index for the "Economic Freedom" criterion measures the rule of law, state size, regulatory efficiency, and market openness;
- Eighth, the tariff and the quota for the "Tariff Barriers" criterion measures the financial trade restriction between two markets;
- Ninth, the Fitch's credit rating for the "Economic Risk", "Political Stability", and "Market Liquidity" criteria measures a country's ability to meet its debt and the risk involved in investing in it;
- Tenth, the Consumer Price Index for the "Inflation" criterion measures the cost of living and shows the effects of inflation on individual consumers;
- Finally, for the "Foreign Investment" criterion, we used the net capital inflow value into a specific market divided by the Gross Domestic Product.

Frame 7 - Criteria structure and data source

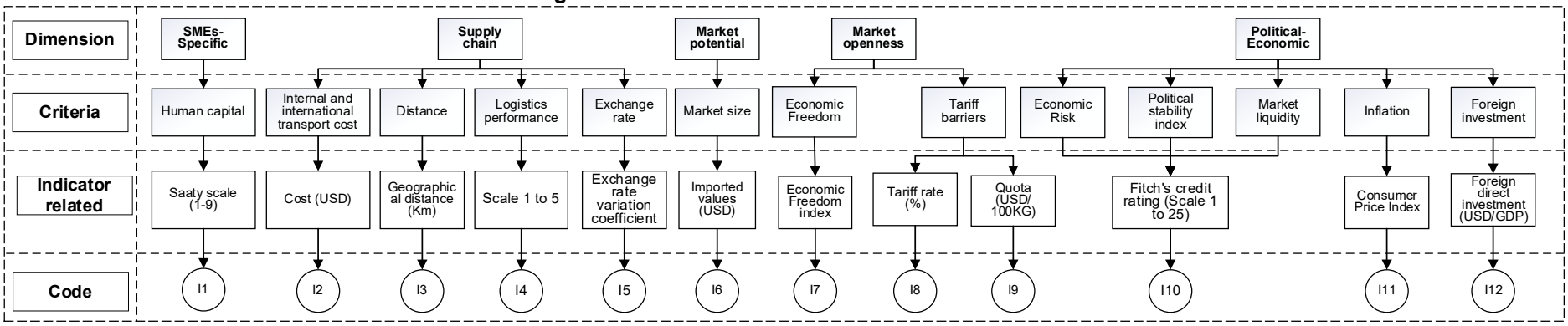
Dimension & criteria	Description and indicator related to the criteria selected	Source	Data source
SMEs-specific barriers (D1)			
Human capital (C1)	A higher human capital level directly affects international trade because it increases productivity and innovation, which can help firms compete in global markets. Human capital can also help countries upgrade their exports by producing higher-quality goods and services that can be sold at higher prices. In this case, an interview was conducted with the business manager about the perception of building a network with the target market. The index runs on a Saaty scale (1-9), with a higher rating representing more outstanding performance.	(CAHEN; LAHIRI; BORINI, 2016)	Company survey
Supply Chain (D2)			
Internal and international transportation cost (C2)	Transportation costs exert an intangible influence on international trade, determining the exported goods prices, the markets choice, the products competitiveness and influencing trade negotiations. Exporters look for nearby markets with lower transportation costs. The distance between the company under study to the nearest port multiplied by the rate per kilometer provided by Sea rates aids in calculating the internal cost. On the other hand, the international cost is obtained from the mentioned page, considering the host country's nearest port and the target market's nearest port.	(OEY; NOVIYANTI; LIM, 2018; SCHÜHLY; TENZER, 2017)	Sea rates (2023) https://bit.ly/2fDFtgW
Geographical distance (C3)	Distance is an essential variable in international trade that significantly influences trade between countries. Its relevance is due to its direct impact on transportation costs, which increase with the geographical separation between the nations involved, affecting the competitiveness and product prices. In addition, a greater distance implies long delivery times, which can be critical for perishable products or those with immediate demand. Logistics management over long distances also presents challenges for operational and organizational efficiency. For this study, the distance (kilometers) between the host country and the target market was used.	(GOKMENOGLU; ALAGHEMAND, 2015)	Distance (2023) https://bit.ly/2Buykfl
Logistics performance index (C4)	The general score of the Logistics Performance Index (LPI) denotes the perceptions about the logistics of a country, considering the efficiency in the customs clearance process, the quality of the infrastructure related to trade and transport, the ease of coordinating shipments at competitive prices, excellence in logistics services, the ability to track and trace shipments, and the punctuality in the recipient freight delivery. The index runs on a scale of 1 to 5, with a higher rating representing more outstanding performance. The data comes from the LPI survey carried out by the World Bank in collaboration with academic and international entities, private companies, and international logistics individuals.	(BAENA-ROJAS *ET AL.*, 2022)	World Bank (2022) https://bit.ly/32vpdrb

Dimension & criteria	Description and indicator related to the criteria selected	Source	Data source
Official exchange rate (C5)	Fluctuations in exchange rates can significantly impact the IMS process. A stable market can reduce the risks associated with exchange rate volatility. Therefore, a lower exchange rate volatility reduces market uncertainty and improves competitiveness and costs predictability. The index was calculated based on the exchange rate variation coefficient from 2018 to 2022.	(GOKMENOGLU; ALAGHEMAND, 2015	World Bank (2018-2022) https://bit.ly/35UTfa3
Market Potential (D3)			
Market Size (C6)	The size of a market refers to the dimension or magnitude of the demand for goods or services within a specific geographic area or population segment. A high market size suggests a substantial market opportunity and potential for sales and revenue generation. The imported value for a specific item is obtained from the international trade center database through their harmonized system code.	(AGHDAIE; ALIMARDANI, 2015)	International trade center (2022) https://bit.ly/3NVUmNs
Market Openness (D4)			
Economic freedom index (C7)	The economic freedom index (EFI) is an indicator comprising 12 quantitative and qualitative variables, grouped into four broad categories: Rule of Law, Size of Government, Regulatory Efficiency, and Open Markets. Each variable is scored on a scale of 0 to 100. A country's overall score is obtained by averaging these twelve economic freedoms, with equal weights for each. Finally, the country score is categorized into: free (80-100), mostly free (79.9-70), moderately free (69.9-60), mostly unfree (59.9-50), and Repressed (49,9-0).	(GORECKA, D. AND SZAŁUCKA, M. 2013)	The Heritage Fundation (2020) https://herit.ag/2K5N3Qe
Tariffs Barriers (C8)	Tariff barriers, known as customs duties or levies applied to imported goods when crossing national borders, protect national industries. This study establishes this value through two complementary indicators: the tariff percentage and the quota per 100 kilograms imposed on specific goods. Reduced tariffs and quotas increase the benefits of exporting to a particular market.	(AGHDAIE; ZOLFANI; ZAVADSKAS, 2013)	WTO (2020) https://bit.ly/31QWOf8
Political-Economic (D5)			
Economic Risk (C9) Market Liquidity (C13) Political Stability Index (C10)	In the country's economic risk assessment field, various indices offer detailed perspectives on its economy. This study uses Fitch's credit rating, whose detailed analysis incorporates political, economic, and financial factors. This indicator represents a weighted measure of a country's ability to meet its debt obligations and, consequently, reflects the level of risk inherent in investments made in its territory. These ratings, generally expressed through alphanumeric categories (such as AAA, AA+, BB-, among others), establish a direct relationship between a lower rating and higher credit risk due to the increased probability of default.	(AGHDAIE, 2015; OEY 2018)	Ratings Fitch (2022) https://bit.ly/44Ra03r

Dimension & criteria	Description and indicator related to the criteria selected	Source	Data source
Consumer Price Index (C11)	The Consumer Price Index (CPI) is a fundamental indicator that reflects the fluctuations in the average consumer's cost associated with acquiring a basket of goods and services, which can be constant or subject to modifications at specific intervals. such as annually. Commonly, the Laspeyres formula aid in calculating the index. The data collected represent averages for particular periods.	(BAENA-ROJAS *et al*., 2020)	World Bank (2022) https://bit.ly/31Rc4ZE
Foreign Direct Investment (C12)	Foreign direct investment (FDI) represents net inflows of capital intended to acquire a lasting management interest in a foreign company. These investments include capital stock, reinvestment of profits, and other long-term and short-term capital. FDI is shown in the balance of payments and reflects net inflows into the host country's economy, expressed as a proportion of GDP. A high ratio may indicate greater integration of the host economy with international markets and greater confidence on the part of foreign investors in the stability and growth potential of the nation.	(GORECKA, D. AND SZAŁUCKA, M. 2013)	World Bank (2022) https://bit.ly/44tiOgb

Source: Own authorship based on Baena-Rojas *et al*. (2020) and Ozturk *et al*. (2015)

Figure 8 - Indicators for each selected criterion



Source: Own authorship (2023)

3.3 Stage 3 - Weight definition

In the MCDM field, there are many methodologies to determine the relative importance of each criterion (SHIH; OLSON, 2022). However, the AHP method or its extension, FAHP is the most commonly used in the IMS process (BAENA-ROJAS *et al*., 2022; VANEGAS LÓPEZ *et al*. 2021; LÓPEZ CADAVID; VANEGAS LÓPEZ; BAENA-ROJAS, 2020; OEY *et al*., 2018; SCHÜHLY; TENZER, 2017; GOKMENOGLU; ALAGHEMAND, 2015; AGHDAIE; ALIMARDANI, 2015; MEHDI KIANI ABARI., 2012; AGHDAIE; ZOLFANI; ZAVADSKAS., 2013). On the other hand, Mobin (2014) employs the entropy method, as the process leverages the variation in data within the criteria.

In this study, the relative importance of each indicator is determined by aggregating the weights obtained from the entropy and ROC method. In this way, the aggregated weights reflect both the decision-makers perspectives and the uncertainty or lack of information about the markets. Table 5 summarizes the final weights ($\tilde{\lambda}_n$) obtained by the combination of the entropy ($\tilde{\lambda}_j$) and the ROC method (w_j).

Table 5 - Weights aggregated by the entropy and rank-order centroid method

Indicator	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
w_j	0,106	0,259	0,134	0,015	0,085	0,068	0,023	0,043	0,032	0,175	0,054	0,007
$\tilde{\lambda}_{j,m=20}$	0,129	0,018	0,043	0,020	0,058	0,188	0,035	0,024	0,022	0,039	0,357	0,065
$\tilde{\lambda}_n$	0,191	0,066	0,081	0,004	0,069	0,179	0,011	0,015	0,010	0,096	0,271	0,006
$\tilde{\lambda}_{j,m=10}$	0,071	0,064	0,065	0,077	0,141	0,087	0,067	0,065	0,145	0,067	0,081	0,069
$\tilde{\lambda}_n$	0,098	0,215	0,112	0,015	0,155	0,077	0,020	0,036	0,060	0,151	0,057	0,006

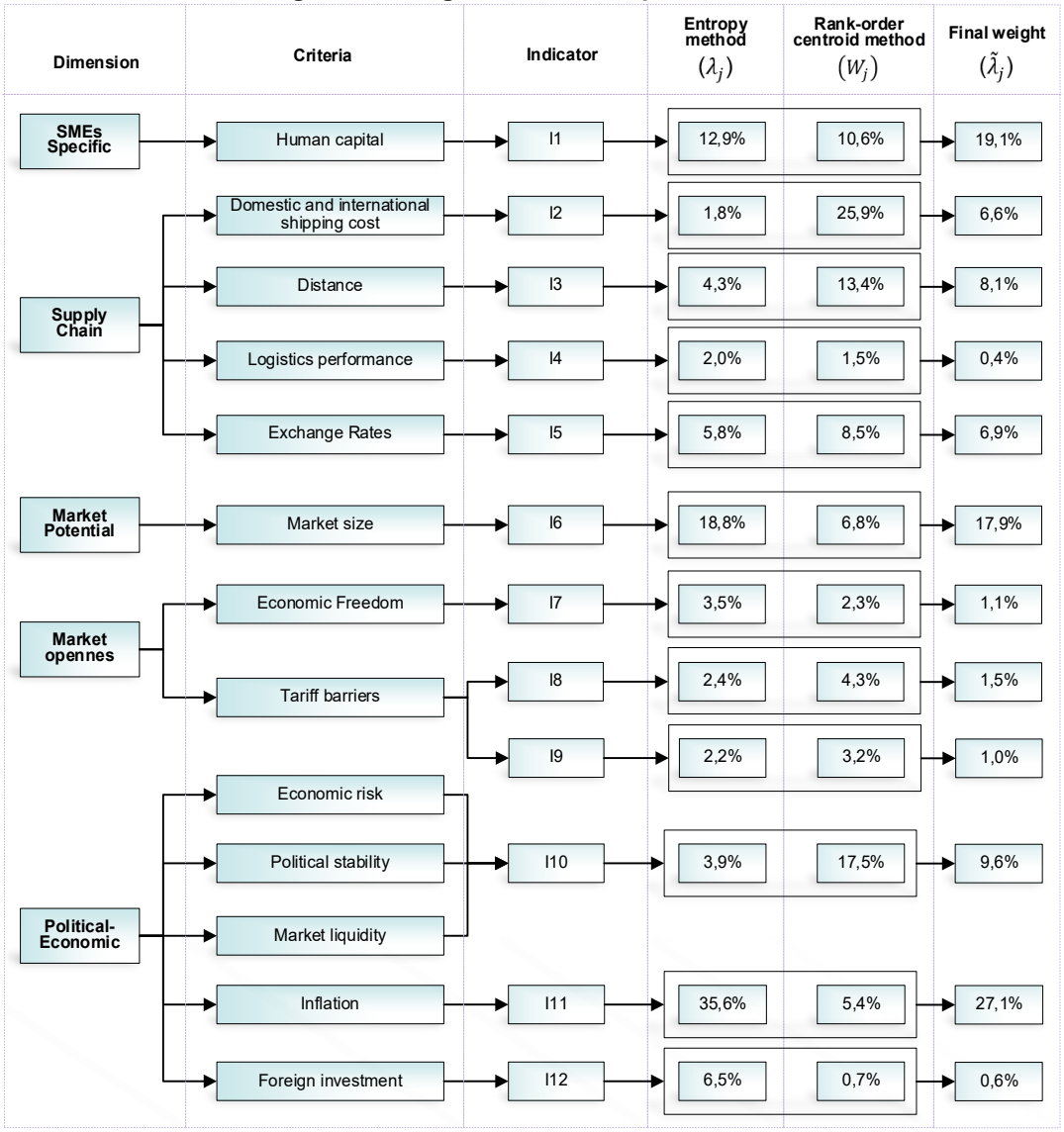
Source: Own authorship (2023)

Our model proposes to evaluate the 20 main importers of insufflated cereals. For this number of alternatives, 79.7% of the relative importance attributed in the entropy method is concentrated in 5 indicators (I11, I6, I1, I12, and I5). This is because the values of each indicator are more varied and, therefore, have a greater impact on the weighting by this method. On the other hand, 82.7% of the relative importance attributed in the ROC method is concentrated in 6 indicators (I2, I10, I3, I1, I5, and I6). This means that the indicators are too relevant for the SME decision-maker.

Finally, the final weights are the result of the aggregation of both methods. In this sense, 81.9% of the total relative importance is concentrated only in 5 indicators (I11, I1, I6, I10, and I3). These results demonstrate that the weight obtained by the

entropy method based on the data obtained from the twenty markets considerably affects the relative importance initially defined by the decision-maker and, consequently, the final weight. The scheme of Figure 9 allows a more straightforward visualization of the distribution of the final weights associated with each indicator.

Figure 9 - Weight distribution per indicator



Source: Own authorship (2023)

From Table 5, it became evident that if the number of markets evaluated is reduced to the leading ten importers, the weight obtained by the entropy method decreases its effect on the weight obtained by the ROC method and consequently on the final weight. Future research should consider that the greater the number of markets, the greater the probability of having more varied entropy values and

generating one-sided weights. The step-by-step procedure for obtaining the aggregate weights using each method is described in the appendix D.

3.4 Stage 4 - Market selection

In the IMS context, the TOPSIS method evaluates and classifies markets. This approach allows for compensating the strengths and weaknesses of each country regarding the criteria identified in the literature. This method involves comparing markets with two key reference points: the ideal point, representing the market that maximizes all chosen indicators, and the anti-ideal point, meaning the market that minimizes all selected indicators. The ranking shown in Table 6 results from the hybrid decision support multicriteria model proposed in this study (Topsis - Entropy & Rank-Order centroid).

Table 6 - Closeness and ranking calculation

Alternative	d_i^+	d_i^-	c_i	Topsis Ranking
USA	0,057	0,099	0,634	1
CAN	0,061	0,088	0,591	2
FRA	0,064	0,07	0,521	4
UK	0,071	0,065	0,477	5
GER	0,076	0,058	0,432	7
ITA	0,083	0,055	0,397	10
NED	0,110	0,035	0,243	18
BEL	0,100	0,038	0,277	16
CHN	0,067	0,096	0,588	3
IRL	0,096	0,039	0,286	15
ESP	0,092	0,068	0,426	8
SWE	0,102	0,036	0,260	17
AUS	0,101	0,041	0,287	14
GRE	0,113	0,029	0,204	19
KSA	0,103	0,070	0,404	9
GTM	0,094	0,075	0,445	6
AUT	0,102	0,067	0,396	11
SUI	0,108	0,064	0,373	12
DEN	0,117	0,03	0,202	20
UAE	0,108	0,053	0,331	13

Source: Own authorship (2023)

The hybrid methodology proposed in this study focused on evaluating the preselected markets, ranking markets with the greatest favorability for the studied sector based on the criteria selected by the experts.

First, the results highlighted the United States (0.634), Canada (0.591), and China (0.521) as destinations with characteristics mostly related to the requirements and vision of the Andean insufflated cereals sector. Secondly, the results for countries with moderate scores, such as France (0.521), England (0.477), and Guatemala (0.445), showed that the overall performance of each market had distinct characteristics because there were outstanding indicators, but also indicators with low performance. Finally, the markets that received more downward ratings were the Netherlands (0.243), Greece (0.204), and Denmark (0.202).

These results aim to promote the diversification of international markets in the Bolivian insufflated cereals sector, considering that the current focus of exports is on destinations such as Spain (25.35%), Canada (19.86%), Chile (19.14%), and the Netherlands (15.07%) according to the International Trade Center. This behavior, as found by Vanegas (2020), indicates a short-sighted approach, which, from a theoretical perspective, is associated with the Uppsala internationalization model (JOHANSON; VAHLNE, 1977, 1990).

Therefore, identifying new markets that offer more significant advantages to entrepreneurs would help meet the constant growth needs of the sector. At the same time, it allows decision-makers to identify and evaluate destinations that must adapt to the specific priorities of the industry, enabling a tailored market selection process. The step-by-step procedure for obtaining the market ranking is described in appendix E.

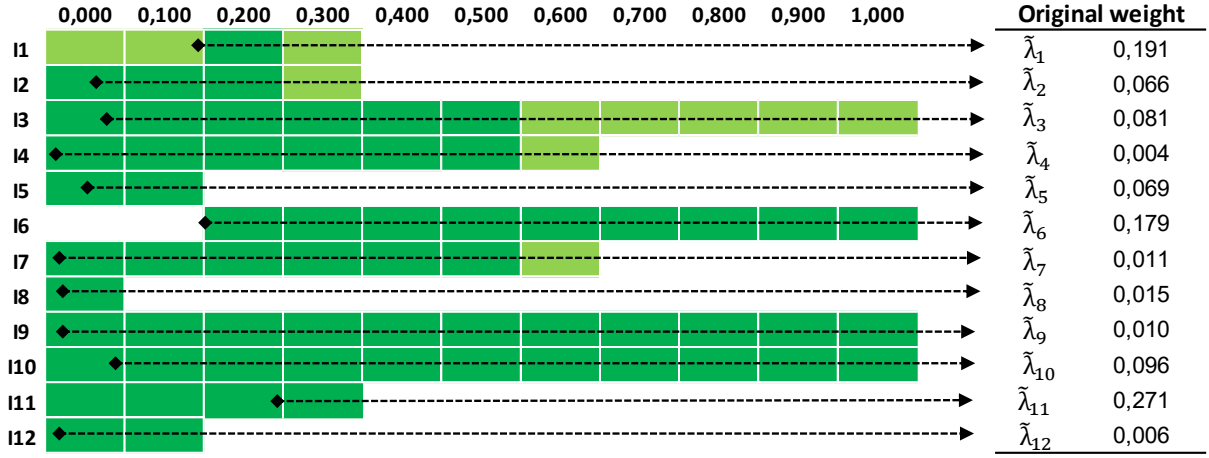
3.4.1 Sensitive analysis

Figure 10 represents the sensitivity analysis result and demonstrates how the indicators' relative importance change affects the chosen market ranking. The dark green rectangles indicate a tolerable change in the indicators' weights, meaning the best market ranking is not sensitive. The light green color represents the weight range that contributes to a single change in the classification. In principle, the horizontal bar length indicates the indicator sensitivity to the weight change and suggests that the shorter the bar, the higher the sensitivity level. The original weights of the indicators are shown on the right side of the Figure.

The result reveals that the indicator tariff quota (I9), credit rating (I10), geographic distance (I3), economic freedom (I7), and logistic performance index (I4) were robust for the Topsis methods. On the other hand, the indicator tariff rate (I8),

foreign direct investment (I12), and the imported value (I6) were identified as the most critical indicator for the best alternative. The step-by-step of the sensitivity analysis procedure is described in the appendix C.

Figure 10 - Sensitivity analysis of the best-performing market (United States)



	Original weight	
I1	$\tilde{\lambda}_1$	0,191
I2	$\tilde{\lambda}_2$	0,066
I3	$\tilde{\lambda}_3$	0,081
I4	$\tilde{\lambda}_4$	0,004
I5	$\tilde{\lambda}_5$	0,069
I6	$\tilde{\lambda}_6$	0,179
I7	$\tilde{\lambda}_7$	0,011
I8	$\tilde{\lambda}_8$	0,015
I9	$\tilde{\lambda}_9$	0,010
I10	$\tilde{\lambda}_{10}$	0,096
I11	$\tilde{\lambda}_{11}$	0,271
I12	$\tilde{\lambda}_{12}$	0,006

Source: Own authorship (2023)

4 FINAL CONSIDERATIONS

The results presented in the previous section objectively and systematically demonstrate the applicability of the proposed model. The model enables small and medium-sized businesses in landlocked countries to assess international markets flexibly and cost-effectively, whether for their first entry into a global market or to diversify their current portfolio. The model allows experts to evaluate and select a range of indicators. Furthermore, it enables the market classification based on these indicators, with the underlying concept that the most preferred market is the one that is closer to the ideal solution and farther from the non-ideal solution.

4.1 Conclusions

The present research has comprehensively addressed the international market selection process of an insufflated cereals company in a landlocked country through a robust and well-founded hybrid multi-criteria approach. This approach emerges as an invaluable tool for small and medium-sized enterprises seeking to optimize their entry into international markets.

The multi-criteria approach proposed in this study, which combines Fuzzy Delphi, entropy, rank order centroid, and the Topsis method, stands out for its ability to balance objectivity in the criteria selection process, allocation of their respective weights (based on readily available official information), and the capacity to classify markets based on the criteria chosen by experts. This combination helps to mitigate the uncertainty typically associated with the international expansion of companies needing more solid data to support their internationalization process.

Furthermore, this model considers different criteria that, according to current literature, directly impact the international market selection. On the one hand, this model captures the perceptions of experts (industry and academic professionals) in foreign trade. Thus, their experience is manifested in the criteria that an industrial sector must consider when selecting its international markets. On the other hand, this model enables quantifying the associated weight in each criterion based on the decision-maker perception and data variability. At this point, combining methods for selecting criteria, assigning weights to each one, and classifying them based on indicators that objectively measure each criterion facilitates informed decision-making.

It is crucial to highlight that the abundance of official data available on the internet offers exceptional opportunities for companies wishing to enter foreign markets. The mentioned sources allow for a thorough market analysis based on international demand. At the same time, including comprehensive data on the criteria considered in this study sheds light on the political, economic, and social aspects of each preselected country. This technique streamlines the international market selection process, overcoming the usual lack of statistical support.

Finally, it is essential to note that the results discussed in this research are limited to the preselected markets and the criteria considered in the applied model. As globalization and international trade evolve, companies must be prepared to incorporate new emerging criteria into this approach, adapting to the new realities of business practices.

4.2 Limitations

This study is subject to some limitations that also highlight directions for future research in at least six areas.

Firstly, the model addresses the demands of a company dealing with insufflated products in landlocked countries. In this regard, it is still being determined to what extent these results can be generalized to other types of companies. Therefore, it is necessary to replicate this study for another business sector.

Secondly, the model employs cross-sectional rather than longitudinal data. Cross-sectional data explore what happens at a specific time and cannot fully capture the dynamic processes of the international market selection process. Hence, an SME intending to use the model must have organizational systems to update the data. Future research should employ a longitudinal method to investigate the dynamic development of the IMS process and the criteria stability of the expert group.

Thirdly, this research is limited by insufficient secondary data; some countries, such as Saudi Arabia and the United Arab Emirates, have not yet provided direct trade flows data of insufflated cereals. Consequently, mirror data reported by bilateral trading partners of these countries have been used. These mirror statistics are used temporarily to compensate for the lack of direct data. Therefore, comparing and updating the database once the data becomes available is required.

Fourthly, within the scope of the systematic literature review, this review focuses solely on empirical research published in the English and Spanish language, which represents an additional limitation associated with the dataset.

Fifthly, evaluating criteria that may serve a dual function is essential. It means that the values of these criteria can generate both opportunities and threats. For example, a country's tariff rate can be both a deterrent factor, reducing the market's attractiveness and becoming a minimization criterion, and an opportunity, as it makes the market less attractive to other foreign competitors. Therefore, dual-function criteria must be evaluated more carefully, considering the specific business sector.

Sixthly, it is essential to recognize that the criteria choice, the weights assignment, and the multicriteria method selection are critical aspects that require careful consideration by the decision-maker. Future research could explore other multicriteria analysis techniques and their impact on the results. Additional investigation could evaluate the model's performance and compare it with alternative approaches, highlighting their strengths and weaknesses. For example, an auxiliary procedure to compensatory models could be obtained using different decision-making techniques. One case would be to use clustering algorithms like K-Means, K-Medoids, and Fuzzy C-Means that define thresholds for using the ELECTRE TRI method.

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APPENDIX A - Criteria factorization

Frame 8 - Criteria related to the Market potential in the IMS process

Criteria	Sub-Criteria	Sub-criteria index variants	Authors
Market Potential	**Perceived benefit (USD)**	Target market price or Price at destination	(BAENA-ROJAS *et al*., 2022; (VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		Net profit amount	(OEY, 2018)
		Stability of profit performance	(LEE; JUNG; HAN, 2017)
		Average profit rate	(LEE; JUNG; HAN, 2017)
		Market reward or Profitability	(LEE, 2017; AGHDAIE, 2015)
		Contribution margins	(AGHDAIE, E. 2013)
		Perceived benefit	(DUAN, 2010)
		Revenue model	(DUAN, 2010)
	Imported value (Usd)	Volume of imports, import penetration, share import, Mean import, Growth of imports and exports	(ARAYA-PIZARRO, 2019; MARCHI *et al*., 2014; ABARI, M., NILCHI, 2012; ABARI, M., NILCHI, 2012; ARAYA-PIZARRO 2019)
		Market size	(SCHÜHLY; TENZER, 2017; AGHDAIE, 2015; AGHDAIE, E. 2013)
		Size of the middle class	(SCHÜHLY; TENZER, 2017)
		Construction market size or Construction market growth rate	(LEE; JUNG; HAN, 2017; LEE; JUNG; HAN, 2017)
		Apparent consumption	(MARCHI *ET AL*., 2014)
		Per cent population in 10-30 age group	(MARCHI *ET AL*., 2014)
		Per cent university students	(MARCHI *ET AL*., 2014)
		Total population	(GORECKA, D. AND SZAŁUCKA, M. 2013)
		Urban population	(GORECKA, D. AND SZAŁUCKA, M. 2013)
		Cotton production	(GORECKA, D. AND SZAŁUCKA, M. 2013)
		Consumption growth	(OEY 2018)
		Market value	(OEY, 2018)

Source: Own authorship (2023)

Frame 9 - Criteria related to the Market Openness aspect in the IMS process

Criteria	Sub-Criteria	Sub-criteria index variants	Authors
Market Openness	**Economic Freedom Index**	Index of economic freedom	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; ARAYA-PIZARRO 2019; GORECKA, D. AND SZAŁUCKA, M. 2013)
	International competitiveness	International competitiveness	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		Construction market competition	(LEE; JUNG; HAN, 2017)
		Competition or Types of competitors	(AGHDAIE, 2015)
		Technological competency	(DUAN, 2010)
		Country of origin advantage	(MOBIN, M., 2014)
		Substitutive product or Imitation risk	(MOBIN, M., 2014)
	Non tariffs barriers	Non-tariff barriers	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
	Protectionism	Protectionism in general	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		Rule of law	(SCHÜHLY; TENZER, 2017)
		Degree of market openness	(LEE; JUNG; HAN, 2017)
		Accessible or Market accessibility	(AGHDAIE, 2015; ABARI, M., NILCHI, 2012)
		Regulation criterion	(MOBIN, 2014)
		Laws and government agency regulations	(AGHDAIE, E. 2013)
	Tariff barriers	Tariffs barriers	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; MARCHI *et al*., 2014)
		International trade engagement	(SCHÜHLY; TENZER, 2017; K. GOKMENOGLU 2015; GORECKA, D. AND SZAŁUCKA, M. 2013)

Source: Own authorship (2023)

Frame 10 - Criteria related to the Political-Economic aspect in the IMS process

Criteria	Sub-Criteria	Sub-criteria index variants	Authors
Political-Economic	**Cost of living index**	Cost of living index	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021)
	GDP per capita (USD/POP)	GDP per capita	(BAENA-ROJAS *et al*., 2022; VANEGAS *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; MARCHI *et al*., 2014; GORECKA., 2013; SCHÜHLY; TENZER, 2017; K. GOKMENOGLU 2015; ABARI, M., NILCHI, 2012)
		Potential market criterion or GPD	(MOBIN., 2014; ARAYA-PIZARRO 2019; OEY 2018; SCHÜHLY; TENZER, 2017; AGHDAIE, 2015; GORECKA, D. AND SZAŁUCKA, M. 2013; ABARI, M., NILCHI, 2012)
		Consumption trend or propensity	(LEE; JUNG; HAN, 2017; K. GOKMENOGLU 2015)
		Economy criterion	(MOBIN., 2014)
		Host country natural log of real GDP; Host country natural log of real GDP per capita; Sum of host country's distance-weighted GDP to all other countries	(K. GOKMENOGLU 2015)
	Economic Risk	Risk country time to resolve insolvency	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021)
		Country risk	(LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; ARAYA-PIZARRO 2019)
	Unemployment	Unemployment rate or Labor force	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; GORECKA, D. AND SZAŁUCKA, M. 2013)
	Political risk	Political stability	(SCHÜHLY; TENZER, 2017)
		Quality of national governance	(LEE; JUNG; HAN, 2017)
		Host country internal conflict	(K. GOKMENOGLU 2015)
		Country risk or Political risk	(MARCHI *et al*., 2014; AGHDAIE, 2015; OEY 2018)
		Politics criterion or Government pressure	(MOBIN., 2014; DUAN, 2010)
	Economic index	Economic complexity index	(AGHDAIE, 2015; AGHDAIE, E. 2013)
	Consumer Price Index	Consumer price index; Purchasing power; Market stability	(LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; MCDM ARAYA-PIZARRO 2019; (LEE; JUNG; HAN, 2017)
	Foreign direct investment	Foreign direct investment net inflows	(GORECKA, D. AND SZAŁUCKA, M. 2013)
	Market Liquidity	Market liquidity	(ARAYA-PIZARRO 2019)

Source: Own authorship (2023)

Frame 11 - Criteria related to the Supply Chain aspect in the IMS process

Criteria	Sub-Criteria	Sub-criteria index variants	Authors
Supply chain	**Internal and international transport cost**	Cost to import border compliance	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021)
		Import cost	(LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		Internal transport	(BAENA-ROJAS *ET AL*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		International transportation cost	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		transportation cost	(OEY 2018)
	Distance (Km)	Geographical or Physical distance	(BAENA-ROJAS *et al*. 2022; VANEGAS-LÓPEZ *et al*.2021; ABARI, M., NILCHI, 2012; SCHÜHLY; TENZER, 2017; MARCHI *et al*., 2014; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; MOBIN, M., 2014)
		Natural log of bilateral distance	(K. GOKMENOGLU 2015)
		Geographic location	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
	Logistics performance index	Logistics performance index	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*. 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		Road density	(GORECKA, D. AND SZAŁUCKA, M. 2013)
	Transit time	Transit time	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		Lead time	(OEY 2018)
		Suppliers' ability	(AGHDAIE, 2015)
		Trading partner influence	(DUAN, 2010)
	Exchange rate	Official exchange rate	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		Currency risks	(OEY 2018)
		Currency & monetary policy	(SCHÜHLY; TENZER, 2017)
		Host country corporate effective tax rate	(K. GOKMENOGLU 2015)

Source: Own authorship (2023)

Frame 12 - Criteria related to Socio-Cultural aspects to the IMS process

Criteria	Sub-Criteria	Sub-criteria index variants	Authors
Socio-Cultural	Corruption perceptions index	Corruption index	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; K. GOKMENOGLU 2015; SCHÜHLY; TENZER, 2017)
		Transparency and corruption	(ARAYA-PIZARRO 2019)
	Cultural difference	Cultural distance or Psychic distance	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; GORECKA, D. AND SZAŁUCKA, M. 2013; MARCHI *et al*., 2014)
		Cultural criterion	(MOBIN, M., DEHGHANI MOHAMMAD, M. 2014)
		Host country religion in politics	(SCHÜHLY; TENZER, 2017; K. GOKMENOGLU 2015)
		Share common language	(K. GOKMENOGLU 2015; SCHÜHLY; TENZER, 2017)
	Ease of doing business index	Ease of doing business	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020; LEE; JUNG; HAN, 2017; ARAYA-PIZARRO 2019)
		Bureaucracy	(OEY 2018)
	Globalization index	Globalization index	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
	Human development index	Age distribution	(SCHÜHLY; TENZER, 2017)
		Country's health infrastructure	(SCHÜHLY; TENZER, 2017; GORECKA, D. AND SZAŁUCKA, M. 2013)
		Urbanization degree	(SCHÜHLY; TENZER, 2017)
		Life expectancy or Life expectancy at birth	(SCHÜHLY; TENZER, 2017; GORECKA, 2013)
		Education	(SCHÜHLY; TENZER, 2017)
		Per capita health care spending	(SCHÜHLY; TENZER, 2017)
		Market Prosperity (IDH)	(SCHÜHLY; TENZER, 2017; MARCHI *ET AL*., 2014)
		Country's general infrastructure in energy and communication	(SCHÜHLY; TENZER, 2017)
		Internet users and Electric power consumption	(SCHÜHLY; TENZER, 2017; K. GOKMENOGLU 2015)

Source: Own authorship (2023)

Frame 13 - Criteria related to SMEs-specific and others

Criteria	Sub-Criteria	Sub-criteria index variants	Authors
SMEs-specific	**Financial resources**	Industry performance	(OEY 2018)
	Human capital	International experiential knowledge	(MARCHI *et al*., 2014; AGHDAIE, 2015)
		Top management support, Managerial skills, Relationship management	(DUAN, 2010; MARCHI *et al*., 2014; DUAN, 2010)
		Foreign network	(MARCHI *et al*., 2014)
	Methodological approach to IMS process	Information	(AGHDAIE, 2015)
		Market information	(MARCHI *et al*., 2014)
	Product Quality	Product superiority	(AGHDAIE, 2015)
		Manufacturing process technology required	(MARCHI *et al*., 2014; AGHDAIE, E. 2013)
		Product standardization	(MOBIN, M., 2014)
		Sustainable	(AGHDAIE, 2015)
		SME readiness	(DUAN, 2010)
Others	**Others**	Shipping frequency	(BAENA-ROJAS *et al*., 2022; VANEGAS-LÓPEZ *et al*., 2021; LÓPEZ-CADAVID 2020; BAENA-ROJAS, 2020)
		Surplus ratio of projects completed	(LEE; JUNG; HAN, 2017)
		Bid-hit ratio	(LEE; JUNG; HAN, 2017)
		Cumulative number of contracts	(LEE; JUNG; HAN, 2017)
		Dollar currency unions	(K. GOKMENOGLU 2015)
		Share colonial relationship	(K. GOKMENOGLU 2015)
		Market orientation or Degree of concentration	(DUAN, 2010; AGHDAIE, E. 2013)
		Homogeneity	(AGHDAIE, 2015)
		Revealed comparative advantage	(MOBIN, M., 2014)

Source: Own authorship (2023)

APPENDIX B - Semi-structured interview to characterize the problem

Frame 14 - Semi-structured interviews Content

Identification questions
Full name Country City Study reached Area of Expertise Years of experience Company or institution name Main sector Company size
Topic-specific questions
SMEs dimension
1.- Financial resources To what extent does the Financial Capacity (FC) of a company influence its internationalization process? **2.- Human capital** To what extent does the Human Capital (HC) of a company influence its internationalization process? **3.- Product quality** To what extent does the Flexibility (F) of a company influence its internationalization process? (Considering that "F" is the ability of the company to adapt its product to international quality standards). **4.- Methodological approach to IMS process** To what extent does the Company Skill (CS) influence its internationalization process? (Considering that the "CS" is the ability to obtain relevant information from the foreign market).
Supply chain dimension
5.- Internal and international transport cost Is it pertinent to evaluate the Transportation Cost (TC) before entering a foreign market? **6.- Distance** Is it pertinent to evaluate the Geographical Distance (GD) before entering a foreign market? **7.- Logistic performance index** Before exporting to a foreign market, is it pertinent to evaluate the Logistics Efficiency (LE) and the commercial easy (CE) of that market? **8.- Transit time** Is it pertinent to evaluate the Transit Time (TT) before entering a foreign market? **9.- Exchange rate** Before exporting to a foreign market, is it pertinent to evaluate the Exchange Rate Fluctuations (FER) with this market?
Market potential dimension
10.- Perceived benefit Before exporting to a foreign market, is it pertinent to evaluate the Estimated Benefit (EB) to exporting in that market? **11.- Market size** Before exporting to a foreign market, is it pertinent to evaluate the Market Size (MS)?
Market openness dimension
12.- Economic freedom index Before exporting to a foreign market, is it pertinent to evaluate the Economic Opening (EO) of that market? (The "EO" promote free competition and facilitate the foreign competitor's entry). **13.- International competitiveness** Before exporting to a foreign market, is it pertinent to evaluate the Capacity to Generate Opportunities for economic and social development (CGO) of that market? **14.- non-tariff barriers** Before exporting to a foreign market, is it pertinent to evaluate the Non-Tariff Barriers (NTB) with that market? (Considering that non-tariff barriers can be licenses, rules of origin, technical standards, sanitary, phyto-sanitary and zoo-sanitary standards). **15.- Protectionism**

Before exporting to a foreign market, is it pertinent to assess the Protectionism Level (PL) of that market? (Considering that "PL" are economic policies that seek to restrict imports from a country through tariffs, quotas, subsidies and other trade barriers). **16.- Tariff barriers** Before exporting to a foreign market, is it pertinent to evaluate the Tariff Barriers (TB) with that market? (Considering that "TB" are taxes or rates applied to imported goods).
Political-Economic dimension
17.- Cost of living index Before exporting to a foreign market, is it pertinent to evaluate the Cost of Living (CL) in that market? (Considering that the "CL" measures the level of expenses necessary to maintain a given standard of living). **18.- GPD per-capita** Before exporting to a foreign market, is it pertinent to evaluate the Life Quality (LQ) in that market? (Considering that the "LQ" measures the level of economic well-being per person). **19.- Economic risk** Before exporting to a foreign market, is it pertinent to evaluate the Economic Risk (ER) of that market? (Considering that "ER" is the probability that a country will be affected by changes in commercial conditions or macro-economic factors). **20.- Unemployment** Before exporting to a foreign market, is it pertinent to evaluate the Unemployment Level (UL) of that market? **21.- Political stability index** Before exporting to a foreign market, is it pertinent to evaluate the Political Stability (PE) of that market? (Considering that "PE" is the government ability to maintain a coherent and predictable political environment over time). **22.- Economic complexity index** Before exporting to a foreign market, is it pertinent to assess the Sophistication and Economic Diversification level (SDE) of that market? (Considering that "SDE" measures the capacity to develop competitive and sustainable industries in the long term). **23.- Consumer price index** Before exporting to a foreign market, is it pertinent to evaluate the Inflation (IF) of that market? **24.- Foreign direct investment** To what extent does Foreign Direct Investment Inflows (FDI) influence the foreign market credibility? **25.- Market liquidity** Before exporting to a foreign market, is it pertinent to evaluate the Financial Liquidity (LF) of that market? (Considering that financial liquidity is the amount of cash and liquid assets that a country has to meet its short-term financial obligations).
Socio-cultural dimension
26.- Corruption perception index Before exporting to a foreign market, is it pertinent to assess the Corruption Level (CL) of that market? **27.-Cultural difference** Before exporting to a foreign market, is it pertinent to evaluate the Cultural Difference (CD) with that market? **28.- Ease of doing business index** Before exporting to a foreign market, is it pertinent to evaluate the Bureaucratic Level (BL) to do business in that market? **29.- Globalization index** Before exporting to a foreign market, is it pertinent to evaluate the Social, Economic and Political Integration level (SEPIL) of that market? **30.- Human development index** Before exporting to a foreign market, is it pertinent to assess the Social Development level (SD) of that market? (Considering that "SD" measures the social development of the population based on life expectancy, education and economic wealth).

Source: Own elaboration based on adjustments by an expert consult (2023)

APPENDIX C - Sensitivity analysis for each indicator

Sensitivity analysis for the human capital indicator

As mentioned in the methodology, sensitivity analysis allows us to determine the robustness and stability of the results in the face of subtle changes in the allocation of weights for each indicator. In this regard, this study adopted the approach proposed by Diaby (2014). In this approach, an indicator is selected to vary its weight in intervals of 10%, and the weights of other indicators are recalculated based on the aggregation of the entropy and rank order centroid method. Subsequently, the relative importance variation is reintegrated into the Topsis method to obtain the new proximity coefficients.

The last phase of the sensitivity analysis implies the elaboration of the pertinent graphs to verify the alternatives ranking behavior. Graphic 3 to 12 present the sensitivity analysis for each indicator evaluated. The *"X"* axis in these graphs represents the weight variation, which covers a continuous range from 0 to 1, and the axis *"Y"* represents the new proximity coefficients (CC_i) calculated by the Topsis method. The black line, perpendicular to the *"X"* axis, represents the original weight value computed by aggregating the entropy and the rank-order centroid method. On the other hand, the colored lines denote the new ranking in the function of the proximity coefficient.

Table 7 represents the new distribution of relative importance based on the weight variation for the "human capital" indicator. Table 8 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 7 - New relative importance distribution about the Human Capital indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0	0,081	0,100	0,005	0,085	0,222	0,014	0,018	0,012	0,119	0,335	0,008
0,1	0,073	0,090	0,005	0,077	0,199	0,013	0,016	0,011	0,107	0,302	0,007
0,2	0,065	0,080	0,004	0,068	0,177	0,011	0,014	0,010	0,095	0,268	0,006
0,3	0,057	0,070	0,004	0,060	0,155	0,010	0,013	0,009	0,083	0,235	0,005
0,4	0,049	0,060	0,003	0,051	0,133	0,008	0,011	0,007	0,071	0,201	0,005
0,5	0,041	0,050	0,003	0,043	0,111	0,007	0,009	0,006	0,060	0,168	0,004
0,6	0,033	0,040	0,002	0,034	0,089	0,006	0,007	0,005	0,048	0,134	0,003
0,7	0,024	0,030	0,002	0,026	0,066	0,004	0,005	0,004	0,036	0,101	0,002
0,8	0,016	0,020	0,001	0,017	0,044	0,003	0,004	0,002	0,024	0,067	0,002
0,9	0,008	0,010	0,001	0,009	0,022	0,001	0,002	0,001	0,012	0,034	0,001
1	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Source: Own authorship (2023)

Table 8 - Proximity coefficients for the new human capital indicator weights

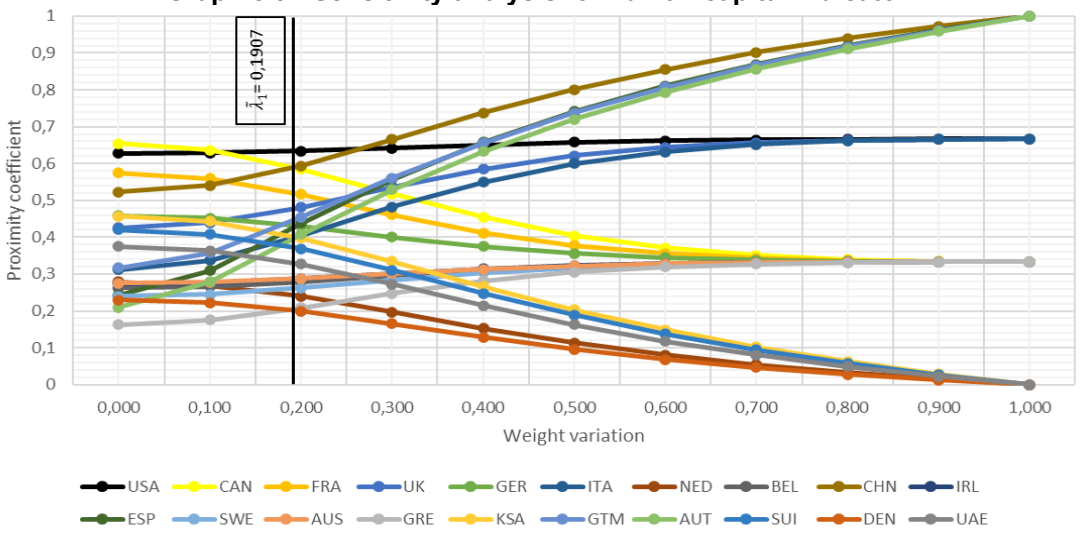
I1	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,628	0,629	0,634	0,642	0,651	0,657	0,662	0,665	0,666	0,667	0,667
CAN	0,654	0,636	0,585	0,517	0,454	0,405	0,371	0,350	0,339	0,335	0,333
FRA	0,574	0,559	0,516	0,461	0,412	0,377	0,356	0,343	0,337	0,334	0,333
UK	0,425	0,439	0,482	0,536	0,585	0,621	0,643	0,656	0,663	0,666	0,667
GER	0,459	0,452	0,430	0,401	0,374	0,356	0,345	0,338	0,335	0,334	0,333
ITA	0,312	0,337	0,404	0,482	0,550	0,599	0,632	0,651	0,661	0,666	0,667
NED	0,279	0,269	0,239	0,196	0,152	0,113	0,081	0,054	0,033	0,015	0,000
BEL	0,262	0,266	0,279	0,296	0,311	0,321	0,327	0,331	0,332	0,333	0,333
CHN	0,523	0,541	0,594	0,666	0,737	0,801	0,855	0,901	0,940	0,972	1,000
IRL	0,273	0,277	0,288	0,302	0,315	0,323	0,328	0,331	0,333	0,333	0,333
ESP	0,242	0,310	0,438	0,557	0,657	0,741	0,810	0,869	0,919	0,962	1,000
SWE	0,240	0,245	0,262	0,284	0,304	0,317	0,325	0,330	0,332	0,333	0,333
AUS	0,275	0,278	0,288	0,301	0,314	0,323	0,328	0,331	0,333	0,333	0,333
GRE	0,163	0,175	0,208	0,248	0,282	0,305	0,319	0,327	0,331	0,333	0,333
KSA	0,457	0,443	0,398	0,334	0,266	0,203	0,149	0,102	0,062	0,029	0,000
GTM	0,316	0,357	0,455	0,560	0,656	0,738	0,807	0,866	0,917	0,961	1,000
AUT	0,209	0,279	0,408	0,529	0,632	0,719	0,793	0,856	0,911	0,958	1,000
SUI	0,420	0,407	0,368	0,310	0,247	0,189	0,138	0,094	0,058	0,027	0,000
DEN	0,229	0,222	0,200	0,165	0,129	0,096	0,069	0,046	0,028	0,012	0,000
UAE	0,375	0,363	0,326	0,273	0,215	0,163	0,118	0,080	0,049	0,022	0,000

Source: Own authorship (2023)

Graphic 3 illustrates the sensitivity analysis applied to the human capital indicator. The graph shows that the United States is stable if the indicator weight remains below 0,3. On the other hand, Canada, France, and China remain stable if the weight is under 0,1. However, the ranking changes completely as those values are surpassed. For example, if the weight reaches 1, the United States goes from first to fifth place. Canada (second) and France (fourth) share the eighth position. On the other hand, China continues to stay within the top 4 in the ranking, going from third to first place.

Therefore, we can infer from Graphic 3 that as the indicator's relative importance increases above the stability values, only China exhibits a slightly constant behavior by maintaining its position among the four leading countries in the original ranking. On the other hand, the rest of the alternatives present a significant variation in their ranking, which suggests that the indicator strongly influences the countries ranking configuration.

Graphic 3 - Sensitivity analysis for human capital indicator



Source: Own authorship (2023)

Sensitivity analysis for the transportation cost indicator

Table 9 represents the new weight distribution based on the weight variation for the "transportation cost" indicator. Table 10 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 9 - New relative importance distribution about the transport cost indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,204	0,000	0,087	0,004	0,074	0,192	0,012	0,016	0,011	0,103	0,290	0,007
0,184	0,100	0,078	0,004	0,067	0,173	0,011	0,014	0,009	0,093	0,261	0,006
0,163	0,200	0,069	0,004	0,059	0,154	0,010	0,012	0,008	0,083	0,232	0,005
0,143	0,300	0,061	0,003	0,052	0,134	0,008	0,011	0,007	0,072	0,203	0,005
0,123	0,400	0,052	0,003	0,044	0,115	0,007	0,009	0,006	0,062	0,174	0,004
0,102	0,500	0,043	0,002	0,037	0,096	0,006	0,008	0,005	0,052	0,145	0,003
0,082	0,600	0,035	0,002	0,030	0,077	0,005	0,006	0,004	0,041	0,116	0,003
0,061	0,700	0,026	0,001	0,022	0,058	0,004	0,005	0,003	0,031	0,087	0,002
0,041	0,800	0,017	0,001	0,015	0,038	0,002	0,003	0,002	0,021	0,058	0,001
0,020	0,900	0,009	0,000	0,007	0,019	0,001	0,002	0,001	0,010	0,029	0,001
0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Source: Own authorship (2023)

Table 10 - Proximity coefficients for the new transportation cost indicator weight

I2	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,633	0,634	0,635	0,638	0,641	0,644	0,646	0,648	0,649	0,649	0,649
CAN	0,599	0,579	0,520	0,439	0,354	0,276	0,205	0,143	0,089	0,042	0,000
FRA	0,517	0,526	0,555	0,601	0,652	0,698	0,734	0,758	0,771	0,778	0,779
UK	0,473	0,483	0,516	0,567	0,625	0,677	0,718	0,745	0,761	0,769	0,771

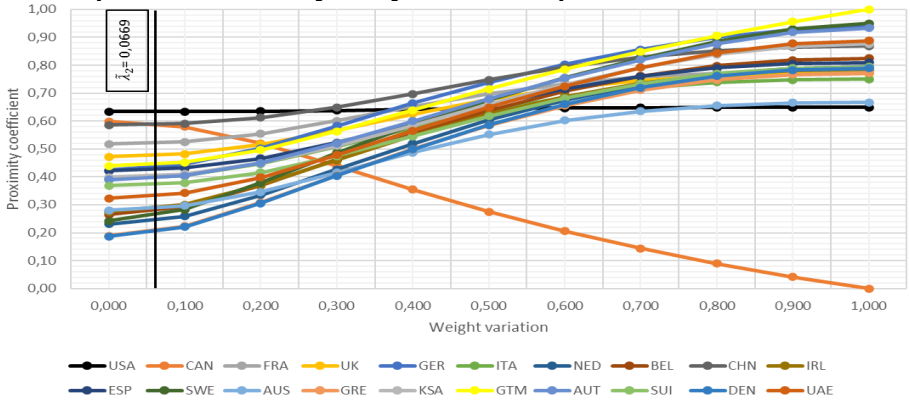
I2	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
GER	0,424	0,444	0,503	0,582	0,664	0,738	0,803	0,857	0,899	0,927	0,937
ITA	0,392	0,405	0,446	0,509	0,576	0,637	0,685	0,719	0,738	0,748	0,750
NED	0,231	0,259	0,334	0,427	0,519	0,603	0,675	0,731	0,769	0,789	0,794
BEL	0,265	0,293	0,369	0,462	0,554	0,637	0,707	0,761	0,799	0,819	0,824
CHN	0,586	0,591	0,612	0,649	0,697	0,747	0,793	0,829	0,853	0,865	0,869
IRL	0,276	0,301	0,371	0,460	0,547	0,625	0,689	0,736	0,766	0,781	0,785
ESP	0,421	0,432	0,466	0,523	0,590	0,657	0,715	0,760	0,790	0,806	0,810
SWE	0,242	0,283	0,378	0,486	0,586	0,676	0,755	0,825	0,884	0,930	0,950
AUS	0,280	0,296	0,345	0,415	0,487	0,552	0,602	0,636	0,656	0,665	0,667
GRE	0,189	0,224	0,308	0,406	0,500	0,585	0,656	0,711	0,747	0,766	0,771
KSA	0,399	0,410	0,449	0,511	0,585	0,661	0,731	0,792	0,839	0,868	0,876
GTM	0,439	0,452	0,496	0,563	0,639	0,715	0,785	0,849	0,905	0,955	1,000
AUT	0,390	0,404	0,450	0,520	0,600	0,679	0,754	0,820	0,876	0,917	0,933
SUI	0,368	0,379	0,415	0,474	0,545	0,617	0,682	0,734	0,770	0,789	0,795
DEN	0,187	0,221	0,306	0,404	0,499	0,586	0,661	0,720	0,761	0,783	0,789
UAE	0,323	0,342	0,398	0,478	0,565	0,649	0,725	0,792	0,844	0,877	0,888

Source: Own authorship (2023)

Graphic 4 illustrates the sensitivity analysis applied to the transportation cost indicator. The graph shows Canada is stable if the indicator weight remains below the original value. On the other hand, the United States, France, and China maintain their stability if the relative importance remains below 0.2, 0.5, and 0.7, respectively.

However, the ranking changes entirely as the weight reaches 1. In this case, Guatemala comes to occupy the United States' first place, and in turn, this one is displaced to the nineteenth position. Sweden comes to occupy Canada's second place, and in turn, this one is displaced to the twentieth position. Germany comes to occupy China's third place, and in turn, this one is displaced to the seventh position. Finally, Australia comes to occupy France's fourth place, and in turn, this one is displaced to the fourteenth position.

Graphic 4 - Sensitivity analysis for transportation cost indicator



Source: Own authorship (2023)

Therefore, we can infer from Graphic 4 that as the indicator's relative importance increases above the stability values, none of the four leading countries in the original ranking exhibits a constant behavior, which suggests that the indicator strongly influences the countries ranking configuration.

Sensitivity analysis for the geographical distance indicator

Table 11 represents the new distribution of relative importance based on the weight variation for the "geographical distance" indicator.

Table 12 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 11 - New relative importance distribution about the Geographical distance indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,208	0,072	0,000	0,004	0,075	0,195	0,012	0,016	0,011	0,105	0,295	0,007
0,187	0,065	0,100	0,004	0,068	0,176	0,011	0,014	0,010	0,094	0,266	0,006
0,166	0,057	0,200	0,004	0,060	0,156	0,010	0,013	0,009	0,084	0,236	0,006
0,145	0,050	0,300	0,003	0,053	0,137	0,009	0,011	0,008	0,073	0,207	0,005
0,125	0,043	0,400	0,003	0,045	0,117	0,007	0,009	0,006	0,063	0,177	0,004
0,104	0,036	0,500	0,002	0,038	0,098	0,006	0,008	0,005	0,052	0,148	0,003
0,083	0,029	0,600	0,002	0,030	0,078	0,005	0,006	0,004	0,042	0,118	0,003
0,062	0,022	0,700	0,001	0,023	0,059	0,004	0,005	0,003	0,031	0,089	0,002
0,042	0,014	0,800	0,001	0,015	0,039	0,002	0,003	0,002	0,021	0,059	0,001
0,021	0,007	0,900	0,000	0,008	0,020	0,001	0,002	0,001	0,010	0,030	0,001
0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Source: Own authorship (2023)

Table 12 - Proximity coefficients for the new geographical distance indicator weight

I3	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,630	0,635	0,653	0,683	0,721	0,758	0,788	0,809	0,821	0,827	0,829
CAN	0,590	0,591	0,594	0,599	0,605	0,610	0,613	0,615	0,617	0,617	0,617
FRA	0,518	0,522	0,534	0,553	0,573	0,589	0,600	0,606	0,610	0,611	0,611
UK	0,474	0,479	0,494	0,519	0,545	0,566	0,581	0,589	0,594	0,596	0,596
GER	0,429	0,434	0,450	0,475	0,501	0,521	0,535	0,543	0,547	0,549	0,549
ITA	0,393	0,399	0,421	0,455	0,491	0,521	0,541	0,553	0,560	0,562	0,563
NED	0,232	0,249	0,297	0,362	0,428	0,482	0,522	0,547	0,561	0,568	0,569
BEL	0,267	0,283	0,329	0,391	0,453	0,504	0,540	0,562	0,574	0,579	0,581
CHN	0,600	0,581	0,523	0,443	0,359	0,280	0,209	0,146	0,091	0,043	0,000
IRL	0,275	0,293	0,346	0,416	0,484	0,540	0,580	0,605	0,619	0,625	0,627
ESP	0,421	0,428	0,453	0,494	0,543	0,588	0,624	0,647	0,661	0,667	0,669

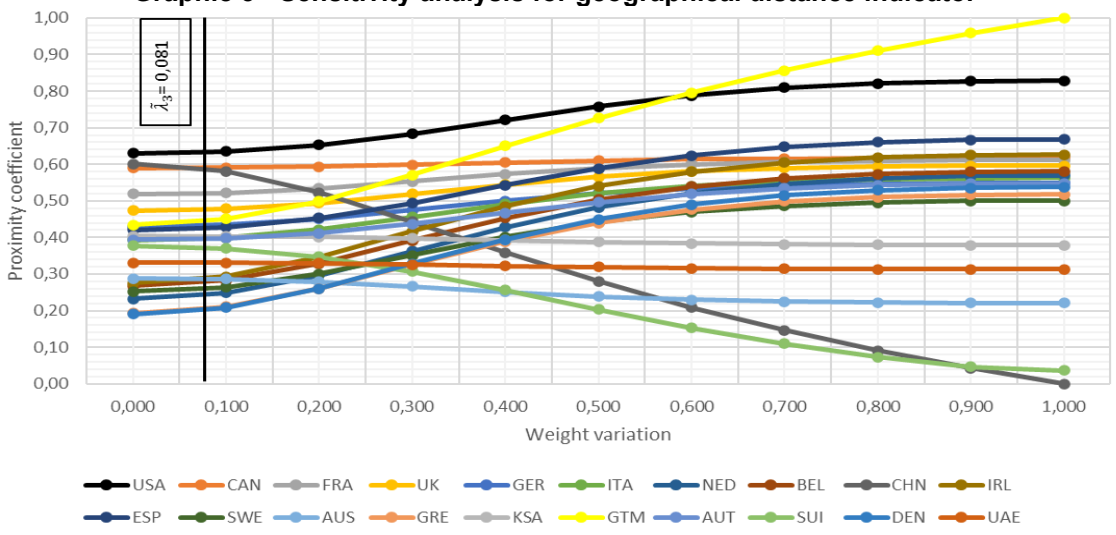
I3	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
SWE	0,253	0,264	0,300	0,351	0,401	0,442	0,470	0,487	0,495	0,499	0,500
AUS	0,288	0,286	0,278	0,266	0,251	0,239	0,230	0,225	0,222	0,221	0,220
GRE	0,193	0,210	0,261	0,326	0,389	0,440	0,476	0,498	0,511	0,516	0,518
KSA	0,404	0,403	0,401	0,397	0,392	0,387	0,384	0,381	0,380	0,379	0,379
GTM	0,435	0,450	0,499	0,571	0,650	0,726	0,795	0,857	0,911	0,958	1,000
AUT	0,394	0,398	0,412	0,436	0,467	0,496	0,519	0,534	0,542	0,546	0,547
SUI	0,377	0,370	0,347	0,307	0,257	0,203	0,153	0,109	0,073	0,046	0,036
DEN	0,190	0,209	0,260	0,328	0,394	0,450	0,490	0,515	0,529	0,536	0,537
UAE	0,331	0,331	0,329	0,326	0,322	0,319	0,316	0,315	0,314	0,313	0,313

Source: Own authorship (2023)

Graphic 5 illustrates the sensitivity analysis applied to the geographical distance indicator. The graph shows that the United States, Canada, and France are stable if the indicator weight remains below 0,5. On the other hand, China presents stability only if the relative importance remains below the original value.

However, the ranking changes entirely as the weight reaches 1. In this case, Guatemala comes to occupy the United States' first place, and in turn, this one is displaced to the second position. Canada, which was initially in second place, now ranks fifth. China's ranking is significantly affected, falling from third place to twentieth position. Finally, France, originally in fourth place, now ranks sixth.

Graphic 5 - Sensitivity analysis for geographical distance indicator



Source: Own authorship (2023)

Therefore, we can infer from Graphic 5 that as the indicator's relative importance increases above the stability values, only the United States exhibits a

constant behavior by maintaining its position among the four leading countries in the original ranking, suggesting that the indicator moderately influences the countries ranking configuration.

Sensitivity analysis for the logistic performance indicator

Table 13 represents the new distribution of relative importance based on the weight variation for the "logistic performance" indicator. Table 14 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 13 - New relative importance distribution about the logistic performance indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,192	0,066	0,081	0,000	0,069	0,180	0,011	0,015	0,010	0,097	0,272	0,006
0,172	0,060	0,073	0,100	0,062	0,162	0,010	0,013	0,009	0,087	0,245	0,006
0,153	0,053	0,065	0,200	0,056	0,144	0,009	0,012	0,008	0,077	0,218	0,005
0,134	0,046	0,057	0,300	0,049	0,126	0,008	0,010	0,007	0,068	0,191	0,004
0,115	0,040	0,049	0,400	0,042	0,108	0,007	0,009	0,006	0,058	0,163	0,004
0,096	0,033	0,041	0,500	0,035	0,090	0,006	0,007	0,005	0,048	0,136	0,003
0,077	0,026	0,033	0,600	0,028	0,072	0,005	0,006	0,004	0,039	0,109	0,003
0,057	0,020	0,024	0,700	0,021	0,054	0,003	0,004	0,003	0,029	0,082	0,002
0,038	0,013	0,016	0,800	0,014	0,036	0,002	0,003	0,002	0,019	0,054	0,001
0,019	0,007	0,008	0,900	0,007	0,018	0,001	0,001	0,001	0,010	0,027	0,001
0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Source: Own authorship (2023)

Table 14 - Proximity coefficients for the new logistic performance indicator weight

I4	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,634	0,634	0,636	0,642	0,652	0,669	0,696	0,731	0,767	0,792	0,800
CAN	0,591	0,592	0,597	0,608	0,629	0,662	0,710	0,770	0,838	0,902	0,933
FRA	0,521	0,522	0,529	0,544	0,571	0,612	0,667	0,732	0,797	0,848	0,867
UK	0,477	0,478	0,483	0,495	0,516	0,549	0,594	0,645	0,693	0,724	0,733
GER	0,432	0,436	0,449	0,476	0,520	0,581	0,655	0,737	0,824	0,913	1,000
ITA	0,397	0,399	0,406	0,422	0,451	0,494	0,551	0,616	0,677	0,720	0,733
NED	0,243	0,250	0,274	0,319	0,383	0,462	0,553	0,654	0,762	0,878	1,000
BEL	0,277	0,283	0,303	0,342	0,400	0,475	0,562	0,659	0,763	0,867	0,933
CHN	0,588	0,588	0,590	0,595	0,604	0,619	0,642	0,673	0,704	0,726	0,733
IRL	0,286	0,289	0,300	0,322	0,358	0,410	0,475	0,545	0,610	0,653	0,667
ESP	0,426	0,427	0,435	0,451	0,479	0,524	0,587	0,664	0,751	0,831	0,867
SWE	0,260	0,266	0,288	0,329	0,389	0,465	0,554	0,652	0,758	0,865	0,933
AUS	0,287	0,290	0,301	0,326	0,366	0,422	0,494	0,575	0,654	0,713	0,733
GRE	0,204	0,209	0,227	0,261	0,312	0,379	0,459	0,549	0,638	0,708	0,733
KSA	0,404	0,404	0,406	0,410	0,417	0,431	0,452	0,480	0,508	0,527	0,533

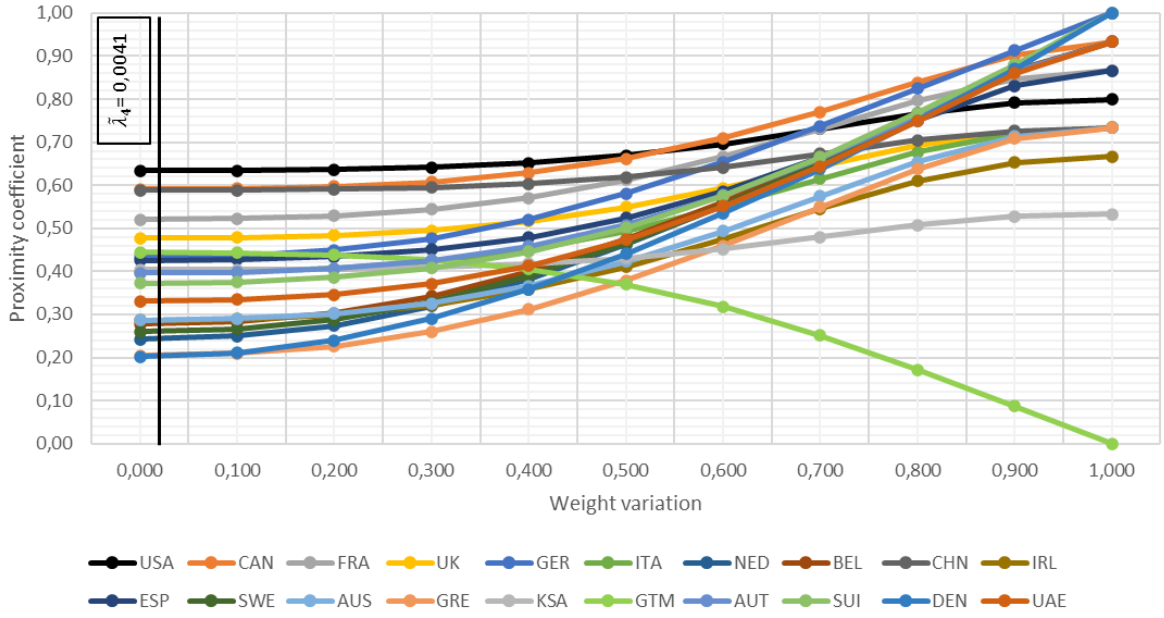
I4	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
GTM	0,445	0,443	0,438	0,426	0,405	0,369	0,318	0,251	0,172	0,087	0,000
AUT	0,396	0,398	0,407	0,425	0,458	0,508	0,576	0,662	0,761	0,865	0,933
SUI	0,373	0,375	0,386	0,408	0,446	0,502	0,576	0,665	0,768	0,880	1,000
DEN	0,202	0,211	0,240	0,290	0,359	0,441	0,535	0,638	0,750	0,871	1,000
UAE	0,331	0,334	0,346	0,371	0,413	0,474	0,552	0,645	0,749	0,860	0,933

Source: Own authorship (2023)

Graphic 6 illustrates the sensitivity analysis applied to the logistics performance indicator. The graph shows that the United States, France, and China are stable if the indicator weight remains below 0,5. On the other hand, Canada presents stability only if the relative importance remains below 0,9.

However, the ranking changes entirely as the weight reaches 1. Where, Germany, the Netherlands, Switzerland, and Denmark came to occupy the United States' first place. In turn, this one is displaced to the twelfth position. Canada, which was initially in second place, now ranks fifth. China, which was initially in third place, now ranks thirteenth. France, which was in fourth place, now ranks tenth.

Graphic 6 - Sensitivity analysis for logistic performance indicator



Source: Own authorship (2023)

Therefore, we can infer from Graphic 6 that as the indicator's relative importance increases above the stability values, none of the four leading countries in

the original ranking exhibits a constant behavior, which suggests that the indicator moderately influences the countries ranking configuration.

Sensitivity analysis for the exchange rate indicator

Table 15 represents the new distribution of relative importance based on the weight variation for the "exchange rate" indicator. Table 16 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 15 - New relative importance distribution about the exchange rate indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,205	0,071	0,087	0,004	0,000	0,193	0,012	0,016	0,011	0,103	0,291	0,007
0,184	0,064	0,078	0,004	0,100	0,173	0,011	0,014	0,010	0,093	0,262	0,006
0,164	0,057	0,070	0,004	0,200	0,154	0,010	0,012	0,008	0,083	0,233	0,005
0,143	0,050	0,061	0,003	0,300	0,135	0,008	0,011	0,007	0,072	0,204	0,005
0,123	0,043	0,052	0,003	0,400	0,116	0,007	0,009	0,006	0,062	0,175	0,004
0,102	0,035	0,044	0,002	0,500	0,096	0,006	0,008	0,005	0,052	0,146	0,003
0,082	0,028	0,035	0,002	0,600	0,077	0,005	0,006	0,004	0,041	0,117	0,003
0,061	0,021	0,026	0,001	0,700	0,058	0,004	0,005	0,003	0,031	0,087	0,002
0,041	0,014	0,017	0,001	0,800	0,039	0,002	0,003	0,002	0,021	0,058	0,001
0,020	0,007	0,009	0,000	0,900	0,019	0,001	0,002	0,001	0,010	0,029	0,001
0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Source: Own authorship (2023)

Table 16 - Proximity coefficients for the new exchange rate indicator weight

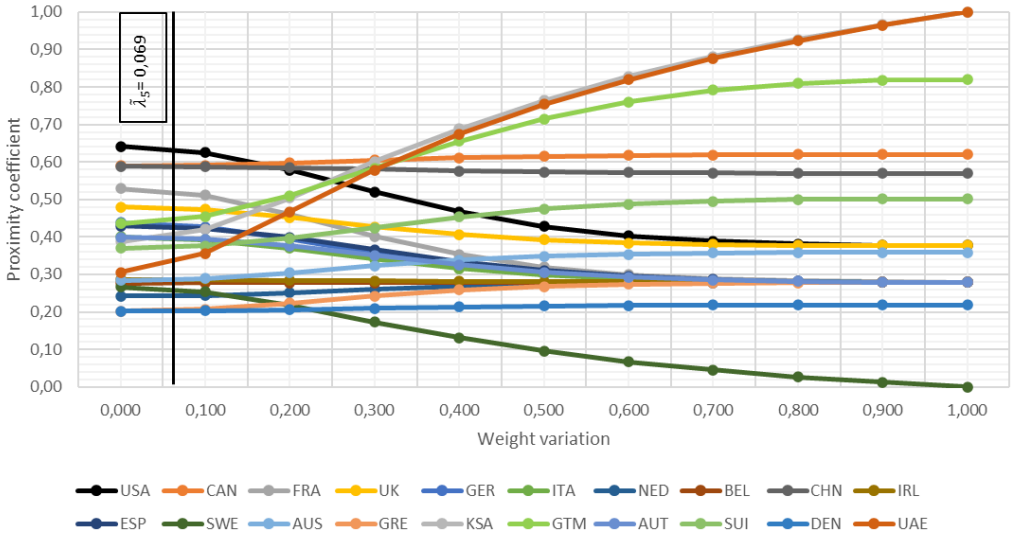
I5	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,641	0,625	0,579	0,520	0,467	0,428	0,403	0,388	0,381	0,378	0,377
CAN	0,590	0,591	0,597	0,604	0,611	0,615	0,618	0,619	0,620	0,620	0,620
FRA	0,529	0,511	0,461	0,402	0,353	0,320	0,299	0,288	0,282	0,280	0,279
UK	0,480	0,473	0,452	0,427	0,406	0,392	0,384	0,380	0,378	0,377	0,377
GER	0,438	0,427	0,395	0,357	0,325	0,304	0,291	0,284	0,281	0,279	0,279
ITA	0,401	0,393	0,370	0,341	0,316	0,299	0,289	0,283	0,281	0,279	0,279
NED	0,242	0,244	0,251	0,261	0,268	0,273	0,276	0,278	0,279	0,279	0,279
BEL	0,277	0,277	0,278	0,278	0,279	0,279	0,279	0,279	0,279	0,279	0,279
CHN	0,588	0,588	0,585	0,580	0,576	0,573	0,571	0,570	0,570	0,570	0,570
IRL	0,287	0,286	0,285	0,283	0,281	0,280	0,280	0,279	0,279	0,279	0,279
ESP	0,429	0,422	0,399	0,366	0,334	0,310	0,295	0,286	0,282	0,280	0,279
SWE	0,266	0,254	0,219	0,173	0,131	0,095	0,067	0,045	0,027	0,012	0,000
AUS	0,284	0,289	0,304	0,323	0,338	0,348	0,354	0,357	0,358	0,359	0,359
GRE	0,202	0,207	0,223	0,243	0,258	0,268	0,274	0,277	0,278	0,279	0,279
KSA	0,388	0,421	0,504	0,601	0,689	0,764	0,828	0,882	0,927	0,966	1,000
GTM	0,436	0,455	0,510	0,583	0,655	0,715	0,761	0,791	0,809	0,818	0,820
AUT	0,398	0,393	0,377	0,351	0,326	0,306	0,293	0,285	0,281	0,280	0,279
SUI	0,370	0,376	0,396	0,425	0,453	0,474	0,488	0,496	0,500	0,501	0,502
DEN	0,202	0,203	0,206	0,210	0,213	0,216	0,217	0,218	0,218	0,218	0,218

UAE	0,306	0,356	0,467	0,578	0,674	0,754	0,820	0,876	0,924	0,965	1,000

Source: Own authorship (2023)

Graphic 7 illustrates the sensitivity analysis applied to the exchange rate indicator. The graph shows that the United States, Canada, France, and China are stable if the indicator weight remains below 0,1. However, the ranking changes entirely as the weight reaches 1. Where Saudi Arabia came to occupy the United States' first place, and in turn, this one was displaced to the seventh position. The United Arab Emirates came to occupy Canada's second place, and in turn, this one was displaced to the fourth position. Guatemala came to occupy China's third place, which in turn, this one was displaced to the fifth position. Finally, Canada came to occupy France's fourth place, and in turn, this one was displaced to the tenth position.

Graphic 7 - Sensitivity analysis for exchange rate indicator



Source: Own authorship (2023)

Therefore, we can infer from Graphic 7 that as the indicator's relative importance increases above the stability value, only Canada exhibits a constant behavior by maintaining its position among the four leading countries of the original ranking, which suggests that the indicator strongly influences the countries ranking configuration.

Sensitivity analysis for the market size indicator

Table 17 represents the new distribution of relative importance based on the weight variation for the "market size" indicator. Table 18 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 17 - New relative importance distribution about the market size indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,232	0,080	0,099	0,005	0,084	0,000	0,014	0,018	0,012	0,117	0,331	0,008
0,209	0,072	0,089	0,005	0,076	0,100	0,012	0,016	0,011	0,106	0,298	0,007
0,186	0,064	0,079	0,004	0,067	0,200	0,011	0,014	0,010	0,094	0,264	0,006
0,163	0,056	0,069	0,004	0,059	0,300	0,010	0,012	0,008	0,082	0,231	0,005
0,139	0,048	0,059	0,003	0,051	0,400	0,008	0,011	0,007	0,070	0,198	0,005
0,116	0,040	0,049	0,003	0,042	0,500	0,007	0,009	0,006	0,059	0,165	0,004
0,093	0,032	0,040	0,002	0,034	0,600	0,006	0,007	0,005	0,047	0,132	0,003
0,070	0,024	0,030	0,002	0,025	0,700	0,004	0,005	0,004	0,035	0,099	0,002
0,046	0,016	0,020	0,001	0,017	0,800	0,003	0,004	0,002	0,023	0,066	0,002
0,023	0,008	0,010	0,001	0,008	0,900	0,001	0,002	0,001	0,012	0,033	0,001
0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000

Source: Own authorship (2023)

Table 18 - Proximity coefficients for the new market size indicator weight

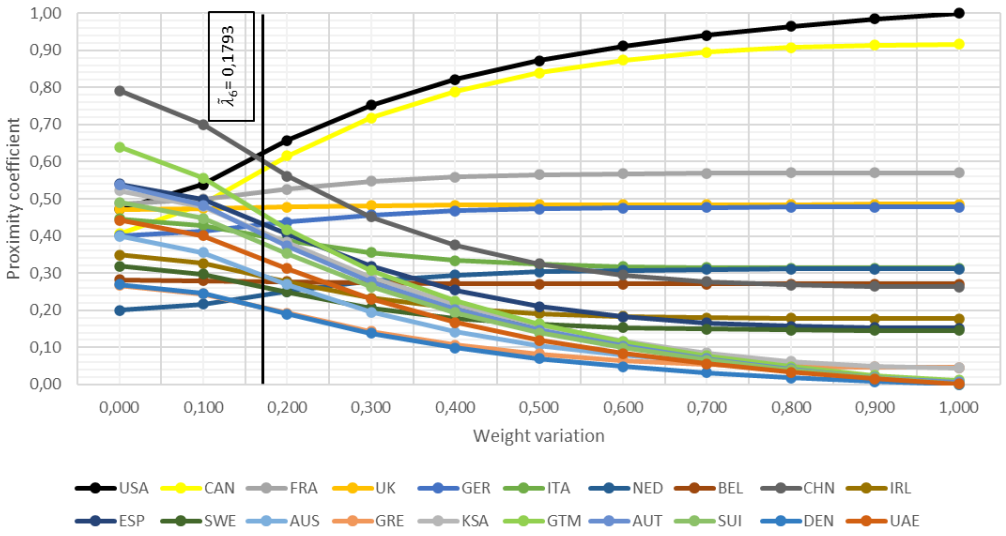
I6	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,471	0,538	0,657	0,752	0,822	0,872	0,911	0,941	0,964	0,984	1,000
CAN	0,406	0,485	0,616	0,717	0,789	0,839	0,873	0,895	0,908	0,914	0,916
FRA	0,487	0,500	0,526	0,547	0,559	0,565	0,568	0,569	0,570	0,570	0,570
UK	0,472	0,474	0,478	0,481	0,483	0,484	0,484	0,485	0,485	0,485	0,485
GER	0,401	0,413	0,438	0,457	0,467	0,473	0,475	0,477	0,477	0,478	0,478
ITA	0,446	0,428	0,389	0,355	0,334	0,324	0,318	0,315	0,314	0,313	0,313
NED	0,200	0,216	0,250	0,278	0,294	0,303	0,307	0,310	0,311	0,311	0,311
BEL	0,282	0,280	0,277	0,274	0,272	0,271	0,271	0,270	0,270	0,270	0,270
CHN	0,791	0,700	0,561	0,452	0,375	0,325	0,295	0,277	0,268	0,264	0,263
IRL	0,349	0,326	0,276	0,233	0,206	0,192	0,184	0,180	0,178	0,177	0,177
ESP	0,539	0,498	0,406	0,319	0,255	0,211	0,183	0,166	0,157	0,153	0,152
SWE	0,318	0,297	0,250	0,207	0,179	0,163	0,154	0,149	0,147	0,146	0,146
AUS	0,400	0,356	0,269	0,195	0,142	0,106	0,080	0,063	0,053	0,048	0,046
GRE	0,267	0,245	0,193	0,144	0,107	0,082	0,065	0,055	0,049	0,047	0,046
KSA	0,523	0,479	0,383	0,290	0,216	0,160	0,117	0,085	0,062	0,049	0,045
GTM	0,640	0,556	0,418	0,307	0,225	0,163	0,116	0,078	0,048	0,024	0,012
AUT	0,537	0,482	0,374	0,277	0,203	0,147	0,103	0,069	0,042	0,020	0,006
SUI	0,491	0,447	0,352	0,263	0,193	0,140	0,098	0,066	0,040	0,018	0,001
DEN	0,269	0,245	0,190	0,138	0,099	0,070	0,048	0,032	0,019	0,008	0,000
UAE	0,443	0,401	0,312	0,230	0,167	0,120	0,084	0,056	0,033	0,015	0,001

Source: Own authorship (2023)

Graphic 8 illustrates the sensitivity analysis applied to the market size indicator. The graph shows that the United States and Canada are stable if the indicator weight remains above 0,2. However, this stability is strongly affected if the

indicator's relative importance decreases below the mentioned value. On the other hand, France presents stability only if the relative importance remains between 0,1 and 0,2. In addition, a 10% increase in this interval improves the ranking by one position. As far as China is concerned, it has a moderately sensible behavior because when the indicator's relative importance increases or decreases from the original weight, the country's ranking worsens and improves, passing from the third to the ninth position in the first case and passing from the third to the first position in the second case.

Graphic 8 - Sensitivity analysis for market size capital indicator



Source: Own authorship (2023)

Therefore, we can infer from Graphic 8 that the United States and Canada maintain stability when the indicator's relative importance increase. On the other hand, France and China have a slight and moderately sensitive behavior to any change in the indicator weight. All this suggests that the indicator slightly influences the countries ranking configuration.

Sensitivity analysis for the economic freedom indicator

Table 19 represents the new distribution of relative importance based on the weight variation for the "economic freedom" indicator. Table 20 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 19 - New relative importance distribution about the economic freedom indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,193	0,067	0,082	0,004	0,070	0,181	0,000	0,015	0,010	0,097	0,274	0,006
0,174	0,060	0,074	0,004	0,063	0,163	0,100	0,013	0,009	0,088	0,247	0,006
0,154	0,053	0,066	0,003	0,056	0,145	0,200	0,012	0,008	0,078	0,220	0,005
0,135	0,047	0,057	0,003	0,049	0,127	0,300	0,010	0,007	0,068	0,192	0,004
0,116	0,040	0,049	0,003	0,042	0,109	0,400	0,009	0,006	0,058	0,165	0,004
0,096	0,033	0,041	0,002	0,035	0,091	0,500	0,007	0,005	0,049	0,137	0,003
0,077	0,027	0,033	0,002	0,028	0,073	0,600	0,006	0,004	0,039	0,110	0,003
0,058	0,020	0,025	0,001	0,021	0,054	0,700	0,004	0,003	0,029	0,082	0,002
0,039	0,013	0,016	0,001	0,014	0,036	0,800	0,003	0,002	0,019	0,055	0,001
0,019	0,007	0,008	0,000	0,007	0,018	0,900	0,001	0,001	0,010	0,027	0,001
0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000

Source: Own authorship (2023)

Table 20 - Proximity coefficients for the new economic freedom indicator weight

I7	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,634	0,633	0,633	0,633	0,633	0,632	0,631	0,630	0,629	0,628	0,628
CAN	0,591	0,591	0,594	0,601	0,612	0,630	0,652	0,675	0,692	0,702	0,704
FRA	0,521	0,520	0,517	0,510	0,499	0,484	0,466	0,450	0,438	0,433	0,431
UK	0,477	0,478	0,482	0,492	0,507	0,530	0,556	0,580	0,597	0,606	0,608
GER	0,432	0,435	0,445	0,466	0,500	0,546	0,599	0,649	0,687	0,709	0,715
ITA	0,397	0,397	0,397	0,397	0,396	0,396	0,395	0,395	0,395	0,394	0,394
NED	0,243	0,251	0,278	0,327	0,394	0,474	0,562	0,653	0,741	0,810	0,837
BEL	0,277	0,280	0,290	0,310	0,343	0,385	0,433	0,476	0,508	0,525	0,530
CHN	0,588	0,584	0,568	0,537	0,488	0,423	0,346	0,262	0,174	0,086	0,000
IRL	0,286	0,296	0,328	0,383	0,456	0,540	0,630	0,721	0,812	0,898	0,949
ESP	0,426	0,426	0,427	0,429	0,434	0,441	0,449	0,458	0,465	0,469	0,470
SWE	0,260	0,268	0,294	0,342	0,408	0,487	0,573	0,660	0,741	0,801	0,823
AUS	0,287	0,292	0,311	0,347	0,402	0,470	0,546	0,623	0,689	0,733	0,746
GRE	0,204	0,205	0,206	0,208	0,213	0,219	0,227	0,234	0,239	0,242	0,242
KSA	0,404	0,403	0,401	0,395	0,385	0,369	0,347	0,321	0,299	0,286	0,282
GTM	0,445	0,444	0,444	0,442	0,438	0,433	0,425	0,417	0,411	0,407	0,406
AUT	0,396	0,398	0,403	0,416	0,438	0,473	0,518	0,566	0,609	0,635	0,642
SUI	0,373	0,377	0,394	0,427	0,478	0,546	0,626	0,715	0,808	0,904	1,000
DEN	0,202	0,211	0,243	0,297	0,368	0,451	0,541	0,635	0,725	0,798	0,825
UAE	0,331	0,333	0,342	0,360	0,391	0,436	0,491	0,549	0,598	0,628	0,637

Source: Own authorship (2023)

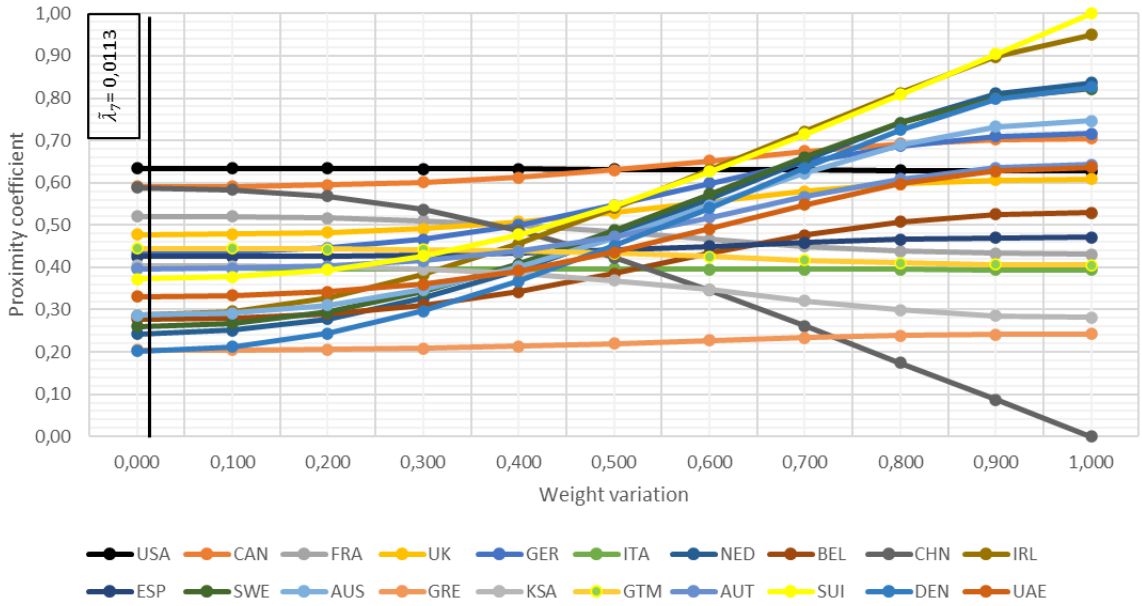
Graphic 9 illustrates the sensitivity analysis applied to the economic freedom indicator. The graph shows the United States is stable if the indicator weight remains below 0,5. On the other hand, Canada, China, and France maintain their stability if the relative importance remains below 0.4, 0.3, and 0.3, respectively.

However, the ranking changes entirely as the indicator weight reaches 1. In this case, Sweden came to occupy the United States' first place, and in turn, this one

was displaced to the eleventh position. Ireland came to occupy Canada ' second place, and in turn, this one was displaced to the eighth position. The Netherlands came to occupy China's third place, and in turn, this one was displaced to the twentieth position. Finally, Denmark came to occupy France's fourth place, and in turn, this one was displaced to the fifteenth position.

Therefore, we can infer from Graphic 9 that as the indicator's relative importance increases above the stability values, none of the four leading countries in the original ranking exhibits a constant behavior, which suggests that the indicator moderately influences the countries ranking configuration.

Graphic 9 - Sensitivity analysis for economic freedom indicator



Source: Own authorship (2023)

Sensitivity analysis for the tariff rate indicator

Table 21 represents the new distribution of relative importance based on the weight variation for the "tariff rate" indicator. Table 22 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 21 - New relative importance distribution about the tariff rate Indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,194	0,067	0,082	0,004	0,070	0,182	0,011	0,000	0,010	0,098	0,275	0,006
0,174	0,060	0,074	0,004	0,063	0,164	0,010	0,100	0,009	0,088	0,248	0,006
0,155	0,054	0,066	0,003	0,056	0,146	0,009	0,200	0,008	0,078	0,220	0,005

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,135	0,047	0,058	0,003	0,049	0,127	0,008	0,300	0,007	0,068	0,193	0,004
0,116	0,040	0,049	0,003	0,042	0,109	0,007	0,400	0,006	0,059	0,165	0,004
0,097	0,033	0,041	0,002	0,035	0,091	0,006	0,500	0,005	0,049	0,138	0,003
0,077	0,027	0,033	0,002	0,028	0,073	0,005	0,600	0,004	0,039	0,110	0,003
0,058	0,020	0,025	0,001	0,021	0,055	0,003	0,700	0,003	0,029	0,083	0,002
0,039	0,013	0,016	0,001	0,014	0,036	0,002	0,800	0,002	0,020	0,055	0,001
0,019	0,007	0,008	0,000	0,007	0,018	0,001	0,900	0,001	0,010	0,028	0,001
0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000

Source: Own authorship (2023)

Table 22 - Proximity coefficients for the new tariff rate weight

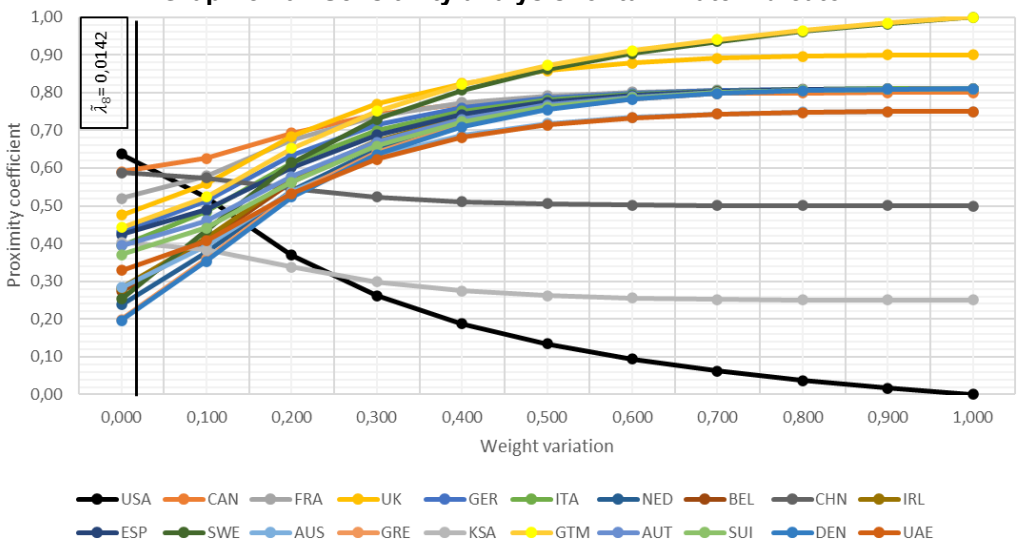
I8	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,637	0,522	0,369	0,262	0,187	0,134	0,094	0,062	0,037	0,017	0,000
CAN	0,590	0,625	0,692	0,742	0,770	0,785	0,793	0,797	0,799	0,800	0,800
FRA	0,519	0,579	0,674	0,738	0,773	0,792	0,801	0,806	0,809	0,810	0,810
UK	0,475	0,559	0,683	0,769	0,824	0,858	0,879	0,890	0,897	0,899	0,900
GER	0,430	0,513	0,634	0,714	0,759	0,785	0,798	0,805	0,808	0,810	0,810
ITA	0,395	0,484	0,613	0,699	0,750	0,779	0,795	0,804	0,808	0,810	0,810
NED	0,239	0,377	0,540	0,649	0,718	0,760	0,785	0,799	0,806	0,809	0,810
BEL	0,273	0,406	0,564	0,667	0,730	0,768	0,789	0,801	0,807	0,809	0,810
CHN	0,588	0,574	0,545	0,523	0,511	0,505	0,502	0,501	0,500	0,500	0,500
IRL	0,282	0,414	0,572	0,673	0,734	0,770	0,790	0,802	0,807	0,809	0,810
ESP	0,424	0,489	0,602	0,687	0,742	0,774	0,793	0,802	0,807	0,809	0,810
SWE	0,253	0,435	0,614	0,729	0,806	0,862	0,903	0,936	0,961	0,982	1,000
AUS	0,284	0,393	0,537	0,631	0,687	0,718	0,735	0,743	0,748	0,750	0,750
GRE	0,198	0,360	0,531	0,642	0,714	0,758	0,784	0,798	0,806	0,809	0,810
KSA	0,404	0,383	0,337	0,298	0,275	0,262	0,256	0,252	0,251	0,250	0,250
GTM	0,443	0,523	0,652	0,751	0,821	0,872	0,911	0,941	0,965	0,984	1,000
AUT	0,395	0,460	0,577	0,669	0,729	0,767	0,789	0,801	0,807	0,809	0,810
SUI	0,371	0,441	0,563	0,659	0,723	0,763	0,786	0,800	0,806	0,809	0,810
DEN	0,197	0,353	0,523	0,636	0,709	0,755	0,782	0,798	0,806	0,809	0,810
UAE	0,329	0,407	0,532	0,623	0,681	0,714	0,733	0,743	0,747	0,749	0,750

Source: Own authorship (2023)

Graphic 10 illustrates the sensitivity analysis applied to the tariff rate indicator. The graph shows France has a moderately stable behavior for any weight variation. Conversely, China is only stable if the indicator weight remains below 0,1. Additionally, The United States and Canada present stability only if the relative importance remains below the original value. However, the ranking changes entirely as the weight reaches 1. Where Guatemala and Sweden came to occupy the United States' first place, and in turn, this one was displaced to the twentieth position. Canada and China are displaced to the fifteenth and eighteenth positions, respectively.

Therefore, we can infer from Graphic 10 that as the indicator's relative importance increases above the stability values, only France exhibits a constant behavior by maintaining its position among the four leading countries in the original ranking, suggesting that the indicator strongly influences the countries ranking configuration.

Graphic 10 - Sensitivity analysis for tariff rate indicator



Source: Own authorship (2023)

Sensitivity analysis for the tariff quota indicator

Table 23 represents the new distribution of relative importance based on the weight variation for the "tariff quota" indicator. Table 24 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 23 - New relative importance distribution about the tariff quota Indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,193	0,067	0,082	0,004	0,070	0,181	0,011	0,015	0,000	0,097	0,274	0,006
0,173	0,060	0,074	0,004	0,063	0,163	0,010	0,013	0,100	0,088	0,247	0,006
0,154	0,053	0,066	0,003	0,056	0,145	0,009	0,012	0,200	0,078	0,219	0,005
0,135	0,047	0,057	0,003	0,049	0,127	0,008	0,010	0,300	0,068	0,192	0,004
0,116	0,040	0,049	0,003	0,042	0,109	0,007	0,009	0,400	0,058	0,164	0,004
0,096	0,033	0,041	0,002	0,035	0,091	0,006	0,007	0,500	0,049	0,137	0,003
0,077	0,027	0,033	0,002	0,028	0,072	0,005	0,006	0,600	0,039	0,110	0,003
0,058	0,020	0,025	0,001	0,021	0,054	0,003	0,004	0,700	0,029	0,082	0,002
0,039	0,013	0,016	0,001	0,014	0,036	0,002	0,003	0,800	0,019	0,055	0,001
0,019	0,007	0,008	0,000	0,007	0,018	0,001	0,001	0,900	0,010	0,027	0,001
0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000

Source: Own authorship (2023)

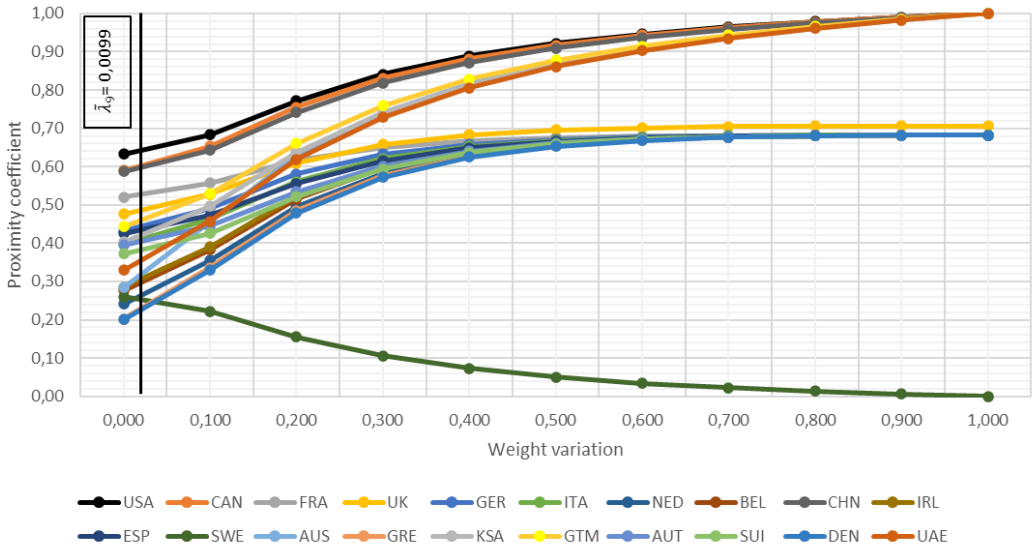
Table 24 - Proximity coefficients for the new tariff quota indicator weight

I9	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,633	0,683	0,772	0,841	0,889	0,922	0,946	0,965	0,979	0,991	1,000
CAN	0,590	0,653	0,756	0,831	0,881	0,917	0,943	0,962	0,978	0,990	1,000
FRA	0,520	0,557	0,616	0,651	0,667	0,675	0,679	0,681	0,682	0,682	0,682
UK	0,476	0,528	0,609	0,658	0,683	0,695	0,701	0,704	0,706	0,706	0,706
GER	0,432	0,492	0,580	0,633	0,658	0,671	0,677	0,680	0,682	0,682	0,682
ITA	0,396	0,463	0,561	0,622	0,653	0,668	0,676	0,680	0,681	0,682	0,682
NED	0,241	0,354	0,495	0,582	0,631	0,657	0,670	0,677	0,681	0,682	0,682
BEL	0,276	0,382	0,516	0,596	0,639	0,661	0,672	0,678	0,681	0,682	0,682
CHN	0,587	0,643	0,741	0,818	0,872	0,910	0,937	0,959	0,976	0,989	1,000
IRL	0,285	0,391	0,522	0,600	0,642	0,662	0,673	0,678	0,681	0,682	0,682
ESP	0,425	0,472	0,556	0,616	0,649	0,666	0,675	0,679	0,681	0,682	0,682
SWE	0,261	0,222	0,155	0,106	0,073	0,051	0,035	0,023	0,013	0,006	0,000
AUS	0,284	0,455	0,629	0,741	0,816	0,869	0,908	0,939	0,964	0,983	1,000
GRE	0,202	0,335	0,485	0,577	0,628	0,655	0,670	0,677	0,680	0,682	0,682
KSA	0,402	0,497	0,637	0,741	0,814	0,867	0,907	0,938	0,963	0,983	1,000
GTM	0,444	0,529	0,661	0,759	0,828	0,877	0,915	0,943	0,966	0,985	1,000
AUT	0,396	0,445	0,534	0,602	0,641	0,662	0,673	0,678	0,681	0,682	0,682
SUI	0,372	0,425	0,521	0,593	0,636	0,659	0,671	0,678	0,681	0,682	0,682
DEN	0,200	0,329	0,478	0,571	0,624	0,653	0,669	0,676	0,680	0,682	0,682
UAE	0,329	0,458	0,618	0,729	0,806	0,861	0,903	0,935	0,961	0,982	1,000

Source: Own authorship (2023)

Graphic 11 illustrates the sensitivity analysis applied to the tariff quota indicator. The graph shows the United States has a moderately stable behavior for any weight variation. At the same time, Canada and China maintain their stability as long as the weight is below 0.9. On the other hand, France maintains their stability for values less than 0.1. However, the ranking changes entirely as the indicator weight reaches 1. The United States, Canada, and China shared the first place when it happened. On the other side, France is displaced from fourth to ninth position.

Graphic 11 - Sensitivity analysis for tariff quota indicator



Source: Own authorship (2023)

Therefore, we can infer from Graphic 11 that the United States, Canada, and China exhibit constant behavior by maintaining their place among the four leading countries in the original ranking, suggesting that the indicator slightly influences the countries ranking configuration.

Sensitivity analysis for the credit risk indicator

Table 25 represents the new distribution of relative importance based on the weight variation for the "credit risk" indicator. Table 26 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 25 - New relative importance distribution about the credit risk Indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,211	0,073	0,090	0,005	0,077	0,198	0,012	0,016	0,011	0,000	0,300	0,007
0,190	0,066	0,081	0,004	0,069	0,179	0,011	0,014	0,010	0,100	0,270	0,006
0,169	0,058	0,072	0,004	0,061	0,159	0,010	0,013	0,009	0,200	0,240	0,006
0,148	0,051	0,063	0,003	0,054	0,139	0,009	0,011	0,008	0,300	0,210	0,005
0,127	0,044	0,054	0,003	0,046	0,119	0,007	0,010	0,007	0,400	0,180	0,004
0,106	0,036	0,045	0,002	0,038	0,099	0,006	0,008	0,005	0,500	0,150	0,004
0,084	0,029	0,036	0,002	0,031	0,079	0,005	0,006	0,004	0,600	0,120	0,003
0,063	0,022	0,027	0,001	0,023	0,060	0,004	0,005	0,003	0,700	0,090	0,002
0,042	0,015	0,018	0,001	0,015	0,040	0,002	0,003	0,002	0,800	0,060	0,001
0,021	0,007	0,009	0,000	0,008	0,020	0,001	0,002	0,001	0,900	0,030	0,001
0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000

Source: Own authorship (2023)

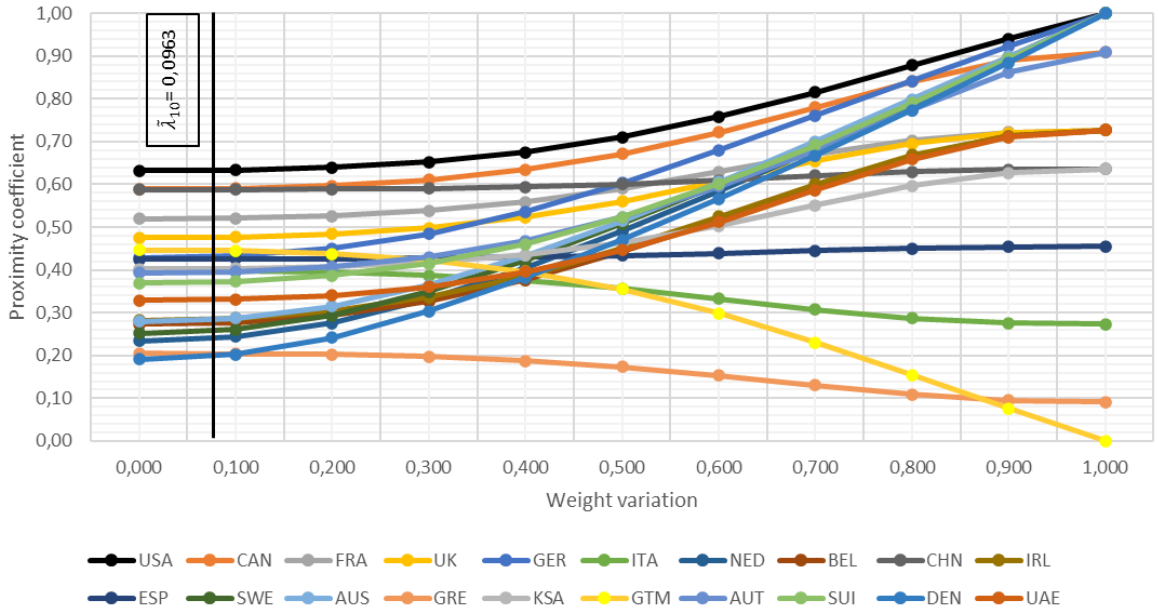
Table 26 - Proximity coefficients for the new credit risk indicator weight

I10	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,632	0,634	0,639	0,652	0,675	0,710	0,758	0,815	0,878	0,940	1,000
CAN	0,589	0,591	0,597	0,610	0,634	0,671	0,721	0,780	0,840	0,890	0,909
FRA	0,519	0,521	0,526	0,538	0,559	0,590	0,629	0,670	0,703	0,722	0,727
UK	0,475	0,477	0,484	0,498	0,523	0,560	0,607	0,655	0,696	0,720	0,727
GER	0,428	0,433	0,450	0,484	0,536	0,603	0,679	0,760	0,842	0,923	1,000
ITA	0,398	0,397	0,394	0,387	0,375	0,357	0,333	0,308	0,288	0,276	0,273
NED	0,234	0,244	0,276	0,332	0,405	0,490	0,583	0,682	0,785	0,891	1,000
BEL	0,273	0,278	0,294	0,327	0,377	0,442	0,517	0,595	0,665	0,712	0,727
CHN	0,588	0,588	0,589	0,591	0,595	0,601	0,610	0,620	0,629	0,635	0,636
IRL	0,282	0,287	0,303	0,336	0,386	0,450	0,525	0,601	0,668	0,713	0,727
ESP	0,425	0,426	0,426	0,427	0,430	0,434	0,439	0,445	0,451	0,454	0,455
SWE	0,251	0,261	0,293	0,349	0,423	0,508	0,600	0,697	0,797	0,898	1,000
AUS	0,280	0,287	0,315	0,365	0,433	0,515	0,605	0,700	0,799	0,899	1,000
GRE	0,205	0,204	0,202	0,197	0,188	0,173	0,153	0,130	0,109	0,095	0,091
KSA	0,403	0,404	0,408	0,417	0,435	0,463	0,503	0,551	0,597	0,627	0,636
GTM	0,446	0,445	0,438	0,423	0,396	0,355	0,299	0,230	0,155	0,077	0,000
AUT	0,394	0,396	0,407	0,429	0,467	0,523	0,595	0,680	0,773	0,862	0,909
SUI	0,370	0,373	0,387	0,415	0,460	0,523	0,602	0,692	0,790	0,893	1,000
DEN	0,191	0,203	0,242	0,304	0,381	0,470	0,566	0,667	0,774	0,885	1,000
UAE	0,329	0,331	0,341	0,361	0,395	0,446	0,512	0,586	0,658	0,710	0,727

Source: Own authorship (2023)

Graphic 12 illustrates the sensitivity analysis applied to the credit risk indicator. The graph shows the United States has a moderately stable behavior for any weight variation. At the same time, Canada, China, and France maintain their stability as long as the weight keeps below 0.7, 0.6, and 0.4, respectively. However, the ranking for the last three countries changes as the indicator weight reaches 1. Canada drops from second to eighth position, China drops from third to fifteenth position, and France drops from fourth to tenth position.

Graphic 12 - Sensitivity analysis for credit risk indicator



Source: Own authorship (2023)

Therefore, we can infer from Graphic 12 that only the United States exhibits constant behavior by maintaining its place among the four leading countries in the original ranking. On the other hand, the other countries remain stable as long as the weight remains below the stability values, suggesting that the indicator moderately influences the countries ranking configuration.

Sensitivity analysis for the inflation indicator

Table 27 represents the new distribution of relative importance based on the weight variation for the "human capital" indicator. Table 28 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 27 - New relative importance distribution about the inflation Indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,262	0,091	0,111	0,006	0,095	0,246	0,015	0,020	0,014	0,132	0,000	0,009
0,236	0,081	0,100	0,005	0,085	0,221	0,014	0,018	0,012	0,119	0,100	0,008
0,209	0,072	0,089	0,005	0,076	0,197	0,012	0,016	0,011	0,106	0,200	0,007
0,183	0,063	0,078	0,004	0,066	0,172	0,011	0,014	0,009	0,093	0,300	0,006
0,157	0,054	0,067	0,003	0,057	0,148	0,009	0,012	0,008	0,079	0,400	0,005
0,131	0,045	0,056	0,003	0,047	0,123	0,008	0,010	0,007	0,066	0,500	0,004
0,105	0,036	0,045	0,002	0,038	0,098	0,006	0,008	0,005	0,053	0,600	0,003
0,079	0,027	0,033	0,002	0,028	0,074	0,005	0,006	0,004	0,040	0,700	0,003
0,052	0,018	0,022	0,001	0,019	0,049	0,003	0,004	0,003	0,026	0,800	0,002
0,026	0,009	0,011	0,001	0,009	0,025	0,002	0,002	0,001	0,013	0,900	0,001

0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000

Source: Own authorship (2023)

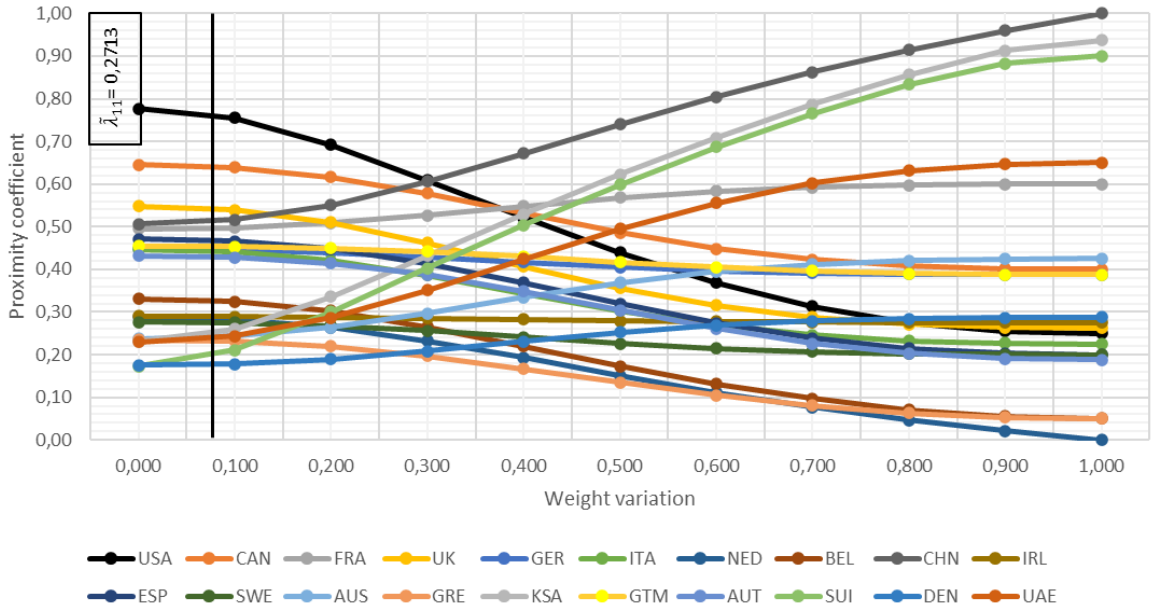
Table 28 - Proximity coefficients for the new inflation indicator weight

I11	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,777	0,755	0,692	0,609	0,521	0,439	0,368	0,313	0,275	0,255	0,250
CAN	0,645	0,639	0,616	0,578	0,531	0,486	0,449	0,423	0,409	0,402	0,400
FRA	0,495	0,498	0,508	0,527	0,548	0,568	0,583	0,592	0,597	0,599	0,600
UK	0,548	0,539	0,510	0,462	0,407	0,356	0,315	0,288	0,272	0,264	0,263
GER	0,447	0,446	0,440	0,429	0,417	0,405	0,397	0,392	0,389	0,388	0,388
ITA	0,446	0,441	0,421	0,386	0,344	0,302	0,269	0,246	0,233	0,227	0,225
NED	0,288	0,282	0,264	0,233	0,192	0,150	0,111	0,076	0,047	0,021	0,000
BEL	0,331	0,325	0,303	0,265	0,220	0,173	0,132	0,097	0,071	0,055	0,050
CHN	0,507	0,517	0,550	0,605	0,672	0,740	0,805	0,863	0,914	0,960	1,000
IRL	0,290	0,290	0,288	0,286	0,282	0,280	0,277	0,276	0,275	0,275	0,275
ESP	0,472	0,466	0,448	0,414	0,369	0,319	0,274	0,238	0,215	0,203	0,200
SWE	0,277	0,275	0,268	0,256	0,241	0,226	0,214	0,207	0,202	0,200	0,200
AUS	0,238	0,244	0,264	0,297	0,335	0,369	0,395	0,411	0,420	0,424	0,425
GRE	0,235	0,232	0,219	0,197	0,167	0,135	0,105	0,080	0,063	0,053	0,050
KSA	0,231	0,260	0,336	0,432	0,529	0,622	0,708	0,787	0,857	0,913	0,938
GTM	0,455	0,454	0,450	0,442	0,430	0,417	0,405	0,396	0,391	0,388	0,388
AUT	0,432	0,428	0,414	0,387	0,349	0,304	0,261	0,226	0,203	0,191	0,188
SUI	0,173	0,211	0,300	0,402	0,503	0,599	0,686	0,765	0,833	0,882	0,900
DEN	0,175	0,178	0,189	0,208	0,231	0,252	0,268	0,279	0,284	0,287	0,288
UAE	0,230	0,243	0,286	0,351	0,424	0,495	0,556	0,602	0,632	0,646	0,650

Source: Own authorship (2023)

Graphic 13 illustrates the sensitivity analysis applied to the inflation indicator. The graph shows that the United States and France are stable only if the indicator weight remains below 0,3. In the same way, Canada and China are stable only if the indicator weight remains below 0.2 and 0.1, respectively. However, the ranking changes entirely as the indicator weight reaches 1. In this case, China came to occupy the United States' first place, and in turn, this one was displaced to the tenth position. Saudi Arabia came to occupy Canada ' second place, and in turn, this one was displaced to the seventh position. The United Arab Emirates came to occupy France's fourth place, and in turn, this one was displaced to the fifth position.

Graphic 13 - Sensitivity analysis for inflation indicator



Source: Own authorship (2023)

Therefore, we can infer from Graphic 13 that as the indicator's relative importance increases over the stability values, only China exhibits a constant behavior while maintaining its position among the four leading countries in the original ranking, suggesting that the indicator moderately influences the countries ranking configuration.

Sensitivity analysis for the foreign direct investment indicator

Table 29 represents the new distribution of relative importance based on the weight variation for the "direct investment" indicator.

Table 30 describes the final weights reintegrated into the Topsis method, generating new proximity coefficients (CC_i).

Table 29 - New relative importance distribution about the foreign investment Indicator weighted variation

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
0,192	0,066	0,082	0,004	0,070	0,180	0,011	0,015	0,010	0,097	0,273	0,000
0,173	0,060	0,073	0,004	0,063	0,162	0,010	0,013	0,009	0,087	0,246	0,100
0,154	0,053	0,065	0,003	0,056	0,144	0,009	0,012	0,008	0,078	0,218	0,200
0,134	0,046	0,057	0,003	0,049	0,126	0,008	0,010	0,007	0,068	0,191	0,300
0,115	0,040	0,049	0,002	0,042	0,108	0,007	0,009	0,006	0,058	0,164	0,400
0,096	0,033	0,041	0,002	0,035	0,090	0,006	0,007	0,005	0,048	0,137	0,500
0,077	0,027	0,033	0,002	0,028	0,072	0,005	0,006	0,004	0,039	0,109	0,600
0,058	0,020	0,024	0,001	0,021	0,054	0,003	0,004	0,003	0,029	0,082	0,700
0,038	0,013	0,016	0,001	0,014	0,036	0,002	0,003	0,002	0,019	0,055	0,800
0,019	0,007	0,008	0,000	0,007	0,018	0,001	0,001	0,001	0,010	0,027	0,900

0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000

Source: Own authorship (2023)

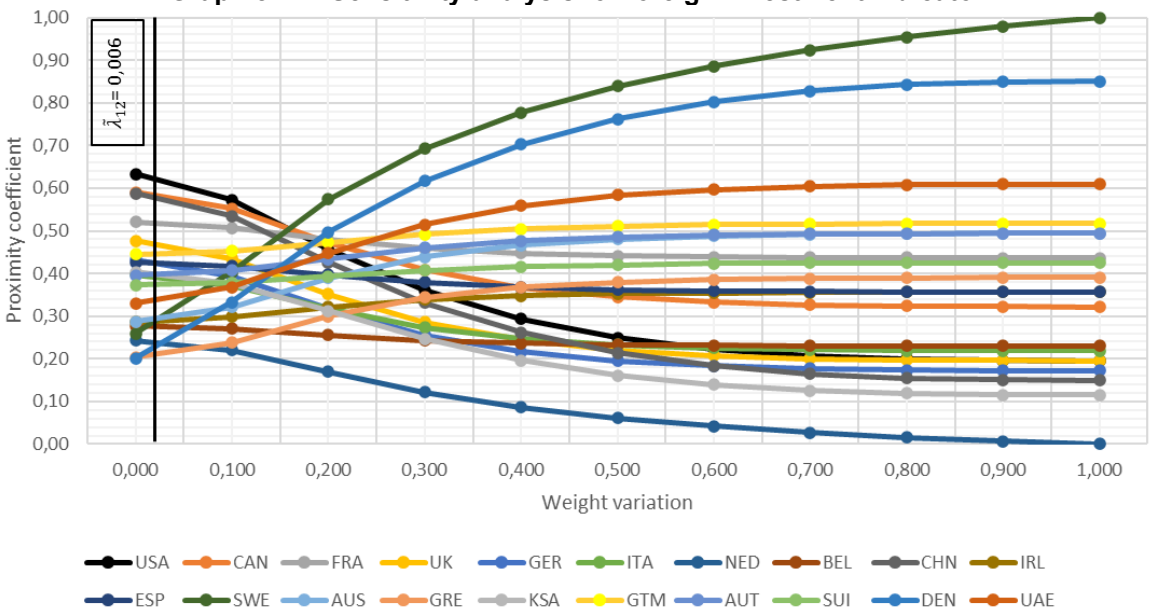
Table 30 - Proximity coefficients for the new foreign investment indicator weight

I12	0,000	0,100	0,200	0,300	0,400	0,500	0,600	0,700	0,800	0,900	1,000
USA	0,634	0,572	0,457	0,361	0,293	0,249	0,223	0,207	0,200	0,196	0,195
CAN	0,591	0,552	0,473	0,408	0,367	0,345	0,333	0,326	0,323	0,322	0,322
FRA	0,521	0,507	0,479	0,458	0,447	0,442	0,439	0,438	0,437	0,437	0,437
UK	0,477	0,435	0,352	0,286	0,244	0,220	0,207	0,200	0,197	0,196	0,195
GER	0,433	0,394	0,317	0,255	0,217	0,195	0,183	0,177	0,174	0,173	0,172
ITA	0,397	0,372	0,318	0,274	0,247	0,233	0,225	0,221	0,219	0,219	0,218
NED	0,243	0,220	0,169	0,122	0,086	0,061	0,042	0,027	0,016	0,007	0,000
BEL	0,277	0,270	0,255	0,243	0,236	0,233	0,231	0,231	0,230	0,230	0,230
CHN	0,588	0,534	0,426	0,331	0,261	0,214	0,183	0,165	0,155	0,151	0,149
IRL	0,286	0,298	0,322	0,339	0,348	0,352	0,354	0,356	0,356	0,356	0,356
ESP	0,426	0,417	0,398	0,380	0,368	0,362	0,359	0,357	0,357	0,356	0,356
SWE	0,259	0,403	0,574	0,693	0,777	0,839	0,886	0,924	0,954	0,979	1,000
AUS	0,287	0,322	0,389	0,439	0,466	0,481	0,488	0,492	0,493	0,494	0,494
GRE	0,204	0,238	0,300	0,344	0,367	0,380	0,386	0,389	0,390	0,391	0,391
KSA	0,404	0,377	0,313	0,247	0,196	0,161	0,139	0,126	0,119	0,116	0,115
GTM	0,445	0,453	0,473	0,492	0,504	0,511	0,514	0,516	0,517	0,517	0,517
AUT	0,396	0,407	0,434	0,460	0,476	0,485	0,490	0,492	0,494	0,494	0,494
SUI	0,373	0,379	0,393	0,407	0,416	0,420	0,423	0,424	0,425	0,425	0,425
DEN	0,201	0,332	0,497	0,617	0,703	0,762	0,803	0,828	0,842	0,849	0,851
UAE	0,331	0,368	0,447	0,515	0,559	0,584	0,597	0,604	0,607	0,609	0,609

Source: Own authorship (2023)

Graphic 14 illustrates the sensitivity analysis applied to the foreign direct investment indicator. The graph shows that the United States, Canada, France, and China are stable if the indicator weight remains below 0,1. However, the ranking changes entirely as the indicator weight reaches 1. In this case, Sweden came to occupy the United States' first place, and in turn, this one was displaced to the fifteenth position. Denmark came to occupy Canada ' second place, and this one was displaced to the twelfth position. The United Arab Emirates came to occupy China's third place, and the last one was displaced to the tenth position. Finally, Guatemala came to occupy France's fourth place, and in turn, this one was displaced to the seventh position.

Graphic 14 - Sensitivity analysis for foreign investment indicator



Source: Own authorship (2023)

Therefore, we can infer from Graphic 14 that as the indicator's relative importance increases above the stability value, none of the four leading countries in the original ranking exhibits a constant behavior, which suggests that the indicator strongly influences the countries ranking configuration.

APPENDIX D - Weights definition for each indicator

Weights definition by entropy method

Table 31 represent the decision matrix (a_{ij}) and must be normalized using the equations 19 and 20.

Table 31 - Decision matrix (a_{ij})

Country/Criteria	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
	+	-	-	+	-	+	+	-	-	+	-	+
United States of America (USA)	5	9346	6821	3,80	0,04	545541	70,60	20,00%	0,00	25	8,00	1,40
Canada (CAN)	3	15157	9616	4,00	0,03	504183	73,30	4,00%	0,00	24	6,80	2,50
France (FRA)	3	8183	9694	3,90	0,05	334770	63,60	3,80%	22,25	22	5,20	3,50
United Kingdom (UK)	5	8258	9892	3,70	0,04	292818	69,90	2,00%	20,57	22	7,90	1,40
Germany (GER)	3	6772	10516	4,10	0,05	289249	73,70	3,80%	22,25	25	6,90	1,20
Italy (ITA)	5	8443	10332	3,70	0,05	208532	62,30	3,80%	22,25	17	8,20	1,60
Netherlands (NED)	1	8047	10251	4,10	0,05	207626	78,00	3,80%	22,25	25	10,00	-0,30
Belgium (BEL)	3	7781	10100	4,00	0,05	187507	67,10	3,80%	22,25	22	9,60	1,70
China (CHN)	7	7382	17781	3,70	0,03	184096	48,30	10,00%	0,00	21	2,00	1,00
Ireland (IRL)	3	8131	9490	3,60	0,05	141769	82,00	3,80%	22,25	22	7,80	2,80
Spain (ESP)	7	7908	8937	3,90	0,05	129645	65,00	3,80%	22,25	19	8,40	2,80
Sweden (SWE)	3	6657	11162	4,00	0,07	126395	77,50	0,00%	70,03	25	8,40	8,40
Australia (AUS)	3	9184	14867	3,70	0,04	77580	74,80	5,00%	0,00	25	6,60	4,00
Greece (GRE)	3	8256	10935	3,70	0,05	77525	56,90	3,80%	22,25	15	9,60	3,10
Saudi Arabia (KSA)	1	7314	12769	3,40	0,00	76967	58,30	15,00%	0,00	21	2,50	0,70
Guatemala (GTM)	7	6207	4553	2,60	0,01	60667	62,70	0,00%	0,00	14	6,90	4,20
Austria (AUT)	7	6806	10543	4,00	0,05	58002	71,10	3,80%	22,25	24	8,50	4,00
Switzerland (SUI)	1	8045	17302	4,10	0,03	55217	83,80	3,80%	22,25	25	2,80	3,40
Denmark (DEN)	1	8095	10671	4.1	0,05	54922	77,60	3,80%	22,25	25	7,70	7,10
United Arab Emirates (UAE)	1	7208	13639	4,00	0,00	55636	70,90	5,00%	0,00	22	4,80	5,00

Source: Own authorship with primary and secondary data (2023)

Positive indicators are normalized by the equation 19.

$$x_{ij} = \frac{a_{ij} - min(a_{ij})}{max(a_{ij}) - min(a_{ij})} \quad (19)$$

Negative indicators are normalized by the equation 20.

$$x_{ij} = \frac{\max(a_{ij}) - a_{ij}}{max(a_{ij}) - min(a_{ij})} \quad (20)$$

The standardized values are shown in Table 32:

Table 32 - Normalized decision matrix (x_{ij})

Country	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
USA	0,67	0,65	0,83	0,80	0,38	1,00	0,63	0,00	1,00	1,00	0,25	0,20
CAN	0,33	0,00	0,62	0,93	0,62	0,92	0,70	0,80	1,00	0,91	0,40	0,32
FRA	0,33	0,78	0,61	0,87	0,28	0,57	0,43	0,81	0,68	0,73	0,60	0,44
UK	0,67	0,77	0,60	0,73	0,38	0,48	0,61	0,90	0,71	0,73	0,26	0,20
GER	0,33	0,94	0,55	1,00	0,28	0,48	0,72	0,81	0,68	1,00	0,39	0,17
ITA	0,67	0,75	0,56	0,73	0,28	0,31	0,39	0,81	0,68	0,27	0,23	0,22
NED	0,00	0,79	0,57	1,00	0,28	0,31	0,84	0,81	0,68	1,00	0,00	0,00
BEL	0,33	0,82	0,58	0,93	0,28	0,27	0,53	0,81	0,68	0,73	0,05	0,23
CHN	1,00	0,87	0,00	0,73	0,57	0,26	0,00	0,50	1,00	0,64	1,00	0,15
IRL	0,33	0,79	0,63	0,67	0,28	0,18	0,95	0,81	0,68	0,73	0,28	0,36
ESP	1,00	0,81	0,67	0,87	0,28	0,15	0,47	0,81	0,68	0,45	0,20	0,36
SWE	0,33	0,95	0,50	0,93	0,00	0,15	0,82	1,00	0,00	1,00	0,20	1,00
AUS	0,33	0,67	0,22	0,73	0,36	0,05	0,75	0,75	1,00	1,00	0,43	0,49
GRE	0,33	0,77	0,52	0,73	0,28	0,05	0,24	0,81	0,68	0,09	0,05	0,39
KSA	0,00	0,88	0,38	0,53	1,00	0,04	0,28	0,25	1,00	0,64	0,94	0,11
GTM	1,00	1,00	1,00	0,00	0,82	0,01	0,41	1,00	1,00	0,00	0,39	0,52
AUT	1,00	0,93	0,55	0,93	0,28	0,01	0,64	0,81	0,68	0,91	0,19	0,49
SUI	0,00	0,79	0,04	1,00	0,50	0,00	1,00	0,81	0,68	1,00	0,90	0,43
DEN	0,00	0,79	0,54	1,00	0,22	0,00	0,83	0,81	0,68	1,00	0,29	0,85
UAE	0,00	0,89	0,31	0,93	1,00	0,00	0,64	0,75	1,00	0,73	0,65	0,61

Source: Own authorship (2023)

The normalized performance of the alternative $\boldsymbol{i}(\boldsymbol{i} = \boldsymbol{1}, \dots, \boldsymbol{m})$ to the indicator $\boldsymbol{j}(\boldsymbol{j} = \boldsymbol{1}, \dots, \boldsymbol{n})$ is determined by equation 21.

Table 33 shows the values.

$$r_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \quad (21)$$

Table 33 - Normalized performance of the alternative to the indicator (r_{ij})

Country	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
USA	0,08	0,04	0,08	0,05	0,05	0,19	0,05	0,00	0,07	0,07	0,03	0,03
CAN	0,04	0,00	0,06	0,06	0,07	0,17	0,06	0,05	0,07	0,06	0,05	0,04
FRA	0,04	0,05	0,06	0,05	0,03	0,11	0,04	0,05	0,04	0,05	0,08	0,06
UK	0,08	0,05	0,06	0,05	0,05	0,09	0,05	0,06	0,05	0,05	0,03	0,03
GER	0,04	0,06	0,05	0,06	0,03	0,09	0,06	0,05	0,04	0,07	0,05	0,02
ITA	0,08	0,05	0,05	0,05	0,03	0,06	0,03	0,05	0,04	0,02	0,03	0,03
NED	0,00	0,05	0,06	0,06	0,03	0,06	0,07	0,05	0,04	0,07	0,00	0,00
BEL	0,04	0,05	0,06	0,06	0,03	0,05	0,04	0,05	0,04	0,05	0,01	0,03
CHN	0,12	0,06	0,00	0,05	0,07	0,05	0,00	0,03	0,07	0,04	0,13	0,02
IRL	0,04	0,05	0,06	0,04	0,03	0,03	0,08	0,05	0,04	0,05	0,04	0,05
ESP	0,12	0,05	0,07	0,05	0,03	0,03	0,04	0,05	0,04	0,03	0,03	0,05
SWE	0,04	0,06	0,05	0,06	0,00	0,03	0,07	0,07	0,00	0,07	0,03	0,13
AUS	0,04	0,04	0,02	0,05	0,04	0,01	0,06	0,05	0,07	0,07	0,06	0,07
GRE	0,04	0,05	0,05	0,05	0,03	0,01	0,02	0,05	0,04	0,01	0,01	0,05
KSA	0,00	0,06	0,04	0,03	0,12	0,01	0,02	0,02	0,07	0,04	0,12	0,02
GTM	0,12	0,06	0,10	0,00	0,10	0,00	0,03	0,07	0,07	0,00	0,05	0,07
AUT	0,12	0,06	0,05	0,06	0,03	0,00	0,05	0,05	0,04	0,06	0,02	0,07
SUI	0,00	0,05	0,00	0,06	0,06	0,00	0,08	0,05	0,04	0,07	0,12	0,06
DEN	0,00	0,05	0,05	0,06	0,03	0,00	0,07	0,05	0,04	0,07	0,04	0,11
UAE	0,00	0,06	0,03	0,06	0,12	0,00	0,05	0,05	0,07	0,05	0,08	0,08

Source: Own authorship (2023)

.

The index information entropy is defined by equation 22.

$$E_J = -(\ln(m))^{-1} * \sum_{i=1}^{m} r_{ij} * \ln(r_{ij}) \quad (22)$$

And the weight obtained from the information entropy is expressed as follow.

$$\lambda_j = \frac{1 - E_J}{\sum_{j=1}^{n} 1 - E_J} \quad (23)$$

Where, $0 \leq \lambda_j \leq 1$ and $\sum_{j=1}^{n} \lambda_j ; = 1$.

Table 34 summarizes the weights obtained by this process.

Table 34 - Weights obtained by the entropy method

Indicator	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
λ_j	0,129	0,018	0,043	0,020	0,058	0,188	0,035	0,024	0,022	0,039	0,357	0,065

Source: Own authorship (2023)

Weights definition by Rank-order centroid method (W_j)

The Rank-order centroid (ROC) weights is a simple way of weighing several items ranked according to their importance. The decision-makers can rank items much more quickly than give weight to them. For this research, the company's sales and marketing manager was asked to rank the indicators from his own perspective.

The following equation obtains the indicator weights.

$$w_j = \frac{1}{m}\sum_{k=1}^{m}\left(\frac{1}{p_j}\right); j = 1,2,\dots,m \quad (24)$$

Where, m represents the criteria number, and p represents the ordinal ranking. Table 35 shows the rank and weights of each indicator.

Table 35 - Weights obtained by the ROC method

Indicator	Ordinal ranking	$(1/p_j)$	w_j
I2	1	1,000	0,259
I10	2	0,500	0,175
I3	3	0,333	0,134
I1	4	0,250	0,106
I5	5	0,200	0,085
I6	6	0,167	0,068
I11	7	0,143	0,054
I8	8	0,125	0,043
I9	9	0,111	0,032
I7	10	0,100	0,023
I4	11	0,091	0,015
I12	12	0,083	0,007

Source: Own authorship (2023)

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Weight aggregation

Equation 25 aggregates the indicators weight obtained from the values given by the entropy method (λ_j) and the criteria weights subjectively assigned by the rank order centroid method (W_j).

$$\tilde{\lambda}_j = \lambda_j * W_j \quad (25)$$

($\tilde{\lambda}_j$) represents the general weight. With this data, we proceed to normalize the weights obtained with the equation 26.

$$\tilde{\lambda}_n = \frac{\lambda_j * W_j}{\sum_{j=1}^{n} \lambda_j * W_j} \quad (26)$$

Table 36 summarizes the final weights ($\tilde{\lambda}_n$) obtained by the combination of the entropy ($\tilde{\lambda}_j$) and the rank-order centroid method (w_j).

Table 36 - Weights aggregated by the entropy and rank-order centroid method

Indicator	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
λ_j	0,129	0,018	0,043	0,020	0,058	0,188	0,035	0,024	0,022	0,039	0,357	0,065
w_j	0,106	0,259	0,134	0,015	0,085	0,068	0,023	0,043	0,032	0,175	0,054	0,007
$\tilde{\lambda}_j$	0,014	0,005	0,006	0,000	0,005	0,013	0,001	0,001	0,001	0,007	0,019	0,000
$\tilde{\lambda}_n$	0,191	0,066	0,081	0,004	0,069	0,179	0,011	0,015	0,010	0,096	0,271	0,006

Source: Own authorship (2023)

APPENDIX E - TOPSIS method application

Market selection with the TOPSIS method

Topsis method encompasses a structured framework comprising the following distinct procedural steps. Firstly, the performances of "n" alternatives ($\boldsymbol{i}$) to the "m" criteria ($\boldsymbol{j}$) are collected in a decision matrix ($\boldsymbol{a_{ij}}$) as in Table 31 where ($\boldsymbol{i} = \mathbf{1}, \ldots, \mathbf{n}$) and ($\boldsymbol{j} = \mathbf{1}, \ldots, \mathbf{m}$). Secondly, the criteria performances are normalized to compare the different unit's measures. Thus, we use distributive normalization (equation 27), which requires dividing the performances by the square root of the sum of each squared element. The method gives the score shown in Table 37.

.

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \tag{27}$$

Table 37 - Distributive normalization

r_{ij}	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
	+	-	-	+	-	+	+	-	-	+	-	+
Weight	**0,191**	**0,066**	**0,081**	**0,004**	**0,069**	**0,179**	**0,011**	**0,015**	**0,010**	**0,096**	**0,271**	**0,006**
USA	0,268	0,250	0,134	0,222	0,219	0,526	0,226	0,648	0,000	0,251	0,245	0,086
CAN	0,161	0,406	0,189	0,234	0,133	0,486	0,234	0,130	0,000	0,241	0,208	0,154
FRA	0,161	0,219	0,190	0,228	0,254	0,323	0,203	0,123	0,214	0,221	0,159	0,216
UK	0,268	0,221	0,194	0,217	0,219	0,282	0,224	0,065	0,198	0,221	0,242	0,086
GER	0,161	0,181	0,206	0,240	0,254	0,279	0,236	0,123	0,214	0,251	0,211	0,074
ITA	0,268	0,226	0,203	0,217	0,254	0,201	0,199	0,123	0,214	0,171	0,251	0,099
NED	0,054	0,215	0,201	0,240	0,254	0,200	0,249	0,123	0,214	0,251	0,306	-0,018
BEL	0,161	0,208	0,198	0,234	0,254	0,181	0,215	0,123	0,214	0,221	0,294	0,105
CHN	0,375	0,198	0,349	0,217	0,151	0,177	0,154	0,324	0,000	0,211	0,061	0,062
IRL	0,161	0,218	0,186	0,211	0,254	0,137	0,262	0,123	0,214	0,221	0,239	0,173
ESP	0,375	0,212	0,175	0,228	0,254	0,125	0,208	0,123	0,214	0,191	0,257	0,173
SWE	0,161	0,178	0,219	0,234	0,352	0,122	0,248	0,000	0,675	0,251	0,257	0,518
AUS	0,161	0,246	0,292	0,217	0,225	0,075	0,239	0,162	0,000	0,251	0,202	0,246
GRE	0,161	0,221	0,214	0,217	0,254	0,075	0,182	0,123	0,214	0,151	0,294	0,191
KSA	0,054	0,196	0,250	0,199	0,000	0,074	0,186	0,486	0,000	0,211	0,077	0,043
GTM	0,375	0,166	0,089	0,152	0,063	0,058	0,201	0,000	0,000	0,141	0,211	0,259
AUT	0,375	0,182	0,207	0,234	0,254	0,056	0,227	0,123	0,214	0,241	0,261	0,246
SUI	0,054	0,215	0,339	0,240	0,175	0,053	0,268	0,123	0,214	0,251	0,086	0,210
DEN	0,054	0,217	0,209	0,240	0,275	0,053	0,248	0,123	0,214	0,251	0,236	0,438
UAE	0,054	0,193	0,267	0,234	0,000	0,054	0,227	0,162	0,000	0,221	0,147	0,308

Source: Own authorship (2023)

The weighted are considered in the subsequent stage, and the weighted normalized decision matrix is formed (Table 38) by multiplying the normalized scores (r_{ij}) by their respective corresponding weights ($\tilde{\lambda}_n$).

$$v_{ij} = r_{ij} * \tilde{\lambda}_n \quad (28)$$

Table 38 - Weighted normalized matrix

v_{ij}	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
	+	-	-	+	-	+	+	-	-	+	-	+
Weight	**0,191**	**0,066**	**0,081**	**0,004**	**0,069**	**0,179**	**0,011**	**0,015**	**0,010**	**0,096**	**0,271**	**0,006**
USA	0,0511	0,0165	0,0108	0,0009	0,0152	0,0943	0,0025	0,0094	0,0000	0,0242	0,0665	0,0005
CAN	0,0307	0,0268	0,0153	0,0010	0,0092	0,0872	0,0026	0,0019	0,0000	0,0232	0,0565	0,0010
FRA	0,0307	0,0144	0,0154	0,0009	0,0175	0,0579	0,0023	0,0018	0,0021	0,0213	0,0432	0,0014
UK	0,0511	0,0146	0,0157	0,0009	0,0152	0,0506	0,0025	0,0009	0,0020	0,0213	0,0657	0,0005
GER	0,0307	0,0120	0,0167	0,0010	0,0175	0,0500	0,0027	0,0018	0,0021	0,0242	0,0574	0,0005
ITA	0,0511	0,0149	0,0164	0,0009	0,0175	0,0360	0,0022	0,0018	0,0021	0,0165	0,0682	0,0006
NED	0,0102	0,0142	0,0163	0,0010	0,0175	0,0359	0,0028	0,0018	0,0021	0,0242	0,0832	-0,0001
BEL	0,0307	0,0137	0,0161	0,0010	0,0175	0,0324	0,0024	0,0018	0,0021	0,0213	0,0798	0,0007
CHN	0,0716	0,0130	0,0283	0,0009	0,0105	0,0318	0,0017	0,0047	0,0000	0,0203	0,0166	0,0004
IRL	0,0307	0,0144	0,0151	0,0009	0,0175	0,0245	0,0030	0,0018	0,0021	0,0213	0,0649	0,0011
ESP	0,0716	0,0140	0,0142	0,0009	0,0175	0,0224	0,0023	0,0018	0,0021	0,0184	0,0699	0,0011
SWE	0,0307	0,0118	0,0177	0,0010	0,0243	0,0218	0,0028	0,0000	0,0067	0,0242	0,0699	0,0033
AUS	0,0307	0,0162	0,0236	0,0009	0,0156	0,0134	0,0027	0,0024	0,0000	0,0242	0,0549	0,0016
GRE	0,0307	0,0146	0,0174	0,0009	0,0175	0,0134	0,0021	0,0018	0,0021	0,0145	0,0798	0,0012
KSA	0,0102	0,0129	0,0203	0,0008	0,0000	0,0133	0,0021	0,0071	0,0000	0,0203	0,0208	0,0003
GTM	0,0716	0,0110	0,0072	0,0006	0,0044	0,0105	0,0023	0,0000	0,0000	0,0136	0,0574	0,0016
AUT	0,0716	0,0120	0,0168	0,0010	0,0175	0,0100	0,0026	0,0018	0,0021	0,0232	0,0707	0,0016
SUI	0,0102	0,0142	0,0275	0,0010	0,0121	0,0095	0,0030	0,0018	0,0021	0,0242	0,0233	0,0013
DEN	0,0102	0,0143	0,0170	0,0010	0,0190	0,0095	0,0028	0,0018	0,0021	0,0242	0,0640	0,0028
UAE	0,0102	0,0127	0,0217	0,0010	0,0000	0,0096	0,0026	0,0024	0,0000	0,0213	0,0399	0,0020

Source: Own authorship (2023)

The weighted scores will compare each value to an ideal and anti-ideal solution. For this study, we collect (Table 39) the best and the worst performance on each indicator from the weighted normalized decision matrix.

Thus, considering our set of alternatives ($i = 1, \ldots, \mathrm{n}$) and indicators ($j = 1, \ldots, \mathrm{m}$). The ideal solution is composed by: $A^+ = (V_1^+, \ldots, V_n^+)$, and the anti-ideal solution is composed by $A^- = (V_1^-, \ldots, V_n^-)$.

Where: $V_j^+ = \{(max(v_{ij})|\, j \in j_1), (min(v_{ij})|\, j \in j_2)|i = 1, \ldots, m\}$ if the indicator j is to be maximized, and $V_j^- = \{(min(v_{ij})|\, j \in j_1), (max(v_{ij})|\, j \in j_2)|i = 1, \ldots, m\}$ if the indicator j is to be minimized. Considering that $j_1 = \{j = 1, .., n|j\ is\ a\ maximization\ indicator\}$ $j_2 = \{j = 1, .., n|j\ is\ a\ minimization\ indicator\}$.

Table 39 - Ideal and anti-ideal solution

Solution	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12
A^+	0,0716	0,0110	0,0072	0,0010	0,0000	0,0943	0,0030	0,0000	0,0000	0,0242	0,0166	0,0033
A^-	0,0102	0,0268	0,0283	0,0006	0,0243	0,0095	0,0017	0,0094	0,0067	0,0136	0,0832	-0,0001

Source: Own authorship (2023)

The next step involves calculating the Euclidean distance of each value from the ideal solution (equation 29) and the anti-ideal solution (equation 30).

$$d_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^2} \tag{29}$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2} \tag{30}$$

Then, the relative closeness coefficient of each value is calculated.

$$c_i = \frac{d_i^-}{d_i^- + d_i^+}, c_i \in [0,1] \; \forall = 1, \dots m \tag{31}$$

Finally, to select the best alternative, the procedure is ranked.

Table 40 - Closeness and ranking calculation

Alternative	d_i^+	d_i^-	c_i	Topsis Ranking
USA	0,057	0,099	0,634	1
CAN	0,061	0,088	0,591	2
FRA	0,064	0,07	0,521	4
UK	0,071	0,065	0,477	5
GER	0,076	0,058	0,432	7
ITA	0,083	0,055	0,397	10
NED	0,110	0,035	0,243	18
BEL	0,100	0,038	0,277	16
CHN	0,067	0,096	0,588	3
IRL	0,096	0,039	0,286	15
ESP	0,092	0,068	0,426	8
SWE	0,102	0,036	0,260	17
AUS	0,101	0,041	0,287	14
GRE	0,113	0,029	0,204	19
KSA	0,103	0,070	0,404	9
GTM	0,094	0,075	0,445	6
AUT	0,102	0,067	0,396	11
SUI	0,108	0,064	0,373	12
DEN	0,117	0,03	0,202	20
UAE	0,108	0,053	0,331	13

Source: Own authorship (2023)